

ROSETTA-RPC-MAG

To Planetary Science Archive Interface Control
Document

EAICD

RO-IGEP-TR0009

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Change Log

Date	Sections Changed	Reasons for Change
7.3.2005	EAICD V1.5 release	
26.9.2005	EAICD V1.7 release	PDS LABEL changes, SOFTWARE deleted
4.10.2005	RPCMAG_SW.CAT changed to RPCMAG_SOFTWARE.CAT	RPC Conventions
13.10.2005	Data Structure adapted to RPC conventions	RPC Conventions
26.10.2005	1.8, 2.4.3, 2.44, 3.11, 3.13, 3.14, 3.2.2, 3.42, 3.4.3.1,3.4.3.3, 4.3.1.6	Changes due to comments listed in RO- EST-LI-3331_1.0
18.01.2006	4.3.x	Geoindex information in DATA LBL files updated
28.09.2006	Sections mentioned in RO-EST-LI-3362	Comments on the Internal ESA Review
18.10.2006	TOC,1.5,1.9,2,22,3.1,4.2,4.3	Implementation of CLK,CLL data and Quality flags
20.4.2007	1.5.1, 1.5.2, 1.6, 1.8, 2.2.2, 2.2.6, 3.2.3, 3.42, 4.3.1.3,4.3.1.6 2.1, 2.2.3.1, 3.1.3, 3.4.3.2 4.3.1.9 4.3.2 – 4.3.15	RID related changes, Editorial Changes due to Improvement of Calibration S/W Chapter added for description of GEOMETRY Information Changes of *LBL files due to new ESA Requirements after DAWG meeting
6.8.2007		Additional changes according to RID 45
5.9.2007	2.2.2	Exact explanation of time stamps

28.10.2009		EAICD Acronym included in Acronym List, List extended with RPCMAG_INST.CAT Acronyms
26.1.2010	3.2	*LBL files updated according to S/W changes related to Archive review in October 2009 LEVEL_H description update due to LAP disturbance correction
18.2.2010	3.3	Logbook Items added
6.1.2012	4.0	Data label format changed due to NOTE Keyword, CSEQ coordinate system added
3.4.2012	4.1	Reference to RPCMAG_SC_ALIGN.TXT due to RID of LUTETIA-Review
20.6.2012	4.2	Filter design added in section 2.1.3. ADC conversion revised in section 2.1.2 Changes due to RIDs of LUTETIA Review
1.7.2012	4.3	Typos corrected
21.2.2016	4.4	Amendments according to Archive Science Review in Feb 2016
6.4.2016	4.5	Editorial amendments according to RID List
24.8.2018	4.6	Changes due to Dataset version V9.0, complete revision
14.11.2018	4.8	Changes due to Archive review in Autumn 2018, OBT explanation changed, Acronyms updated

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1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to (Science) Archive Interface Control Document) is twofold. First it provides users of the RPC-MAG with detailed description of the product and a description of how it was generated, including data sources and destinations. Secondly, it is the official interface between your instrument team and your archiving authority.

1.2 Archiving Authorities

The Planetary Data System Standard is used as archiving standard by

- NASA for U.S. planetary missions, implemented by PDS
- ESA for European planetary missions, implemented by the Research and Scientific Support Department (RSSD) of ESA

ESA implements an online science archive, the PSA,

- to support and ease data ingestion
- to offer additional services to the scientific user community and science operations teams as e.g.
 - search queries that allow searches across instruments, missions and scientific disciplines
 - several data delivery options as
 - direct download of data products, linked files and data sets
 - ftp download of data products, linked files and data sets

The PSA aims for online ingestion of logical archive volumes and will offer the creation of physical archive volumes on request.

1.3 Contents

This document describes the data flow of the RPC-MAG instrument on ROSETTA from the s/c to the insertion into the PSA for ESA. It includes information on how data were processed, formatted, labeled and uniquely identified. The document discusses general naming schemes for data volumes, data sets, data and label files. Standards used to generate the product are explained. Software that may be used to access the product is explained further on.

The design of the data set structure and the data product is given. Examples of these are given in the appendix.

1.4 Intended Readership

The staff of the archiving authority (Planetary Science Archive, ESA, RSSD, design team) and any potential user of the RPC-MAG data.

1.5 Scientific Objectives

1.5.1 Overview

The ROSETTA orbiter magnetometer is part of the ROSETTA Plasma Consortium set of scientific instruments. The purpose of the magnetometer is the measurement of the interplanetary magnetic field close to different targets visited by the ROSETTA spacecraft.

Special points of interest are:

- Measurements of the interplanetary magnetic field during the flybys at planet Mars & Earth, the asteroids and in the environment of comet 67P/Churyumov-Gerasimenko.
- Study of the structure and dynamics of the cometary-solar wind interaction region.
- Study of the generation and evolution of the cometary diamagnetic Cavity.
- Study of cometary tail evolution and structure.
- Study of plasma waves in the cometary environment

1.5.2 The Cometary Magnetic Field - A historical perspective

In 1951 the German Astronomer Ludwig Biermann used the fact that cometary tails are always pointing away from the Sun to postulate the solar wind.

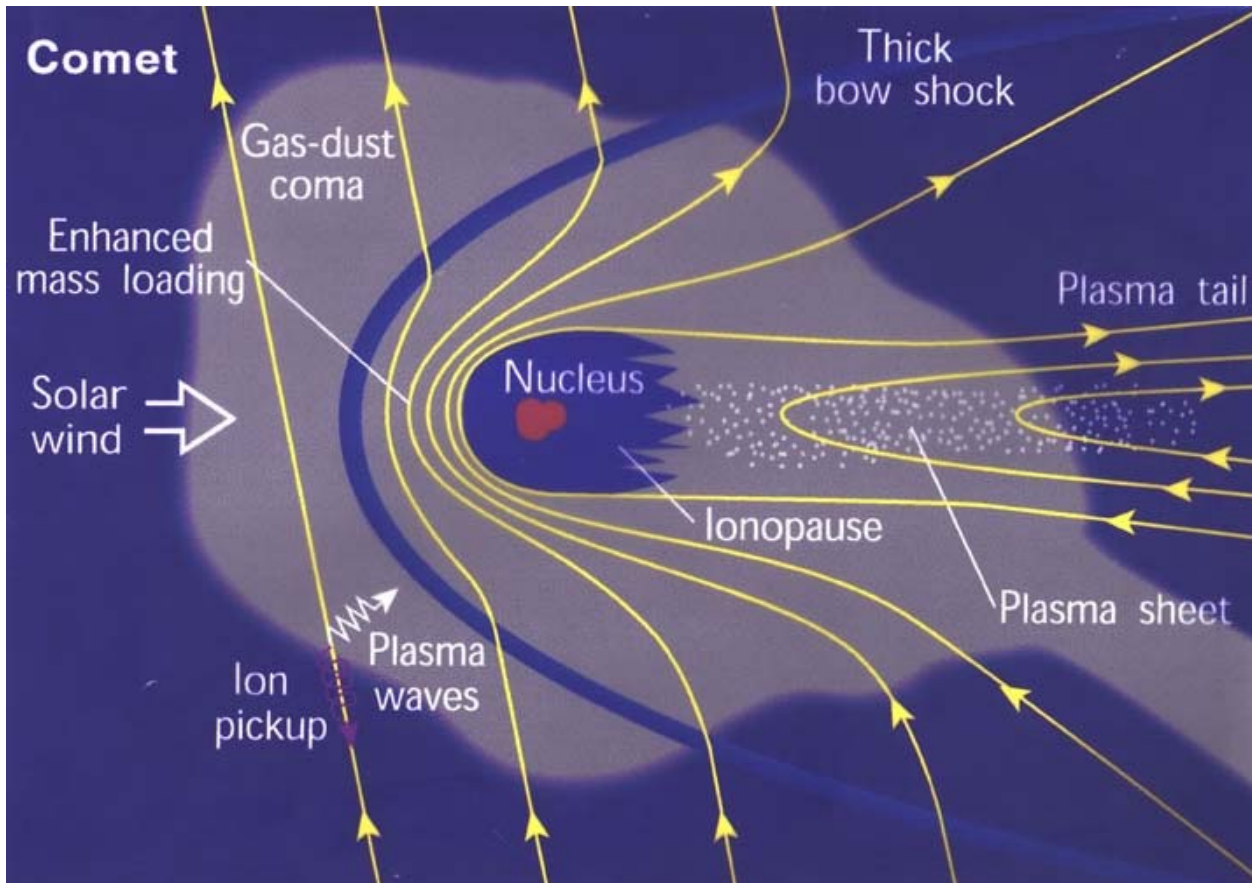
It was Hannes Alfvén who suggested in 1957 that cometary tails are due to the draping of the interplanetary magnetic field around the cometary nucleus.

To explain this draping effect C.S. Wu and R.C. Davidson in 1972 studied the pick-up of cometary ions and the associated mass loading of the solar wind.

Associated strong plasma wave turbulence due to this mass loading was first detected by B.T. Tsurutani and E.J. Smith in 1986.

The magnetic field draping itself was first measured by F. M. Neubauer and co-workers using magnetic field measurements made onboard the GIOTTO spacecraft.

1.5.3 The Cometary Magnetic field



1.6 Applicable Documents

Planetary Data System Data Preparation Workbook, February 1, 1995, Version 3.1, JPL, D-7669, Part1
 Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part 2
 ROSETTA, Archive Generation, Validation and Transfer Plan, January 10, 2006, RO-EST-PL-5011
 RPC-MAG Knowledge Management, Power-Point Presentation and Video (RO-3DSE-MAG)
 RO-RPC-UM, Rosetta Plasma Consortium: User's Manual
 RO-IGM-TR-0002, Fluxgate Magnetometer Calibration for Rosetta: Report on the FM and FS Calibration
 RO-IGM-TR-0003, Fluxgate Magnetometer Calibration for Rosetta: Analysis of the FM Calibration
 RO-IWF-TR-0001, Calibration Report, Sample Rate and Frequency Response - Analysis of ROSETTA RPCMAG
 RO-IGEP-TR-0007, DDS2PDS User Manual
 RO-IGEP-TR-0016, RPC Archiving Guidelines
 RO-IGEP-TR-0028, RPCMAG Step by step Calibration Procedure
 RO-IGEP-TR-0074, RPCMAG Userguide, Proper Usage of Magnetic Field Data and potential Pitfalls
 RPC User Guide
 RO-EST-TN-3165, ROSETTA Time Handling, 1.1, 28Feb 2006

1.7 Relationships to Other Interfaces

This EAICD describes the overall RPC-MAG archiving details. If there will be changes in the DDS2PDS Software, this EAICD and the DDS2PDS User manual, RO-IGM-TR0007, will be affected. Changes of the EAICD will not have any feedback to other documents, as the EAICD is changed at the end of the chain, taking into account any other document update made before. The current version V4.6 reflects the actual pipeline status which generated the datasets of version V9.0.

1.8 Acronyms and Abbreviations

A/D:	Analog/Digital
A/R:	As Required
AAD:	Attitude Anomaly Detector
AC:	Alternate Current
ACID:	Application Configuration Interface Data
ACK:	Acknowledge
ACM:	Active Cruise Mode
ACS:	Avionics Computer System
ACS:	Attitude Control System
ACU:	Attitude Control Unit
AD:	Applicable Document
ADC:	Analog-Digital-Converter
ADD:	Architectural Design Document
ADP:	Acceptance Data Package
AFM:	Asteroid Flyby Mode
AIT:	Assembly Integration Tests
AIU:	AOCMS Interface Unit
AIV:	Assembly, Integration and Verification
ALICE:	ORBITER PAYLOAD INSTRUMENT
ALS:	Alenia Spazio
AM:	Activation Mode
AME:	Absolute Measurement Error
AND:	Alphanumeric Display
ANSI:	American National Standards Institute
AO:	Announcement of Opportunity
AOCMS:	Attitude & Orbit Control Measurement System
AOCS:	Attitude and Orbit Control System
AOS:	Acquisition Of Signal
AOU:	Astronomical Observatory Uppsala
APC:	Active Payload Checkout
APD:	Active Payload Data Dump
APE:	Absolute Pointing Error
APID:	Application Process Identifier

APM:	Antenna Pointing Mechanism
APXS:	LANDER PAYLOAD INSTRUMENT
AQP:	Acquisition Period
AS:	Address State (1750 Processor)
ASA:	Austrian Space Agency
ASAP:	As soon as possible
ASF:	Additional Safety Factors
ASI:	Agenzia Spaziale Italiana
ASIC:	Application Specific Integrated Circuit
ATA:	Alignment Test Adapter
ATP:	Approach Transition Point
AU:	Astronomical Unit
AWG:	American Wire Gauge
BB:	Broad Band
BC:	Bus Controller
BCP1:	Broadcast Command Pulse
BCU:	Battery Charge Unit
BDR:	Battery Discharge Regulator
BDU:	Battery Discharge Unit
BER:	Bit Error Rate
B-FIELD:	Magnetic Field
BFL:	Back Focal Length
BIT:	Build In Test
BL:	Block Length, LAP
BMOS:	Buckling Margin Of Safety
BOB:	Break Out Box
BOL:	Beginning of Life
BPS:	Bits per second
BRU:	Battery Regulator Unit, Battery Recharge Unit
BSM:	Bus Support Module
C/C:	Collectively Controlled
CA:	Contract Authorisation
CADU:	Channel Access Data Unit
CAP:	Comet Acquisition Point
CAPS:	Cassini Plasma Spectrometer
CAV:	Command Acceptance Verification
CC:	Cost Code
CCB:	Configuration Control Board
CCCS:	Common Checkout & Control System
CCD:	Charged Coupled Device
CCDB:	Configuration Control Database
CCE:	Central Checkout Equipment
CCITT:	Consultative Committee International Telegraph & Telephone

CCN:	Change Contract Notice
CCR:	Configuration Control Request
CCS:	Central Check-out System
CCSDS:	Consultative Committee for Space Data Systems
CCU:	Central Computing Unit
CDC:	Clock Drift Correction
CDMS:	Central Data Management System
CDMU:	Central Data Management Unit
CDR:	Critical Design Review
CDV:	Command Dispatch Verification
CE:	Conducted Emission
CESR:	Centre d'Etude Spatiale des Rayonnements
CEV:	Command Execution Verification
CFRP:	Carbon Fibre Reinforced Plastic
CG:	67P/Churyumov-Gerasimenko
CGSE:	Cryocooling Ground Support Equipment
CHF:	Critical History File
CHL:	Command History Log
CHM:	Critical Housekeeping Unit
CI:	Configuration Item
CIA:	Communication Interface Adapter
CIDL:	Configuration Item Data List
CISAS:	Centro Interdipartimentale di Studi e Attivit... Spaziali
CIVA:	Comet nucleus Infrared and Visibility Analyser (Lander Payload)
CLA:	Calibration level A, data in URF coordinates
CLB:	Calibration level B, data in S/C coordinates
CLC:	Calibration level C, data in celestial coordinates
CLCW:	Command Link Control Word
CLE:	Calibration level E, resampled data in URF coordinates
CLF:	Calibration level F, resampled data in S/C coordinates
CLG:	Calibration level G, resampled data in celestial coordinates
CLH:	Calibration level H, RW disturbance eliminated data in celestial coordinates
CLTU:	Command Link Transmission Unit
CM:	Configuration Management
CMD:	Command
CMF:	Configuration Management Facility
CMO:	Configuration Management Officer
CMP:	Configuration Management Plan
CNES:	Centre Nationale d'Etude Spatiale
COB:	Consolidated Observation Request
COG:	Centre Of Gravity
Co-I:	Co-Investigator
COM:	Centre Of Mass

CONCERT:	ORBITER & LANDER PAYLOAD INSTRUMENTS
COP:	Command Operations Procedure
COSAC:	LANDER PAYLOAD INSTRUMENT
COSIMA:	ORBITER PAYLOAD INSTRUMENT
COTS:	Commercial Off The Shelf
CPDU:	Command Pulse Distribution Unit
CPU:	Central Processing Unit
CR:	Compression Ratio
CRAF:	Comet Rendezvous and Asteroid Fly-by mission
CRB:	CCD Readout Board
CRC:	cyclic redundancy check
CRF:	Command Request Files
CRID:	Command Request Interface Document
CReMA:	Consolidated Report on Mission Analysis
CRP:	Contingency Recovery Procedure
CRV:	Command Station Reception Verification
CS:	Checksum
CS:	Conducted Susceptibility
CSEQ:	Comet-Centric-Solar-Equatorial Coordinates
CSG:	Centre Spatiale Guyanaise
CSM:	Communication Switching Matrix
CSME:	Communication Switching Matrix Element
CSP:	Charge Sensitive Preamplifier
CSPL:	Consolidated Parameter Scenario List
CSV:	Command Station Radiation Verification
CSY:	Converter Synchronisation
CTC:	Cost to Completion
CUC:	CCSDS Unsegmented Time Code
CuL:	Kupferlackdraht, Enamelled copper wire
CUV:	Command Uplink Verification
CVP:	Commissioning and Verification Phase
D&D:	Design and Development
D/L:	Down Link
D/TOS:	Directorate of Technical and Operational Support
DARA:	Deutsche Agentur fuer Raumfahrtangelegenheiten
DAT:	Digital Analog Tape
DAWG:	Data Archiving Working Group
DB:	Database
DBMS:	Data Base Management System
DC:	Data Centre
DC:	Direct Current
DCA:	Dedicated Control Area
DCL:	Declared Components List

DCR:	Document Change Request
DCR:	Data Change Request
DCR:	Dedicated Control Room
DCS:	Dust Collector Subsystem (COSIMA)
DCT:	Discrete Cosine Transform
DDD:	Detailed Design Document
DDID:	Data Delivery Interface Document
DDS:	Data Distribution System
DDV:	Design Development and Verification
DEF:	Deflector
DFMS:	Double Focusing Mass Spectrometer
DIB:	DPU Interface Board
DISR:	Descent Imager/Spectral Radiometer
DLR:	Deutsches Zentrum fuer Luft und Raumfahrt e.V.
DM:	Dynamic Model
DMA:	Direct Memory Access
DML:	Declared Materials List
DML:	Delayed Memory Load command
DMPL:	Declared Mechanical Parts List
DMS:	Data Management System
DMSS:	Distributed Mission Support System
DoD:	Depth of Discharge
DOF:	Degree Of Freedom
DOP:	Division Operating Procedures
DOR:	Direct Operation Request
DPL:	Declared Process List
DPSS:	Data Packet Switching System
DPU:	Digital Processing Unit
DQE:	Detector Quantum Efficiency
DRAM:	Dynamic Random Access Memory
DRB:	Delivery Review Board
DS:	Digital Serial Acquisition
DS-1:	NASA's DeepSpace 1 Mission
DSDB:	Data Sheet Database
DSN:	Deep Space Network
DSP:	Digital Signal Processor
DSS:	Dornier Space Systems
DST:	Deep Space Transponder
DTMM:	Detailed Thermal Mathematical Model
DVAL:	ESA software to check PDS compliant datasets
DVALNG:	DVAL Next Generation
DWG:	Drawing
DWT:	Discrete Wavelet Transform

EAICD:	Experimenter to Archive Interface Control Document
ECDR:	Experiment Critical Design Review
ECF:	Expedited Command File
ECLIPJ2000:	Ecliptic J2000 Reference Frame
ECP:	Executable Control Procedures
ECR:	Expedite Command Request
ECR:	Engineering Change Request
EDAC:	Error Detection And Correction
EDC:	Error Detection Correction
EDF:	Experiment Description File
E-DSF:	Expedite - Detailed Schedule File
EE:	External Entity (SCOE)
EEPROM:	Electrically Erasable Programmable Read Only Memory
EFDR:	Experiment Final Design Review
EFOR:	Experiment Flight Operations Review
EGSE:	Electrical Ground Support Equipment
EID:	Event ID
EID:	Experiment Interface Document
EID:	Event Identification
EID-A:	Experiment Interface Document ,Part A
EID-B:	Experiment Interface Document ,Part B
EIDR:	Experiment Intermediate Design Review
EIRP:	Equivalent Isotropic Radiated Power
ELC:	Electron
EM:	Engineering Model
EMC:	ElectroMagnetic Compatibility
EMI:	ElectroMagnetic Interference
EOC:	End of Cycle
EOL:	End of Life
EOM:	End of Mission
EOP:	End of Packet
EPC:	Electrical Power Conditioner
EPS:	Electrical Power Subsystem
EPS:	Experiment Planning System
EQM:	Electrical Qualification Model
ERF:	Event Reporting Function
ERT:	Earth Received Time
ESA:	European Space Agency
ESA:	Electrostatic Analyzer
ESAC:	European Space Astronomy Centre
ESANET:	European Space Agency's communications Network
ESARAD:	ESA RADiation
ESATAN:	ESA Thermal Analyser

ESD:	Electrostatic Discharge
ESDS:	Electrostatic Discharge Sensitive
ESM:	Earth Strobing Mode
ESOC:	European Space Operations Centre
ESS:	Electrical Support System
ESTEC:	European Space Research and Technology Centre
ESTRACK:	European Space Tracking Network
ETS:	EMC Test Station
EUT:	Equipment under Test
EUV:	Extreme Ultra Violet
F/D:	Flight Dynamics
FAR:	Flight Acceptance Review
FAT:	Factory Acceptance Test
FAU:	File Assembly Unit
FCL:	Fold-Back Current Limiter
FCP:	Flight Control Procedure
FCS:	Flight Control System
FCT:	Flight Control Team
FCV:	Flow Control Valve
FD:	Flight Dynamics
FD:	Frequency Domain
FDIR:	Failure Detection, Isolation and Recovery
FDR:	Flight Dynamics (Control) Room
FDR:	Functional Design Review
FDR:	Flight Dynamics Request
FDS:	Flight Dynamics System
FE:	Front End
FEC:	Front End Controller
FEE:	Front End Equipment
FE-LAN:	Front-End Local Area Network
FEM:	Finite Element Model
FF:	Full Frame
FGM:	Fluxgate-Magnetometer
FID:	Function Identifier
FIFO:	First In First Out
FITO:	Fabrication and Test Outline
FM:	Flight Model
FM:	File Management
FMECA:	Failure Mode and Effects and Criticality Analysis
FMI:	Finnish Meteorological Institute
FMS:	Failure Management system
FMS:	File Management System
FOD:	Flight Operations Director

FOP:	Flight Operations Plan
FOP:	Flight Operation Procedure
FOV:	Field Of View
FP:	Formal Procedures
FPA:	Focal Plane Assembly
FPGA:	Field Programmable Gate Array
FRAP:	Fine Pointing Accuracy Phase
FRR:	Flight Readiness Review
FS:	Flight Spare
FSS:	First Science Sequence
FT:	File Transfer
FTA:	Fault Tree Analysis
FTP:	File Transfer Protocol
FTS:	File Transfer System
FUSE:	Far Ultraviolet Spectrograph Experiment
FUV:	Far Ultra Violet
FWM:	Filter Wheel Mechanism
G/S:	Ground Station
GFURD:	Ground Facilities User Requirements Document
GH:	Grand Heading
GIADA:	Grain Impact Analyser and Dust Accumulator (Orbiter Payload)
GLEP:	Pointing on Ephemeris Phase Phase with gyroless stellar estimator
GMI:	Global Mapping Insertion
GMT:	Greenwich Mean Time
GPIB:	General Purpose Instrument Bus (IEEE 488-75)
GPR:	Ground Penetrating Radar
GRD:	Graphic Display
GRM:	Ground Reference Model
GS:	Ground Station
GSDR:	Ground Segment Design Review
GSE:	Ground Support Equipment
GSEP:	Pointing on Ephemeris Phase Phase with Gyro-stellar estimator
GSIR:	Ground Segment Implementation Review
GSIS:	Ground Station Interface Specification
GSM:	Ground Segment Manager
GSMP:	Ground Segment Management Plan
GSOC:	German Space Operations Centre
GSP:	Ground commanded Slew Phase
GSRQR:	Ground Segment Requirements Review
GSRR:	Ground Segment Readiness Review
GW:	Gravitational Waves
H/W:	Hardware
HDBK:	Handbook

HDR:	Hardware Design Review
HF:	High Frequency
HFC:	High Frequency Clock
HGA:	High Gain Antenna
HGAPM:	HGA Pointing Mechanism
HIB:	Hibernation
HIPPS:	Highly Integrated Pluto Payload System
HK:	Housekeeping
HL:	High Limit
HM:	Hibernation Mode
HMC:	Halley Multicolour Camera
HOOD:	Hierarchical Object Oriented Design
HPA:	High Power Amplifier
HPC:	High Power Command
HPCM:	HPC Module
HPD:	High Performance Demodulator
HRM:	Holddown & Release Mechanism
HSD:	High Speed Data
HTCB:	Handling Transport Clamp Band
HV:	High Voltage
HVPS:	High Voltage Power Supply
I&T:	Integration & Testing
I/C:	Individually Controlled
I/F:	Interface
I/O:	Input/Output
IAA:	Instituto de Astrofisica de Andalucia
IABG:	Industrieanlagenbetriebsgesellschaft
IAS:	Institute d'Astrophysique Spatiale
IAS-CNR:	Istituto di Astrofisica Spaziale/Consiglio Nazionale delle Ricerche
IB:	Inboard
I-BOB:	Intelligent Break Out Box
IC:	Imperial College, London
ICA:	RPC Ion Composition Analyzer
ICD:	Interface Control Document
ID:	Identifier
IDA:	Institut fuer Datenverarbeitungsanlagen
IDL:	Interactive Data Language
IDR:	Instrument Design Review
IEEE:	Institute of Electric and Electronics Engineers
IES:	RPC Ion and Electron Spectrometer
IF:	Intermediate Frequency
IFEM:	Interface Finite Element Model
IFOV:	Intrinsic Field Of View

IGEP:	Institut fuer Geophysik und extraterrestrische Physik, TU-Braunschweig
IMMM:	Interface Mechanical Mathematical Model
IMP:	Imager for Mars Pathfinder
INTA:	Instituto Nacional de Tecnica Aeroespacial
IQR:	Internal Quality Report
IR:	Infra Red
IS:	Impact Sensor (GIADA)
ISO:	International Standards Organisation
IST:	Integrated System Test
IT:	Integration Test
IT:	Interruption
ITL:	Instrument Time Line
ITMM:	Interface Thermal Mathematical Model
ITP:	Integration Test Plan
ITR:	Integration Test Report
ITT:	Invitation To Tender
IUE:	Internal Ultraviolet Explorer
IWF:	Institut fuer Weltraumforschung, Graz
JPEG:	Joint Photographics Experts Group
JPL:	Jet Propulsion Laboratory
KAL:	Keep Alive Line
KAU:	Kilo Accounting Units
KBPS:	Kilo-Bits Per Second
KFKI:	Hungarian Research Institute for Particle and Nuclear Physics
KO:	Kick Off
L:	Launch (time)
LABVIEW:	Graphic S/W for Data analysis and H/W control
LAN:	Local Area Network
LAP:	RPC Langmuir Probe Experiment
LAS:	Laboratoire d'Astronomie Spatiale
LCB:	Last Chance Bit
LCDA:	Launcher Coupled Dynamic Analysis
LCL:	Latching Current Limiter
LDL:	Long Debye Length (LAP/MIP Mode)
LEOP:	Launch and Early Orbit Phase
LESS:	Lander Electrical Support System
LET:	Linear Energy Transfer
LEXAN:	Polycarbonate resin thermoplastic
LF:	Low Frequency
LGA:	Low Gain Antenna
LID:	Lander Interface Document
LIFO:	Last In First Out
LIGA:	Lithographie, Galvanoformung und Abformung

LILT:	Low Intensity Low Temperature
LISN:	Line Impedance Stabilization Network
LIT:	Listen-In Test
LL:	Low Limit
LM:	Launch Mode
LMSS:	Lander Mechanical Support and Separation systems
LNA:	Low Noise Amplifier
LO:	Local Oscillator
LOR:	Lander Operational Request
LOS:	Loss Of Signal
LOS:	Line Of Sight
LPCE:	Laboratoire de Physique et Chimie de l'Environnement
LRR:	Launch Readiness Review
LSB:	Least Significant Bit
LSI:	Large Scale Integration
LTP:	Long Term Planning
LU:	Latch Up
LV:	Latch Valve
LVO:	Label Value Object
LVPS:	Low Voltage Power Supply
LW:	Launch Window
LZ:	Lander = SSP
M&C:	Monitoring and Control
MAC:	Model Assurance Criterion
MACOR:	Machinable glas ceramic
MACS:	Modular Attitude Control System
MAG:	Fluxgate Magnetometer (RPC)
MAP:	Multiplexing Access Point
MAS:	Mission Analysis Section
MB:	Measurement Block
MBS:	Micro Balance Sensor (GIADA)
MC:	Measurement Cycle
MCF:	Magnetic Coil Facility
MCM:	Monitoring and Control Module
MCM:	Multi Chip Module
MC-OCF:	Master Channel - Operational Control Field
MCP:	Micro Channel Plate
MCR:	Main Control Room
MCR:	Memory Checksum Request
MCRR:	Mission Commissioning Results Review
MCS:	Mission Control System
MDR:	Memory Dump Request
MGA:	Medium Gain Antenna

MGM:	Magnetometer
MGSE:	Mechanical Ground Support Equipment
MIB:	Mission Information Base
MICD:	Mechanical Interface Control Document
MID:	Memory Identifier
MIDAS:	ORBITER PAYLOAD INSTRUMENT
MINT:	Monitoring Interval
MIP:	RPC Mutual Impedance Probe
MIP:	Mission Implementation Plan
MIP:	Mandatory Inspection Points
MIRD:	Mission Implementation Requirements Document
MIRO:	Microwave Instrument for the Rosetta Orbiter (Orbiter Payload)
ML:	Memory Load, Medium Level
MLC:	Memory Load Command
MLI:	Multi Layer Insulation
MM:	Mass Memory
MM:	Memory Management
MMB:	Mass Memory Board
MMD:	Mimic Display
MMH:	Mono Methyl Hydrazine, (MMH-LTO)
MMI:	Man Machine Interface
MMS:	Matra Marconi Space
MMU:	Memory Management Unit
MOC:	Mission Operations Centre
MOD:	Mission Operations Department
MOI:	Moment Of Inertia
MOM:	Minutes of Meeting
MOP:	Mission Operations Phase
MOS:	Margin Of Safety
MOU:	Memorandum Of Understanding
MPA:	Mission Planning Area
MPAE:	Max Planck Institut fuer Aeronomie
MPI:	Max Planck Institut
MPIK:	Max Planck Institut fuer Kernphysik
MPP:	Multiple Phase Pinning
MPPT:	Maximum Power Point Tracking
MPR:	Memory Patch Request
MPS:	Mission Planning System
MPS:	Max Planck Institut fuer Sonnensystemforschung
MPTS:	Multi Purpose Tracking System
MRB:	Material Review Board
MRODE:	Magnetsrode Coil Facility, TUBS
MRT:	Mission Readiness Test

MSB:	Most Significant Bit
MSDR:	Mission System Design Review
MSP :	Master Science Plan
MSS:	Mechanical Support and Separation system
MSSW:	Mission Specific Software
MST:	Mission Simulation Test
MTL:	Mission Timeline
MTP:	Mid Term Planning
MTTR:	Mean Time To Repair
MUPUS:	Multi Purpose Sensor experiment (Lander Payload)
MUSC:	Microgravity User Support Centre
MUX:	Multiplexer
N/A:	Not Applicable
NAC:	Narrow Angle Camera
NACK:	Not Acknowledge
NAIF:	Navigation and Ancillary Information System of NASA
NASA:	National Aeronautics and Space Administration
NASAPSCN:	NASA Private System Communication Network
NASTRAN:	NASA Structural Analysis Tool
NAVCAM:	Navigation Camera
NB:	Narrow Band
NC:	Non Conformity
NCM:	Near Comet Mode
NCR:	Non Conformance Report
NCTRS:	Network Control and Telemetry Receiver System
NDIU:	Network Data Interface Unit
NDM:	Neutral Dynamics Monitor
NF:	Normal Frequency
NI:	Nation Instruments
NM:	Normal Mode
NOCC:	Network Operations Control Centre (JPL)
NRT:	Near Real Time
NRZ-L:	Never Return to Zero-Level
NTO:	Nitrogen Tetroxide
OA:	Operational Archive
OAP:	Off Axis Paraboloid
OB:	Onboard
OB:	Outboard
OBC:	On-Board Computer
OBC:	On-Board Clock
OBCP:	On-Board Control Procedure
OBDH:	On-Board Data Handling
OBEM:	On-Board Event Monitoring

OBR:	Observation Request
OBS:	On-Board Software
OBSM:	On-Board Software Maintenance
OBSW:	On-Board Software
OBT:	On-Board Time
OC:	Output Code
OC:	Open Centre
OCC:	Operations Control Centre
OCM:	Orbit Correction Manoeuvre
OCM:	Orbit Control Mode
OCXO:	Oven Controlled Crystal Oscillator
OD:	Operations Director
OGS:	Operations Ground Segment
OHP:	Observatoire d'Haute Provence
OIOR:	Orbiter Instrument Operational Request
OIP:	Orbit Injection Point
OM:	Operations Manager
OMM:	Operational Macro Mode
OOL:	Out Of Limits
OPAMP:	Operational Amplifier
OPI:	Orbiter Payload Instrument
OPS:	Operations
ORATOS:	Orbit Attitude Operations System
ORS:	Operation Request Structure
OSI:	Open System Interconnection
OSIRIS:	Optical, Spectroscopic and Infrared Remote Imaging System (Orbiter Payload)
OU:	Open University
P/B:	Play Back (data from Solid State Recorder)
P/L:	Payload
PA:	Product Assurance
PAIP:	Product Assurance Implementation Plan
PALASIM:	Parallel Access Large Silicon Memory
PC:	Project Control
PC:	Passive Checkout
PCA:	Pressure Controlled Assembly
PCAT:	Packet Category
PCB:	Printed Circuit Board
PCE:	Power Controller Electronics
PCM:	Pulse Code Modulation
PCM:	Power Converter Module
PCS:	Packet Check Sequence
PCU:	Power Control Unit

PDF:	Product Definition File
PDL:	Pseudo Design Language
PDOR:	Payload Direct Operation Request
PDR:	Preliminary Design Review
PDS :	Planetary Data System
PDU:	Power Distribution Unit
PEM:	Project Element Manager
PEM:	Plasma Environment Monitor
PERMALLOY:	Nickel Iron magnetic alloy
PES:	Performance Evaluation System
PFC:	Parameter Format Code
PFM:	Proto Flight Model
PHD:	Project History Documents
PI:	Principal Investigator
PID:	Process Identifier
PID:	Parameter Identifier
PIR:	Post Integration Review
PISA:	Principal Investigators Support Area
PIU:	Plasma Interface Unit (RPC)
PKT:	Packet
PLM:	Payload Module
PM:	Project Manager
PM:	Processing Module
PMD:	Propellant Management Device
PMIS:	Project Management Information System
PMP:	Part Material and Process
PMU:	Processor Module Unit
POR:	Payload Operation Request
PPWR:	Primary Power
PRNU:	Pixel Response Non Uniformity
PROM:	Programmable Read Only Memory
PRR:	Propellant Refillable Reservoir
PS:	Pass Schedule
PSA:	Planetary Science Archive
PSF:	Point Spread Function
PSK:	Phase Shift Key
PSM:	Payload Support Module
PSR:	Project Support Room
PSR:	Processor Status Registers
PSR:	Project Status Review
PSRI:	Planetary Science Research Institute
PSS:	Portable Satellite Simulator
PSS:	Procedures, Specifications and Standards

PSS:	Programme System Standards
PSU:	Power Supply Unit
PT:	Product Tree
PT1000:	Platinum Thermistor with 1000 Ohm nominal resistance
PTC:	Parameter Type Code
PTR:	Pointing Requirement File
PTT:	Post, Telegraph and Telephone authority
PTV:	Pre-Transmission Validation
PUS:	Packet Utilisation Standard
PVNC:	Pyro Valve Normally Closed
PVNO:	Pyro Valve Normally Opened
QA:	Quality Assurance
QAE:	Quality Assurance Engineer
QAM:	Quality Assurance Management
QAPM:	Quality Assurance Procedures Manual
QC:	Quality Control
QPM:	Quality Policy Manual
QTR:	Qualification Test Review
R&D:	Research & Development
R/T:	Real Time (system)
RAF:	Return All Frames
RAL:	Rutherford Appleton Laboratory
RAM:	Random Access Memory
RAMS:	Reliability, Availability, Maintainability and Safety
RAW:	Data in units of ADC counts in instrument coordinates
RBW:	Resolution Band Width
RC:	Responsibility Code
RC:	Remote Computer
RCCCS:	Rosetta Common Checkout & Control System
RCS:	Reaction Control Subsystem
RD:	Reference Document
RDB:	Rosetta Database
RDDD:	Rosetta Database Definition Document
RDDS:	Rosetta Data Disposition System
RDM:	Raw Data Medium
RDVM:	Rendezvous Manoeuvre
RE:	Radiation Emission
RF:	Radio Frequency
RF S/S:	Radio Frequency Subsystem (TT&C S/S)
RFC:	Request For Change
RFC:	Radio Frequency Self Compatibility
RFD:	Request for Deviation
RFDU:	Radio Frequency Distribution Unit

RFI:	Radio Frequency Interface
RFMU:	Radio Frequency Mock-Up
RFW:	Request For Waiver
RH:	Radiation Hardened
RID:	Review Item Discrepancy
RIS:	Remote Imaging System
RISC:	Reduced Instruction Set Computer
RL:	Register Load
RLA:	Register Load Address
RLG:	Ring Laser Gyro
RLGS:	Rosetta Lander Ground Segment
RM:	Reconfiguration Module
RMCS:	Rosetta Mission Control System
RMOC:	Rosetta Mission Operations Centre
RNCTRS:	Rosetta Network Control & Telemetry Receiver System
ROIRD:	ROSETTA Operations Interface Requirements Document
ROKSY:	ROSETTA Knowledge Management System
ROLIS:	LANDER PAYLOAD INSTRUMENT
ROM:	Read Only Memory
ROMAP:	Rosetta Magnetic Field and Plasma experiment (Lander Payload) Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (Orbiter Payload)
ROSINA:	Payload)
ROSIS:	ROSETTA Spacecraft Interface Simulator
RP:	Rundown Phase
RPC:	Rosetta Plasma Consortium (Orbiter Payload)
RPC-0:	RPC Main Electronics Box
RPCMAG:	ROSETTA Orbiter Magnetometer
RPC-MAG:	ROSETTA Orbiter Magnetometer
RPE:	Relative Pointing Error
RPM:	Remote Processing Module
RPRO:	ROSETTA Common Packetized Protocol
RRP:	Rate Reduction Phase
RS:	Radiated Susceptibility
RSDB:	Rosetta System Data Base
RSI:	Radio Science Investigation (Orbiter Payload)
RSOC:	Rosetta Science Operations Centre
RSS:	Root Sum Square
RT:	Real Time
RT:	Remote Terminal
RTC:	Real Time Clock
RTM:	Reduced Thermal Model
RTMM:	Reduced Thermal Mathematical Model
RTOF:	Reflectron Time Of Flight

RTU:	Remote Terminal Unit
RW:	Reaction Wheels
RWA:	Reaction Wheel Assembly
RWL:	Reaction Wheel
RX:	Receiver
S/A:	Solar Array
S/C:	Spacecraft
S/C:	Spacecraft
S/HM:	Safe/Hold Mode
S/S:	Spacecraft Subsystem
S/W:	Software
SA:	Solar Array
SAA:	Solar Aspect Angle
SADM:	Solar Array Drive Mechanism
SAM:	Sun Aquisition Mode
SAP:	Sun Aquisition Phase
SAP:	Science Activity Plan
SAS:	Sun Aquisition Sensor
SASW:	Standard Application Software
SBDL:	Standard Balanced Digital Link
SCET:	Spacecraft Elapsed Time
SCL:	Spacecraft Control Language
SCOE:	Spacecraft Check Out Equipment
SCP:	Sun Capture Phase
SDB:	Satellite (Spacecraft) Data Base
SDD:	System Design Document
SDE:	Software Development Environment
SDID:	Station Data Interchange Document
SDR:	System Design Review
SE:	System Engineer
SEL:	Single Event Latch-up
SEPAC:	Space Experiment with Particule Accelerator
SESAME:	LANDER PAYLOAD INSTRUMENT
SEU:	Single Event Upset
SF:	Safety Factor
SFDU:	Standard Formatted Data Units
SFT:	System Functional Test
SGICD:	Space Ground Interface Control Document
SGM:	Safeguard Memory
SGS:	Science Ground Segment
SI:	Silicon
SID:	Science Mode Identifier
SID:	Structure Identifier

SIM:	Simulator
SIMSAT:	Software Infrastructure for Modelling SATellites
SIR:	Simulation Room
SIS:	Spacecraft Information System
SIS:	Spacecraft Interface Simulator
SIV:	Software Independent Validation
SKM:	Sun Keeping Mode
SLE:	Space Link Extension
SLI:	Space wire Link I/F
SM:	Structural Model
SMCS:	Scalable Multi-Channel Communication Subsystem
SMD:	Surface Mounted Device
SNR:	Signal to Noise Ratio
SOC:	Science Operations Centre
SOHO:	Solar & Heliospheric Observatory
SOM:	Spacecraft Operations Manager
SOR:	Spacecraft Operation Request
SOT:	Science Operations Team
SOW:	Statement of Work
SOWG:	Science operating working group
SPACON:	Spacecraft Controller
SPB:	Superpixel Binning
SPC:	Science Programme Committee
SPD:	Space Division
SPEVAL:	Spacecraft Performance Evaluation System
SPG:	Single Point Ground
SPICE:	Comprehensive S/W system for Celestial Mechanics by NAIF
SPL:	Scenario Parameter List
SpM:	Sin-up Mode
SPP:	Sun Point Phase
SPR:	Software Problem Report
SPT:	Specific Performance Test
SPWR:	Secondary Power
SQA:	Terma Space Division Quality Assurance
SR:	Software Requirements
SRD:	Software Requirements Document
SREM:	Standard Radiation Environment Model
SRR:	Subsystems Requirements Review
SSC:	Source Sequence Counter
SSC:	Status Consistency Checking
SSD:	Space Science Department
SSMM:	Solid State Mass Memory
SSP:	Surface Science Package

SSPA:	Solid State Power Amplifier
SSR:	Solid State Recorder
STC:	Station Computer
STIL:	Irish Space Technology Institute
STM:	Structural Thermal Model
STN:	Standard
STO:	Soyuz Transfer Orbit
STP:	Short Term Planning
STP:	System Temperature Point
STR:	Star Tracker
STSP:	Solar Terrestrial Science Programme
SUM:	Software User Manual
SuM:	Survival Mode
SVF:	Software Validation Facility
SVM:	Service Module
SVT:	System Validation Test
SW:	Software
SWG:	Science Working Group
SWR:	Standing Wave Ratio
SWRI:	South West Research Institute
SWT:	Science Working Team
TBC:	To be confirmed
TBD:	To be Defined
TBI:	To be Inserted
TBP:	Time Broadcast Pulse
TBR:	To be resolved
TBS:	To be supplied
TBW:	To be written
TC:	Telecommand
TC S/S:	Thermal Control Subsystem
TCDL:	Test Configuration Data List
TCDP:	Tele Command Detail Parameter
TCGP:	Tele Command Global Parameter
TCM:	Trajectory Correction Manoeuvre
TCP-IP:	Transport Protocol-Internet Protocol
TCS:	Test Control System
TCS:	Thermal Control Subsystem
TCSL:	Test Configuration Status List
TD:	Time Domain
TER:	Terma Elektronik A.S.
TF:	Transfer Function
TFG:	Transfer Frame Generator
THA:	Transport Handling Adapter

TID:	Task Identifier
TIDE:	Thermal Ion Dynamics Explorer
TLC:	Telecommand
TLM:	Telemetry
TM:	Telemetry
TM:	Technical Manager
TM:	Telemetry
TMM:	Thermal Mathematical Model
TMP:	Telemetry Processing System (within ground station)
TOP:	Transfer Orbit Phase
TR:	Tone Ranging
TRB:	Test Review Board
TRP:	Temperature Reference Point
TRP:	Test Report
TRP:	Temperature Reference Point
TRR:	Test Readiness Review
TRRB:	Test Readiness Review Board
TS:	Time Series
TSE:	Test Support Equipment
TSP:	Test Specification
TSY:	Timer Synchronisation Pulse
TT&C:	Tracking, Telemetry & Commanding
TT&C S/S:	Telemetry, Telecommand and Communication Subsystem (RF S/S)
TUB:	Technical University of Berlin
TUB:	Technical University Braunschweig
TUBS:	Technical University Braunschweig
TUB:	Technical University of Budapest
TV:	Thermal Vacuum
TWTA:	Travelling Wave Tube Assembly
TWTL:	Two Way Travelling Lighttime
TX:	Transmitter
U/L:	Up Link
UARS:	Upper Atmospheric Research satellite
UD:	User Defined
UFT:	Unit Functional Test
UM:	User Manual
UMOS:	Ultimate Margin Of Safety
UPM:	Universidad Politecnica de Madrid
URD:	User Requirements Document
URF:	Unit Reference Frame
us:	microsecond
USO:	Ultra Stable Oscillator
UTC:	Universal Time Coordinated

UTC:	Universal Time Code
UV:	Ultra Violet
UVD:	Under Voltage Detector
UVSC:	Ultra Violet Spectrometer Component
V&V:	Verification & Validation
VC:	Virtual Channel
VCA:	Virtual Channel Assembler
VCN:	Virtual Channel Multiplexer
VDC:	Voltage Direct Current
VDU:	Video Display Unit
VHDL:	VHSIC Hardware Description Language
VHF:	Very High Frequency
VHSIC:	Very High Speed Integrated Circuit
VI:	Virtual Instrument, S/W Routine for NI Labview
VIMS:	Visual Infrared Mapping Spectrometer
VIRTIS:	ORBITER PAYLOAD INSTRUMENT
VIS:	Vertical Integration Stand
VIS:	Visual
VSWR:	Voltage Standing Wave Ratio
VT:	Validation Test
VTP:	Validation Test Plan
VTR:	Validation Test Report
W/S:	Work Station
WAC:	Wide Angle Camera
WAOSS:	Wide Angle Optoelectric Stereo Scanner
WBS:	Work Breakdown Structure
WBS:	Workpackage Breakdown Structure
WCA:	Worst Case Analysis
WD:	Watch Dog
WDE:	Wheel Drive Electronics
WDW:	Window
WIU:	Wave Guide Interface Unit
WOL:	Wheel Offloading of RW
WP:	Work Package
WPD:	Work Package Description
WRT:	With Respect To
WTC:	Wavelet Transform Coding
WVR:	Water Vapor Radiometer
WWW:	World Wide Web
YMOS:	Yield Margin Of Safety
ZOM:	Zero Order Monitor

1.9 Contact Names and Addresses

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2 Overview of Instrument Design, Data Handling Process and Product Generation

The ROSETTA orbiter magnetometer is part of the ROSETTA Plasma Consortium set of scientific instruments. The purpose of the magnetometer is the measurement of the interplanetary magnetic field close to different targets visited by the ROSETTA spacecraft.

To measure the magnetic field a system of two ultra light triaxial fluxgate magnetometers (about 36 g each) is used, with the outboard (OB) sensor mounted close to the tip of the about 1.55 m long spacecraft boom pointing away from the comet nucleus and with the inboard (IB) sensor on the same boom about 15 cm closer to the spacecraft body. The OB position on the boom is at 1.48m, the IB position is at 1.33m distance from the spacecraft. Two magnetometer sensors are required to minimise the influence of the rather complex spacecraft field on the actual measurements, and for redundancy purposes.

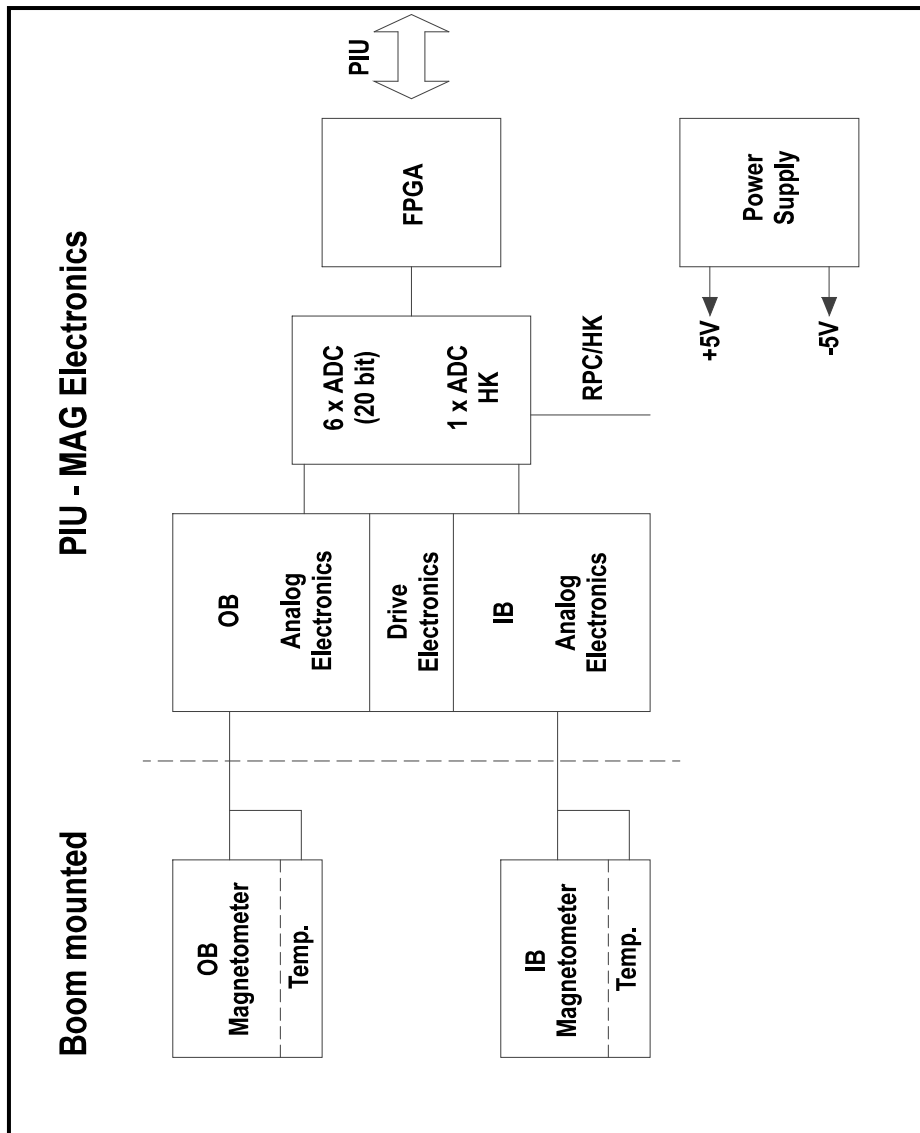
In order to meet the scientific requirements as discussed above the spacecraft magnetic DC-field requirement is about 25 nT at the outboard MAG sensor. To achieve this goal a magnetic cleanliness programme was planned, conducted by the experimenter team, supported by the ROSETTA project.

To further eliminate spacecraft fields and zero-offsets the so called multi-magnetometer technique will be applied in conjunction with statistical in-flight techniques. To increase time resolution 6 A/D converters (one for each of the six sensor channels) will be used synchronously. The A/D converters have a resolution of 20 bits each. MAG is operated with a maximum temporal resolution of about 20 vectors/sec outboard and 1 vector/s inboard. The raw vectors are transmitted from MAG to PIU with this constant vector rate. PIU is undersampling and filtering the raw vectors according to the current mode which is set according to the actual telemetry budget available. (Refer to refer to Table 7 on page 79 for details.)

The Orbiter Magnetometer RPCMAG can be characterized by the following features:

- Fluxgate-Magnetometer with a resolution of +/- 31 pT
- Measurement Range ; +/- 16384 nT
- 2 Sensors: Outboard (OB) / Inboard (IB)
- 20 Bit ADC
- Measuring B-Field in 3 components with a maximum vector rate of 20 Hz.
- The Fluxgate Magnetometer RPC-MAG performance parameters are in full accordance with the EID-B design goals

- The Outboard/ Inboard sampling rate can be inverted by command either for higher Inboard time resolution or in case of outboard failure. For the nominal sampling rate of each mode refer to Table 7 on page 79.
- The sensors are fully calibrated also versus a wide temperature range.
- The temperature at Outboard and Inboard sensor is monitored in MAG housekeeping data.
- The instrument delivers time series of the 3 dimensional magnetic field vector.



Block diagram of the RPCMAG Instrument

2.1 Data Handling Process

The RPC-MAG data are provided by IGEP using mainly the DDS2PDS S/W package.

2.1.1 Data Processing from DDS to PDS

Details can be found in the DDS2PDS User Manual RO-IGEP-TR0007.

- The overall data processing can be done mainly by the IDL S/W package **DDS2PDS**. This consists of several routines for different purposes:
 - Copying TM raw data from our ftp-server to the local analysis PC
 - Converting /Decoding these binary data to ASCII data. This is done by calling the MATLAB S/W **RAW2ASCII** from the IDL program.
 - Reading Attitude and Orbit info from SPICE kernels
 - Generating PDS Files from these ASCII raw data (Routine: **GEN_CAL_DATA**)
 - Generating Plots
 - Elimination of Reaction wheel influence
 - Elimination of LAP Disturbance
 - Considering Lander heater current disturbance
 - Setting Quality flags to CALIBRATED and RESAMPLED data
 - Generating log files

- Binary TM data can be just read and converted to ASCII by **RAW2ASCII**

Program Details:

- developed in MATLAB under Windows by Hans Eichelberger, IWF, GRAZ
- this S/W acts as I/F between the binary raw data transmitted by the DDS/EGSE/IC-FTP server and the scientific usable data.
- The program converts binary raw data into ASCII data and adds the necessary time information (UTC) for the subsequent scientific analysis. Bad vectors are marked. All written ASCII files get a header starting with #
- It reads
 - Magnetic field raw data in all modes (SID1 - SID6)
 - Temperature data (IB/OB)
 - HK data
- The program can be executed via a batch job to guarantee a more or less automatic data generation/conversion process.
- The converted ASCII data will be merged with auxiliary data and processed with **GEN_CAL_DATA** to obtain scientific usable data in PDS format. This IDL routine acts as I/F between the ASCII raw data converted by RAW2ASCII and the PDS System.
 - GEN_CAL_DATA reads: (files can be read from a list for automatic data generation)

Magnetic field ASCII raw data:

RPCMAGyymmddThhmm_RAW_<sensor>_<MODE>.ASS

Auxiliary data - Attitude: SPICE Kernel

Auxiliary data - Position: SPICE Kernel

Housekeeping data: RPCMAGyymmddThhmm_RAW_HK.ASC

Calibration files: RPCMAG_GND_CALIB_FSDPU_FM<sensor>.TXT,

Boom alignment file: RPCMAG_SC_ALIGN.TXT

Boom_alignmnt_improvement: RPCMAG_BOOM_ALIGN_CORR_EF1.ASC

Inflight Calibration coefficients INFCAL_OFF_<sensor>_20180305_009.ASC

INFCAL_PARA_<sensor>_20180305_009.ASC

- Functions of GEN_CAL_DATA:
 - 1) Apply temperature dependent ground calibration results to get B-field in unit coordinates.
 - 2) Apply actual "inflight" temperature model to get rid of temperature influence. This model has been created using long term magnetic field data during the whole mission in order to extend the ground calibration down to -160°C (s. below).
 - 3) Apply an inflight offset model derived from long term observations at the comet. It uses the properties of statistical solar wind features, cavity signatures, joint ROMAP observations after landing on 67P.
 - 3) Turn B-field from instrument to s/c coordinates
 - 4) Apply attitude data to get B-field in CSEQ frame (or a similar one)
 - 5) Apply filters, spike detectors ... data processing routines to get "scientific usable magnetic field data" in ASCII time series.
- GEN_CAL_DATA writes

PDS compliant calibrated data files and labels on different stages (*.TAB, *.LBL).

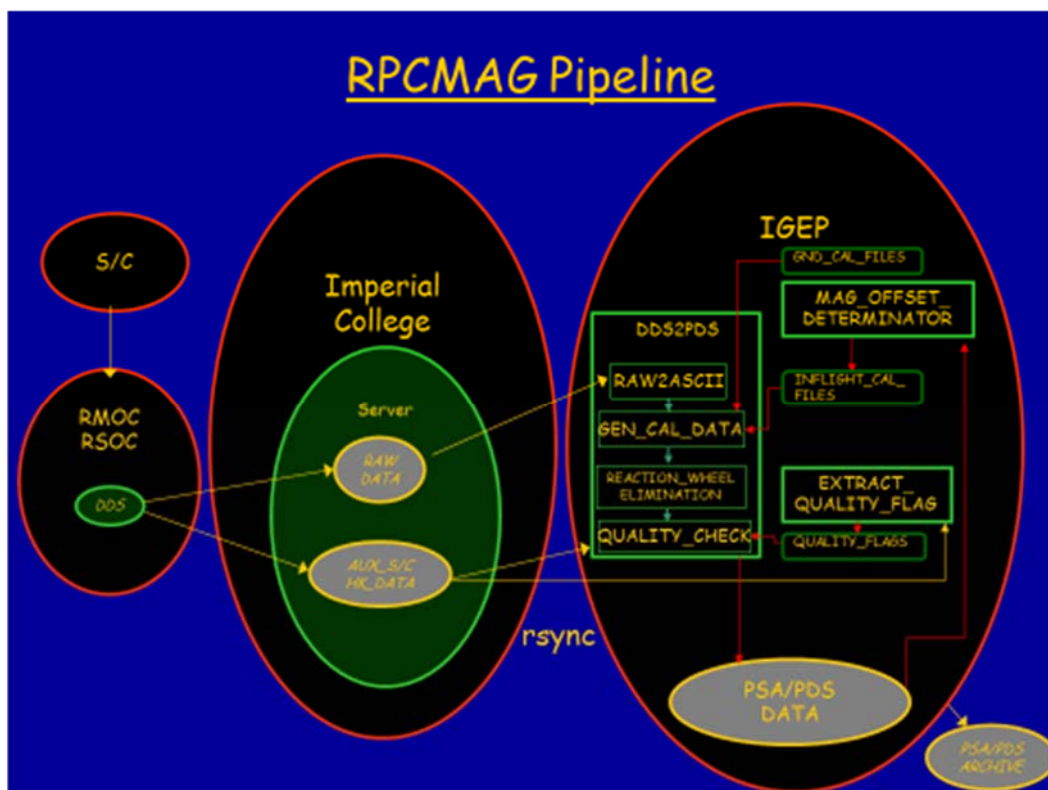
- After the first generation of data the global offset and temperature model can be generated using an interactive software package called

MAG_OFFSET_DETERMINATOR_CLE_CLG_TEMPERATURE_AUTO_SW_CAV_SDL_V10A_<sensor>.vi
which is written in LABVIEW. This S/W reads averaged magnetic field data (600s) and auxiliary

information about solar wind phases, times of diamagnetic cavity, thruster activities, etc. and computes the INFLIGHT_CALIBRATION files containing a temperature model for the offset behavior and times of offset jumps and the height of these jumps. These calibration files will then be read by DDS2PDS in a second step in order to generate the final PDS data with adjusted offsets and new label files.

- At the next step of the pipeline the disturbances of the s/c reaction wheels can be automatically eliminated using the IDL routine REACTION_WHEEL_ELIMINATION. This needs the nominal frequencies of the Reaction wheels (RW) at any time as input. The elimination is conducted in the frequency domain of the magnetic field data by subtracting a certain amount of the known RW-disturbance lines in order to smooth the spectrum. Finally the purged data are Fourier retransformed to the time domain. This elimination can be and is only done for the high sampled OB data in burst mode, as the disturbance for these kind of data appears in the higher frequent range of 1 – 10 Hz. For IB or normal mode data the disturbance occurs in the working range of 0 -500 mHz and cannot uniquely be distinguished from the real plasmaphysical signals.
- At a final step the data and label files have to be reprocessed in order to fulfill the PDS3 standards completely. The label *.LBL files are checked, quality information is added, dataset information is updated, and the files are reformatted to 80 characters per line.

The placeholders for the quality flags in the data files *.TAB have to be exchanged by real quality flags. This can only be done after a scientific analysis of the data and comparison with s/c housekeeping data, like spacecraft and payload events, thruster activities during Wheel offloading (WOL) and orbit correction maneuvers (OCM) have been conducted. Furthermore the OB and IB data are checked mutually to derive a joint quality measure. For these tasks various manual steps have to be performed using specific IDL s/w (*quality_check.pro*) and interactively operated LABVIEW software (*extract_quality_flags_OCM_WOLt.vi*).



After generating all the dataset and checking them with ESA's validation tool DVAL the data are copied (via SCP) to the Imperial college SFTP server as backup and in compressed form to ESA's PSA server.

2.1.2 Conversion of ADC-Counts to Physical Values

The measured values of the instrument are digitized by ADC-converters. The conversion from the raw ADC-counts to meaningful physical raw values (still uncalibrated) is different for magnetic field values and housekeeping values like e.g. instrument voltages. The following subsections show detailed algorithms of the conversion from ADC counts to physical values

- General Remarks

RPCMAG contains seven 20bit ADCs. 3 are used for the digitalization of magnetic field data measured by the OB sensor, 3 are used for the magnetic field data of the IB sensor, and the seventh, which is operated with a multiplexer, converts various Housekeeping (HK) data.

The reference voltage of the ADCs is 2.5 V. The converters are operated in a bipolar mode, thus input voltages in the range of +-2.5V can be converted. The relation of input voltage and counts is:

00000h <-> -2.5V

80000h <-> 0V

FFFFFFh <-> +2.5V

Due to the small input range some voltage adaption has to be done in the MAG instrument for certain HK values:

- * the 2.5V reference voltage is monitored behind a voltage divider

$100016 \text{ Ohm} / (100000 \text{ Ohm} + 100016 \text{ Ohm}) = 0.499$ as 1.2497V nominal voltage.

- * the +5V supply voltage is monitored behind a voltage divider

$90956 \text{ Ohm} / (99972 \text{ Ohm} + 90956 \text{ Ohm}) = 0.476$ as 2.38V nominal voltage.

- * the -5V supply voltage is monitored behind a voltage divider

$27400 \text{ Ohm} / (100024 \text{ Ohm} + 27400 \text{ Ohm}) = 0.215$ as -0.997 V nominal voltage.

- * the temperatures are measured as the voltage drop of PT1000 thermistors connected to the 2.5V reference voltage via a 1kOhm serial resistor: $U(T) = U_{ref} \cdot (1 / (R_{ser} / R(T) + 1))$. Therefore, the nominal voltages at 273K are 1.25V. Conversion to temperatures are obtained by application of 3rd order polynomials.

RPCMAG sends always 20bit data to the PIU. The PIU reduces the amount of data in the following way:

- Science data:

<i>Data</i>	<i>PIU-Input</i>	<i>PIU-Output</i>	<i>PIU-Operation</i>
Magnetic field IB	20 bit	20 bit	subtract 2^{19}
Magnetic field OB	20 bit	20 bit	subtract 2^{19}

- **Housekeeping data:**

<i>Data</i>	<i>PIU-Input</i>	<i>PIU-Output</i>	<i>PIU-Operation</i>
Magnetic field OB	20bit	16bit	subtract 2 ¹⁹ right shift by 4 digits
2.5V Ref. Voltage	20bit	20bit	subtract 2 ¹⁹
+5V Supply Voltage	20bit	8bit	subtract 2 ¹⁹ right shift by 4digits subtract offset 79F7h right shift by 4 digits
-5V Supply Voltage	20bit	8bit	subtract 2 ¹⁹ right shift by 4digits subtract offset -370Eh right shift by 3 digits
Temperature OB	20bit	16bit	subtract 2 ¹⁹ right shift by 4 digits
Temperature IB	20bit	16bit	subtract 2 ¹⁹ right shift by 4 digits

- Detailed description of the conversion

1) Science Data: Magnetic field (range = +/-15000nT, 20 Bit):

Definitions:

B_max = +15000 nT

B_min = -15000 nT

counts20 = 2^{20} = 1048576

Nominal_Factor = $(B_{max} - B_{min}) / (counts20 - 1)$

The TLM data contain signed 20bit data. The data range of these values in decimal representation is $-(counts20/2) \dots +counts20/2 - 1$. These signed integers are the EDITED RAW DATA. Unit is [counts].

In the first step of conversion to physical values an offset of $counts20/2$ is added, which yields to data in the range of 00000h:FFFFFh. The nominal relation between these converted TLM data and magnetic field is now as follows:

00000h <-> B_min

80000h <-> 0

FFFFFh <-> B_max

To convert these data into uncalibrated [engineering, enT] nanotesla values, the following algorithm has to be applied:

$$B = [TLMdata + counts20/2] * Nominal_Factor + B_{min} \text{ [enT]}$$

2) Housekeeping Data: Magnetic field (range = +/-16384nT, 16 Bit):

Definitions:

B_max = +16384 nT

B_min = -16384 nT

counts16 = 2^{16} = 65536

Nominal_Factor = $(B_{max} - B_{min}) / (counts16 - 1)$

The TLM data contain 16bit data. The relation between the ADCvalues and the PIU output (TLM) is: $TLM = (ADCvalue - 2^{19}) \text{ shr } 4$. The data range of these TLM data is $0 \dots +counts16 - 1$. The decimal representation of these unsigned integers are the EDITED RAW HK DATA. Unit is [counts].

In the first step of the conversion to physical values an offset of $counts16/2$ is added if the value is smaller than $counts16/2$ and subtracted in the other case. The nominal relation between these converted data and magnetic field is now as follows:

0000h <-> B_min
8000h <-> 0
FFFFh <-> B_max

To convert these values into uncalibrated [engineering, enT] nanotesla values, the following algorithm has to be applied:

$$B = \text{converted data} * \text{Nominal_Factor} + B_min \text{ [enT]}$$

3) Housekeeping Data: 2.5V Reference Voltage (Typical divided input voltage: 1.2497V, 20 Bit)

Definitions:

$$U_max = +2.5 \text{ V}$$

$$U_min = -2.5 \text{ V}$$

$$\text{counts20} = 2^{20} = 1048576$$

$$\text{voltage_divider} = 100016/200016 = 0.49996$$

$$\text{Nominal_Factor} = (U_max - U_min) / (\text{counts20}-1)$$

The TLM data contain 20bit data. The relation between the ADCvalues and the PIU output (TLM) is: $TLM = (ADCvalue - 2^{19})$. The data range of these TLM data is $0 \dots +\text{counts20}-1$. The decimal representation of these unsigned integers are the EDITED RAW HK DATA. Unit is [counts].

In the first step of the conversion to physical values an offset of $\text{counts20}/2$ is added if the value is smaller than $\text{counts20}/2$ and subtracted in the other case. The nominal relation between these converted data and magnetic field is now as follows:

$$0000h \text{ <-> } U_min$$

$$8000h \text{ <-> } 0$$

$$FFFFh \text{ <-> } U_max$$

To convert these values into voltages the following algorithm has to be applied:

$$U_REF = (\text{converted data} * \text{Nominal_Factor} + U_min) / \text{voltage_divider} \text{ [V]}$$

4) Housekeeping Data: +5V Supply Voltage (Typical divided input voltage: 2.38V, 8 Bit)

Definitions:

$$U_{\max} = +2.5 \text{ V}$$

$$U_{\min} = -2.5 \text{ V}$$

$$U_{\text{Ref}} = +2.4996 \text{ V}$$

$$U_{\text{center}} = +5.0\text{V}$$

$$\text{counts8} = 2^8 = 256$$

$$\text{volt_divider} = 90956/(99972+90956) = 0.476389$$

$$\text{cal_fak} = U_{\text{ref}} / (\text{counts}20-1) / \text{volt_divider} * 512 = 0.002562$$

The TLM data contain 8bit data. The relation between the ADCvalues and the PIU output (TLM) is: $TLM = (((ADCvalue - 2^{19}) \text{ shr } 4) - 79F7h) \text{ shr } 4$). The data range of these TLM data is $0 \dots +\text{counts}8-1$. The decimal representation of these unsigned integers are the EDITED RAW HK DATA. Unit is [counts].

In the first step of the conversion to physical values these unsigned integer TLM values are converted to signed integers, thus an offset of counts8 is subtracted if the value is greater than counts8/2. the nominal relation between these converted data and the original voltage is now as follows:

$$80h = -128d \leftrightarrow 4.673V$$

$$00h = 0d \leftrightarrow 5.000V$$

$$7Fh = 127d \leftrightarrow 5.327V$$

To convert these values into voltages, the following algorithm has to be applied:

$$U_{\text{plus}} = \text{cal_fak} * \text{converted data} + U_{\text{center}} \text{ [V]}$$

5) Housekeeping Data: -5V Supply Voltage

(Typical divided input voltage: 0.997 V, 8 Bit)

Definitions:

$$U_{\max} = +2.5 \text{ V}$$

$$U_{\min} = -2.5 \text{ V}$$

$$U_{\text{Ref}} = +2.4996 \text{ V}$$

$$U_{\text{center}} = -5.0\text{V}$$

$$\text{counts8} = 2^8 = 256$$

$$\text{volt_devider} = 27400/(100024+27400) = 0.21503$$

$$\text{cal_fak} = U_{\text{ref}} / (\text{counts}20-1) / \text{volt_devider} * 256 = 0.002838$$

The TLM data contain 8bit data. The relation between the ADCvalues and the PIU output (TLM) is:

$$\text{TLM} = (((\text{ADCvalue} \cdot 2^{19}) \text{ shr } 4) + 370\text{Eh}) \text{ shr } 3$$

The data range of these TLM data is 0...+counts8-1.

The decimal representation of these unsigned integers are the EDITED RAW HK DATA. Unit is [counts].

In the first step of the conversion to physical values these unsigned integer TLM values are converted to signed integers, thus an offset of counts8 is subtracted if the value is greater than counts8/2.

The nominal relation between these converted data and the original voltages is now as follows:

$$80\text{h} = -128\text{d} \leftrightarrow -5.36\text{V}$$

$$00\text{h} = 0\text{d} \leftrightarrow -5.00\text{V}$$

$$7\text{Fh} = 127\text{d} \leftrightarrow -4.64\text{V}$$

To convert these values into voltages, the following algorithm has to be applied:

$$U_{\text{minus}} = \text{cal_fak} * \text{converted data} + U_{\text{center}} \text{ [V]}$$

6) Housekeeping Data: Temperatures (range = +-200 °C, 16 Bit)
(Related input voltages: 0.5...1.6V, 16 Bit)

Definitions:

$$U_{\max} = +2.5V$$

$$U_{\min} = -2.5V$$

$$\text{counts}_{16} = 2^{16} = 65536$$

$$\text{Nominal_Factor} = (U_{\max} - U_{\min}) / (\text{counts}_{16} - 1)$$

The TLM data contain 16bit data. The relation between the ADCvalues and the PIU output (TLM) is: $TLM = (\text{ADCvalue} - 2^{19}) \text{shr } 4$. The data range of these TLM data is $0 \dots \text{counts}_{16} - 1$. The decimal representation of these unsigned integers are the EDITED RAW HK DATA. Unit is [counts].

In the first step of the conversion to physical values an offset of $\text{counts}_{16}/2$ is added to the TLM data. To convert these values into voltages, the following algorithm has to be applied:

$$U(T) = (\text{TLM data} + \text{counts}_{16}/2) * \text{Nominal_Factor} + U_{\min} \text{ [V]}$$

The calibrated temperatures can be derived from these voltages by application of a 3rd order calibration polynomial:

$$T = T_0 + T_1 * U(T) + T_2 * U(T) * U(T) + T_3 * U(T) * U(T) * U(T)$$

The coefficients T_i are:

$$T_0 = -368.6107$$

$$T_1 = +458.4930$$

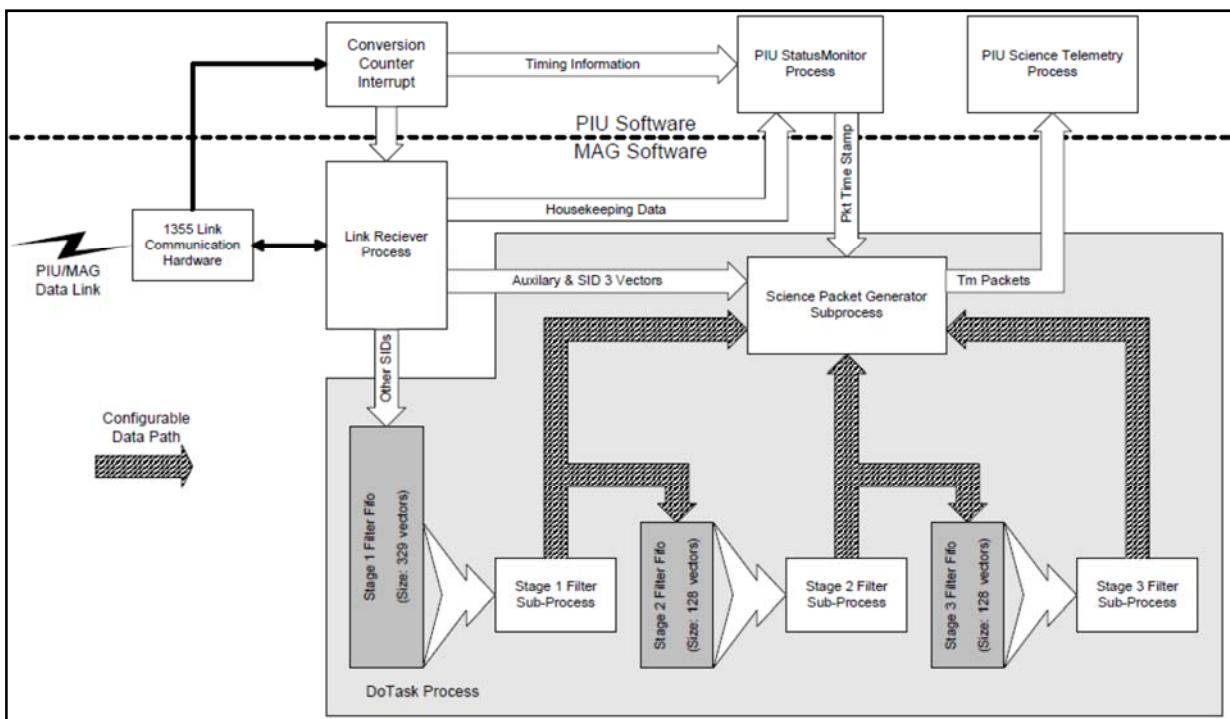
$$T_2 = -356.0289$$

$$T_3 = +180.0064$$

2.1.3 Description of the Filter – Amplitude and Phase Response

RPCMAG comprises an analog fluxgate magnetometer and measures time series of the magnetic field vector. Prior to the digitalization with 20 bit ADCs the analog signal has to pass an analog low-pass-filter in order to eliminate any aliasing effects possibly occurring during the digitalization. This low-pass is a 3rd order Bessel-type filter with a corner frequency of 25 Hz. The filtered and digitized data are then sent to the PIU. As the digitization is always done with 20 Hz sampling frequency, all MAG output data are magnetic field vectors with a vector rate of 20 Hz.

The data are received by the PIU and further processed. A schematic overview about the processing is presented in the following diagram:



Simplified diagram of PIU data processing & data flow

The details of the PIU processing are presented in Lee, Chris: RO-RPC-MAG-6007, PIU Magnetometer Processing Software, Imperial College, London, 2005. All facts concerning the PIU which are listed here are taken from that document.

Each Telemetry packet of MAG data is marked with the conversion time of the first vector used in the calculation of the first result in the science telemetry packet. The time is generated when the PIU receives the conversion signal sent by the MAG electronics for the relevant vector. The latency time between the MAG conversion and the receipt of the conversion signal at the PIU should be added to this time.

For all data products apart from burst mode the data is passed through up to 3 stages of a symmetric digital filter (FIR) and decimated. Depending on the actual mode (SID) the specific filters (identified by a specific filter ID) are activated at each stage to provide the desired overall characteristics defined by the effective sample rate, the desired frequency & phase behavior and the cut-off frequency. Each filter is calculated from an odd number of filter coefficients which is symmetric around the centre coefficient. It is assumed that the time of a result is the time of the sample which is multiplied with this centre coefficient.

To reduce the storage and the processing the coefficients are folded around the centre coefficient so that the actual number of coefficients stored for a given filter is $(\text{No of coefficients for whole filter} + 1) / 2$. The Figure below illustrates the relative timing between the samples of each filter stage. It can be seen that it is dependent both on the number of coefficients (N) the filter has and the decimation interval (D) for each stage as defined

by the variables “CoefficientsNo” and “DecimationInterval” in the filter header. It can be seen that the number of samples between the receipt of the latest vector and that of the vector directly relating to the time of the result is given by:

$$n = (N_3 - 1) \cdot D_2 \cdot D_1 + (N_2 - 1) \cdot D_1 + N_1$$

If the filter stage is off the value of N is 1. Results for the default set of vectors is given below. For the secondary vectors the time of the vector in a non-burstmode relative to the packet time is given by (number of primary results * $D_3 * D_2 * D_1 - 1$) * 0.05 sec

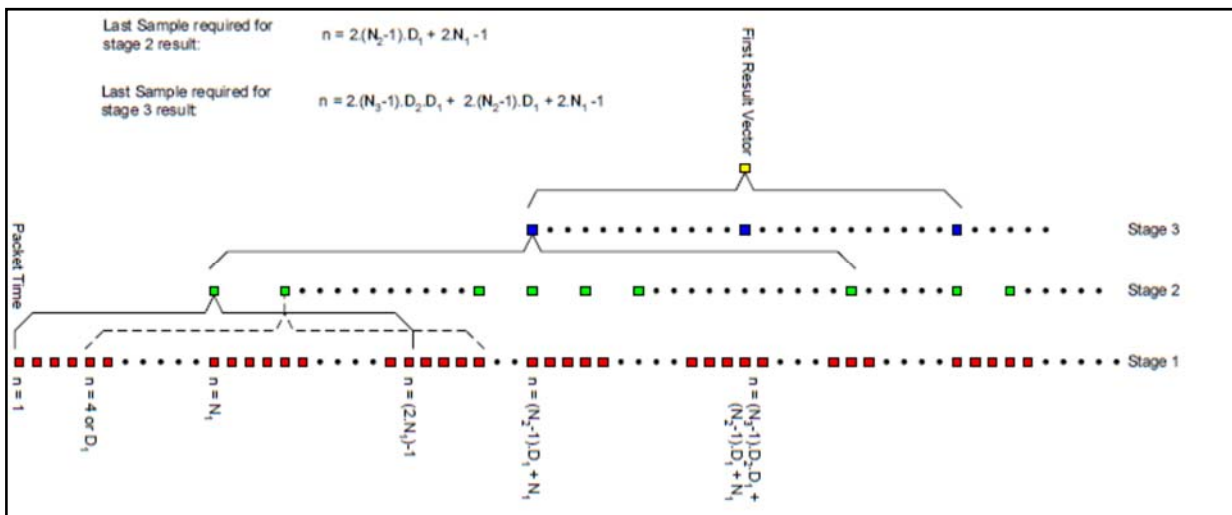


Diagram of the timing between samples in each filter level

The following table presents the details about this design for each mode:

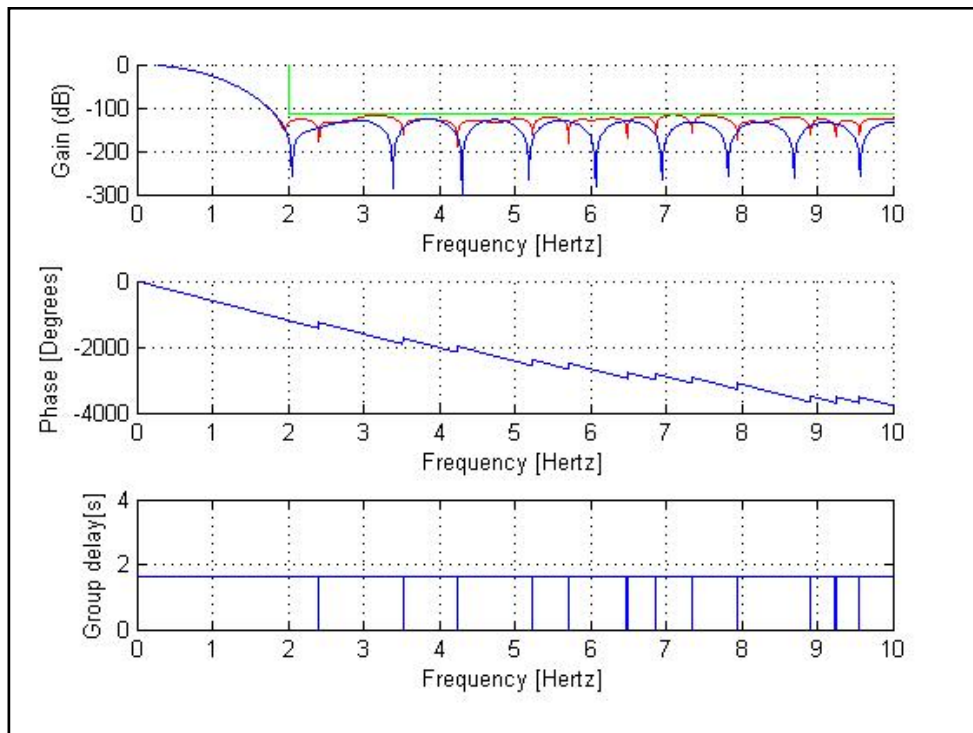
SID No.	Name	Rate (Hz)	Filter Id's			Samples per packet	
			Stage 1	Stage 2	Stage 3	Primary	Secondary
1	Minimum	1/32	4	3	3	32	1
2	Norm	1	1	2	Off	32	1
3	Burst	20	Off	Off	Off	320	16
4	Medium	5	2	Off	Off	160	1
5	Low	1/4	4	3	Off	32	1

Table 1: Definitions of each Science mode (SID) including application of specific filters

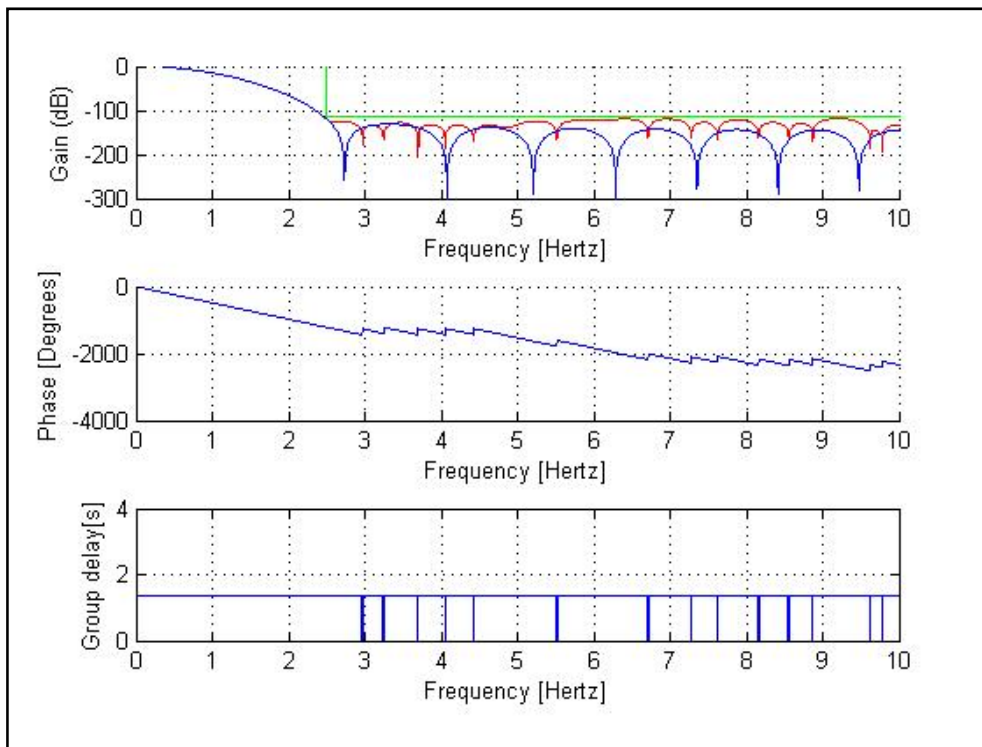
The default filters were designed to give no aliasing to any decimation given that the maximum amplitude of the signal was 2^{19} counts. This means that an attenuation of at least -114 dB is required at the Nyquist point. All filters have linear phase so that no distortion will be seen.

The following figures show in the upper panel the filter responses calculated from coefficients in real numbers (blue) and the actual response from the integer coefficients (red) used by the software. The design goal is displayed in green. In the middle panels the actual phase response is plotted. The steps in the phase function at higher frequencies do not cause any problem as they occur far beyond the cut-off frequency where the signal is already damped by at least -130dB.

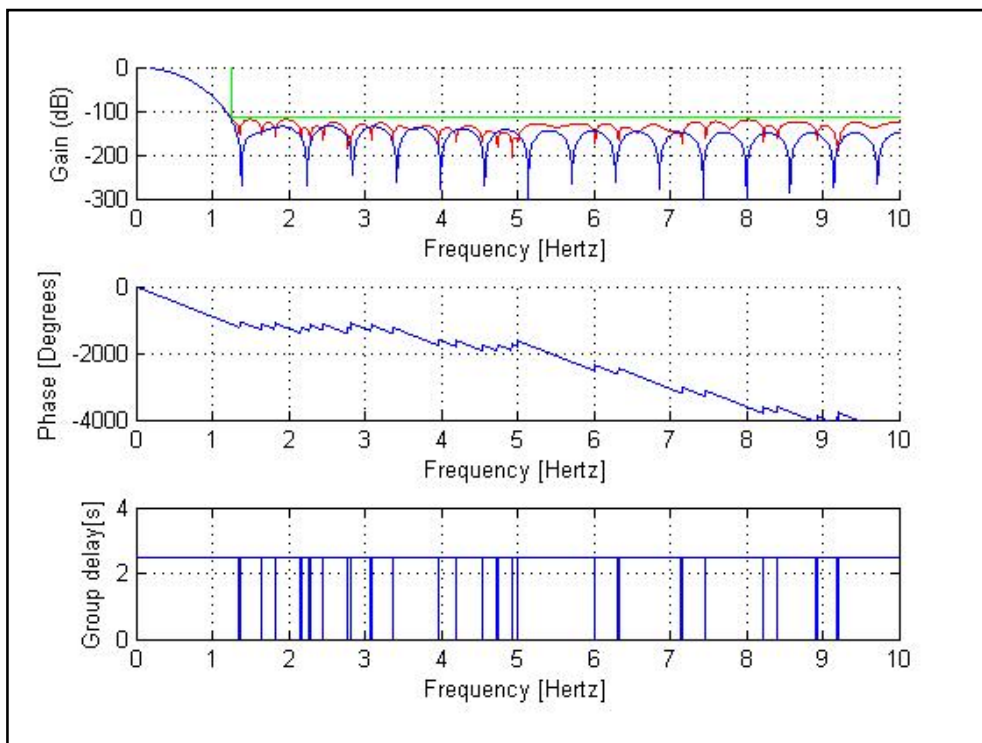
The third panels finally show the derived group delay of each filter stage, derived from the phase behaviour as $\tau_{\text{group}} = -d\phi/d\omega$. As the filters are characterized by linear phase responses they show of course a constant time delay. Only at the singular frequencies where the phase jumps, singular jumps in the time delay can be seen, which do, however, not influence the filter as this happens only in the stop band of the filter.



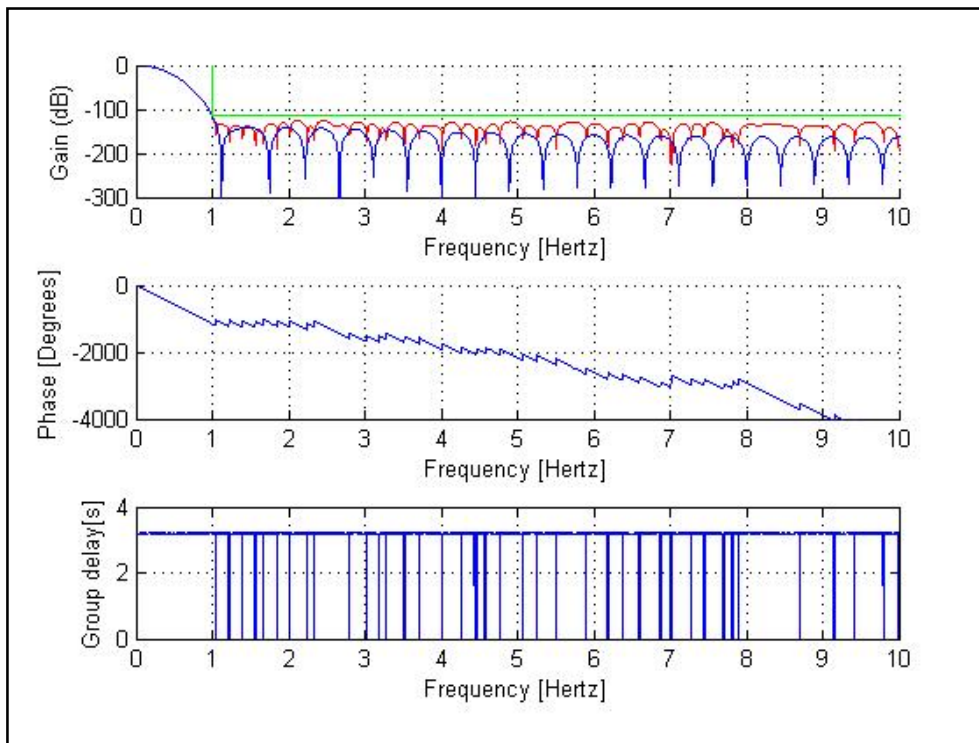
**Amplitude, Phase Response and Group Delay of the Digital Filter for Filter-ID 1.
Cutoff frequency = 2Hz, Decimation 5:1, Group delay = 1.65 s**



Amplitude, Phase Response and Group Delay of the Digital Filter for Filter-ID 2.
Cutoff frequency = 2.5Hz, Decimation 4:1, Group delay = 1.35 s



Amplitude, Phase Response and Group Delay of the Digital Filter for Filter-ID 3.
Cutoff frequency = 1.25Hz, Decimation 8:1, Group delay = 2.5 s



**Amplitude, Phase Response and Group Delay of the Digital Filter for Filter-ID 4.
Cutoff frequency = 1Hz, Decimation 10:1, Group delay = 3.2 s**

2.2 Overview of Data Products

RPCMAG does only deliver flight data to the PSA. Data of the Ground calibration and the system tests cannot be converted to PDS compliant format and will therefore be stored directly at IGEP. Relevant documentation will also be saved on the IGEP archive server.

Software will neither be archived at the PSA nor at PDS.

2.2.1 Instrument Calibrations

The calibration for RPC-MAG has been performed completely. This means every electronics unit (DPU:FS,DPU:FM) has been calibrated connected with each sensor (Outboard sensor FS & FM, Inboard sensor FS & FM). Thus the results of all calibrations and cross calibrations will be archived.

But only the results of the Ground calibration are archived in PDS. These are

- Temperature dependent Sensitivity-Matrices
- Temperature dependent Alignment-Matrices
- Temperature dependent Offsets-Matrices
- Frequency behavior

During the calibration and integration of the instrument it turned out, that there were slight differences between the Flight model (FM) and Flight spare unit (FS) of the instruments. It can be seen in the ground calibration report RO-IGM-TR0003 that the FM sensors showed a few dB lower attenuation of the AC transfer function in the higher frequent stop band and therefore a better rejection of any alias frequencies. Additionally the temperature calibration of the FM sensor showed a smoother temperature dependency of the sensitivity and misalignment than the FS sensor. As these calibration tests have extensively be performed in the combination FS DPU/ FM sensors, we choose exactly this combination for the real flying units:

- DPU: FS
- IB-Sensor: FM
- OB-Sensor: FM

2.2.2 In-Flight Data Products

Sensor temperatures of the MAG inboard and outboard sensors are delivered in the raw and calibrated data files.

From the DDS we get raw data in instrument coordinates. After conversion to ASCII format, the ground calibration parameters will be applied, the temperature dependence for the sensitivity coefficients and the misalignment angles, derived from the ground calibration, will be implemented.

In a second step the long term inflight temperature model for the offsets will be applied, taken from the *INFCAL_OFF_<sensor>_20180305_009.ASC* file. These files contain the non-linear pairs of offset and temperature for a range from 136 K to 227 K for each component, generated by the LABVIEW S/W

MAG_OFFSET_DETERMINATOR_CLE_CLG_TEMPERATURE_AUTO_SW_CAV_SDL_V10A_<sensor>.vi

Furthermore individual offset jumps due to s/c interference or hysteresis effects related to instrument reboots will be used as well as physical background information like long-term mean values of the solar wind field, known zero-fields during diamagnetic cavity events, the cometary magnetic field at the time of the PHILAE landing, PHILAE separation jumps, and thruster induced s/c-magnetic field changes to tweak the instrument

offsets to reasonable values. This is a semi- automatic task, partly being achieved by the interactively operated LABVIEW S/W,

MAG_OFFSET_DETERMINATOR_CLE_CLG_TEMPERATURE_AUTO_SW_CAV_SDL_V10A_<sensor>.vi
and finally completed by manual entries/changes of the two generated calibration files
INFCAL_PARA__<sensor>_20180305_009.ASC.

These files contain time intervals and the related effective offsets for that period, e.g. the actual sums over all previously occurred offset jumps, in order to shift the data to the right level. Additionally they contain some “extra offsets” at special times which had to be added manually due to disturbing events on the spacecraft which can unfortunately not be specified more detailed. But to get transparency into the calibration process all these tweaking values are written to the mentioned inflight calibration files and not hardcoded in the pipeline software.

After this extensive preprocessing, the data will be rotated into the s/c-coordinates system. The result of these procedures are already calibrated data.

On a higher level a rotation of these data in a convenient celestial body frame (e.g. EME2000, ECLIPJ2000, CSEQ, ...) and averaging to a convenient rate (e.g. 1s or 60 s mean values) is performed to generate more calibrated and resampled data types.

The principal structure of the data products is the same for all mission phases. We deliver ASCII tables containing at least 3 component magnetic field data and the related times in UTC and OBT. The raw data files contain the sensor temperatures as well, as these are needed to calculate the real magnetic field.

The term “Calibrated data” means that the results of the ground and inflight calibration are applied to the raw data. The spacecraft generated residual fields and the structures arising from the s/c noise can only be partly removed in these data “on best effort base” as written above.

The elimination of these effects is still under development and will possibly lead to improved data products in the future.

A major success in improving the data quality has been achieved by creating a Reaction Wheel frequency elimination algorithm. The rotation frequencies of ROSETTA’s 4 reaction wheels can be identified as disturbance spectral lines in the dynamic spectra of the MAG data. Therefore, a frequency elimination filter (dynamic sharp notch filter) had to be developed to get rid of the reaction wheel impact. The filter works satisfactory, especially for the burst data. A quite similar filter also purges the data from the LAP disturbances, which occurred as constant frequency lines (mode dependent) in the dynamic spectrum.

During the Earth Swing- by #1 it turned out that the Lander heater currents disturb the RPCMAG data. The disturbance is in the order of a nanotesla. The elimination of this disturbance ought to be done semi manually.

Furthermore the long term operations at 67P/C-G showed that there are lots of disturbing sources on the spacecraft which can change the spacecraft magnetic bias field and lead to changing absolute readings of the magnetic field at the MAG sensors. E.g. the movable magnetic latches of the thrusters are generating jumps in the order of 3 nT on the By component (s/c-coordinates). This happens during every wheel offloading manoeuvre (WOL) for about 3 minutes. Every orbit correction manoeuvre (OCM) will generate spikes of about 6 nTpp with a frequency of ~625 mHz and a pulse width of 200ms. These are only two sources of possible interference. A careful, time consuming inspection of the data has already shed some light in all these disturbances. We are looking forward to develop more algorithms for proper data cleaning. Some of this additional effort is already part of the extended standard pipeline (as mentioned above). Information on specific cleaning procedures applied to the data is given at appropriate locations within the datasets.

All higher level data products (CALIBRATED, RESAMPLED) contain an extended system of quality flags for each magnetic field vector. Please refer to section 3 for details.

During the analysis of the EAR1 data and the comparison of the measured data with the Earth Magnetic Field model data (POMME model from GFZ, Potsdam) it turned out that the time stamp of the measured and filtered data has to be shifted slightly due to the filter algorithm used in the PIU software. If the time stamp is uncorrected, as it is for all the data products for the phases CVP, EAR1, and CR2 level V1.0, the time of the data is a little bit too early. This means that a certain dt (s. tables) has to be added to the time stamp to get the right times. This additional time offset is mode dependent and also dependent on the actual primary / secondary sensor.

For the data of the PRIMARY sensor, which is usually the OB sensor, the following table shows the times to be added to the time stamp of the vector to get the real physical event time:

SID	Mode Name	Packet Length [s]	Time to add to PRIMARY data timestamp [s]
SID1	Minimum	1024	223.7
SID2	Normal	32	8.2 ¹
SID3	Burst	16	0
SID4	Medium	32	1.35
SID5	Low	128	27.7
SID6	Test	16	0

Table 2: Modes and Times

For the SECONDARY vectors the situation is different as these vectors are not filtered but just picked out of the data stream. The following table applies for the time shift of the SECONDARY vectors.

SID	Mode Name	Packet Length [s]	Time to add to SECONDARY data timestamp [s]
SID1	Minimum	1024	1023.95
SID2	Normal	32	31.95
SID3	Burst	16	15.95
SID4	Medium	32	31.95
SID5	Low	128	127.95

Table 3: Modes and Times

For the later data products, starting with MARS or delivery levels higher than V1.0, thus especially for the current version V9.0, these corrections will be taken into account automatically by the archive generation software. The correction is done only for the CALIBRATED, RESAMPLED and DERIVED science data, neither for EDITED data nor for HOUSEKEEPING data. Only the UTC time stamps are changed, the OBT is kept in the originally state to maintain a reference to the original TLM data.

¹ The analysis of the Earth Fly-by data resulted in a time shift of 8.3s. The stated 8.2 s is a theoretical value derived from the digital filter design.

All the data processing performed by the analysis software is done on the base of the UTC timestamps. The OBT is never used during the calibration or analysis.

Data products:

EDITED RAW DATA: Data in ADC Counts

- Housekeeping Data
UTC, OBT, T_OB, T_IB, STAGE_ID_A, STAGE_ID_B, FILTER_CFG, MAG_REF_VOLT,
MAG_NEG_VOLT, MAG_POS_VOLT, BX_OB, BY_OB, BZ_OB
- IB & OB Data
UTC, OBT, BX, BY, BZ, T, QUALITY

CALIBRATED DATA: DATA in Physical units, bad vectors removed, Quality flagged

LEVEL_A Data:

- Housekeeping Data
UTC, OBT, T_OB, T_IB, STAGE_ID_A, STAGE_ID_B, FILTER_CFG, MAG_REF_VOLT,
MAG_NEG_VOLT, MAG_POS_VOLT, BX_OB, BY_OB, BZ_OB
- IB & OB Data in Instrument coordinates
UTC, OBT, BX, BY, BZ, T, QUALITY

LEVEL_B Data:

- IB & OB Data in s/c coordinates
UTC, OBT, BX, BY, BZ, T, QUALITY

LEVEL_C Data:

- IB & OB Data in Celestial body coordinate system.
This is ECLIPJ2000 until hibernation in 2011, and CSEQ for the comet phase in 2014 - 2016.
UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ, QUALITY

RESAMPLED DATA: DATA in Physical units, bad vectors removed, Quality flagged

LEVEL_E Data:

- IB & OB Data in Instrument coordinates, derived from LEVEL_A data, data resampled to specified average interval, e.g., 1s, or 1 min
UTC, OBT, BX, BY, BZ, T, QUALITY

LEVEL_F Data:

- IB & OB Data in s/c - coordinates, derived from LEVEL_B, data resampled to specified average interval, e.g. 1s, or 1 min

UTC, OB, BX, BY, BZ, T, QUALITY

LEVEL_G Data:

- o IB & OB Data in Celestial body coordinate system.

This is ECLIPJ2000 until hibernation in 2011, and CSEQ for the comet phase in 2014 – 2016, derived from LEVEL_C data, data resampled to specified average interval, e.g. 1s, or 1 min
UTC, OB, POS_X, POS_Y, POS_Z, BX, BY, BZ, QUALITY

LEVEL_H Data: Reaction Wheel Corrected Data

OB Data in Celestial body coordinate system. This is ECLIPJ2000 until hibernation in 2011, and CSEQ for the comet phases in 2014 - 2016, derived from LEVEL_C data, reaction wheel influence eliminated by filtering in frequency domain.

UTC, OB, POS_X, POS_Y, POS_Z, BX, BY, BZ, QUALITY

Normally EDITED RAW DATA, CLA, CLB, CLC, CLF and CLG data will be produced,. In case of Reaction wheel or LAP disturbance also CLH data will be generated for the OB sensor operated in burst mode (automatic elimination not possible at lower sampling rates).

The following figure shows an overview about the relation of all produced data types:

DATA TYPE	COORDINATE SYSTEM	PROCESSING LEVEL		
		EDITED	CALIBRATED	RESAMPLED
				Sampling Time
HK-DATA		RAW_HK	CLA_HK	
SCIENCE-DATA	Instrument Coordinates	RAW	CLA	CLE 1s, 60s
SCIENCE-DATA	SC-Coordinates		CLB	CLF 1s, 60s
SCIENCE-DATA	Celestial Coordinates		CLC	CLG 1s, 60s
SCIENCE-DATA	Celestial Coordinates			CLH original CLC

DATA PRODUCT OVERVIEW

2.2.3 Software

We do not deliver any software.

2.2.3.1 Calibration Software

The ground calibration s/w is a complex package of different routines which has been used since many years for many missions (e.g. CLUSTER, DS-1, CASSINI, ...). The s/w is stored at the IGEP.

A single binary calibration file (*.CCD, Complete Calibration Data) produced by the calibration facility contains all information needed to perform a specific calibration task like offset determination or calculation of sensitivity and alignment. The calibration analysis s/w extracts the needed frames like applied magnetic field of the coil facility, measured fields of the FGM under test, and the actual temperatures. Then an appropriate sensor model will be applied to the data (e.g. linear model or models of higher order) to calculate the temperature dependent sensor parameters like offset, alignment and sensitivity. The frequency behavior is investigated as well.

At the end of the process a report is written containing all results needed to use the magnetometer. All necessary parameters are written to the result files which are read by the DDS2PDS S/W.

DDS2PDS will apply the ground calibration results and additionally inflight calibration parameter to the data to generate proper archive data. In case of disturbance by ROSETTA's reaction wheels special filters in the frequency domain can be applied to get rid of the reaction wheel frequencies in the magnetic field data. This can be done automatically if needed. This elimination requires the knowledge of the reaction wheel frequencies which have to be retrieved from the DDS prior to the analysis.

Also the Lander heater currents have an influence to the magnetic field data. This impact can be eliminated semi manually by comparing Lander HK data, ROMAP signatures and the RPCMAG data. The used s/w is not part of the DDS2PDS package.

It is a known fact that the magnetic field sensors are very temperature sensitive. This behavior has been calibrated at the ground calibration down to -60°C . In flight, however, lower temperatures are seen. It turned out that the extrapolation of the ground calibration results (only the temperature dependent offset shift) did not lead to really convincing results. Therefore, inflight data were taken to create a new temperature model of the offset behavior. For the early mission phases a common model, based on CVP & EAR1 data was used – the so called model 002. During the Mars swing by it turned out that the usage of a model based on daily changes yields to even better results. Especially due to hysteretic effects (in terms of temperature influence) of the magnetic field sensor it showed up that a more sophisticated temperature model was needed.

Legacy Calibration Model 006:

The CALIB_ROS_TEMP_XXXX and the GEN_CAL_DATA S/W (IDL) were improved/extended to handle this more complex task, leading to model 006. Also the method was changed. The model 002 was achieved by calculating a best fit 3rd order polynomial of the sensor temperatures to the magnetic field (one polynomial for each of the 6 sensor components).

For the calculation of the new model 006 a different approach based on the following items, has been chosen:

- The correlation of the OB magnetic field readings and the OB temperature has to be minimal.
- The correlation of the IB magnetic field readings and the IB temperature has to be minimal.
- The correlation of the IB magnetic field readings and the OB magnetic field readings has to be maximal.
- The influence of the temperature can be eliminated (minimized) by subtracting suitable polynomials $P(T)$ from the magnetic field readings.

- The coefficients of these 6 polynomials are calculated from the optimization of the 9 above mentioned correlation coefficients.

Mathematically this is done by a POWELL minimization routine.

After the early years in the mission it showed up that the best result is achieved if this calculation is done day by day in order to really take the right temperature behavior into account. The former temperature model showed significantly worse results especially at lower temperatures and faster temperature changes. The calculated polynomials can be of 5th order, but the analysis yielded that linear ones with only very little quadratic and cubic contribution are the best ones. All the MARS data and future data were initially be calibrated using this model 006.

Actual calibration model 009:

In 2014 ROSETTA arrived at the comet and finally the opportunity arose to conduct almost continuous observations for nearly 3 years (Remark: such operations were requested (but not conceded) already after launch in 2004 for the cruise phase. They would have led to much better data much earlier in the mission). Thus we collected a tremendous treasure of data under lots of different conditions and could apply much improved tools and methods to obtain a real global model for the complete temperature range down to -160°C. Furthermore we were able to study the influence of S/C and P/L interference in detail offline during the enhanced archiving phase in 2017 and 2018. All these extended investigations led to the final calibration model 009 which is used for all data sets of version V9.0. All data released earlier characterized by lower version numbers should therefore not be used anymore. Data for all the mission are available on the calibration level 009.

So, what are the improvements and properties of model 009?

- It's a known fact that the s/c residual magnetic field is changing due to usual operations. Mainly the thruster activity is causing the changing fields. On the other hand the temperature dependence of the fluxgate sensors results in drifting instrument offsets caused e.g. by s/c attitude changes and related temperature variations due to changing solar irradiation. Thus a model is required to shift the offset to reasonable values using known plasmaphysical constraints of the environmental magnetic field and s/c properties.
- The first assumption is that the long term average of the solar wind field – pure solar wind, not influenced by planetary magnetospheres or cometary environment – is zero:

$$\langle \mathbf{B}_{sw}^{CSEQ} \rangle_{\text{quiet mission phases}} = \mathbf{0}$$

- At the comet we were very lucky as 665 time intervals of a diamagnetic cavity could be detected. The plasmaphysical theory yields that the magnetic field has to be exactly zero during such events:

$$\mathbf{B}^{CSEQ}(t=\text{cavity}(i)) = \mathbf{0} \quad ; \quad (i=1\dots 665)$$

- On November 12, 2014 PHILAE was separated from ROSETTA. This event was accompanied by a specific jump of the residual s/c-magnetic field, which has to be taken into account individually for data obtained before and after that time:

$$\mathbf{SDL: Separation of Philae} \rightarrow \text{Jump } \Delta \mathbf{B}^{URF}(t_{\text{sep}}) = (-8.35, -14.9, -4.11)$$

$$\rightarrow \text{For all data BEFORE } t_{\text{sep}} : \mathbf{B}_{\text{new}} = \mathbf{B}_{\text{old}} - \Delta \mathbf{B}$$

- From the joint analysis of RPCMAG and ROMAP data after the landing on 67P/C-G the absolute magnetic field for a specific time could be computed. This fixed value can be used to shift the RPCMAG data for that time:

Field adjustment using ROMAP after Landing:

$$\mathbf{B}^{RPCMAG}(t=2014-11-12T19:00) = \mathbf{B}^{ROMAP}(t=2014-11-12T19:00) = (1.6, 1.6, 1.6) \text{ nT}$$

- During cruise the absolute field can be estimated using s/c rotations. Let's assume an ideally calibrated magnetometer, a non-vanishing s/c-residual field and an external zero field. If the s/c would now fly some

turns or rolls the magnetometer readings in s/c-coordinates would stay constant but not zero due to the residual field. In a celestial coordinate system (e.g. CSEQ), however, the transformed magnetic field data would show variations according to the attitude changes. If, however, the magnetometer would be calibrated according to the sum of intrinsic magnetometer offset and s/c residual field, the readings would be zero in s/c coordinates and no variations would be seen in the celestial system. This means for the general situation, that one should shift the magnetometer readings in s/c- or better instrument-coordinates that way, that the variation of the transformed magnetic field in a celestial system is minimized. Thus only the external field changes would remain, ideally. Due to lots of different changes in the s/c field this algorithm does not work perfectly, but the offsets obtained for separated time intervals, improve the data quality drastically:

$$\text{VAR}(B_x^{\text{CSEQ}}) + \text{VAR}(B_y^{\text{CSEQ}}) + \text{VAR}(B_z^{\text{CSEQ}}) = \min$$

- For the data processing the time series are separated in various time intervals. These should be chosen according to switch on / switch off times of the RPCMAG instrument or reboot times after system crashes. Due to not further specified hysteresis effects it is reasonable that the instrument offset might change. Additionally times of obvious s/c state changes can be used as well as extra time interval boundaries.
- Magnetic field data as input for the global model are taken only at times where PHILAE was switched off while it was still attached to ROSETTA, as the lander creates lots of interference due to a peculiar grounding system.
- Time intervals during Earth swing-bys have to be disregarded for a global model, as magnetic fields differ from pure solar wind fields.
- The remaining variations of the magnetic field can be correlated to the temperatures of the magnetic field sensor. It showed up that a third order polynomial model of the temperature at times of quiet magnetic field conditions reflects the sensor offset shift quite well but not really satisfactory. Therefore a point by point temperature model for a range from 136 K to 227 K was established with a temperature resolution of 0.1 K. Especially the x component of the magnetic field benefits from this approach and particularly at temperatures of ~145 K, ~167 K, ~182 K and 237 K the data quality is being improved significantly this way.
- The model is calculated using 10 min mean values of the magnetic field.
- Consideration of all these constraints and boundary conditions led to the S/W packages
`MAG_OFFSET_DETERMINATOR_CLE_CLG_TEMPERATURE_AUTO_SW_CAV_SDL_V10A_OB.vi`
and
`MAG_OFFSET_DETERMINATOR_CLE_CLG_TEMPERATURE_AUTO_SW_CAV_SDL_V10A_IB.vi`
which were used to calculate the models.

For more details of the new model 009 refer to RPCMAG Userguide RO-IGEP-TR0074 and especially the calibration cookbook RO-IGEP-TR0028.

2.2.3.2 Pipeline processing Software

The pipeline processing s/w is named DDS2PDS. A coarse overview has been given already in chapter 2.2. DDS2PDS can be used with a command file in batch mode. Thus, data of many days can be processed automatically. The output of DDS2PDS are PDS files sorted by modes and times and calibration levels. Usually there will be one file per day and mode and level. The format and the content of all PDS *:TAB files is stated in chapter 2.4.5.

2.2.3.3 Scientific analysis Software

The DDS2PDS software has also the capability to generate different kinds of plots. Thus time series can be plotted for every calibrated data level. Additionally spectra plots can be generated as well as plots of the differences of the OB & IB sensor.

Higher Level analysis software like the *MAG_PLASMA_ANALYSER.VI* is a powerful LABVIEW S/W tailored to the needs of spacecraft magnetic field data analysis. The Software, however, is neither part of the pipeline nor delivered to the archives.

2.2.4 Documentation

The features of the DDS2PDS s/w package are described in detail in the

DDS2PDS User Manual, RO-IGEP-TR0007.

This manual is not anymore part of the documentation package, because a reviewer did not find it very useful to deliver this documentation. Also the S/W will not be delivered to the archive.

The calibration itself is described in the ***Step by step Calibration Procedure RO-IGEP-TR0028***, which is part of every dataset.

Hints on the usage of the Archive can be found in the **RPCMAG Userguide RO-IGEP-TR0074** as well as in the common **RPC Users's Guide**.

2.2.5 Derived and other Data Products

It is not planned to deliver other data products than the described ones in this EAICD.

2.2.6 Ancillary Data Usage

For calculation of the magnetic field in a celestial reference coordinate system it is essential to have information about the attitude of the s/c and the position of the s/c.

In earlier times of the mission ancillary data (ATNR, ORER, ORHR,...) provided by ESOC were used for the generation of LEVEL_C (or higher level) data. The files could be retrieved from the AUXILIARY data section of the ROSETTA DDS. The format and content of these files is described in the ROSETTA DDID RO-ESC-IF-5003.

The attitude information was extracted from the actual ATNR file, which is provided by ESOC/TOS-GFI and contains ROSETTA'S state attitude quaternions.

The positions of the s/c were retrieved from the ORxx files. All positions are given here in the EME2000 frame. The coordinate systems centers, however, are different:

FILE	COORDINATE SYSTEM CENTER
ORHR	SUN
ORER, ORFR, ORGR	EARTH
ORMR	MARS

Table 4: Geometry AUX files related to different bodies

These ASCII file were provided by ESOC/TOS-GFI as well and contain ROSETTA'S state vectors (positions & velocities for given times). The position for a specific time can be evaluated using the OASW S/W provided by ESOC.

Later in the mission the calibration software and the geometry calculation methods have been changed. For the transformation between instrument or s/c-coordinates and celestial coordinates only the SPICE system, provided by the JPL NAIF group, has been used. The input of the ROSETTA trajectory and attitude kernels is provided by the ESOC Flight dynamic team. The needed kernel files can either be found on the ESA file server **ssols01.esac.esa.int** or the NAIF ftp-server **naif.jpl.nasa.gov**.

All needed SPICE transformation routines are embedded in the IDL pipeline software and the scientific analysis s/w. Each single magnetic field vector is transformed time dependently to the desired celestial coordinate system. The SPICE kernels used for the transformations of the specific magnetic field data file are listed in each related *:LBL file.

All data sets of version V9.0 are generated using the mentioned SPICE system and no ESOC geometry S/W anymore.

3 Archive Format and Content

3.1 Format and Conventions

3.1.1 Deliveries and Archive Volume Format

PDS 3 compliant data are delivered to ESA on DATA SET Level. One Data Set corresponds to one Volume.

Data of different Processing Levels are archived in different Data Sets.

The Data Sets are transferred in compressed form (.tar.gz) from IGEP to the PSA server.

A complete backup of the RPCMAG Data Sets can be found on the the Imperial College server.

3.1.2 Data Set ID Formation

Example: DATA_SET_ID = "RO-X-RPCMAG-3-CVP-RAW-V9.0"

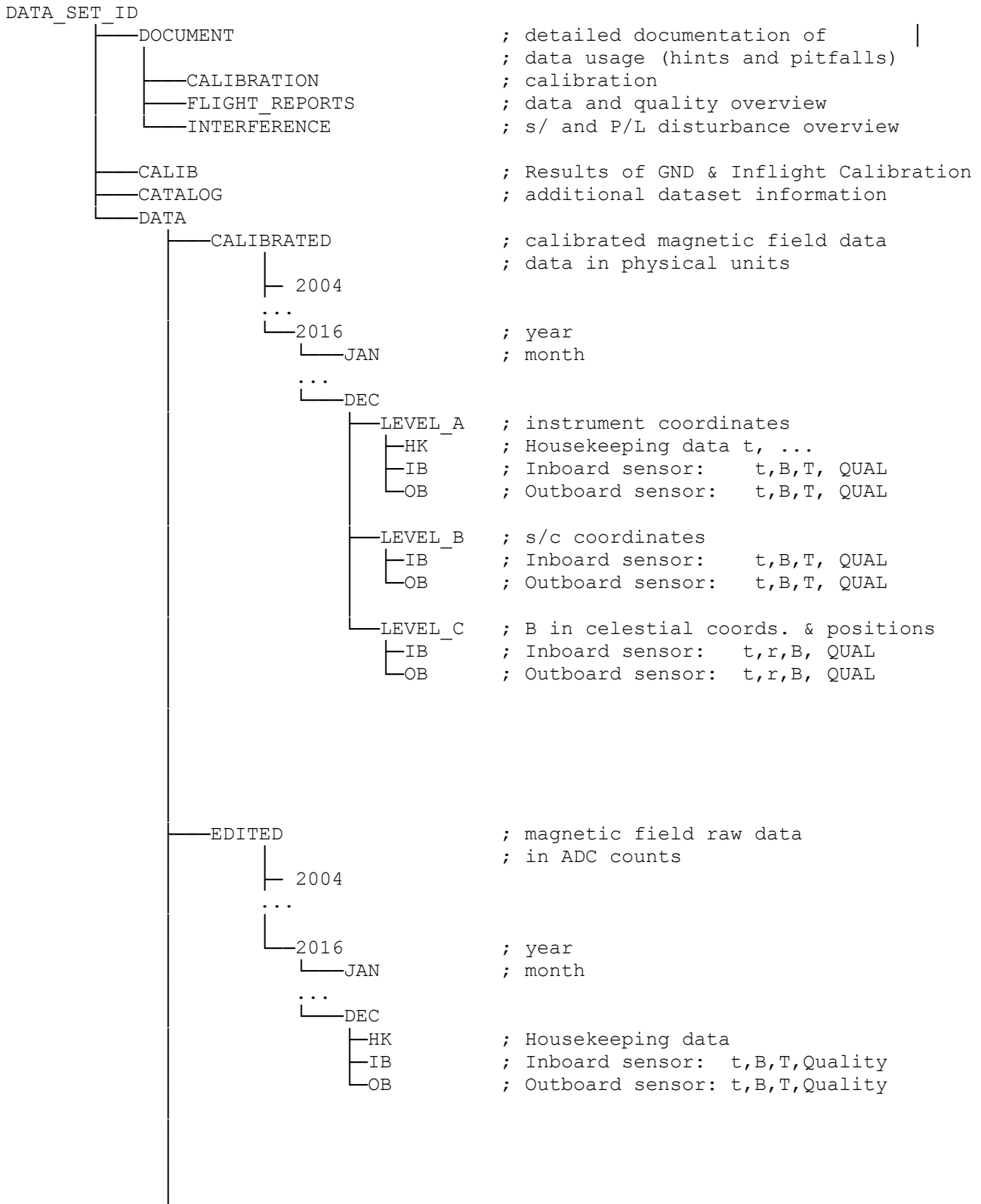
The Data Set Id has the following structure

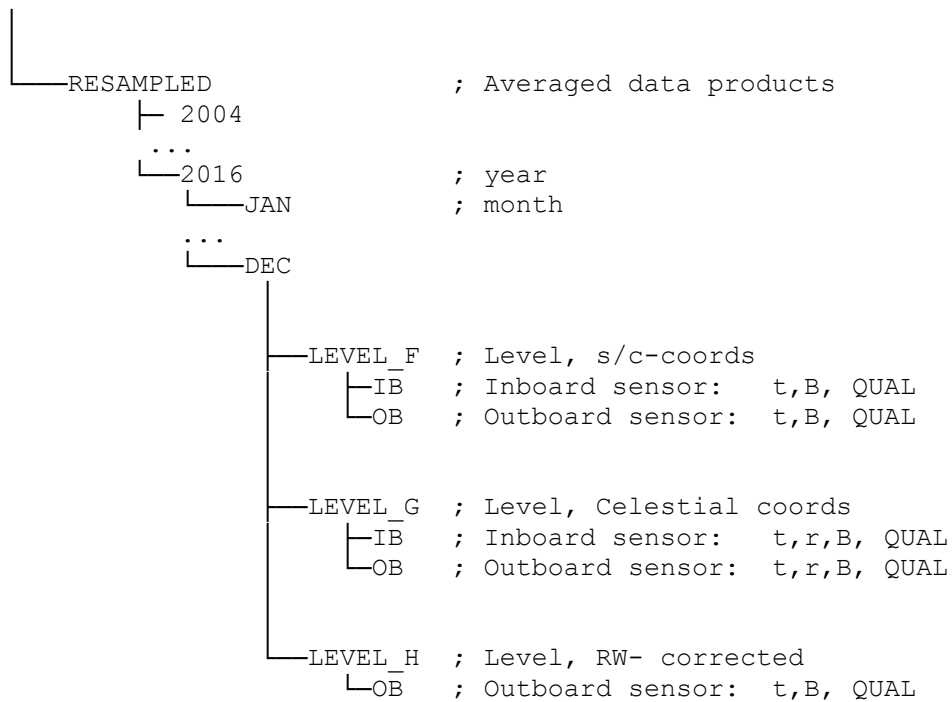
- RO: Rosetta Orbiter as instrument host
- <target_Id> :
 - E: Earth,
 - A: Asteroid
 - M:Mars
 - C:Comet
 - X: Checkout
 - CAL Calibration
 - SS:SOLAR WIND
- RPCMAG: Magnetometer Instrument
- <data_Processing_level> : Codmac Level 1...4.
According to PDS Standard Reference, Chapter 6.5
- <Mission Phase abbreviation>:
 - CVP: Commissioning
 - EAR1,EAR2,EAR3 : Earth Swing-By
 - CR1...Rn : Cruise Phases
 - MARS
 - AST1,AST2 : Asteroid Fly-by
 - RVM n : Rendezvous Manoeuvre n
 - PRL: Prelanding Phase
 - ESC n: Escort Phase n
 - EXT n: Extended Mission Phase n

Designators according to RO-EST-PL-5011, Table 2

- Description: processing level: RAW, CALIBRATED;RESAMPLED
- V9.0 version number

3.1.3 Data Directory Naming Convention





This directory listing shows the complete internal data structure, which gives an detailed overview of all processed data. When the data are delivered to the PSA, the transmitted structure is adapted in that way, that only the data of a single processing level (EDITED, CALIBRATED, RESAMPLED,...) is injected into the designated data set. There are no empty folders . Data of different processing levels are stored in different data sets.

For every activated mode there is one single file for each day where data have been measured. This means that there can be data gaps in the files, if e.g. there were some observations in the morning and some others in the evening.

3.1.4 Filenaming Convention

Magnetic Field data filename convention for EDITED and CALIBRATED data:

```
<inst> <begin of observation>_<level>_<sensor>_<inst mode>.<ext>
RPCMAG yymmddThhmm RAW IB M1..M3 LBL
          CLA OB TAB
          CLB
          CLC
```

Example: RPCMAG040528T1230_CLC_OB_M3.LBL
RPCMAG040528T1230_CLC_OB_M3.TAB

Magnetic Field data filename convention for RESAMPLED averaged data (CLE,CLF,CLG):

```
<inst> <begin of observation>_<level>_<sensor>_A<average>.<ext>
RPCMAG yymmdd CLF IB A1, A60 LBL
          CLG OB TAB
```

Example: RPCMAG040528_CLG_OB_A1.LBL
RPCMAG040528_CLG_OB_A1.TAB

Average denotes the time interval for one average period in seconds.

Magnetic Field data filename convention for RESAMPLED Reaction Wheel disturbance eliminated data (CLH):

```
<inst> <begin of observation>_<level>_<sensor>_<inst mode>.<ext>
RPCMAG yymmddThhmm CLH OB M3 LBL
          TAB
```

Example: RPCMAG040528T1230_CLH_OB_M3.LBL
RPCMAG040528T1230_CLH_OB_M3.TAB

Housekeeping data Convention:

```
<inst> <begin of observation>_<datatype>.<ext>
RPCMAG yymmddThhmm _ HK LBL
          TAB
```

Example: RPCMAG040528T1230_HK.LBL
RPCMAG040528T1230_HK.TAB

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

MAG complies to PDS version 3, and we use version 3.6 of the PDS standard reference.

3.2.2 Time Standards

The Time Standard used for RPC-MAG obey the definitions stated in
Rosetta Time Handling, RO-EST-TN-3165, sect. 4.2

UTC Time Format :

Time(UTC) in LBL files: yyyy-mm-ddThh:mm:ss.sss

Time(UTC) in TAB files: yyyy-mm-ddThh:mm:ss.ssssss

ss.sss means: "seconds . decimal fractional seconds"

OBT Time Format:

The PDS keywords

SPACECRAFT_CLOCK_START_COUNT and
SPACECRAFT_CLOCK_STOP_COUNT
refer to OBT.

The header of the experiment telemetry source packets contains the data acquisition start time in OBT as 32 bit of unit seconds followed by 16 bit of fractional seconds. OBT = 0 is at 2003-01-01-T00:00:00 UTC. The time resolution is $2^{(-16)} = 1.53E-5$ seconds. The OBT is represented in the following format:

SPACECRAFT_CLOCK_START/STOP_COUNT = "<reset number>/<unit seconds>.<fractional seconds>"

The unit seconds and the fractional seconds are separated by the full stop character ("."). Note that this is not a decimal point. The fractional seconds are expressed as multiples of $2^{(-16)} = 1.53E-5$ seconds and count from 0 to $2^{16} - 1 = 65535$.

E.g. in SPACECRAFT_CLOCK_START_COUNT = "1/21983325.392" the 392 fractional seconds correspond to $392 * 2^{(-16)} = 0.00598$ decimal seconds.

The spacecraft clock could be reset during the mission (although this is not planned). This would imply a change of the zero point. The zero point of the OBT will be indicated by pre-pending the reset number (integer starting at 1) and a slash to the unit seconds, i.e. "1/" means OBT = 0 at 2003-01-01T00:00:00 UTC.

The conversion from OBT to UTC is done using the standard ESA conversion procedures described in RO-EST-TN-3165.

Spacecraft Clock (OBT) in LBL files: "r/nnnnnnnnnn.nnnnn"

Spacecraft Clock (OBT) in TAB files: nnnnnnnnnn.nnnnn

Here r means the reset number starting at 1. As the OBT is in the TAB files is supposed to be just an add-on information only the value of the clock without the reset number is stored. Probably nobody will use the OBT inside the TAB files as UTC is available for a comparison with other data.

3.2.3 Reference Systems

System Name	Definition
Instrument coordinates	RPC-MAG unit reference systems for the Inboard (IB) and Outboard (OB) sensor. Systems are defined relative to the S/C coordinate system using matrices for the stowed and deployed boom orientations. The matrices can be found in the ./calib/RPCMAG_SC_ALIGN.TXT file, distributed with each CALIBRATED and RESAMPLED dataset.
S/C coordinates	Orientation: x: pointing from the LANDER to the s/c center, perpendicular to solar array axes; y: parallel to solar array axis; pointing to the left, when standing in front of the Lander, z: pointing up
EME2000	Earth Mean Equator inertial reference frame related to Equinox of Epoch J2000. Orientation: x: pointing from SUN to Vernal Equinox, y: perpendicular to X in Earth Equatorial plane, z: perpendicular to Earth Equator plane, pointing up
ECLIPJ2000	Ecliptic Coordinates related to Equinox of Epoch J2000. Orientation: x: pointing from SUN to Vernal Equinox, y: perpendicular to X in Ecliptic Plane, z: perpendicular to Ecliptic plane, pointing up
CSO	Comet Centric Solar Orbital System. Orientation:

	<p>x: Pointing from COMET to SUN, y: The inertially referenced velocity of the sun relative to the comet is the secondary vector: the Y axis is the component of this velocity vector orthogonal to the X axis. z: perpendicular to X and Y, completing system to be right handed</p>
GSE	<p>GEO Centric Solar Ecliptic System. Orientation: x: pointing from EARTH to SUN, y: perpendicular to X in Ecliptic plane, z: perpendicular to Ecliptic plane, pointing up</p>
MSO	<p>Mars Centric Solar Orbital System. Orientation: x: pointing from MARS to SUN, y: perpendicular to X against planetary motion, z: perpendicular to X & Y, completing system to be right handed</p>
CSEQ	<p>Body-centered Solar EQUatorial This frame is defined as a two-vector style dynamic frame as follows: +x axis is the position of the Sun relative to the body; it's the primary vector and points from the body to the Sun; +z axis is the component of the Sun's north pole of date orthogonal to the +X axis; +y axis completes the right-handed reference frame; The origin of this frame is the body's center of mass.</p>

Table 5: Coordinate Systems

REMARK:

As celestial coordinate system for the data of the calibration levels CLC,CLG,CLH only the following reference frames were used:

- ECCLIPJ2000: for all data in 2004 – 2011.
These this are all cruise phases, swing-bys, fly-bys and checkout phases.
- 67P/C-G_CSEQ: for all data in 2014 – 2016.
These are all comet phases from the “Prelanding Phase” until the end of the “Extended Mission Phase”, hence PRL, ESC1, ESC2, ESC3, ESC4, EXT1, EXT2, EXT3.

3.2.4 Other Applicable Standards

N/A

3.3 Data Validation

For the validation of the data, data of the OB and IB sensor will be compared. They should show similar structures, originated in the solar wind. Due to the distortions of the s/c, however, there will be uncorrelated structures as well. The temperatures of both sensors should be nearly identical. A comparison of the MAG data with the data of the Lander magnetometer ROMAP was conducted whenever it was possible.

For a more quantitative assessment quality flags have been implemented to each magnetic field vector stored in TAB file. The quality flag is a string of 11 digits. The definition of this flag system is given in the following table:

REMARK: These quality flags are applicable for CALIBRATED and RESAMPLED data only. For EDITED RAW data only 0/1 flags at the end of each data row in the *.TAB files are available, indicating good/bad data according to telemetry data packet problems only. For those details refer to the Label files *.LBL accompanied with each *.TAB files in the EDITED datasets.

QUALITY FLAG DEFINITION:

```
# ROSETTA RPCMAG QUALITY INDEX FILE
# IR August 2018
#
These flags describe the quality of the magnetic field data.
# The quality is coded in a 11 byte string. Each character can have
# the following values:
# VALUE:      MEANING:
# x           property described by flag is still unknown
# 0           no disturbance, good quality
# 1..9,A..F  specific disturbance/problems, see below
#             Value is hexadecimal coded
#
# Description of the specific flags:
#
# FLAG-STRING  FLAG  DESCRIPTION
# BA987654321
# -----: 1  RELATION BETWEEN IB AND OB SENSOR (binary coded)
# -----: 1  Digit 3 2 1 0 : Value
# -----: 1  : x  no assessment
# -----: 1  0 0 : 0  Difference < 1nT , PERFECT
# -----: 1  0 1 : +1  Difference < 2nT , GOOD
# -----: 1  1 0 : +2  Difference < 4nT , AMPLE
# -----: 1  1 1 : +3  Difference > 4nT , POOR
# -----: 1  1  : +4  IB Temperature drifting
# -----: 1  1  : +8  OB Temperature drifting
#
# -----: 2  PERCENTAGE OB / IB DIFFERENCE
# -----: 2  x = no assessment
# -----: 2  0 = deviation < 10 \%, PERFECT CORRELATION
# -----: 2  1 = deviation < 20 \%, GOOD CORRELATION
```

```

# -----: 2 2 = deviation < 50 \%, AMPLE CORRELATION
# -----: 2 3 = deviation > 50 \%, POOR CORRELATION
#
# -----: 3 IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
# -----: 3 x = impact not assessed
# -----: 3 0 = probably no disturbance
# -----: 3 1 = disturbance eliminated during data analysis
# -----: 3 2 = disturbance possible
# -----: 3 3 = disturbance not clear
#
# -----: 3 4 = data disturbed, cleaned CLH data available
# -----: 3 5 = data disturbed, elimination not possible
#
# -----: 4 VARIOUS DISTURBANCE EFFECTS
# -----: 4 x = no assessment
# -----: 4 0 = no other problems detected
# -----: 4 1 = severe heater impact at EAR1 eliminated
# -----: 4 2 = severe heater impact at EAR1, about 2nTpp PWM
# -----: 4 3 = S/C 28 V Power failure
# -----: 4 4 = dT/dt > threshold, no thermal equilibrium
# -----: 4 5 = data disturbed by AC-signal, origin at S/C
# -----: 4 6 = data noisy due to power on failure
# -----: 4 7 = ADC latch-up: bit error. Final data corrected!
# -----: 4 8 = sensor saturated due to huge external field
# -----: 4 9 = sensor saturated, instrument power on failed
#
# -----: 5 LANDER HEATER STATUS (binary coded)
# -----: 5 MSS: Mechanical support Heaters
# -----: 5 HIB: Hibernation Heaters
# -----: 5 digit 3 2 1 0 : Value
# -----: 5 : x no assessment
# -----: 5 1 : +1 MSS1 off/on (0/1)
# -----: 5 1 : +2 MSS2 off/on (0/1)
# -----: 5 1 : +4 HIB1 off/on (0/1)
# -----: 5 1 : +8 HIB2 off/on (0/1)
#
# -----: 6 LANDER P/L STATUS (binary coded)
# -----: 6 digit 3 2 1 0 : Value
# -----: 6 : x no assessment
# -----: 6 1 : +1 COSAC off/on (0/1)
# -----: 6 1 : +2 COSAC active (0/1)
# -----: 6 1 : +4 PTOLEMY off/on (0/1)
# -----: 6 1 : +8 PTOLEMY active (0/1)
#
# -----: 7 LANDER STATUS (binary coded)
# -----: 7 digit 3 2 1 0 : Value
# -----: 7 : x no assessment
# -----: 7 1 : +1 Lander detached/attached (0/1)
# -----: 7 2 : +2 ROMAP data available(0/1)
# -----: 7 4 : +4 LANDER off/on (0/1)
# -----: 7 8 : +8 Separation ongoing (0/1)
#
# ---: 8 BOOM DEPLOYMENT:
# ---: 8 x = no assessment
# ---: 8 0 = boom deployed
# ---: 8 1 = boom stowed
# ---: 8 2 = boom deployment ongoing. Data only valid

```

```
# ---:      8      in instrument coordinates
# ---:      8      3 = pyros fired for boom release
#
# --:       9      IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
# --:       9      x = no assessment
# --:       9      0 = WOL not active
# --:       9      1 = WOL active, no disturbance visible
# --:       9      2 = Start of WOL not visible
# --:       9      3 = End of WOL not visible
# --:       9      4 = WOL completely visible
#
# -:        A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
# -:        A      x = no assessment
# -:        A      0 = OCM not active
# -:        A      1 = OCM active, no disturbance visible
# -:        A      2 = Jump visible (in B and/or dB/dt)
# -:        A      3 = Comb-disturbance visible (in B and/or dB/dt)
# -:        A      4 = Jump and comb visible
# -:        A      5 = no data during OCM
#
# :         B      PLASMA ENVIRONMENT
# :         B      x = no assessment
# :         B      0 = Cavity
# :         B      1 = pure solar wind
# :         B      2 = cometary influenced solar wind
# :         B      3 = pure cometary environment, sw not present
# :         B      4 = Earth swing-by
# :         B      5 = Mars swing-by
# :         B      6 = Steins fly-by
# :         B      7 = Lutetia fly-by
#
```

With this complex quality assessment system it is possible to quantify the quality of each single vector in a detailed way. It is flexible enough to be adapted to widely spread future needs.

A complete description and assessment of these flags can be found in

RO-IGEP-TR0074: The RPCMAG USERGUIDE

At a first step the flags have to be determined and written to an overall time oriented index file. Each time a flag changes a new entry has to be generated. This step has to be done semi-manually day by day. Specific quality flag files had to be created before using different parameters from the DDS, like commands for execution Wheel Offloadings (WOLs), Orbit correction manoeuvres (OCMs), Switch on/switch off times of various P/L Instruments, thruster activities, boom deploy manoeuvres, PHILAE operations, specific currents, etc. Afterwards all these single files had to be merged to one master quality file, containing all quality information of the complete mission. This process is assisted by the LABVIEW S/W *EXTRACT_QUALITY_FLAGS_OCM_WOL_32bit.vi*. Once this index file had been generated the IDL S/W *SET_QUALITY.PRO* reads this file and pad each vector in every related TAB file with the right quality flag.

Flag evaluation Process:

Flag 1: **Relation between IB and OB**

It's a known fact that the quality of magnetic field measurements is inter alia strongly dependent on the

- sensor offset
- s/c residual-field

The sensor offset is a temperature dependent entity, which has been calibrated on ground in a limited temperature range. Using inflight data it was possible to create an improved temperature offset-model for an extended temperature range. Thus, the sensor offset can be calibrated if the sensor is in thermal equilibrium and the s/c is in reasonable magnetic state. In phases of fast changing temperatures (e.g. a flyby with a fast varying pointing) the actual offset might not be computed correctly. Therefore, data might drift during such phases. Additionally the s/c residual field affects the magnetic field measurements strongly.

Changes in the s/c residual field (either drifts or jumps) occur quite often due to varying payload or s/c-subsystem activities. Reasons are varying currents, moving magnetic parts or temperature effects acting on spacecraft parts and causing magnetic properties to be changed.

The magnetic cleanliness requirements for the ROSETTA s/c were far from the requirements applied to e.g. the CLUSTER spacecraft. Therefore, a very limited magnetic cleanliness program yielded a relatively unstable and "magnetically dirty" ROSETTA satellite which generates the disturbances seen in the magnetic field data during flight.

The offset is temperature dependent. Although an extended model of the offset's temperature dependence has been applied the offset cannot be determined exactly at any time. Especially immediately after powering on the instrument (up to a few hours later) the thermal equilibrium is not reached and therefore the thermal model cannot be applied. This leads to arbitrary offset values – different for each sensor.

The averaged differences of the magnetic field components are computed by the IDL S/W *QUALITY_CHECK.PRO* to create the content of Quality-Flag 1 on the one hand and overview plots, provided in the *DATA_SUMMARY* reports (delivered with each dataset) on the other hand. The stated magnetic field differences are not the pure differences but the differences reduced by the daily mean of the differences. The indicator has been created this way, because the relative trend is more important than the absolute difference. These differences are binned (perfect, good, ample, poor) and color-coded in the plots. Bits 0 and 1 of Flag 1 are set accordingly.

Correlation between Inboard (IB) and Outboard (OB) Sensor

Under ideal conditions the IB and OB sensor measure the same field. This perfect situation can, however, be declined by different effects:

- Different temperature dynamics (e.g. due to different shadowing and different solar irradiation) cause different offset behavior of both sensors.
- Due to different locations the sensors measure the disturbing sources of the s/c in different ways. Therefore changing s/c fields produce different changes at the locations of the sensors and cause the correlation between the sensor data to be decreased.
- Often the real offset of the sensors is not as important as a good common AC-behavior. Thus, the short term "high frequent" behavior can be acceptable where

as the long term behavior is poor due to offset or s/c residual-field drifts. This possible characteristics can be reflected by the flagging system

The different thermal behaviors of the sensors are characterized using the following indicator:

$$I = d(T_{OB}(t) - T_{IB}(t)) / dt$$

It is used in the QUALITY_CHECK S/W to obtain a qualitative measure of the thermal behavior. If this indicator exceeds the threshold level of 0.1 mK/s (empirically chosen) the data in the overview plots (DATA_SUMMARY Reports) provided with each dataset will be marked violet, indicating that the thermal equilibrium is not reached, and that the time series of both sensors can show different trends. In this case the quality digits 3 and 4 of flag 1 will be set.

Flag 2: Percentage Difference between IB and OB

For the description and background refer to Flag 1. Percentage Flag 2 is, however, derived from normalized differences in order to obtain a percentage data quality indicator.

Flag 3: Impact of Reaction wheels

This influence is checked by comparison of the dynamic frequency spectra of the magnetic field vectors and the spectra of the reaction wheels obtained from the DDS TM files. After calculation of the spectra the flags can easily be determined manually day by day (Optical comparison of plots: do disturbing spectral lines exist or not)

Flag 4: Various Disturbance Effects

This flag provides information about various disturbances or event happened during the mission. Heater signatures have been taken directly taken from magnetic field data and DDS command lists. Any power failure of the RPCMAG instrument is logged in the Event Logbook provided with each dataset. Any steep thermal changes of the MAG sensor have been computed by parts of the pipeline software and automatically converted into specific flag lists. AC disturbances by different, not further specified s/c sources, is quasi-continuously present and therefore preemptively flagged. Noisy data can very rarely occur after a faulty power-on cycle. This bit would be set manually after visual inspection of MAG data. Sensor saturation happened during C/A at Earth. Flags set manually after data inspection. Saturation due to partial power failure can happen as well and has to be flagged manually. All the failure events happened extremely seldom during the whole mission.

Flag 5: Lander Heater Status

The overall switch on/off times of the Lander S/S heater disturbance can be retrieved from Lander HK data. Here we distinguish between the Mechanical subsystem survival heaters (MSS) and the Hibernation Heaters (HIB). The retrieved activation times are regarded as correct, no further validation is conducted.

Flag 6: Lander P/L Status

The switch on/off times of the Lander (via ESS) can be retrieved from Lander HK data. The PHILAE Separation time can be seen in the magnetic field data and in the Lander HK data, the ROMAP switch on/off times are provided by the ROMAP Team.

The retrieved times are regarded as correct, jumps in magnetic field data at Lander activation/deactivation and separation times correlate with the related times retrieved from the DDS, no further validation is conducted.

Flag 7: Lander Status

The overall switch on/off times of the Lander P/L instruments can be retrieved from Lander HK data. Here we consider the COSAC and PTOLEMY instruments, which showed significant disturbance pattern during the LUTETIA flyby. The retrieved activation times are regarded as correct, no further validation is conducted.

Flag 8: Boom Deployment

The boom has been deployed on March 19, 2004. Exact times are known and the process can be seen in the magnetic field data.

Flag 9: Impact of Wheel Offloading manoeuver (WOL)

The execution start times of the WOLs have been retrieved from the command history file available on the DDS. All events have been inspected manually by eye, the execution end times have been determined by eye using MAG data. Therefore, the WOL disturbance is fully validated. See WOL reports delivered within the datasets

Flag A: Impact of Orbit Correction Manoeuvres (OCM)

The execution start times of the OCMs have been retrieved from the command history file available on the DDS. All events have been inspected manually by eye, the execution end times have been determined by eye using MAG data. Therefore, the OCM disturbance is fully validated. See OCM reports delivered within the datasets.

Flag B: Plasma Environment

The times for specific environmental conditions have been collected from different sources. Cavity times have directly been derived from magnetic field data. Solar wind- and Cometary-influenced time intervals have been determined by interdisciplinary data analysis of all RPC instruments. The fly-bys at the Asteroid and the swing-by times at the Planets have been taken from the official ROSETTA mission calendar.

The Quality assessment is done by the data producer.

More details about the quality flag system can be found in the reports

“Overview of available RPCMAG data and quality assessment ...” delivered with each data set in the DATA_SUMMARY Reports to be found in the FLAIGHT_REPORT folders.

3.4 Content

3.4.1 Volume Set

According to Planetary Data System Standard Reference, Version 3.6, Chapter 19, Figure 19.1.

3.4.2 Data Set

Our naming convention for the DATA_SET_NAME will follow the same principles as the DATA_SET_ID in chapter 3.1.2.

```
DATA_SET_NAME="ROSETTA-ORBITER <target_name> RPCMAG <level> <Mission phase  
abbreviation> <Description> <version number>"
```

<target_name> =

- 67P
- <asteroid short name>
- EARTH
- MARS
- CHECK
- CAL
- SW

Target names according to RO-EST-PL-5011, table 4

<level> = Codmac Level 1...4. According to PDS Standard Reference, Chapter 6.5

<Mission Phase abbreviation> =

- CVP : Commissioning
- EAR1,EAR2,EAR3 : Earth Swing-By
- CR1...CRn : Cruise Phases
- MARS
- AST1,AST2 : Asteroid Fly-by
- RVM1,RVM2 : Rendezvous Manoeuvre
- PRL: Prelanding Phase
- ESC n: Escort Phase n
- EXT n: Extended Mission Phase n

Designators according to RO-EST-PL-5011, Table 2

<Description> = This contains the processing level in text form:

- EDITED
- CALIBRATED
- RESAMPLED

<Version Number> = Contains the Dataset version, e.g. V9.0

One data set will be used for each processing level. Multiple targets will be used for each data set and within each data set TARGET_NAME and TARGET_TYPE will be used to identify the current target (Thus they will not stay the same within one data set, but data set id will). The data set name fits in the full length thus 60 characters.

3.4.3 Directories

3.4.3.1 Root Directory

The root directory for the RPCMAG data is named with the DATA_SET_ID. It will only contain the **AAREADME.TXT**, the **VOLDESC.CAT** and the PDSVOLUME.XML info file.

3.4.3.2 Calibration Directory

Contains the files:

CALINFO.TXT ; Info File
RPCMAG_SC_ALIGN.TXT ; Results of the sensor to S/C coordinates alignment
After the S/C integration an optical measurement of the sensor and boom orientation has been carried out by ASTRIUM people at ESTEC. Mirrors were attached to the sensors and the exact alignment wrt. the spacecraft has been determined. The resulting angles are listed in this file for a stowed and a deployed boom.

RPCMAG_GND_CALIB_FSDPU_FMIB.TXT ; GND Calibration results of FS DPU & FM IB sensor
RPCMAG_GND_CALIB_FSDPU_FMOB.TXT; GND Calibration results of FS DPU & FM OB sensor

These two files contain the results of the ground calibration for each SENSOR/DPU combination. All temperature dependent sensitivity, misalignment and offset coefficients (refer to RO-IGM-TR0003, Analysis of the FMG Calibration, Chapters 7 & 8 & 9) are listed here to be read by the data calibration software.

During flight it turned out that the temperature model had to be extended to lower temperatures. Therefore, a new model with additional coefficients has been created. These coefficients are stored in inflight calibration files.

INFCAL_OFF_IB_20180305_009.TXT ; Inflight Calibration results for the IB sensor, Temperature Model
INFCAL_OFF_OB_20180305_009.TXT ; Inflight Calibration results for the OB sensor, Temperature Model

INFCAL_PARA_IB_20180305_009.TXT ; Inflight Calibration results for the IB sensor, Offset jumps
INFCAL_PARA_OB_20180305_009.TXT ; Inflight Calibration results for the OB sensor, Offset jumps

3.4.3.3 Catalog Directory

Contains the files:

FILENAME	DESCRIPTION
CATINFO.TXT	This file contains a list of all catalog files located in the CATALOG directory. A brief description of these files is given.
DATASET.CAT	This files describes the MAGNETOMETER dataset in the actual mission phase
ROSETTA_INSTHOST.CAT	This file describes the ROSETTA s/c acting as instrument host for all the experiments. This file was provided by ESA.
ROSETTA_MISSION.CAT	This file describes the ROSETTA mission to Comet 67P/Churyumov-Gerasimenko. The file was provided by ESA.
RPCMAG_INST.CAT	This files contains a complete instrument description of the orbiter magnetometer RPC-MAG.
RPCMAG_PERS.CAT	In the file all people responsible for the RPC-MAG data archiving are listed. Contact information is added.
RPCMAG_REF.CAT	The file contains publication references of all publications mentioned in the CATALOG files. Additionally all references to ESA documents are listed here. These references were provided by ESA. Scientific RCPMAG publications are listed as well.
RPCMAG_SOFTWARE.CAT	The files is empty, as no S/W will be provided.

Table 6:Catalog Directory

3.4.3.4 Index Directory

This directory contains the index files generated by the ESA S/W DVAL.

Additionally the GEOINDEX.LBL and GEOINDEX.TAB files will be located here- under responsibility of ESA

3.4.3.5 Browse Directory and Browse Files

N/A

3.4.3.6 Geometry Directory

The needed geometry information will be taken from the ancillary files provided by RSOC via the DDS.

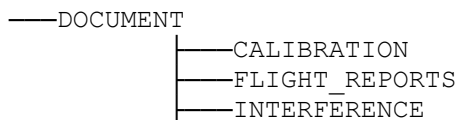
These files are not PDS compliant. RSOC is responsible for archiving them. Thus, there will not be any GEOMETRY directory.

3.4.3.7 Software Directory

It is not planned to deliver any software.

3.4.3.8 Document Directory

Directory Structure:



Details about the content of this directory can be found in the DOCINFO.TXT file.

The DOCUMENT root contains this EAICD (RO-IGEP-TR0009), the RPCMAG User Guide (RO-IGEP-TR0074), the RPC User Guide. For a detailed instrument overview also the Instrument Paper RPCMAG_INSTRUMENT is added as PDF version.

A good overview about all instrument operations and events occurring during flight is presented in the RPCMAG Logbook-file. This file is available in ASCII format. Most parts of this file are directly extracted from the DDS TC logging file and the DDS Events-File.

The CALIBRATION directory contains the calibration protocols and analysis reports. Also a STEP by STEP Calibration Procedure (RO-IGEP-TR0028) is added here.

The FLIGHT_REPORTS folder contains the results from the commissioning (RO-IGEP-TR0013) and data summary reports of the actual mission phase with an overview about data availability and data quality: (RO-IGEP-TR00XX_DATA_SUMMARY).

The INTERFERENCE folder contains all information available about data disturbance: Wheel Offloading Reports (RO-IGEP-TR00XX_WOL), Orbit Correction Manoeuvres (RO-IGEP-TR00XX_OCM), Cavity Signature Investigation (RO-IGEP-TR0066), and S/C Current Investigation (RO-IGEP-TR0070_CURRENTS)

All documents are saved as PDF files.

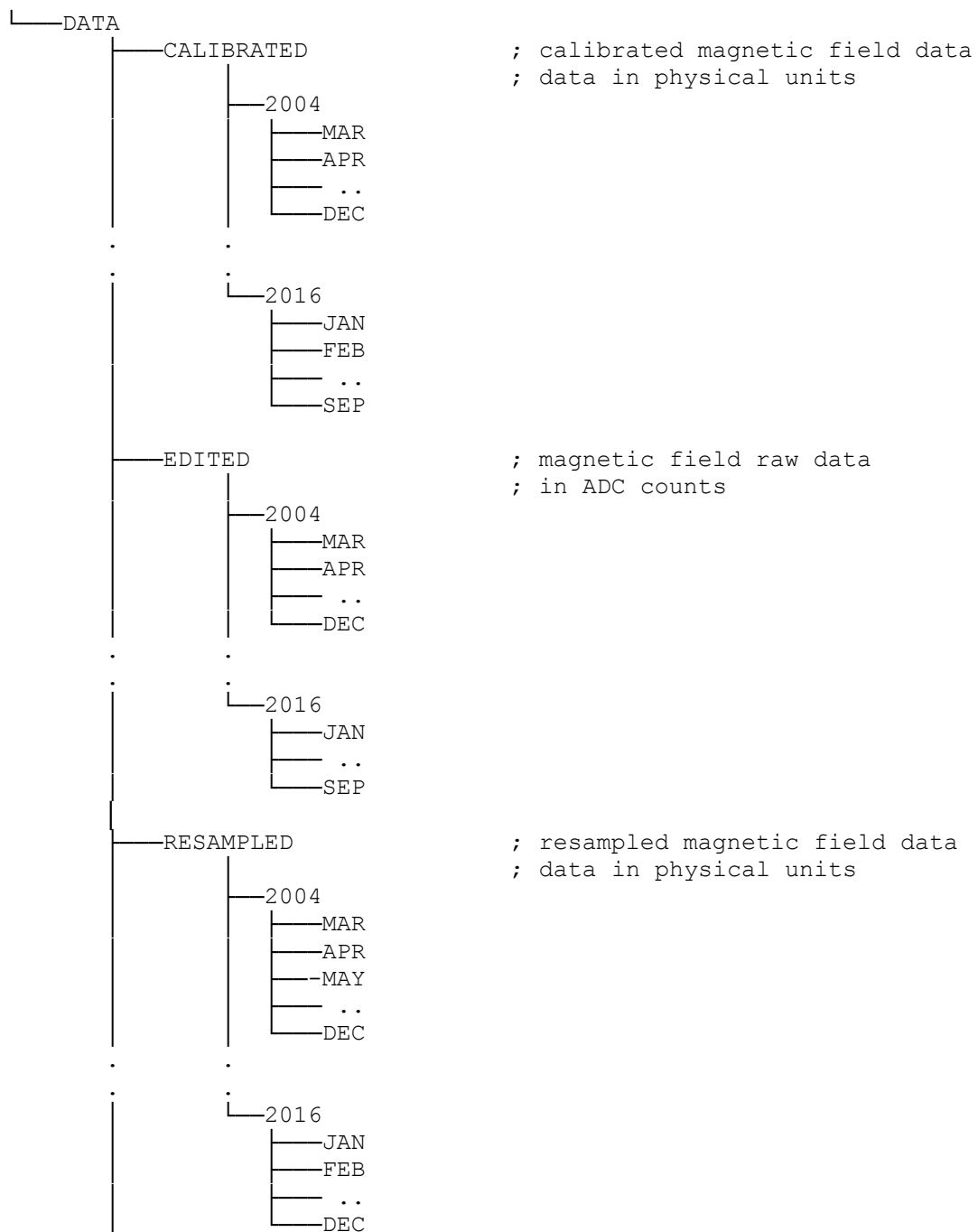
3.4.3.9 Data Directory

Refer to 3.1.3

4 Detailed Interface Specifications

4.1 Structure and Organization Overview

The principle data directory structure sorted by data types was presented in chapter 3.1.3. The sortation with respect to the time is displayed in the following tree.



Each "Month" directory contains the different Level and sensor directories as described in Chapter 3.1.3. For the CALIBRATED data we have

```

|
|--LEVEL_A ; instrument coordinates
|   |--HK ; Housekeeping data t, ...
|   |--IB ; Inboard sensor: t,B,T,QUAL
|   |--OB ; Outboard sensor: t,B,T,QUAL
|
|--LEVEL_B ; s/c coordinates
|   |--IB ; Inboard sensor: t,B,T,QUAL
|   |--OB ; Outboard sensor: t,B,T,QUAL
|
|--LEVEL_C ; B in celestial coords. & positions
|   |--IB ; Inboard sensor: t,r,B,QUAL
|   |--OB ; Outboard sensor: t,r,B,QUAL

```

For the EDITED Data there are only the sensor and housekeeping subdirectories.

```

|
|--HK ; Housekeeping data
|--IB ; Inboard sensor: t,B,T
|--OB ; Outboard sensor: t,B,T

```

For the RESAMPLED data there are LEVEL_N n={E;F;G} data, which represent s second averaged data merged from all available mode files of the given day. As standard we deliver 1 s and 60 s averaged data.

```

|
|--LEVEL_n
|   |--IB ; Inboard sensor: t, (r), B, T, QUAL
|   |--OB ; Outboard sensor: t, (r), B, T, QUAL

```

Last but not least the are the LEVEL_H data in the RESAMPLED folder, which represent Reaction Wheel disturbance eliminated data at the original sampling frequency but Fourier transformed (forth and back) as the elimination is conducted in the Frequency domain. Due to the physical constraints there are only OB data observed in Burst mode.

```

|
|--LEVEL_H
|   |--OB ; Outboard sensor: t, (r), B, QUAL

```

4.2 Data Sets, Definition and Content

We distinguish between three levels: EDITED, CALIBRATED, RESAMPLED data.

The EDITED data just contain the decommutated TM data in units of ADC counts. Basic Quality flags assign the data quality.

All calibrated data contain data in physical units like Nanotesla and Kelvin. This means, that the results of the ground calibration and inflight calibration have been applied to the data.

The CALIBRATED directory is divided in various sublevels:

- LEVEL_A data are data in instrument coordinates including also sensor temperatures.
S/C generated noise and residual fields are taken into account as far as possible, at least by flagging.
- LEVEL_B data are magnetic field data in s/c coordinates including temperatures as well.
S/C generated noise and residual field are taken into account as far as possible, at least by flagging.
- LEVEL_C data are data in celestial coordinates. Nominal s/c position and attitude have been considered during the evaluation. s/c generated noise and residual fields are taken into account as far as possible, at least by flagging. Data contain s/c positions as well.

The RESAMPLED data are derived from the CALIBRATED data by averaging to a specified average period, e.g. 1 second (A1) or 1 minute (A60) or correcting specific disturbance sources by application of special filters. This leads to

- LEVEL_E data.
These are calibrated data in instrument coordinates. Input were LEVEL_A data.
Data averaged. Different modes are taken into account if necessary. Used for internal use only.
- LEVEL_F data.
These are calibrated data in s/c-coordinates. Input were LEVEL_B.
Data averaged. Different modes are taken into account if necessary.
- LEVEL_G data.
These are calibrated data in celestial coordinates. S/C position and attitude have been considered during the evaluation. Data contain s/c positions as well. Data averaged. Different modes are taken into account if necessary.
Input were LEVEL_C data.
- LEVEL_H data.
These data are derived from LEVEL_C data. A filter algorithm has been applied to get rid of the noise produced by ROSETTA's reaction wheels. Nominal S/C position and attitude have been considered during the evaluation. Data contain s/c positions as well. Data are not averaged but resampled due to filter algorithm in frequency domain.

All data are stored in *.TAB files. All timeseries contain UTC and OBT spacecraft clock as time stamps. Data Sets have been created for each mission phase and delivered at convenient time afterwards. The data sets contain the data described in this document.

4.3 Data Product Design

4.3.1 General OVERVIEW

We have three types of data:

- Housekeeping data (HK),
- Outboard sensor magnetic field data (OB) and
- Inboard sensor magnetic field data (IB).

The format of the HK data is different to the OB and the IB data. The latter have, however, the same format inside a given level. Magnetic field data exist for every level, whereas HK data only exist for EDITED and CALIBRATED LEVEL_A data.

A complete set of EDITED Data consists of HK, OB & IB data.
A complete set of LEVEL_A Data consists of HK, OB & IB data.
Higher level data only contain OB & IB data.

RAW data will be delivered as EDITED DATA in one DATA_SET.

LEVEL_A, LEVEL_B and LEVEL_C data will be delivered as CALIBRATED DATA in one DATA_SET.

LEVEL_F, LEVEL_G, and LEVEL_H data will be delivered as RESAMPLED DATA in one DATA_SET.

4.3.1.1 File Characteristics Data Elements

The *.LBL and *.TAB files will be identified by the FILE_NAME

4.3.1.2 Data Object Pointers Identification Data Elements

One pointer is used to link the *.TAB file to the related *.LBL file.

Example:

```
^TABLE = "RPCMAG080905T0438_CLH_OB_M3.TAB"
```

Other pointers are used to get an easy access to important documents. Thus reference-document pointers are can be found in the **.LBL files:

Example:

```
^ARCHIVE_CONTENT_DESC = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"
```

4.3.1.3 Instrument and Detector Descriptive Data Elements

- INSTRUMENT_MODE_ID = "SID<n>"

The instrument can operate in six modes SID1 ... SID6 (n=1..6). Meaning:

- SID1: Minimum Mode , not used
- SID2: Normal Mode
- SID3: Burst Mode
- SID4: Medium Mode , not used
- SID5: Low Mode , not used
- SID6: Test Mode , not used

Mode	Sample Rate	Packet Period	Packet Length	Bit Rate	Vector Rate	Name
SID 1	1/32 Hz	1024 s	32 OB vec 1 IB vec	2 bits/s 0.0625 bits/s	0.03125 vec/s 0.000976 vec/s	Minimum Mode
SID 2	1 Hz	32 s	32 OB vec 1 IB vec	64 bits/s 2 bits/s	1 vec/s 0.03125 vec/s	Normal Mode
SID 3	20 Hz	16 s	320 OB vec 16 IB vec	1280 bits/s 64 bits/s	20 vec/s 1 vec/s	Burst Mode
SID 4	5 Hz	32 s	160 OB vec 1 IB vec	320 bits/s 2 bits/s	5 vec/s 0.03125 vec/s	Medium Mode
SID 5	¼ Hz	128 s	32 OB vec 1 IB vec	16 bits/s 0.5 bits/s	0.25 vec/s 0.007812 vec/s	Low Mode
SID 6	20 Hz	16 s	320 OB vec 1 IB vec	1280 bits/s 4 bits/s	20 vec/s 0.0625 vec/s	Test Mode
HK	1280 Hz Internal	32 s	8 words	4 bits/s		House Keeping

Table 7: Science Modes and Sample Rates

For every activated mode and calibration level there will be one single file for each day where data have been measured. This means that there can be data gaps in the file if e.g. there were some measurements in the morning and some others in the evening. Data for heater or reaction wheel corrected data will only be available if any disturbance occurred.

Mode SID6 is normally switched on only for a few minutes after powering the instrument. This is just a test mode and therefore, SID 6 data are not considered at all and hence not included in the datasets.

- INSTRUMENT_MODE_DESC = "<name> MODE: <p> PRIMARY & <s> SECONDARY
VECTORS PER <q> SECONDS"

The mode description explains exactly how many <p> primary vectors (usually OB) and how many <s> secondary vectors (usually IB) are generated Per <q> seconds and how this mode <name> is named.

- FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"

The coefficients of the digital filter in the MAG flight software can be changed during flight (but hasn't). The Flight software ID can take these features into account.

- PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

The lower magnetometer boom has three positions: STOWED, moving during deployment, and DEPLOYED. For the launch it was stowed, and after the commissioning it will be deployed for the rest of the mission. The knowledge of the boom status is important for the right evaluation of the coordinate system.

- NOTE = "..."
The NOTE keyword is used to provide different information concerning s/w versions, coordinate systems, units, calibration file identification, and timing shift information.

4.3.1.4 Structure Definition of Instrument Parameter Objects

N/A

4.3.1.5 Data Object Definition

All data are stored in *.TAB files. Their structure is defined in the OBJECT Table definition within the *.LBL Files. Each data definition block has as DESCRIPTION which explains the meaning of the assigned data column exactly.

4.3.1.6 Description of Instrument

The detailed description of the instrument is done in the RPCMAG knowledge management video and in a brief overview in the RPCMAG_INST.CAT file. The video (RO_3DSE_MAG) is stored and administrated by ESA on the ROKSY server. It contains all available information about our instrument. Therefore, the access is limited to the MAG instrument team.

Furthermore a detailed instrument description and first scientific results obtained during the first Earth Flyby in March 2005 can be found in the RPCMAG Instrument paper

RPC-MAG: The Fluxgate Magnetometer in the ROSETTA Plasma Consortium, Glassmeier, Richter, et al., Space Science Reviews, 2006"

A copy of this paper is delivered in the DOCUMENT folder of each DATASET.

4.3.1.7 Parameters Index File Definition

N/A

4.3.1.8 Mission Specific Keyword

None

4.3.1.9 Geometry Information

ESA asked for GEOMETRY information in the *.LBL files. The RPCMAG team provides this in the following way:

```
SC_SUN_POSITION_VECTOR      = . . .
SC_TARGET_POSITION_VECTOR  = . . .
SC_TARGET_VELOCITY_VECTOR  = . . .
SPACECRAFT_ALTITUDE        = . . .
SUB_SPACECRAFT_LATITUDE    = . . .
SUB_SPACECRAFT_LONGITUDE   = . . .
NOTE                        ="
```

```
    THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
    SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
    ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
    SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
    ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
    PLANETOCENTRIC IAU_<TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
    FOR THE TIME T= START_TIME.
    DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>"
```

This means that the geometry items SC_SUN_POSITION_VECTOR, SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR provided in the label of the data product are related to the Ecliptic-J2000 frame. The SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE, however, are related to the actual Planetocentric coordinate system. All the values are valid only for one particular time, the time given by the START_TIME value. All the distances are computed in Kilometer and all angles are given in degree.

4.3.2 Data Product "EDITED Magnetic field data" Design

```

PDS_VERSION_ID           = PDS3
LABEL_REVISION_NOTE      = "V1.0"
RECORD_TYPE              = FIXED_LENGTH
RECORD_BYTES             = 79
FILE_RECORDS             = 86253
DATA_SET_ID              = "RO-C-RPCMAG-2-EXT3-RAW-V9.0"
DATA_SET_NAME = "ROSETTA-ORBITER 67P RPCMAG 2 EXT3 RAW V9.0"
PRODUCT_ID               = "RPCMAG160901T0000_RAW_OB_M2"
PRODUCT_CREATION_TIME    = 2018-08-21T13:20:00
PRODUCT_TYPE             = "EDR"
MISSION_ID               = "ROSETTA"
MISSION_NAME              = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME       = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE         = "N/A"
INSTRUMENT_HOST_ID       = "RO"
INSTRUMENT_HOST_NAME     = "ROSETTA-ORBITER"
INSTRUMENT_ID            = "RPCMAG"
INSTRUMENT_NAME = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE          = "MAGNETOMETER"
INSTRUMENT_MODE_ID       = "SID2"
INSTRUMENT_MODE_DESC     = "
  NORMAL MODE: 32 PRIMARY & 1 SECONDARY VECTORS PER 32 SECONDS"
TARGET_NAME              = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE              = "COMET"
START_TIME               = 2016-09-01T00:00:22.478
STOP_TIME                = 2016-09-01T23:59:59.201
SPACECRAFT_CLOCK_START_COUNT = "1/431308733.50587"
SPACECRAFT_CLOCK_STOP_COUNT  = "1/431395110.30611"

START_JULIAN_DATE_VALUE   = 2457632.5002601626
STOP_JULIAN_DATE_VALUE   = 2457633.4999907529
SC_SUN_POSITION_VECTOR   = ( 524262631.01, 160669212.22, -36953319.77)
SC_TARGET_POSITION_VECTOR = (      8.86,      -10.33,       7.82)
SC_TARGET_VELOCITY_VECTOR = (      0.00,       0.00,       0.00)
SPACECRAFT_ALTITUDE      =      13.786
SUB_SPACECRAFT_LATITUDE  =      2.561
SUB_SPACECRAFT_LONGITUDE =      72.058
SPICE_FILE_NAME          = {"PREHIB\ATNR_P040302093352_00127.BC",
  "PREHIB\ORER_____00031.BSP",
  "PREHIB\ORFR_____00067.BSP",
  "PREHIB\ORGR_____00096.BSP",
  "PREHIB\ORHR_____00122.BSP",
  "PREHIB\ORMR_____00052.BSP",
  "PREHIB\ORHO_____00077.BSP",
  "ROS_ORBITER_EXTENSION_V2.BSP",
  "ROS_SA_2004_V0001.BC",
  "ROS_SA_2005_V0001.BC",
  "ROS_SA_2006_V0001.BC",
  "ROS_SA_2007_V0001.BC",
  "ROS_SA_2008_V0038.BC",
  "ROS_SA_2009_V0054.BC",
  "ROS_SA_2010_V0052.BC",

```

"ROS_SA_2011_V0013.BC",
"ROS_SA_2014_V0047.BC",
"ROS_SA_2015_V0042.BC",
"ROS_SA_2016_V0041.BC",
"ROS_HGA_2008_V0018.BC",
"ROS_HGA_2009_V0051.BC",
"ROS_HGA_2010_V0045.BC",
"ROS_HGA_2011_V0018.BC",
"ROS_HGA_2014_V0044.BC",
"ROS_HGA_2015_V0053.BC",
"ROS_HGA_2016_V0042.BC",
"ROS_LBOOM_V0.BC",
"ROS_V32.TF",
"ROS_RPC_V19.TI",
"NAIF0012.TLS.PC",
"PCK00010.TPC",
"DE403_MASSES.TPC",
"ROS_160929_STEP.TSC",
"DE430.BSP",
"ROS_RPC_STRUCT_V1.BSP",
"ROS_STRUCT_V6.BSP",
"RORB_DV_145_01_T19_00216.BSP",
"RATT_DV_145_01_01_00216.BC",
"RORB_DV_223_01_T19_00302.BSP",
"RATT_DV_223_01_01_00302.BC",
"RORB_DV_257_03_T19_00345.BSP",
"RATT_DV_257_02_01_T6_00344.BC",
"LATT_CFF2LDR_FSS_V2_0.BC",
"LATT_EME2LDR_SDL_V1_0.BC",
"LATT_ROS2LDR_PRESEP_V1_0.BC",
"LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",
"ROS_SC_MES_050501_060101_V03.BC",
"ROS_SC_MES_060101_070101_V03.BC",
"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01_A_00067.BSP",
"CORL_DL_002_01_B_00043.BSP",
"CORL_DL_003_01_C_00068.BSP",
"CORL_DL_006_01_H_00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_00216.BSP",
"CATT_DV_145_02_00216.BC",
"CORB_DV_223_01_T19_00302.BSP",
"LORB_DV_223_01_T19_00302.BSP",
"CATT_DV_223_01_00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",

```

"LOBR_DV_236_01___T19_00318.BSP",
"CORB_DV_257_03___T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

PRODUCER_ID = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID = "N/A"
DATA_QUALITY_DESC = "
THE DATA QUALITY IS CODED FOR EACH VECTOR IN THE LAST COLUMN OF THE TABLE.
CODE: 0= GOOD DATA; 1= BAD DATA -- EACH SENSOR HAS ITS OWN QUALITY BIT --
BIT0:X, BIT1:Y, BIT2:Z, BIT3=0:OB, BIT3=1 IB"
PROCESSING_LEVEL_ID = "2"

DESCRIPTION = "
THIS FILE CONTAINS MAGNETIC FIELD VECTOR RAW DATA OBTAINED BY THE OUTBOARD
MAGNETOMETER ABOARD THE ROSETTA S/C AND THE TEMPERATURE OF THE OUTBOARD
SENSOR. ALL VALUES ARE 20 BIT ADC COUNTS.
FIELD IS GIVEN IN INSTRUMENT COORDINATES"
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID = "RPCMAG"
^ARCHIVE_CONTENT_DESC = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"

NOTE = "
A)
MAGNETIC_COORDINATE_SYSTEM : INSTRUMENTCOORDS
B)
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
FOR THE TIME T= START_TIME.
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
C)
LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
"
^TABLE = "RPCMAG160901T0000_RAW_OB_M2.TAB"

OBJECT = TABLE
NAME = "RPCMAG-OB-SID2-RAW"
INTERCHANGE_FORMAT = ASCII
ROWS = 86253
COLUMNS = 7
ROW_BYTES = 79

OBJECT = COLUMN
NAME = "TIME.UTC"
DATA_TYPE = TIME

```

```

START_BYTE      = 1
BYTES           = 26
DESCRIPTION     = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "TIME_OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 28
BYTES           = 15
DESCRIPTION     = "S/C CLOCK AT OBSERVATION TIME, SECONDS SINCE 00:00
AT 1.1.2003: SSSSSSSS.FFFFF,
SSSSSSSS: REAL SECONDS,
FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "BX_OB"
DATA_TYPE       = ASCII_INTEGER
START_BYTE      = 44
BYTES           = 7
UNIT            = "N/A"
DESCRIPTION     = "
MAGNETIC FIELD X COMPONENT, UNCALIBRATED RAW DATA,
INSTRUMENT COORDINATES, OB SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "BY_OB"
DATA_TYPE       = ASCII_INTEGER
START_BYTE      = 52
BYTES           = 7
UNIT            = "N/A"
DESCRIPTION     = "MAGNETIC FIELD Y COMPONENT, UNCALIBRATED RAW DATA,
INSTRUMENT COORDINATES, OB SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "BZ_OB"
DATA_TYPE       = ASCII_INTEGER
START_BYTE      = 60
BYTES           = 7
UNIT            = "N/A"
DESCRIPTION     = "MAGNETIC FIELD Z COMPONENT, UNCALIBRATED RAW DATA,
INSTRUMENT COORDINATES, OB SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "T_OB"
DATA_TYPE       = ASCII_INTEGER
START_BYTE      = 68
BYTES           = 7

```

```

UNIT                = "N/A"
DESCRIPTION         = "RAW TEMPERATURE OF RPCMAG OB SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME              = "QUALITY"
DATA_TYPE         = ASCII_INTEGER
START_BYTE       = 76
BYTES            = 2
DESCRIPTION       = "REFER TO DATA_QUALITY_DESC. VALUE REPRESENTS A FLAG"
END_OBJECT       = COLUMN

END_OBJECT        = TABLE
END

```

4.3.3 Data Product "EDITED Housekeeping data" Design

```

PDS_VERSION_ID      = PDS3
LABEL_REVISION_NOTE = "V1.0"
RECORD_TYPE         = FIXED_LENGTH
RECORD_BYTES        = 106
FILE_RECORDS        = 2700
DATA_SET_ID         = "RO-C-RPCMAG-2-EXT3-RAW-V9.0"
DATA_SET_NAME       = "ROSETTA-ORBITER 67P RPCMAG 2 EXT3 RAW V9.0"
PRODUCT_ID          = "RPCMAG160901T0000_RAW_HK"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE        = "EDR"
MISSION_ID          = "ROSETTA"
MISSION_NAME        = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME  = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE    = "N/A"
INSTRUMENT_HOST_ID  = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"
INSTRUMENT_ID       = "RPCMAG"
INSTRUMENT_NAME     = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE     = "MAGNETOMETER"
INSTRUMENT_MODE_ID  = "HK"
INSTRUMENT_MODE_DESC = "HOUSEKEEPING MODE: 8 WORDS PER 32 SECONDS"
TARGET_NAME         = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE         = "COMET"
START_TIME          = 2016-09-01T00:00:19.945
STOP_TIME           = 2016-09-01T23:59:47.973
SPACECRAFT_CLOCK_START_COUNT = "1/431308731.23927"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/431395099.23927"

START_JULIAN_DATE_VALUE = 2457632.5002308455
STOP_JULIAN_DATE_VALUE  = 2457633.4998607989
SC_SUN_POSITION_VECTOR  = ( 524262616.07, 160669177.13, -36953321.13)
SC_TARGET_POSITION_VECTOR = (      8.86,      -10.33,      7.82)
SC_TARGET_VELOCITY_VECTOR = (      0.00,      0.00,      0.00)
SPACECRAFT_ALTITUDE     = 13.786
SUB_SPACECRAFT_LATITUDE = 2.562
SUB_SPACECRAFT_LONGITUDE = 72.088

```

```
SPICE_FILE_NAME = {"PREHIB\ATNR_P040302093352_00127.BC",  
                  "PREHIB\ORER_00031.BSP",  
                  "PREHIB\ORFR_00067.BSP",  
                  "PREHIB\ORGR_00096.BSP",  
                  "PREHIB\ORHR_00122.BSP",  
                  "PREHIB\ORMR_00052.BSP",  
                  "PREHIB\ORHO_00077.BSP",  
                  "ROS_ORBITER_EXTENSION_V2.BSP",  
                  "ROS_SA_2004_V0001.BC",  
                  "ROS_SA_2005_V0001.BC",  
                  "ROS_SA_2006_V0001.BC",  
                  "ROS_SA_2007_V0001.BC",  
                  "ROS_SA_2008_V0038.BC",  
                  "ROS_SA_2009_V0054.BC",  
                  "ROS_SA_2010_V0052.BC",  
                  "ROS_SA_2011_V0013.BC",  
                  "ROS_SA_2014_V0047.BC",  
                  "ROS_SA_2015_V0042.BC",  
                  "ROS_SA_2016_V0041.BC",  
                  "ROS_HGA_2008_V0018.BC",  
                  "ROS_HGA_2009_V0051.BC",  
                  "ROS_HGA_2010_V0045.BC",  
                  "ROS_HGA_2011_V0018.BC",  
                  "ROS_HGA_2014_V0044.BC",  
                  "ROS_HGA_2015_V0053.BC",  
                  "ROS_HGA_2016_V0042.BC",  
                  "ROS_LBOOM_V0.BC",  
                  "ROS_V32.TF",  
                  "ROS_RPC_V19.TI",  
                  "NAIF0012.TLS.PC",  
                  "PCK00010.TPC",  
                  "DE403_MASSES.TPC",  
                  "ROS_160929_STEP.TSC",  
                  "DE430.BSP",  
                  "ROS_RPC_STRUCT_V1.BSP",  
                  "ROS_STRUCT_V6.BSP",  
                  "RORB_DV_145_01_T19_00216.BSP",  
                  "RATT_DV_145_01_01_00216.BC",  
                  "RORB_DV_223_01_T19_00302.BSP",  
                  "RATT_DV_223_01_01_00302.BC",  
                  "RORB_DV_257_03_T19_00345.BSP",  
                  "RATT_DV_257_02_01_T6_00344.BC",  
                  "LATT_CFF2LDR_FSS_V2_0.BC",  
                  "LATT_EME2LDR_SDL_V1_0.BC",  
                  "LATT_ROS2LDR_PRESEP_V1_0.BC",  
                  "LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",  
                  "ROS_SC_MES_050501_060101_V03.BC",  
                  "ROS_SC_MES_060101_070101_V03.BC",  
                  "ROS_SC_MES_070101_080101_V03.BC",  
                  "ROS_SC_MES_080101_090101_V03.BC",  
                  "ROS_SC_MES_090101_100101_V03.BC",  
                  "ROS_SC_MES_100101_110101_V03.BC",  
                  "ROS_SC_MES_110101_110608_V03.BC",  
                  "ROS_SC_MES_140120_150101_V03.BC",  
                  "ROS_SC_MES_150101_160101_V03.BC",  
                  "ROS_SC_MES_160101_160930_V03.BC",  
                  "RSSD0002.TF",
```



```
"DE405.BSP",
"CORL_DL_003_01___A___00067.BSP",
"CORL_DL_002_01___B___00043.BSP",
"CORL_DL_003_01___C___00068.BSP",
"CORL_DL_006_01___H___00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_____00216.BSP",
"CATT_DV_145_02_____00216.BC",
"CORB_DV_223_01___T19_00302.BSP",
"LORB_DV_223_01___T19_00302.BSP",
"CATT_DV_223_01_____00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01___T19_00318.BSP",
"CORB_DV_257_03___T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

```

```
PRODUCER_ID           = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME    = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID       = "N/A"
DATA_QUALITY_DESC     = "N/A"
PROCESSING_LEVEL_ID   = "2"

```

```
DESCRIPTION           = "
THIS FILE CONTAINS HOUSEKEEPING RAW DATA OBTAINED BY THE FLUXGATE
MAGNETOMETER ABOARD THE ROSETTA S/C. ALL VALUES ARE 20 BIT ADC COUNTS."
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

```

```
DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID   = "RPCMAG"
^ARCHIVE_CONTENT_DESC   = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"

```

```
NOTE = "
```

```
A)
MAGNETIC_COORDINATE_SYSTEM : INSTRUMENTCOORDS
```

```
B)
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
FOR THE TIME T= START_TIME.
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
```

```
C)
LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
```

```
^TABLE = "RPCMAG160901T0000_RAW_HK.TAB"
```

```

OBJECT          = TABLE
NAME            = "RPCMAG-HK-RAW"
INTERCHANGE_FORMAT = ASCII
ROWS           = 2700
COLUMNS       = 13
ROW_BYTES      = 106

OBJECT          = COLUMN
NAME            = "TIME.UTC"
DATA_TYPE       = TIME
START_BYTE     = 1
BYTES          = 26
DESCRIPTION     = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "TIME.OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 28
BYTES          = 15
DESCRIPTION     = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00
AT 1.1.2003: SSSSSSSSS.FFFFF,
SSSSSSSSS: REAL SECONDS,
FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "T.OB"
DATA_TYPE       = ASCII_INTEGER
START_BYTE     = 44
BYTES          = 7
UNIT           = "N/A"
DESCRIPTION     = "
TEMPERATURE OF THE RPCMAG OUTBOARD SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "T.IB"
DATA_TYPE       = ASCII_INTEGER
START_BYTE     = 52
BYTES          = 7
UNIT           = "N/A"
DESCRIPTION     = "
TEMPERATURE OF THE RPCMAG INBOARD SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "STAGE_A.ID"
DATA_TYPE       = ASCII_INTEGER
START_BYTE     = 60
BYTES          = 1
DESCRIPTION     = "FILTER TYPE IDENTIFICATION FLAG A"
END_OBJECT      = COLUMN

```

OBJECT = COLUMN
 NAME = "STAGE_B_ID"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 62
 BYTES = 1
 DESCRIPTION = "FILTER TYPE IDENTIFICATION FLAG B"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "FILTER_CFG"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 64
 BYTES = 1
 DESCRIPTION = "FILTER CONFIGURATION FLAG"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "MAG_REF_VOLTAGE"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 66
 BYTES = 7
 UNIT = "N/A"
 DESCRIPTION = "
 MAGNETOMETER REFERENCE VOLTAGE: 2.5 V.
 VALUE IS GIVEN IN ADC_COUNTS"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "MAG_NEG_VOLTAGE"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 74
 BYTES = 3
 UNIT = "N/A"
 DESCRIPTION = "
 MAGNETOMETER NEGATIVE SUPPLY VOLTAGE:-5V.
 VALUE IS GIVEN IN ADC_COUNTS"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "MAG_POS_VOLTAGE"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 78
 BYTES = 3
 UNIT = "N/A"
 DESCRIPTION = "
 MAGNETOMETER POSITIVE SUPPLY VOLTAGE:+5V.
 VALUE IS GIVEN IN ADC_COUNTS"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "BX_OB"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 82
 BYTES = 7
 UNIT = "N/A"
 DESCRIPTION = "

```

MAGNETIC FIELD X COMPONENT, UNCALIBRATED RAW DATA,
INSTRUMENT COORDINATES, OB-SENSOR.
VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BY_OB"
DATA_TYPE           = ASCII_INTEGER
START_BYTE         = 90
BYTES               = 7
UNIT                = "N/A"
DESCRIPTION         = "
    MAGNETIC FIELD Y COMPONENT, UNCALIBRATED RAW DATA,
    INSTRUMENT COORDINATES, OB-SENSOR.
    VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BZ_OB"
DATA_TYPE           = ASCII_INTEGER
START_BYTE         = 98
BYTES               = 7
UNIT                = "N/A"
DESCRIPTION         = "
    MAGNETIC FIELD Z COMPONENT, UNCALIBRATED RAW DATA,
    INSTRUMENT COORDINATES, OB-SENSOR.
    VALUE IS GIVEN IN ADC_COUNTS"
END_OBJECT          = COLUMN

END_OBJECT          = TABLE
END

```

4.3.4 Data Product "CALIBRATED LEVEL_A Housekeeping data" Design

```

PDS_VERSION_ID      = PDS3
LABEL_REVISION_NOTE = "V1.0"
RECORD_TYPE         = FIXED_LENGTH
RECORD_BYTES        = 114
FILE_RECORDS        = 2700
DATA_SET_ID         = "RO-C-RPCMAG-3-EXT3-CALIBRATED-V9.0"
DATA_SET_NAME       = "ROSETTA-ORBITER 67P RPCMAG 3 EXT3 CALIBRATED V9.0"
PRODUCT_ID          = "RPCMAG160901T0000_CLA_HK"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE        = "RDR"
MISSION_ID           = "ROSETTA"
MISSION_NAME         = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME   = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE     = "N/A"
INSTRUMENT_HOST_ID   = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"
INSTRUMENT_ID        = "RPCMAG"
INSTRUMENT_NAME      = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE      = "MAGNETOMETER"
INSTRUMENT_MODE_ID   = "HK"

```



```
"RATT_DV_257_02_01_T6_00344.BC",
"LATT_CFF2LDR_FSS_V2_0.BC",
"LATT_EME2LDR_SDL_V1_0.BC",
"LATT_ROS2LDR_PRESEP_V1_0.BC",
"LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",
"ROS_SC_MES_050501_060101_V03.BC",
"ROS_SC_MES_060101_070101_V03.BC",
"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01__A_00067.BSP",
"CORL_DL_002_01__B_00043.BSP",
"CORL_DL_003_01__C_00068.BSP",
"CORL_DL_006_01__H_00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_____00216.BSP",
"CATT_DV_145_02_____00216.BC",
"CORB_DV_223_01__T19_00302.BSP",
"LORB_DV_223_01__T19_00302.BSP",
"CATT_DV_223_01_____00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01__T19_00318.BSP",
"CORB_DV_257_03__T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

```

```
PRODUCER_ID = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID = "N/A"
DATA_QUALITY_DESC = "N/A"
PROCESSING_LEVEL_ID = "3"

```

```
DESCRIPTION = "
THIS FILE CONTAINS HOUSEKEEPING RAW DATA OBTAINED BY THE FLUXGATE
MAGNETOMETER ABOARD THE ROSETTA S/C. ENTITIES ARE CONVERTED TO PHYSICAL
UNITS. MAGNETIC FIELD IN INSTRUMENT COORDINATES.
NO ALIGNMENT, SENSITIVITY OR TEMPERATURE CORRECTIONS."

```

```
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

```

```
DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID = "RPCMAG"
^ARCHIVE_CONTENT_DESC = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"

```

```

NOTE                                     = "
A)
  MAGNETIC_COORDINATE_SYSTEM : INSTRUMENTCOORDS
B)
  THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
  SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
  ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
  SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
  ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
  PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
  FOR THE TIME T= START_TIME.
  DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
C)
  LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
  "
^TABLE                                  = "RPCMAG160901T0000_CLA_HK.TAB"

OBJECT                                 = TABLE
NAME                                   = "RPCMAG-HK-RAW"
INTERCHANGE_FORMAT                    = ASCII
ROWS                                  = 2700
COLUMNS                               = 13
ROW_BYTES                             = 114

OBJECT                                 = COLUMN
NAME                                   = "TIME.UTC"
DATA_TYPE                             = TIME
START_BYTE                            = 1
BYTES                                  = 26
DESCRIPTION                            = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
NAME                                   = "TIME.OBT"
DATA_TYPE                             = ASCII_REAL
START_BYTE                            = 28
BYTES                                  = 15
DESCRIPTION                            = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00
  AT 1.1.2003: SSSSSSSSS.FFFFFF,
  SSSSSSSSS: REAL SECONDS,
  FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
  FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
  CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
NAME                                   = "T.OB"
DATA_TYPE                             = ASCII_REAL
START_BYTE                            = 44
BYTES                                  = 6
UNIT                                   = "KELVIN"
DESCRIPTION                            = "TEMPERATURE OF THE RPCMAG OUTBOARD SENSOR"
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
NAME                                   = "T.IB"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 51
BYTES          = 6
UNIT           = "KELVIN"
DESCRIPTION    = "TEMPERATURE OF THE RPCMAG INBOARD SENSOR"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "STAGE_A_ID"
DATA_TYPE     = ASCII_INTEGER
START_BYTE    = 58
BYTES         = 1
DESCRIPTION   = "FILTER TYPE IDENTIFICATION FLAG A"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "STAGE_B_ID"
DATA_TYPE     = ASCII_INTEGER
START_BYTE    = 60
BYTES         = 1
DESCRIPTION   = "FILTER TYPE IDENTIFICATION FLAG B"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "FILTER_CFG"
DATA_TYPE     = ASCII_INTEGER
START_BYTE    = 62
BYTES         = 1
DESCRIPTION   = "FILTER CONFIGURATION FLAG"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "MAG_REF_VOLTAGE"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 64
BYTES         = 8
UNIT          = "VOLT"
DESCRIPTION   = "MAGNETOMETER REFERENCE VOLTAGE: 2.5 V"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "MAG_NEG_VOLTAGE"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 73
BYTES         = 6
UNIT          = "VOLT"
DESCRIPTION   = "MAGNETOMETER NEGATIVE SUPPLY VOLTAGE:-5V"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "MAG_POS_VOLTAGE"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 80
BYTES         = 6
UNIT          = "VOLT"
DESCRIPTION   = "MAGNETOMETER POSITIVE SUPPLY VOLTAGE:+5V"
END_OBJECT    = COLUMN

```



```

OBJECT          = COLUMN
NAME            = "BX_OB"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 87
BYTES          = 8
UNIT           = "NANOTESLA"
DESCRIPTION    = "MAGNETIC FIELD X COMPONENT, CONVERTED RAW DATA,
INSTRUMENT COORDINATES, OB-SENSOR"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "BY_OB"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 96
BYTES          = 8
UNIT           = "NANOTESLA"
DESCRIPTION    = "MAGNETIC FIELD Y COMPONENT, CONVERTED RAW DATA,
INSTRUMENT COORDINATES, OB-SENSOR"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "BZ_OB"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 105
BYTES          = 8
UNIT           = "NANOTESLA"
DESCRIPTION    = "MAGNETIC FIELD Z COMPONENT, CONVERTED RAW DATA,
INSTRUMENT COORDINATES, OB-SENSOR"
END_OBJECT     = COLUMN

END_OBJECT     = TABLE
END

```

4.3.5 Data Product "CALIBRATED LEVEL_A Magnetic Field data" Design

```

PDS_VERSION_ID = PDS3
LABEL_REVISION_NOTE = "V1.0"
RECORD_TYPE     = FIXED_LENGTH
RECORD_BYTES   = 93
FILE_RECORDS    = 86225
DATA_SET_ID     = "RO-C-RPCMAG-3-EXT3-CALIBRATED-V9.0"
DATA_SET_NAME = "ROSETTA-ORBITER 67P RPCMAG 3 EXT3 CALIBRATED V9.0"
PRODUCT_ID      = "RPCMAG160901T0000_CLA_OB_M2"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE    = "RDR"
MISSION_ID      = "ROSETTA"
MISSION_NAME    = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE = "N/A"
INSTRUMENT_HOST_ID = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"

```

```

INSTRUMENT_ID = "RPCMAG"
INSTRUMENT_NAME = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE = "MAGNETOMETER"
INSTRUMENT_MODE_ID = "SID2"
INSTRUMENT_MODE_DESC = "
  NORMAL MODE: 32 PRIMARY & 1 SECONDARY VECTORS PER 32 SECONDS"
TARGET_NAME = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE = "COMET"
START_TIME = 2016-09-01T00:00:30.678
STOP_TIME = 2016-09-02T00:00:31.151
SPACECRAFT_CLOCK_START_COUNT = "1/431308741.63694"
SPACECRAFT_CLOCK_STOP_COUNT = "1/431395142.27334"

START_JULIAN_DATE_VALUE = 2457632.5003550700
STOP_JULIAN_DATE_VALUE = 2457633.5003605443
SC_SUN_POSITION_VECTOR = ( 524262679.37, 160669325.79, -36953315.34)
SC_TARGET_POSITION_VECTOR = ( 8.86, -10.33, 7.82)
SC_TARGET_VELOCITY_VECTOR = ( 0.00, 0.00, 0.00)
SPACECRAFT_ALTITUDE = 13.786
SUB_SPACECRAFT_LATITUDE = 2.558
SUB_SPACECRAFT_LONGITUDE = 71.962
SPICE_FILE_NAME = {"PREHIB\ATNR_P040302093352_00127.BC",
  "PREHIB\ORER_00031.BSP",
  "PREHIB\ORFR_00067.BSP",
  "PREHIB\ORGR_00096.BSP",
  "PREHIB\ORHR_00122.BSP",
  "PREHIB\ORMR_00052.BSP",
  "PREHIB\ORHO_00077.BSP",
  "ROS_ORBITER_EXTENSION_V2.BSP",
  "ROS_SA_2004_V0001.BC",
  "ROS_SA_2005_V0001.BC",
  "ROS_SA_2006_V0001.BC",
  "ROS_SA_2007_V0001.BC",
  "ROS_SA_2008_V0038.BC",
  "ROS_SA_2009_V0054.BC",
  "ROS_SA_2010_V0052.BC",
  "ROS_SA_2011_V0013.BC",
  "ROS_SA_2014_V0047.BC",
  "ROS_SA_2015_V0042.BC",
  "ROS_SA_2016_V0041.BC",
  "ROS_HGA_2008_V0018.BC",
  "ROS_HGA_2009_V0051.BC",
  "ROS_HGA_2010_V0045.BC",
  "ROS_HGA_2011_V0018.BC",
  "ROS_HGA_2014_V0044.BC",
  "ROS_HGA_2015_V0053.BC",
  "ROS_HGA_2016_V0042.BC",
  "ROS_LBOOM_V0.BC",
  "ROS_V32.TF",
  "ROS_RPC_V19.TI",
  "NAIF0012.TLS.PC",
  "PCK00010.TPC",
  "DE403_MASSES.TPC",
  "ROS_160929_STEP.TSC",
  "DE430.BSP",
  "ROS_RPC_STRUCT_V1.BSP",
  "ROS_STRUCT_V6.BSP",

```

```
"RORB_DV_145_01__T19_00216.BSP",
"RATT_DV_145_01_01__00216.BC",
"RORB_DV_223_01__T19_00302.BSP",
"RATT_DV_223_01_01__00302.BC",
"RORB_DV_257_03__T19_00345.BSP",
"RATT_DV_257_02_01_T6_00344.BC",
"LATT_CFF2LDR_FSS_V2_0.BC",
"LATT_EME2LDR_SDL_V1_0.BC",
"LATT_ROS2LDR_PRESEP_V1_0.BC",
"LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",
"ROS_SC_MES_050501_060101_V03.BC",
"ROS_SC_MES_060101_070101_V03.BC",
"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01__A_00067.BSP",
"CORL_DL_002_01__B_00043.BSP",
"CORL_DL_003_01__C_00068.BSP",
"CORL_DL_006_01__H_00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01__00216.BSP",
"CATT_DV_145_02__00216.BC",
"CORB_DV_223_01__T19_00302.BSP",
"LORB_DV_223_01__T19_00302.BSP",
"CATT_DV_223_01__00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01__T19_00318.BSP",
"CORB_DV_257_03__T19_00345.BSP",
"CATT_DV_257_03__00344.BC"}

```

```
PRODUCER_ID = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID = "N/A"
DATA_QUALITY_DESC = "
ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"
PROCESSING_LEVEL_ID = "3"

```

```
DESCRIPTION = "
THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE
OUTBOARD MAGNETOMETER ABOARD THE ROSETTA S/C AND THE TEMPERATURE OF THE
OUTBOARD SENSOR. GROUND CALIBRATION RESULTS HAVE BEEN APPLIED TO THE RAW
DATA. FIELD IS GIVEN IN INSTRUMENT-COORDINATES"

```

```
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

```

```
DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
```

```

CALIBRATION_SOURCE_ID      = "RPCMAG"
^ARCHIVE_CONTENT_DESC      = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC    = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC  = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC   = "RO_IGEP_TR0028_CALPROC.PDF"

NOTE                        = "
A)
  MAGNETIC_COORDINATE_SYSTEM : INSTRUMENTCOORDS
B)
  THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
  SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
  ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
  SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
  ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
  PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
  FOR THE TIME T= START_TIME.
  DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
C)
  LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
D)
  GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMOB.ASC
E)
  INFLIGHT CALIBRATION FILE: INFCAL_OFF__OB_20180305_009.ASC
F)
  TIMESTAMPS (UTC) OF PRIMARY SENSOR VECTORS HAVE BEEN SHIFTED BY 8.20 S AND
  TIMESTAMPS (UTC) OF SECONDARY SENSOR VECTORS HAVE BEEN SHIFTED BY 31.95 S
  IN ORDER TO CORRECT DIGITAL FILTER TRANSFER FUNCTION.
  "
^TABLE                      = "RPCMAG160901T0000_CLA_OB_M2.TAB"

OBJECT                      = TABLE
NAME                        = "RPCMAG-OB-SID2-CLA"
INTERCHANGE_FORMAT         = ASCII
ROWS                        = 86225
COLUMNS                    = 7
ROW_BYTES                   = 93

OBJECT                      = COLUMN
NAME                        = "TIME.UTC"
DATA_TYPE                   = TIME
START_BYTE                  = 1
BYTES                       = 26
DESCRIPTION                  = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
NAME                        = "TIME.OBT"
DATA_TYPE                   = ASCII_REAL
START_BYTE                  = 28
BYTES                       = 15
DESCRIPTION                  = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00
  AT 1.1.2003: SSSSSSSS.FFFFF,
  SSSSSSSS: REAL SECONDS,
  FFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
  FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.

```

```

CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BX_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 44
BYTES               = 9
UNIT                = "NANOTESLA"
UNIT_ID             = "nT"
DESCRIPTION         = "MAGNETIC FIELD X COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, INSTRUMENT-COORDINATES, OB SENSOR"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BY_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 54
BYTES               = 9
UNIT                = "NANOTESLA"
UNIT_ID             = "nT"
DESCRIPTION         = "MAGNETIC FIELD Y COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, INSTRUMENT-COORDINATES, OB SENSOR"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BZ_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 64
BYTES               = 9
UNIT                = "NANOTESLA"
UNIT_ID             = "nT"
DESCRIPTION         = "MAGNETIC FIELD Z COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, INSTRUMENT-COORDINATES, OB SENSOR"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "T_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 74
BYTES               = 6
UNIT                = "KELVIN"
UNIT_ID             = "K"
DESCRIPTION         = "TEMPERATURE OF RPCMAG OB SENSOR"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "QUALITY_FLAGS"
DATA_TYPE           = CHARACTER
START_BYTE         = 81
BYTES               = 11
DESCRIPTION         = "
These flags describe the quality of the magnetic field data.
The quality is coded in a 11 byte string. Each character can have
the following values:
VALUE:      MEANING:
  x         property described by flag is still unknown

```

0 no disturbance, good quality
1..9,A..F specific disturbance/problems, see below
Value is hexadecimal coded

Description of the specific flags:

FLAG-STRING	FLAG	DESCRIPTION
BA987654321		
-----:	1	RELATION BETWEEN IB AND OB SENSOR (binary coded)
-----:	1	Digit 3 2 1 0 : Value
-----:	1	: x no assessment
-----:	1	0 0 : 0 Difference < 1nT , PERFECT
-----:	1	0 1 : +1 Difference < 2nT , GOOD
-----:	1	1 0 : +2 Difference < 4nT , AMPLE
-----:	1	1 1 : +3 Difference > 4nT , POOR
-----:	1	1 : +4 IB Temperature drifting
-----:	1	1 : +8 OB Temperature drifting
-----:	2	PERCENTAGE OB / IB DIFFERENCE
-----:	2	x = no assessment
-----:	2	0 = deviation < 10 \%, PERFECT CORRELATION
-----:	2	1 = deviation < 20 \%, GOOD CORRELATION
-----:	2	2 = deviation < 50 \%, AMPLE CORRELATION
-----:	2	3 = deviation > 50 \%, POOR CORRELATION
-----:	3	IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
-----:	3	x = impact not assessed
-----:	3	0 = probably no disturbance
-----:	3	1 = disturbance eliminated during data analysis
-----:	3	2 = disturbance possible
-----:	3	3 = disturbance not clear
-----:	3	4 = data disturbed, cleaned CLH data available
-----:	3	5 = data disturbed, elimination not possible
-----:	4	VARIOUS DISTURBANCE EFFECTS
-----:	4	x = no assessment
-----:	4	0 = no other problems detected
-----:	4	1 = severe heater impact at EAR1 eliminated
-----:	4	2 = severe heater impact at EAR1, about 2nTpp PWM
-----:	4	3 = S/C 28 V Power failure
-----:	4	4 = dT/dt > threshold, no thermal equilibrium
-----:	4	5 = data disturbed by AC-signal, origin at S/C
-----:	4	6 = data noisy due to power on failure
-----:	4	7 = ADC latch-up:bit error.Final data corrected!
-----:	4	8 = sensor saturated due to huge external field
-----:	4	9 = sensor saturated, instrument power on failed
-----:	5	LANDER HEATER STATUS (binary coded)
-----:	5	MSS: Mechanical support Heaters
-----:	5	HIB: Hibernation Heaters
-----:	5	digit 3 2 1 0 : Value
-----:	5	: x no assessment
-----:	5	1 : +1 MSS1 off/on (0/1)
-----:	5	1 : +2 MSS2 off/on (0/1)
-----:	5	1 : +4 HIB1 off/on (0/1)
-----:	5	1 : +8 HIB2 off/on (0/1)

```

-----:      6      LANDER P/L STATUS (binary coded)
-----:      6      digit 3 2 1 0 : Value
-----:      6              : x   no assessment
-----:      6              1 : +1  COSAC   off/on (0/1)
-----:      6              1 : +2  COSAC   active (0/1)
-----:      6              1 : +4  PTOLEMY off/on (0/1)
-----:      6              1 : +8  PTOLEMY active (0/1)

-----:      7      LANDER STATUS (binary coded)
-----:      7      digit 3 2 1 0 : Value
-----:      7              : x   no assessment
-----:      7              1 : +1  Lander detached/attached (0/1)
-----:      7              2 : +2  ROMAP data available(0/1)
-----:      7              4 : +4  LANDER off/on (0/1)
-----:      7              8 : +8  Separation ongoing (0/1)

----:      8      BOOM DEPLOYMENT:
----:      8      x = no assessment
----:      8      0 = boom deployed
----:      8      1 = boom stowed
----:      8      2 = boom deployment ongoing. Data only valid
----:      8      in instrument coordinates
----:      8      3 = pyros fired for boom release

---:      9      IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
---:      9      x = no assessment
---:      9      0 = WOL not active
---:      9      1 = WOL active, no disturbance visible
---:      9      2 = Start of WOL not visible
---:      9      3 = End of WOL not visible
---:      9      4 = WOL completely visible

--:      A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
--:      A      x = no assessment
--:      A      0 = OCM not active
--:      A      1 = OCM active, no disturbance visible
--:      A      2 = Jump visible (in B and/or dB/dt)
--:      A      3 = Comb-disturbance visible (in B and/or dB/dt)
--:      A      4 = Jump and comb visible
--:      A      5 = no data during OCM

:      B      PLASMA ENVIRONMENT
:      B      x = no assessment
:      B      0 = Cavity
:      B      1 = pure solar wind
:      B      2 = cometary influenced solar wind
:      B      3 = pure cometary environment, sw not present
:      B      4 = Earth swing-by
:      B      5 = Mars swing-by
:      B      6 = Steins fly-by
:      B      7 = Lutetia fly-by
"

END_OBJECT      = COLUMN
END_OBJECT      = TABLE
END

```

4.3.6 Data Product "CALIBRATED LEVEL_B Magnetic Field data" Design

```

PDS_VERSION_ID           = PDS3
LABEL_REVISION_NOTE      = "V1.0"
RECORD_TYPE              = FIXED_LENGTH
RECORD_BYTES            = 93
FILE_RECORDS             = 2696
DATA_SET_ID              = "RO-C-RPCMAG-3-EXT3-CALIBRATED-V9.0"
DATA_SET_NAME = "ROSETTA-ORBITER 67P RPCMAG 3 EXT3 CALIBRATED V9.0"
PRODUCT_ID               = "RPCMAG160901T0000_CLB_IB_M2"
PRODUCT_CREATION_TIME    = 2018-08-21T13:20:00
PRODUCT_TYPE             = "RDR"
MISSION_ID               = "ROSETTA"
MISSION_NAME             = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME      = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE        = "N/A"
INSTRUMENT_HOST_ID      = "RO"
INSTRUMENT_HOST_NAME    = "ROSETTA-ORBITER"
INSTRUMENT_ID           = "RPCMAG"
INSTRUMENT_NAME = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE         = "MAGNETOMETER"
INSTRUMENT_MODE_ID      = "SID2"
INSTRUMENT_MODE_DESC    = "
    NORMAL MODE: 32 PRIMARY & 1 SECONDARY VECTORS PER 32 SECONDS"
TARGET_NAME              = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE              = "COMET"
START_TIME               = 2016-09-01T00:00:54.428
STOP_TIME                = 2016-09-01T23:59:55.390
SPACECRAFT_CLOCK_START_COUNT = "1/431308765.47310"
SPACECRAFT_CLOCK_STOP_COUNT  = "1/431395106.42970"

START_JULIAN_DATE_VALUE  = 2457632.5006299540
STOP_JULIAN_DATE_VALUE   = 2457633.4999466441
SC_SUN_POSITION_VECTOR   = ( 524262819.46, 160669654.75, -36953302.51)
SC_TARGET_POSITION_VECTOR = (      8.86,      -10.33,      7.82)
SC_TARGET_VELOCITY_VECTOR = (      0.00,      0.00,      0.00)
SPACECRAFT_ALTITUDE      =      13.787
SUB_SPACECRAFT_LATITUDE  =      2.548
SUB_SPACECRAFT_LONGITUDE =      71.685
SPICE_FILE_NAME          = {"PREHIB\ATNR_P040302093352_00127.BC",
    "PREHIB\ORER_00031.BSP",
    "PREHIB\ORFR_00067.BSP",
    "PREHIB\ORGR_00096.BSP",
    "PREHIB\ORHR_00122.BSP",
    "PREHIB\ORMR_00052.BSP",
    "PREHIB\ORHO_00077.BSP",
    "ROS_ORBITER_EXTENSION_V2.BSP",
    "ROS_SA_2004_V0001.BC",
    "ROS_SA_2005_V0001.BC",
    "ROS_SA_2006_V0001.BC",
    "ROS_SA_2007_V0001.BC",
    "ROS_SA_2008_V0038.BC",
    "ROS_SA_2009_V0054.BC",
    "ROS_SA_2010_V0052.BC",

```


"ROS_SA_2011_V0013.BC",
"ROS_SA_2014_V0047.BC",
"ROS_SA_2015_V0042.BC",
"ROS_SA_2016_V0041.BC",
"ROS_HGA_2008_V0018.BC",
"ROS_HGA_2009_V0051.BC",
"ROS_HGA_2010_V0045.BC",
"ROS_HGA_2011_V0018.BC",
"ROS_HGA_2014_V0044.BC",
"ROS_HGA_2015_V0053.BC",
"ROS_HGA_2016_V0042.BC",
"ROS_LBOOM_V0.BC",
"ROS_V32.TF",
"ROS_RPC_V19.TI",
"NAIF0012.TLS.PC",
"PCK00010.TPC",
"DE403_MASSES.TPC",
"ROS_160929_STEP.TSC",
"DE430.BSP",
"ROS_RPC_STRUCT_V1.BSP",
"ROS_STRUCT_V6.BSP",
"RORB_DV_145_01_T19_00216.BSP",
"RATT_DV_145_01_01_00216.BC",
"RORB_DV_223_01_T19_00302.BSP",
"RATT_DV_223_01_01_00302.BC",
"RORB_DV_257_03_T19_00345.BSP",
"RATT_DV_257_02_01_T6_00344.BC",
"LATT_CFF2LDR_FSS_V2_0.BC",
"LATT_EME2LDR_SDL_V1_0.BC",
"LATT_ROS2LDR_PRESEP_V1_0.BC",
"LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",
"ROS_SC_MES_050501_060101_V03.BC",
"ROS_SC_MES_060101_070101_V03.BC",
"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01_A_00067.BSP",
"CORL_DL_002_01_B_00043.BSP",
"CORL_DL_003_01_C_00068.BSP",
"CORL_DL_006_01_H_00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_00216.BSP",
"CATT_DV_145_02_00216.BC",
"CORB_DV_223_01_T19_00302.BSP",
"LORB_DV_223_01_T19_00302.BSP",
"CATT_DV_223_01_00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",

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"LOBR_DV_236_01___T19_00318.BSP",
"CORB_DV_257_03___T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

PRODUCER_ID                = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME        = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID           = "N/A"
DATA_QUALITY_DESC         = "
ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"
PROCESSING_LEVEL_ID       = "3"

DESCRIPTION                = "
THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE
INBOARD MAGNETOMETER ABOARD THE ROSETTA S/C AND THE TEMPERATURE OF THE
INBOARD SENSOR. GROUND CALIBRATION RESULTS HAVE BEEN APPLIED TO THE RAW
DATA. FIELD IS GIVEN IN S/C-COORDINATES"
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC  = "MAGNETOMETER_BOOM:DEPLOYED"

DATA_SET_PARAMETER_NAME    = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID      = "RPCMAG"
^ARCHIVE_CONTENT_DESC      = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC    = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC  = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC   = "RO_IGEP_TR0028_CALPROC.PDF"

NOTE                        = "
A)
MAGNETIC_COORDINATE_SYSTEM : ROS_SPACECRAFT
B)
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
PLANETOCENTRIC IAU_<TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
FOR THE TIME T= START_TIME.
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
C)
LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
D)
GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMIB.ASC
E)
INFLIGHT CALIBRATION FILE: INFCAL_OFF_IB_20180305_009.ASC
F)
TIMESTAMPS (UTC) OF PRIMARY SENSOR VECTORS HAVE BEEN SHIFTED BY 8.20 S AND
TIMESTAMPS (UTC) OF SECONDARY SENSOR VECTORS HAVE BEEN SHIFTED BY 31.95 S
IN ORDER TO CORRECT DIGITAL FILTER TRANSFER FUNCTION.
"
^TABLE                      = "RPCMAG160901T0000_CLB_IB_M2.TAB"

OBJECT                      = TABLE
NAME                        = "RPCMAG-IB-SID2-CLB"
INTERCHANGE_FORMAT         = ASCII
ROWS                        = 2696

```

```

COLUMNS                = 7
ROW_BYTES               = 93

OBJECT                  = COLUMN
NAME                    = "TIME.UTC"
DATA_TYPE               = TIME
START_BYTE              = 1
BYTES                   = 26
DESCRIPTION              = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
NAME                    = "TIME.OBT"
DATA_TYPE               = ASCII_REAL
START_BYTE              = 28
BYTES                   = 15
DESCRIPTION              = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00
  AT 1.1.2003: SSSSSSSSS.FFFFF,
  SSSSSSSSS: REAL SECONDS,
  FFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
  FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
  CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
NAME                    = "BX_IB"
DATA_TYPE               = ASCII_REAL
START_BYTE              = 44
BYTES                   = 9
UNIT                    = "NANOTESLA"
UNIT_ID                 = "nT"
DESCRIPTION              = "MAGNETIC FIELD X COMPONENT, CALIBRATED, TEMPERATURE
  CORRECTED DATA, S/C-COORDINATES, IB SENSOR"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
NAME                    = "BY_IB"
DATA_TYPE               = ASCII_REAL
START_BYTE              = 54
BYTES                   = 9
UNIT                    = "NANOTESLA"
UNIT_ID                 = "nT"
DESCRIPTION              = "MAGNETIC FIELD Y COMPONENT, CALIBRATED, TEMPERATURE
  CORRECTED DATA, S/C-COORDINATES, IB SENSOR"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
NAME                    = "BZ_IB"
DATA_TYPE               = ASCII_REAL
START_BYTE              = 64
BYTES                   = 9
UNIT                    = "NANOTESLA"
UNIT_ID                 = "nT"
DESCRIPTION              = "MAGNETIC FIELD Z COMPONENT, CALIBRATED, TEMPERATURE
  CORRECTED DATA, S/C-COORDINATES, IB SENSOR"
END_OBJECT              = COLUMN
  
```

```
OBJECT      = COLUMN
NAME        = "T_IB"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 74
BYTES       = 6
UNIT        = "KELVIN"
UNIT_ID     = "K"
DESCRIPTION = "TEMPERATURE OF RPCMAG IB SENSOR"
END_OBJECT  = COLUMN
```

```
OBJECT      = COLUMN
NAME        = "QUALITY_FLAGS"
DATA_TYPE   = CHARACTER
START_BYTE  = 81
BYTES       = 11
DESCRIPTION = ""
```

These flags describe the quality of the magnetic field data.
The quality is coded in a 11 byte string. Each character can have
the following values:

VALUE:	MEANING:
x	property described by flag is still unknown
0	no disturbance, good quality
1..9,A..F	specific disturbance/problems, see below

Value is hexadecimal coded

Description of the specific flags:

FLAG-STRING	FLAG	DESCRIPTION
BA987654321		
-----:	1	RELATION BETWEEN IB AND OB SENSOR (binary coded)
-----:	1	Digit 3 2 1 0 : Value
-----:	1	: x no assessment
-----:	1	0 0 : 0 Difference < 1nT , PERFECT
-----:	1	0 1 : +1 Difference < 2nT , GOOD
-----:	1	1 0 : +2 Difference < 4nT , AMPLE
-----:	1	1 1 : +3 Difference > 4nT , POOR
-----:	1	1 : +4 IB Temperature drifting
-----:	1	1 : +8 OB Temperature drifting
-----:	2	PERCENTAGE OB / IB DIFFERENCE
-----:	2	x = no assessment
-----:	2	0 = deviation < 10 \%, PERFECT CORRELATION
-----:	2	1 = deviation < 20 \%, GOOD CORRELATION
-----:	2	2 = deviation < 50 \%, AMPLE CORRELATION
-----:	2	3 = deviation > 50 \%, POOR CORRELATION
-----:	3	IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
-----:	3	x = impact not assessed
-----:	3	0 = probably no disturbance
-----:	3	1 = disturbance eliminated during data analysis
-----:	3	2 = disturbance possible
-----:	3	3 = disturbance not clear
-----:	3	4 = data disturbed, cleaned CLH data available
-----:	3	5 = data disturbed, elimination not possible
-----:	4	VARIOUS DISTURBANCE EFFECTS
-----:	4	x = no assessment

```

-----:      4      0 = no other problems detected
-----:      4      1 = severe heater impact at EAR1 eliminated
-----:      4      2 = severe heater impact at EAR1,about 2nTpp PWM
-----:      4      3 = S/C 28 V Power failure
-----:      4      4 = dT/dt > threshold, no thermal equilibrium
-----:      4      5 = data disturbed by AC-signal, origin at S/C
-----:      4      6 = data noisy due to power on failure
-----:      4      7 = ADC latch-up:bit error.Final data corrected!
-----:      4      8 = sensor saturated due to huge external field
-----:      4      9 = sensor saturated, instrument power on failed

-----:      5      LANDER HEATER STATUS (binary coded)
-----:      5      MSS: Mechanical support Heaters
-----:      5      HIB: Hibernation Heaters
-----:      5      digit  3 2 1 0 : Value
-----:      5              : x      no assessment
-----:      5              1 : +1    MSS1 off/on (0/1)
-----:      5              1 : +2    MSS2 off/on (0/1)
-----:      5              1 : +4    HIB1 off/on (0/1)
-----:      5              1 : +8    HIB2 off/on (0/1)

-----:      6      LANDER P/L STATUS (binary coded)
-----:      6      digit  3 2 1 0 : Value
-----:      6              : x      no assessment
-----:      6              1 : +1    COSAC  off/on (0/1)
-----:      6              1 : +2    COSAC  active (0/1)
-----:      6              1 : +4    PTOLEMY off/on (0/1)
-----:      6              1 : +8    PTOLEMY active (0/1)

-----:      7      LANDER STATUS (binary coded)
-----:      7      digit  3 2 1 0 : Value
-----:      7              : x      no assessment
-----:      7              1 : +1    Lander detached/attached (0/1)
-----:      7              2 : +2    ROMAP data available(0/1)
-----:      7              4 : +4    LANDER off/on (0/1)
-----:      7              8 : +8    Separation ongoing (0/1)

----:      8      BOOM DEPLOYMENT:
----:      8      x = no assessment
----:      8      0 = boom deployed
----:      8      1 = boom stowed
----:      8      2 = boom deployment ongoing. Data only valid
----:      8      in instrument coordinates
----:      8      3 = pyros fired for boom release

--:      9      IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
--:      9      x = no assessment
--:      9      0 = WOL not active
--:      9      1 = WOL active, no disturbance visible
--:      9      2 = Start of WOL not visible
--:      9      3 = End of WOL not visible
--:      9      4 = WOL completely visible

-:      A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
-:      A      x = no assessment
-:      A      0 = OCM not active
-:      A      1 = OCM active, no disturbance visible
  
```

```

-:      A      2 = Jump visible (in B and/or dB/dt)
-:      A      3 = Comb-disturbance visible (in B and/or dB/dt)
-:      A      4 = Jump and comb visible
-:      A      5 = no data during OCM

:      B      PLASMA ENVIRONMENT
:      B      x = no assessment
:      B      0 = Cavity
:      B      1 = pure solar wind
:      B      2 = cometary influenced solar wind
:      B      3 = pure cometary environment, sw not present
:      B      4 = Earth swing-by
:      B      5 = Mars swing-by
:      B      6 = Steins fly-by
:      B      7 = Lutetia fly-by
"
END_OBJECT      = COLUMN
END_OBJECT      = TABLE
END

```

4.3.7 Data Product "CALIBRATED LEVEL_C Magnetic Field data" Design

```

PDS_VERSION_ID      = PDS3
LABEL_REVISION_NOTE  = "V1.0"
RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 128
FILE_RECORDS         = 86225
DATA_SET_ID          = "RO-C-RPCMAG-3-EXT3-CALIBRATED-V9.0"
DATA_SET_NAME = "ROSETTA-ORBITER 67P RPCMAG 3 EXT3 CALIBRATED V9.0"
PRODUCT_ID           = "RPCMAG160901T0000_CLC_OB_M2"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE         = "RDR"
MISSION_ID           = "ROSETTA"
MISSION_NAME         = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME   = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE     = "N/A"
INSTRUMENT_HOST_ID   = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"
INSTRUMENT_ID        = "RPCMAG"
INSTRUMENT_NAME = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE      = "MAGNETOMETER"
INSTRUMENT_MODE_ID   = "SID2"
INSTRUMENT_MODE_DESC = "
NORMAL MODE: 32 PRIMARY & 1 SECONDARY VECTORS PER 32 SECONDS"
TARGET_NAME          = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE          = "COMET"
START_TIME           = 2016-09-01T00:00:30.678
STOP_TIME            = 2016-09-02T00:00:31.151
COORDINATE_SYSTEM_CENTER_NAME = "EARTH"
SPACECRAFT_CLOCK_START_COUNT = "1/431308741.63694"
SPACECRAFT_CLOCK_STOP_COUNT = "1/431395142.27334"

```


"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01___A___00067.BSP",
"CORL_DL_002_01___B___00043.BSP",
"CORL_DL_003_01___C___00068.BSP",
"CORL_DL_006_01___H___00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_____00216.BSP",
"CATT_DV_145_02_____00216.BC",
"CORB_DV_223_01___T19_00302.BSP",
"LORB_DV_223_01___T19_00302.BSP",
"CATT_DV_223_01_____00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01___T19_00318.BSP",
"CORB_DV_257_03___T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

PRODUCER_ID = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID = "N/A"
DATA_QUALITY_DESC = "
ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"
PROCESSING_LEVEL_ID = "3"

DESCRIPTION = "
THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE
OUTBOARD MAGNETOMETER ABOARD THE ROSETTA S/C. GROUND CALIBRATION RESULTS HAVE
BEEN APPLIED TO THE RAW DATA. FIELD IS ROTATED TO ECLIPJ2000 COORDINATES.
THE S/C POSITION IS GIVEN IN ECLIPJ2000 COORDINATES AS WELL."
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID = "RPCMAG"
^ARCHIVE_CONTENT_DESC = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"

NOTE = "
A)
MAGNETIC_COORDINATE_SYSTEM : ECLIPJ2000
B)
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,

SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
FOR THE TIME T= START_TIME.
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>

C)

LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123

D)

GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMOB.ASC

E)

INFLIGHT CALIBRATION FILE: INFCAL_OFF__OB_20180305_009.ASC

F)

TIMESTAMPS (UTC) OF PRIMARY SENSOR VECTORS HAVE BEEN SHIFTED BY 8.20 S AND
TIMESTAMPS (UTC) OF SECONDARY SENSOR VECTORS HAVE BEEN SHIFTED BY 31.95 S
IN ORDER TO CORRECT DIGITAL FILTER TRANSFER FUNCTION.

"

^TABLE = "RPCMAG160901T0000_CLC_OB_M2.TAB"

OBJECT = TABLE
NAME = "RPCMAG-OB-SID2-CLC"
INTERCHANGE_FORMAT = ASCII
ROWS = 86225
COLUMNS = 9
ROW_BYTES = 128

OBJECT = COLUMN
NAME = "TIME.UTC"
DATA_TYPE = TIME
START_BYTE = 1
BYTES = 26
DESCRIPTION = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "TIME_OBT"
DATA_TYPE = ASCII_REAL
START_BYTE = 28
BYTES = 15
DESCRIPTION = "S/C CLOCK AT OBSERVATION TIME, SECONDS SINCE 00:00
AT 1.1.2003: SSSSSSSSS.FFFFFF,
SSSSSSSS: REAL SECONDS,
FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "POSITION_X"
DATA_TYPE = ASCII_REAL
START_BYTE = 44
BYTES = 13
UNIT = "KILOMETER"
UNIT_ID = "km"
DESCRIPTION = "SPACECRAFT POSITION, X COMPONENT, ECLIPJ2000"

```

END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "POSITION_Y"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 58
BYTES               = 13
UNIT                = "KILOMETER"
UNIT_ID             = "km"
DESCRIPTION         = "SPACECRAFT POSITION, Y COMPONENT, ECLIPJ2000"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "POSITION_Z"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 72
BYTES               = 13
UNIT                = "KILOMETER"
UNIT_ID             = "km"
DESCRIPTION         = "SPACECRAFT POSITION, Z COMPONENT, ECLIPJ2000"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BX_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 86
BYTES               = 9
UNIT                = "NANOTESLA"
UNIT_ID             = "nT"
DESCRIPTION         = "MAGNETIC FIELD X COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, OB SENSOR, ECLIPJ2000"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BY_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 96
BYTES               = 9
UNIT                = "NANOTESLA"
UNIT_ID             = "nT"
DESCRIPTION         = "MAGNETIC FIELD Y COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, OB SENSOR, ECLIPJ2000"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "BZ_OB"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 106
BYTES               = 9
UNIT                = "NANOTESLA"
UNIT_ID             = "nT"
DESCRIPTION         = "MAGNETIC FIELD Z COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, OB SENSOR, ECLIPJ2000"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "QUALITY_FLAGS"

```

DATA_TYPE = CHARACTER
START_BYTE = 116
BYTES = 11
DESCRIPTION = "

These flags describe the quality of the magnetic field data.
The quality is coded in a 11 byte string. Each character can have
the following values:

VALUE:	MEANING:
x	property described by flag is still unknown
0	no disturbance, good quality
1..9,A..F	specific disturbance/problems, see below

Value is hexadecimal coded

Description of the specific flags:

FLAG-STRING	FLAG	DESCRIPTION
BA987654321		
-----:	1	RELATION BETWEEN IB AND OB SENSOR (binary coded)
-----:	1	Digit 3 2 1 0 : Value
-----:	1	: x no assessment
-----:	1	0 0 : 0 Difference < 1nT , PERFECT
-----:	1	0 1 : +1 Difference < 2nT , GOOD
-----:	1	1 0 : +2 Difference < 4nT , AMPLE
-----:	1	1 1 : +3 Difference > 4nT , POOR
-----:	1	1 : +4 IB Temperature drifting
-----:	1	1 : +8 OB Temperature drifting
-----:	2	PERCENTAGE OB / IB DIFFERENCE
-----:	2	x = no assessment
-----:	2	0 = deviation < 10 \%, PERFECT CORRELATION
-----:	2	1 = deviation < 20 \%, GOOD CORRELATION
-----:	2	2 = deviation < 50 \%, AMPLE CORRELATION
-----:	2	3 = deviation > 50 \%, POOR CORRELATION
-----:	3	IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
-----:	3	x = impact not assessed
-----:	3	0 = probably no disturbance
-----:	3	1 = disturbance eliminated during data analysis
-----:	3	2 = disturbance possible
-----:	3	3 = disturbance not clear
-----:	3	4 = data disturbed, cleaned CLH data available
-----:	3	5 = data disturbed, elimination not possible
-----:	4	VARIOUS DISTURBANCE EFFECTS
-----:	4	x = no assessment
-----:	4	0 = no other problems detected
-----:	4	1 = severe heater impact at EAR1 eliminated
-----:	4	2 = severe heater impact at EAR1, about 2nTpp PWM
-----:	4	3 = S/C 28 V Power failure
-----:	4	4 = dT/dt > threshold, no thermal equilibrium
-----:	4	5 = data disturbed by AC-signal, origin at S/C
-----:	4	6 = data noisy due to power on failure
-----:	4	7 = ADC latch-up:bit error.Final data corrected!
-----:	4	8 = sensor saturated due to huge external field
-----:	4	9 = sensor saturated, instrument power on failed
-----:	5	LANDER HEATER STATUS (binary coded)

```

-----:      5      MSS: Mechanical support Heaters
-----:      5      HIB: Hibernation Heaters
-----:      5      digit 3 2 1 0 : Value
-----:      5              : x      no assessment
-----:      5              1 : +1    MSS1 off/on (0/1)
-----:      5              1 : +2    MSS2 off/on (0/1)
-----:      5              1 : +4    HIB1 off/on (0/1)
-----:      5              1 : +8    HIB2 off/on (0/1)

-----:      6      LANDER P/L STATUS (binary coded)
-----:      6      digit 3 2 1 0 : Value
-----:      6              : x      no assessment
-----:      6              1 : +1    COSAC  off/on (0/1)
-----:      6              1 : +2    COSAC  active (0/1)
-----:      6              1 : +4    PTOLEMY off/on (0/1)
-----:      6              1 : +8    PTOLEMY active (0/1)

-----:      7      LANDER STATUS (binary coded)
-----:      7      digit 3 2 1 0 : Value
-----:      7              : x      no assessment
-----:      7              1 : +1    Lander detached/attached (0/1)
-----:      7              2 : +2    ROMAP data available(0/1)
-----:      7              4 : +4    LANDER off/on (0/1)
-----:      7              8 : +8    Separation ongoing (0/1)

----:      8      BOOM DEPLOYMENT:
----:      8      x = no assessment
----:      8      0 = boom deployed
----:      8      1 = boom stowed
----:      8      2 = boom deployment ongoing. Data only valid
----:      8      in instrument coordinates
----:      8      3 = pyros fired for boom release

---:      9      IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
---:      9      x = no assessment
---:      9      0 = WOL not active
---:      9      1 = WOL active, no disturbance visible
---:      9      2 = Start of WOL not visible
---:      9      3 = End of WOL not visible
---:      9      4 = WOL completely visible

--:      A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
--:      A      x = no assessment
--:      A      0 = OCM not active
--:      A      1 = OCM active, no disturbance visible
--:      A      2 = Jump visible (in B and/or dB/dt)
--:      A      3 = Comb-disturbance visible (in B and/or dB/dt)
--:      A      4 = Jump and comb visible
--:      A      5 = no data during OCM

:      B      PLASMA ENVIRONMENT
:      B      x = no assessment
:      B      0 = Cavity
:      B      1 = pure solar wind
:      B      2 = cometary influenced solar wind
:      B      3 = pure cometary environment, sw not present
:      B      4 = Earth swing-by
  
```

```

:           B      5 = Mars swing-by
:           B      6 = Steins fly-by
:           B      7 = Lutetia fly-by
"
END_OBJECT      = COLUMN
END_OBJECT      = TABLE
END

```

4.3.8 Data Product "RESAMPLED LEVEL_F Magnetic Field data" Design

```

PDS_VERSION_ID      = PDS3
LABEL_REVISION_NOTE = "V1.0"
RECORD_TYPE         = FIXED_LENGTH
RECORD_BYTES        = 93
FILE_RECORDS        = 86367
DATA_SET_ID         = "RO-C-RPCMAG-4-EXT3-RESAMPLED-V9.0"
DATA_SET_NAME       = "ROSETTA-ORBITER 67P RPCMAG 4 EXT3 RESAMPLED V9.0"
PRODUCT_ID          = "RPCMAG160901_CLF_OB_A1"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE        = "REFDR"
MISSION_ID          = "ROSETTA"
MISSION_NAME        = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME  = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE    = "N/A"
INSTRUMENT_HOST_ID = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"
INSTRUMENT_ID       = "RPCMAG"
INSTRUMENT_NAME     = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE     = "MAGNETOMETER"
INSTRUMENT_MODE_ID  = "AVERAGED"
INSTRUMENT_MODE_DESC = "1 S AVERAGES"
TARGET_NAME         = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE         = "COMET"
START_TIME          = 2016-09-01T00:00:31.178
STOP_TIME           = 2016-09-01T23:59:57.178
SPACECRAFT_CLOCK_START_COUNT = "1/431308742.13694"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/431395108.13694"

START_JULIAN_DATE_VALUE = 2457632.5003608572
STOP_JULIAN_DATE_VALUE  = 2457633.4999673385
SC_SUN_POSITION_VECTOR  = ( 524262682.32, 160669332.72, -36953315.07)
SC_TARGET_POSITION_VECTOR = (      8.86,      -10.33,      7.82)
SC_TARGET_VELOCITY_VECTOR = (      0.00,      0.00,      0.00)
SPACECRAFT_ALTITUDE     =      13.786
SUB_SPACECRAFT_LATITUDE =      2.558
SUB_SPACECRAFT_LONGITUDE =      71.957
SPICE_FILE_NAME         = {"PREHIB\ATNR_P040302093352_00127.BC",
                          "PREHIB\ORER_00031.BSP",
                          "PREHIB\ORFR_00067.BSP",
                          "PREHIB\ORGR_00096.BSP",
                          "PREHIB\ORHR_00122.BSP",
                          "PREHIB\ORMR_00052.BSP",

```

"PREHIB\ORHO_00077.BSP",
"ROS_ORBITER_EXTENSION_V2.BSP",
"ROS_SA_2004_V0001.BC",
"ROS_SA_2005_V0001.BC",
"ROS_SA_2006_V0001.BC",
"ROS_SA_2007_V0001.BC",
"ROS_SA_2008_V0038.BC",
"ROS_SA_2009_V0054.BC",
"ROS_SA_2010_V0052.BC",
"ROS_SA_2011_V0013.BC",
"ROS_SA_2014_V0047.BC",
"ROS_SA_2015_V0042.BC",
"ROS_SA_2016_V0041.BC",
"ROS_HGA_2008_V0018.BC",
"ROS_HGA_2009_V0051.BC",
"ROS_HGA_2010_V0045.BC",
"ROS_HGA_2011_V0018.BC",
"ROS_HGA_2014_V0044.BC",
"ROS_HGA_2015_V0053.BC",
"ROS_HGA_2016_V0042.BC",
"ROS_LBOOM_V0.BC",
"ROS_V32.TF",
"ROS_RPC_V19.TI",
"NAIF0012.TLS.PC",
"PCK00010.TPC",
"DE403_MASSES.TPC",
"ROS_160929_STEP.TSC",
"DE430.BSP",
"ROS_RPC_STRUCT_V1.BSP",
"ROS_STRUCT_V6.BSP",
"RORB_DV_145_01_T19_00216.BSP",
"RATT_DV_145_01_01_00216.BC",
"RORB_DV_223_01_T19_00302.BSP",
"RATT_DV_223_01_01_00302.BC",
"RORB_DV_257_03_T19_00345.BSP",
"RATT_DV_257_02_01_T6_00344.BC",
"LATT_CFF2LDR_FSS_V2_0.BC",
"LATT_EME2LDR_SDL_V1_0.BC",
"LATT_ROS2LDR_PRESEP_V1_0.BC",
"LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",
"ROS_SC_MES_050501_060101_V03.BC",
"ROS_SC_MES_060101_070101_V03.BC",
"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01_A_00067.BSP",
"CORL_DL_002_01_B_00043.BSP",
"CORL_DL_003_01_C_00068.BSP",
"CORL_DL_006_01_H_00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",

```
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_00216.BSP",
"CATT_DV_145_02_00216.BC",
"CORB_DV_223_01_T19_00302.BSP",
"LORB_DV_223_01_T19_00302.BSP",
"CATT_DV_223_01_00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01_T19_00318.BSP",
"CORB_DV_257_03_T19_00345.BSP",
"CATT_DV_257_03_00344.BC"}

```

```
PRODUCER_ID = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID = "N/A"
DATA_QUALITY_DESC = "
ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"
PROCESSING_LEVEL_ID = "4"

```

```
DESCRIPTION = "
THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE
OUTBOARD MAGNETOMETER ABOARD THE ROSETTA S/C. GROUND CALIBRATION RESULTS HAVE
BEEN APPLIED TO THE RAW DATA. FIELD IS ROTATED TO ROS_SPACECRAFT
COORDINATES.DATA ARE AVERAGED TO 1 S MEANS."
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

```

```
DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID = "RPCMAG"
^ARCHIVE_CONTENT_DESC = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"

```

```
NOTE = "
A)
MAGNETIC_COORDINATE_SYSTEM : ROS_SPACECRAFT
B)
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
FOR THE TIME T= START_TIME.
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
C)
LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
D)
GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMOB.ASC
E)
INFLIGHT CALIBRATION FILE: INFCAL_OFF__OB_20180305_009.ASC
F)
DATA SOURCE FOR CLF DATA: LEVEL_B DATA

```

```

"
^TABLE          = "RPCMAG160901_CLF_OB_A1.TAB"

OBJECT          = TABLE
NAME            = "RPCMAG-OB-1S_AVERAGE-CLF"
INTERCHANGE_FORMAT = ASCII
ROWS           = 86367
COLUMNS       = 7
ROW_BYTES      = 93

OBJECT          = COLUMN
NAME            = "TIME.UTC"
DATA_TYPE       = TIME
START_BYTE     = 1
BYTES           = 26
DESCRIPTION     = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "TIME_OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 28
BYTES           = 15
DESCRIPTION     = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00
AT 1.1.2003: SSSSSSSSS.FFFFF,
SSSSSSSS: REAL SECONDS,
FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "BX_OB"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 44
BYTES           = 9
UNIT            = "NANOTESLA"
UNIT_ID        = "nT"
DESCRIPTION     = "MAGNETIC FIELD X COMPONENT, CALIBRATED,
TEMPERATURE CORRECTED DATA, S/C-COORDINATES, 1S_AVERAGE-OB SENSOR"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "BY_OB"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 54
BYTES           = 9
UNIT            = "NANOTESLA"
UNIT_ID        = "nT"
DESCRIPTION     = "MAGNETIC FIELD Y COMPONENT, CALIBRATED,
TEMPERATURE CORRECTED DATA, S/C-COORDINATES, 1S_AVERAGE-OB SENSOR"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "BZ_OB"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 64
  
```



```

BYTES          = 9
UNIT           = "NANOTESLA"
UNIT_ID       = "nT"
DESCRIPTION    = "MAGNETIC FIELD Z COMPONENT, CALIBRATED,
  TEMPERATURE CORRECTED DATA, S/C-COORDINATES, 1S_AVERAGE-OB SENSOR"
END_OBJECT    = COLUMN

OBJECT        = COLUMN
NAME          = "T_OB"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 74
BYTES        = 6
UNIT         = "KELVIN"
UNIT_ID     = "K"
DESCRIPTION = "TEMPERATURE OF RPCMAG OB SENSOR"
END_OBJECT = COLUMN
  
```

```

OBJECT        = COLUMN
NAME          = "QUALITY_FLAGS"
DATA_TYPE     = CHARACTER
START_BYTE    = 81
BYTES        = 11
DESCRIPTION   = "
  
```

These flags describe the quality of the magnetic field data.
 The quality is coded in a 11 byte string. Each character can have
 the following values:

VALUE:	MEANING:
x	property described by flag is still unknown
0	no disturbance, good quality
1..9,A..F	specific disturbance/problems, see below Value is hexadecimal coded

Description of the specific flags:

FLAG-STRING	FLAG	DESCRIPTION
BA987654321		
-----:	1	RELATION BETWEEN IB AND OB SENSOR (binary coded)
-----:	1	Digit 3 2 1 0 : Value
-----:	1	: x no assessment
-----:	1	0 0 : 0 Difference < 1nT , PERFECT
-----:	1	0 1 : +1 Difference < 2nT , GOOD
-----:	1	1 0 : +2 Difference < 4nT , AMPLE
-----:	1	1 1 : +3 Difference > 4nT , POOR
-----:	1	1 : +4 IB Temperature drifting
-----:	1	1 : +8 OB Temperature drifting
-----:	2	PERCENTAGE OB / IB DIFFERENCE
-----:	2	x = no assessment
-----:	2	0 = deviation < 10 \%, PERFECT CORRELATION
-----:	2	1 = deviation < 20 \%, GOOD CORRELATION
-----:	2	2 = deviation < 50 \%, AMPLE CORRELATION
-----:	2	3 = deviation > 50 \%, POOR CORRELATION
-----:	3	IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
-----:	3	x = impact not assessed
-----:	3	0 = probably no disturbance
-----:	3	1 = disturbance eliminated during data analysis

```

-----: 3 2 = disturbance possible
-----: 3 3 = disturbance not clear
-----: 3 4 = data disturbed, cleaned CLH data available
-----: 3 5 = data disturbed, elimination not possible

-----: 4 VARIOUS DISTURBANCE EFFECTS
-----: 4 x = no assessment
-----: 4 0 = no other problems detected
-----: 4 1 = severe heater impact at EAR1 eliminated
-----: 4 2 = severe heater impact at EAR1, about 2nTpp PWM
-----: 4 3 = S/C 28 V Power failure
-----: 4 4 = dT/dt > threshold, no thermal equilibrium
-----: 4 5 = data disturbed by AC-signal, origin at S/C
-----: 4 6 = data noisy due to power on failure
-----: 4 7 = ADC latch-up: bit error. Final data corrected!
-----: 4 8 = sensor saturated due to huge external field
-----: 4 9 = sensor saturated, instrument power on failed

-----: 5 LANDER HEATER STATUS (binary coded)
-----: 5 MSS: Mechanical support Heaters
-----: 5 HIB: Hibernation Heaters
-----: 5 digit 3 2 1 0 : Value
-----: 5 : x no assessment
-----: 5 1 : +1 MSS1 off/on (0/1)
-----: 5 1 : +2 MSS2 off/on (0/1)
-----: 5 1 : +4 HIB1 off/on (0/1)
-----: 5 1 : +8 HIB2 off/on (0/1)

-----: 6 LANDER P/L STATUS (binary coded)
-----: 6 digit 3 2 1 0 : Value
-----: 6 : x no assessment
-----: 6 1 : +1 COSAC off/on (0/1)
-----: 6 1 : +2 COSAC active (0/1)
-----: 6 1 : +4 PTOLEMY off/on (0/1)
-----: 6 1 : +8 PTOLEMY active (0/1)

-----: 7 LANDER STATUS (binary coded)
-----: 7 digit 3 2 1 0 : Value
-----: 7 : x no assessment
-----: 7 1 : +1 Lander detached/attached (0/1)
-----: 7 2 : +2 ROMAP data available (0/1)
-----: 7 4 : +4 LANDER off/on (0/1)
-----: 7 8 : +8 Separation ongoing (0/1)

----: 8 BOOM DEPLOYMENT:
----: 8 x = no assessment
----: 8 0 = boom deployed
----: 8 1 = boom stowed
----: 8 2 = boom deployment ongoing. Data only valid
----: 8 in instrument coordinates
----: 8 3 = pyros fired for boom release

--: 9 IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
--: 9 x = no assessment
--: 9 0 = WOL not active
--: 9 1 = WOL active, no disturbance visible
--: 9 2 = Start of WOL not visible

```

```

--:          9      3 = End of WOL not visible
--:          9      4 = WOL completely visible

-:          A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
-:          A      x = no assessment
-:          A      0 = OCM not active
-:          A      1 = OCM active, no disturbance visible
-:          A      2 = Jump visible (in B and/or dB/dt)
-:          A      3 = Comb-disturbance visible (in B and/or dB/dt)
-:          A      4 = Jump and comb visible
-:          A      5 = no data during OCM

:           B      PLASMA ENVIRONMENT
:           B      x = no assessment
:           B      0 = Cavity
:           B      1 = pure solar wind
:           B      2 = cometary influenced solar wind
:           B      3 = pure cometary environment, sw not present
:           B      4 = Earth swing-by
:           B      5 = Mars swing-by
:           B      6 = Steins fly-by
:           B      7 = Lutetia fly-by
"

END_OBJECT      = COLUMN
END_OBJECT      = TABLE
END

```

4.3.9 Data Product "RESAMPLED LEVEL_G Magnetic Field data" Design

```

PDS_VERSION_ID      = PDS3
LABEL_REVISION_NOTE = "V1.0"
RECORD_TYPE         = FIXED_LENGTH
RECORD_BYTES        = 128
FILE_RECORDS        = 86333
DATA_SET_ID         = "RO-C-RPCMAG-4-EXT3-RESAMPLED-V9.0"
DATA_SET_NAME = "ROSETTA-ORBITER 67P RPCMAG 4 EXT3 RESAMPLED V9.0"
PRODUCT_ID          = "RPCMAG160901_CLG_IB_A1"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE        = "REFDR"
MISSION_ID          = "ROSETTA"
MISSION_NAME        = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME  = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE    = "N/A"
INSTRUMENT_HOST_ID  = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"
INSTRUMENT_ID       = "RPCMAG"
INSTRUMENT_NAME     = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE     = "MAGNETOMETER"
INSTRUMENT_MODE_ID  = "AVERAGED"
INSTRUMENT_MODE_DESC = "1 S AVERAGES"

```



```
"RATT_DV_257_02_01_T6_00344.BC",
"LATT_CFF2LDR_FSS_V2_0.BC",
"LATT_EME2LDR_SDL_V1_0.BC",
"LATT_ROS2LDR_PRESEP_V1_0.BC",
"LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",
"ROS_SC_MES_050501_060101_V03.BC",
"ROS_SC_MES_060101_070101_V03.BC",
"ROS_SC_MES_070101_080101_V03.BC",
"ROS_SC_MES_080101_090101_V03.BC",
"ROS_SC_MES_090101_100101_V03.BC",
"ROS_SC_MES_100101_110101_V03.BC",
"ROS_SC_MES_110101_110608_V03.BC",
"ROS_SC_MES_140120_150101_V03.BC",
"ROS_SC_MES_150101_160101_V03.BC",
"ROS_SC_MES_160101_160930_V03.BC",
"RSSD0002.TF",
"DE405.BSP",
"CORL_DL_003_01__A_00067.BSP",
"CORL_DL_002_01__B_00043.BSP",
"CORL_DL_003_01__C_00068.BSP",
"CORL_DL_006_01__H_00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_____00216.BSP",
"CATT_DV_145_02_____00216.BC",
"CORB_DV_223_01__T19_00302.BSP",
"LORB_DV_223_01__T19_00302.BSP",
"CATT_DV_223_01_____00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01__T19_00318.BSP",
"CORB_DV_257_03__T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

```

```
PRODUCER_ID = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID = "N/A"
DATA_QUALITY_DESC = ""
ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"
PROCESSING_LEVEL_ID = "4"

```

```
DESCRIPTION = ""
THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE
INBOARD MAGNETOMETER ABOARD THE ROSETTA S/C. GROUND CALIBRATION RESULTS HAVE
BEEN APPLIED TO THE RAW DATA. FIELD IS ROTATED TO ECLIPJ2000 COORDINATES.
THE S/C POSITION IS GIVEN IN ECLIPJ2000 COORDINATES AS WELL.
DATA ARE AVERAGED TO 1 S MEANS."
```

```
FLIGHT SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC = "MAGNETOMETER_BOOM: DEPLOYED"

```

```
DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID = "RPCMAG"
^ARCHIVE_CONTENT_DESC = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"

```

```

^RPCMAG_SCIENCE_USAGE_DESC      = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC        = "RO_IGEP_TR0028_CALPROC.PDF"

NOTE                               = "

A)
MAGNETIC_COORDINATE_SYSTEM : ECLIPJ2000

B)
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
PLANETOCENTRIC IAU_<TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
FOR THE TIME T= START_TIME.
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>

C)
LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123

D)
GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMIB.ASC

E)
INFLIGHT CALIBRATION FILE: INFCAL_OFF__IB_20180305_009.ASC

F)
DATA SOURCE FOR CLG DATA: LEVEL_C DATA
"

^TABLE                              = "RPCMAG160901_CLG_IB_A1.TAB"

OBJECT                               = TABLE
NAME                                 = "RPCMAG-IB-1S_AVERAGE-CLG"
INTERCHANGE_FORMAT                   = ASCII
ROWS                                 = 86333
COLUMNS                             = 9
ROW_BYTES                            = 128

OBJECT                               = COLUMN
NAME                                 = "TIME.UTC"
DATA_TYPE                            = TIME
START_BYTE                           = 1
BYTES                                 = 26
DESCRIPTION                           = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
NAME                                 = "TIME_OBT"
DATA_TYPE                            = ASCII_REAL
START_BYTE                           = 28
BYTES                                 = 15
DESCRIPTION                           = "S/C CLOCK AT OBSERVATION TIME, SECONDS SINCE 00:00
AT 1.1.2003: SSSSSSSSS.FFFFFF,
SSSSSSSSS: REAL SECONDS,
FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
NAME                                 = "POSITION_X"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 44
BYTES          = 13
UNIT           = "KILOMETER"
UNIT_ID        = "km"
DESCRIPTION    = "SPACECRAFT POSITION, X COMPONENT, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "POSITION_Y"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 58
BYTES         = 13
UNIT         = "KILOMETER"
UNIT_ID      = "km"
DESCRIPTION  = "SPACECRAFT POSITION, Y COMPONENT, ECLIPJ2000"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "POSITION_Z"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 72
BYTES         = 13
UNIT         = "KILOMETER"
UNIT_ID      = "km"
DESCRIPTION  = "SPACECRAFT POSITION, Z COMPONENT, ECLIPJ2000"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "BX_IB"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 86
BYTES         = 9
UNIT         = "NANOTESLA"
UNIT_ID      = "nT"
DESCRIPTION  = "MAGNETIC FIELD X COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, 1S_AVERAGE-IB SENSOR, ECLIPJ2000"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "BY_IB"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 96
BYTES         = 9
UNIT         = "NANOTESLA"
UNIT_ID      = "nT"
DESCRIPTION  = "MAGNETIC FIELD Y COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, 1S_AVERAGE-IB SENSOR, ECLIPJ2000"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "BZ_IB"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 106
BYTES         = 9
UNIT         = "NANOTESLA"
UNIT_ID      = "nT"
  
```

DESCRIPTION = "MAGNETIC FIELD Z COMPONENT, CALIBRATED, TEMPERATURE
CORRECTED DATA, 1S_AVERAGE-IB SENSOR, ECLIPJ2000"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "QUALITY_FLAGS"
DATA_TYPE = CHARACTER
START_BYTE = 116
BYTES = 11
DESCRIPTION = "

These flags describe the quality of the magnetic field data.
The quality is coded in a 11 byte string. Each character can have
the following values:

VALUE:	MEANING:
x	property described by flag is still unknown
0	no disturbance, good quality
1..9,A..F	specific disturbance/problems, see below

Value is hexadecimal coded

Description of the specific flags:

FLAG-STRING	FLAG	DESCRIPTION
BA987654321		
-----:	1	RELATION BETWEEN IB AND OB SENSOR (binary coded)
-----:	1	Digit 3 2 1 0 : Value
-----:	1	: x no assessment
-----:	1	0 0 : 0 Difference < 1nT , PERFECT
-----:	1	0 1 : +1 Difference < 2nT , GOOD
-----:	1	1 0 : +2 Difference < 4nT , AMPLE
-----:	1	1 1 : +3 Difference > 4nT , POOR
-----:	1	1 : +4 IB Temperature drifting
-----:	1	1 : +8 OB Temperature drifting
-----:	2	PERCENTAGE OB / IB DIFFERENCE
-----:	2	x = no assessment
-----:	2	0 = deviation < 10 \%, PERFECT CORRELATION
-----:	2	1 = deviation < 20 \%, GOOD CORRELATION
-----:	2	2 = deviation < 50 \%, AMPLE CORRELATION
-----:	2	3 = deviation > 50 \%, POOR CORRELATION
-----:	3	IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
-----:	3	x = impact not assessed
-----:	3	0 = probably no disturbance
-----:	3	1 = disturbance eliminated during data analysis
-----:	3	2 = disturbance possible
-----:	3	3 = disturbance not clear
-----:	3	4 = data disturbed, cleaned CLH data available
-----:	3	5 = data disturbed, elimination not possible
-----:	4	VARIOUS DISTURBANCE EFFECTS
-----:	4	x = no assessment
-----:	4	0 = no other problems detected
-----:	4	1 = severe heater impact at EAR1 eliminated
-----:	4	2 = severe heater impact at EAR1, about 2nTpp PWM
-----:	4	3 = S/C 28 V Power failure
-----:	4	4 = dT/dt > threshold, no thermal equilibrium
-----:	4	5 = data disturbed by AC-signal, origin at S/C


```

-----:      4      6 = data noisy due to power on failure
-----:      4      7 = ADC latch-up:bit error.Final data corrected!
-----:      4      8 = sensor saturated due to huge external field
-----:      4      9 = sensor saturated, instrument power on failed

-----:      5      LANDER HEATER STATUS (binary coded)
-----:      5      MSS: Mechanical support Heaters
-----:      5      HIB: Hibernation Heaters
-----:      5      digit  3 2 1 0 : Value
-----:      5              : x    no assessment
-----:      5              1 : +1  MSS1 off/on (0/1)
-----:      5              1 : +2  MSS2 off/on (0/1)
-----:      5              1 : +4  HIB1 off/on (0/1)
-----:      5              1 : +8  HIB2 off/on (0/1)

-----:      6      LANDER P/L STATUS (binary coded)
-----:      6      digit  3 2 1 0 : Value
-----:      6              : x    no assessment
-----:      6              1 : +1  COSAC  off/on (0/1)
-----:      6              1 : +2  COSAC  active (0/1)
-----:      6              1 : +4  PTOLEMY off/on (0/1)
-----:      6              1 : +8  PTOLEMY active (0/1)

-----:      7      LANDER STATUS (binary coded)
-----:      7      digit  3 2 1 0 : Value
-----:      7              : x    no assessment
-----:      7              1 : +1  Lander detached/attached (0/1)
-----:      7              2 : +2  ROMAP data available(0/1)
-----:      7              4 : +4  LANDER off/on (0/1)
-----:      7              8 : +8  Separation ongoing (0/1)

----:      8      BOOM DEPLOYMENT:
----:      8      x = no assessment
----:      8      0 = boom deployed
----:      8      1 = boom stowed
----:      8      2 = boom deployment ongoing. Data only valid
----:      8      in instrument coordinates
----:      8      3 = pyros fired for boom release

--:      9      IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
--:      9      x = no assessment
--:      9      0 = WOL not active
--:      9      1 = WOL active, no disturbance visible
--:      9      2 = Start of WOL not visible
--:      9      3 = End of WOL not visible
--:      9      4 = WOL completely visible

--:      A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
--:      A      x = no assessment
--:      A      0 = OCM not active
--:      A      1 = OCM active, no disturbance visible
--:      A      2 = Jump visible (in B and/or dB/dt)
--:      A      3 = Comb-disturbance visible (in B and/or dB/dt)
--:      A      4 = Jump and comb visible
--:      A      5 = no data during OCM

:      B      PLASMA ENVIRONMENT
  
```

```

:           B       x = no assessment
:           B       0 = Cavity
:           B       1 = pure solar wind
:           B       2 = cometary influenced solar wind
:           B       3 = pure cometary environment, sw not present
:           B       4 = Earth swing-by
:           B       5 = Mars swing-by
:           B       6 = Steins fly-by
:           B       7 = Lutetia fly-by
"
END_OBJECT      = COLUMN
END_OBJECT      = TABLE
END

```

4.3.10 Data Product "RESAMPLED LEVEL_H Magnetic Field data" Design

```

PDS_VERSION_ID      = PDS3
LABEL_REVISION_NOTE = "V1.0"
RECORD_TYPE         = FIXED_LENGTH
RECORD_BYTES        = 128
FILE_RECORDS        = 931840
DATA_SET_ID         = "RO-C-RPCMAG-4-EXT3-RESAMPLED-V9.0"
DATA_SET_NAME = "ROSETTA-ORBITER 67P RPCMAG 4 EXT3 RESAMPLED V9.0"
PRODUCT_ID          = "RPCMAG160902T1101_CLH_OB_M3"
PRODUCT_CREATION_TIME = 2018-08-21T13:20:00
PRODUCT_TYPE        = "REFDR"
MISSION_ID          = "ROSETTA"
MISSION_NAME        = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME  = "ROSETTA EXTENSION 3"
OBSERVATION_TYPE    = "N/A"
INSTRUMENT_HOST_ID  = "RO"
INSTRUMENT_HOST_NAME = "ROSETTA-ORBITER"
INSTRUMENT_ID       = "RPCMAG"
INSTRUMENT_NAME     = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER"
INSTRUMENT_TYPE     = "MAGNETOMETER"
INSTRUMENT_MODE_ID  = "SID3"
INSTRUMENT_MODE_DESC = "
BURST MODE: 320 PRIMARY & 16 SECONDARY VECTORS PER 16 SECONDS"
TARGET_NAME         = "67P/CHURYUMOV-GERASIMENKO 1 (1969 R1)"
TARGET_TYPE         = "COMET"
COORDINATE_SYSTEM_CENTER_NAME = "EARTH"
START_TIME          = 2016-09-02T11:01:57.662
STOP_TIME           = 2016-09-02T23:59:15.905
SPACECRAFT_CLOCK_START_COUNT = "1/431434828.59976"
SPACECRAFT_CLOCK_STOP_COUNT  = "1/431481467.09363"

START_JULIAN_DATE_VALUE = 2457633.9596951627
STOP_JULIAN_DATE_VALUE  = 2457634.4994896417
SC_SUN_POSITION_VECTOR  = ( 525003046.38, 162414714.48, -36884996.89)
SC_TARGET_POSITION_VECTOR = ( 1.14, 4.16, 8.52)
SC_TARGET_VELOCITY_VECTOR = ( -0.00, 0.00, -0.00)
SPACECRAFT_ALTITUDE     = 7.963
SUB_SPACECRAFT_LATITUDE = -60.439
SUB_SPACECRAFT_LONGITUDE = 107.087

```

```
SPICE_FILE_NAME = {"PREHIB\ATNR_P040302093352_00127.BC",  
                  "PREHIB\ORER_00031.BSP",  
                  "PREHIB\ORFR_00067.BSP",  
                  "PREHIB\ORGR_00096.BSP",  
                  "PREHIB\ORHR_00122.BSP",  
                  "PREHIB\ORMR_00052.BSP",  
                  "PREHIB\ORHO_00077.BSP",  
                  "ROS_ORBITER_EXTENSION_V2.BSP",  
                  "ROS_SA_2004_V0001.BC",  
                  "ROS_SA_2005_V0001.BC",  
                  "ROS_SA_2006_V0001.BC",  
                  "ROS_SA_2007_V0001.BC",  
                  "ROS_SA_2008_V0038.BC",  
                  "ROS_SA_2009_V0054.BC",  
                  "ROS_SA_2010_V0052.BC",  
                  "ROS_SA_2011_V0013.BC",  
                  "ROS_SA_2014_V0047.BC",  
                  "ROS_SA_2015_V0042.BC",  
                  "ROS_SA_2016_V0041.BC",  
                  "ROS_HGA_2008_V0018.BC",  
                  "ROS_HGA_2009_V0051.BC",  
                  "ROS_HGA_2010_V0045.BC",  
                  "ROS_HGA_2011_V0018.BC",  
                  "ROS_HGA_2014_V0044.BC",  
                  "ROS_HGA_2015_V0053.BC",  
                  "ROS_HGA_2016_V0042.BC",  
                  "ROS_LBOOM_V0.BC",  
                  "ROS_V32.TF",  
                  "ROS_RPC_V19.TI",  
                  "NAIF0012.TLS.PC",  
                  "PCK00010.TPC",  
                  "DE403_MASSES.TPC",  
                  "ROS_160929_STEP.TSC",  
                  "DE430.BSP",  
                  "ROS_RPC_STRUCT_V1.BSP",  
                  "ROS_STRUCT_V6.BSP",  
                  "RORB_DV_145_01_T19_00216.BSP",  
                  "RATT_DV_145_01_01_00216.BC",  
                  "RORB_DV_223_01_T19_00302.BSP",  
                  "RATT_DV_223_01_01_00302.BC",  
                  "RORB_DV_257_03_T19_00345.BSP",  
                  "RATT_DV_257_02_01_T6_00344.BC",  
                  "LATT_CFF2LDR_FSS_V2_0.BC",  
                  "LATT_EME2LDR_SDL_V1_0.BC",  
                  "LATT_ROS2LDR_PRESEP_V1_0.BC",  
                  "LATT_ROS2LDR_SDL_ROMAP_V1_0.BC",  
                  "ROS_SC_MES_050501_060101_V03.BC",  
                  "ROS_SC_MES_060101_070101_V03.BC",  
                  "ROS_SC_MES_070101_080101_V03.BC",  
                  "ROS_SC_MES_080101_090101_V03.BC",  
                  "ROS_SC_MES_090101_100101_V03.BC",  
                  "ROS_SC_MES_100101_110101_V03.BC",  
                  "ROS_SC_MES_110101_110608_V03.BC",  
                  "ROS_SC_MES_140120_150101_V03.BC",  
                  "ROS_SC_MES_150101_160101_V03.BC",  
                  "ROS_SC_MES_160101_160930_V03.BC",  
                  "RSSD0002.TF",
```

```
"DE405.BSP",
"CORL_DL_003_01___A___00067.BSP",
"CORL_DL_002_01___B___00043.BSP",
"CORL_DL_003_01___C___00068.BSP",
"CORL_DL_006_01___H___00156.BSP",
"CORL_DL_010_03_P_T19_00335.BSP",
"LORB_ROS_SC_PRESEP_V1_0.BSP",
"LORB_DV_145_01_____00216.BSP",
"CATT_DV_145_02_____00216.BC",
"CORB_DV_223_01___T19_00302.BSP",
"LORB_DV_223_01___T19_00302.BSP",
"CATT_DV_223_01_____00302.BC",
"ROS_CHURYUMOV_V01.TF",
"ROS_CGS_RSOC_V03.TPC",
"ROS_CG_ROT_1408_1409_V10.TPC",
"LORB_DV_236_01___T19_00318.BSP",
"CORB_DV_257_03___T19_00345.BSP",
"CATT_DV_257_03_____00344.BC"}

```

```
PRODUCER_ID           = "RPC_MAG_TEAM"
PRODUCER_FULL_NAME    = "INGO RICHTER"
PRODUCER_INSTITUTION_NAME = "IGEP-TU-BRAUNSCHWEIG"
DATA_QUALITY_ID       = "N/A"
DATA_QUALITY_DESC     = "
  ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"
PROCESSING_LEVEL_ID   = "4"

```

```
DESCRIPTION           = "
  THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE
  OUTBOARD MAGNETOMETER ABOARD THE ROSETTA S/C. GROUND CALIBRATION RESULTS HAVE
  BEEN APPLIED TO THE RAW DATA. FIELD IS ROTATED TO ECLIPJ2000 COORDINATES.
  THE S/C POSITION IS GIVEN IN ECLIPJ2000 COORDINATES AS WELL.
  LAP DISTURBANCE OCCURRING AT CONSTANT FREQUENCIES HAS BEEN ELIMINATED.
  DYNAMIC REACTION WHEEL DISTURBANCE SIGNATURE ELIMINATED IN SPECTRUM."
FLIGHT_SOFTWARE_VERSION_ID = "FIL:V1.0"
PLATFORM_OR_MOUNTING_DESC  = "MAGNETOMETER_BOOM: DEPLOYED"

```

```
DATA_SET_PARAMETER_NAME = "MAGNETIC FIELD"
CALIBRATION_SOURCE_ID   = "RPCMAG"
^ARCHIVE_CONTENT_DESC   = "RO_IGEP_TR0009_EAICD.PDF"
^RPC_SCIENCE_USAGE_DESC = "RPC_USER_GUIDE.PDF"
^RPCMAG_DATA_QUALITY_DESC = "RO_IGEP_TR0047_DATA_SUMMARY.PDF"
^RPCMAG_SCIENCE_USAGE_DESC = "RO_IGEP_TR0074_MAG_USRGUIDE.PDF"
^RPCMAG_CALIBRATION_DESC = "RO_IGEP_TR0028_CALPROC.PDF"

```

```
NOTE = "
A)
  MAGNETIC_COORDINATE_SYSTEM : ECLIPJ2000
B)
  THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,
  SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,
  ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.
  SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE
  ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD
  PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED
  FOR THE TIME T= START_TIME.
  DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG>
```

- C) LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20180123
- D) GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMOB.ASC
- E) INFLIGHT CALIBRATION FILE: INFCAL_OFF__OB_20180305_009.ASC
- F) REACTION WHEEL CORRECTIONS HAVE BEEN COMPUTED USING FILE:
 D:\ROSETTA\DATA\REACTION_WHEELS\ASCII_DATA\SCHK7_2016-09-02.TXT
 THIS REFERENCE IS LISTED FOR INTERNAL USE ONLY.THE FILE IS NOT DELIVERED TO
 THE ARCHIVE. REACTION WHEEL DATA CAN BE FOUND ON THE ROSETTA DDS
- G) DATA SOURCE FOR CLH DATA: LEVEL_C DATA

```

^TABLE          = "RPCMAG160902T1101_CLH_OB_M3.TAB"

OBJECT          = TABLE
NAME            = "RPCMAG-OB-RW_CORR-CLH"
INTERCHANGE_FORMAT = ASCII
ROWS           = 931840
COLUMNS       = 9
ROW_BYTES      = 128

OBJECT          = COLUMN
NAME            = "TIME.UTC"
DATA_TYPE       = TIME
START_BYTE     = 1
BYTES          = 26
DESCRIPTION     = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "TIME_OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 28
BYTES          = 15
DESCRIPTION     = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00
AT 1.1.2003: SSSSSSSSS.FFFFF,
SSSSSSSSSS: REAL SECONDS,
FFFFFF: NO FRACTIONAL DECIMAL SECONDS BUT 16 BIT CLOCK COUNTS
FROM 0 TO 65535. RESOLUTION: 1/65536 SECONDS PER COUNT.
CONVERSION TO UTC ACCORDING TO ESA STANDARD PROCEDURE."
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "POSITION_X"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 44
BYTES          = 13
UNIT            = "KILOMETER"
UNIT_ID        = "km"
DESCRIPTION     = "SPACECRAFT POSITION, X COMPONENT, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "POSITION_Y"
  
```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 58
BYTES          = 13
UNIT           = "KILOMETER"
UNIT_ID        = "km"
DESCRIPTION    = "SPACECRAFT POSITION, Y COMPONENT, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "POSITION_Z"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 72
BYTES          = 13
UNIT           = "KILOMETER"
UNIT_ID        = "km"
DESCRIPTION    = "SPACECRAFT POSITION, Z COMPONENT, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "BX_OB"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 86
BYTES          = 9
UNIT           = "NANOTESLA"
UNIT_ID        = "nT"
DESCRIPTION    = "MAGNETIC FIELD X COMPONENT, CALIBRATED, TEMPERATURE
AND REACTION WHEEL AND LAP DISTURBANCE CORRECTED DATA,
OB SENSOR, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "BY_OB"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 96
BYTES          = 9
UNIT           = "NANOTESLA"
UNIT_ID        = "nT"
DESCRIPTION    = "MAGNETIC FIELD Y COMPONENT, CALIBRATED, TEMPERATURE
AND REACTION WHEEL AND LAP DISTURBANCE CORRECTED DATA,
OB SENSOR, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "BZ_OB"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 106
BYTES          = 9
UNIT           = "NANOTESLA"
UNIT_ID        = "nT"
DESCRIPTION    = "MAGNETIC FIELD Z COMPONENT, CALIBRATED, TEMPERATURE
AND REACTION WHEEL AND LAP DISTURBANCE CORRECTED DATA,
OB SENSOR, ECLIPJ2000"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "QUALITY_FLAGS"
DATA_TYPE      = CHARACTER

```

START_BYTE = 116
BYTES = 11
DESCRIPTION = "

These flags describe the quality of the magnetic field data.
The quality is coded in a 11 byte string. Each character can have
the following values:

VALUE:	MEANING:
x	property described by flag is still unknown
0	no disturbance, good quality
1..9,A..F	specific disturbance/problems, see below
	Value is hexadecimal coded

Description of the specific flags:

FLAG-STRING	FLAG	DESCRIPTION
BA987654321		
-----:	1	RELATION BETWEEN IB AND OB SENSOR (binary coded)
-----:	1	Digit 3 2 1 0 : Value
-----:	1	: x no assessment
-----:	1	0 0 : 0 Difference < 1nT , PERFECT
-----:	1	0 1 : +1 Difference < 2nT , GOOD
-----:	1	1 0 : +2 Difference < 4nT , AMPLE
-----:	1	1 1 : +3 Difference > 4nT , POOR
-----:	1	1 : +4 IB Temperature drifting
-----:	1	1 : +8 OB Temperature drifting
-----:	2	PERCENTAGE OB / IB DIFFERENCE
-----:	2	x = no assessment
-----:	2	0 = deviation < 10 \%, PERFECT CORRELATION
-----:	2	1 = deviation < 20 \%, GOOD CORRELATION
-----:	2	2 = deviation < 50 \%, AMPLE CORRELATION
-----:	2	3 = deviation > 50 \%, POOR CORRELATION
-----:	3	IMPACT OF REACTION WHEELS AND LAP DISTURBANCE
-----:	3	x = impact not assessed
-----:	3	0 = probably no disturbance
-----:	3	1 = disturbance eliminated during data analysis
-----:	3	2 = disturbance possible
-----:	3	3 = disturbance not clear
-----:	3	4 = data disturbed, cleaned CLH data available
-----:	3	5 = data disturbed, elimination not possible
-----:	4	VARIOUS DISTURBANCE EFFECTS
-----:	4	x = no assessment
-----:	4	0 = no other problems detected
-----:	4	1 = severe heater impact at EAR1 eliminated
-----:	4	2 = severe heater impact at EAR1, about 2nTpp PWM
-----:	4	3 = S/C 28 V Power failure
-----:	4	4 = dT/dt > threshold, no thermal equilibrium
-----:	4	5 = data disturbed by AC-signal, origin at S/C
-----:	4	6 = data noisy due to power on failure
-----:	4	7 = ADC latch-up:bit error.Final data corrected!
-----:	4	8 = sensor saturated due to huge external field
-----:	4	9 = sensor saturated, instrument power on failed
-----:	5	LANDER HEATER STATUS (binary coded)
-----:	5	MSS: Mechanical support Heaters

```

-----:      5      HIB: Hibernation Heaters
-----:      5      digit 3 2 1 0 : Value
-----:      5              : x      no assessment
-----:      5              1 : +1     MSS1 off/on (0/1)
-----:      5              1 : +2     MSS2 off/on (0/1)
-----:      5              1 : +4     HIB1 off/on (0/1)
-----:      5              1 : +8     HIB2 off/on (0/1)

-----:      6      LANDER P/L STATUS (binary coded)
-----:      6      digit 3 2 1 0 : Value
-----:      6              : x      no assessment
-----:      6              1 : +1     COSAC  off/on (0/1)
-----:      6              1 : +2     COSAC  active (0/1)
-----:      6              1 : +4     PTOLEMY off/on (0/1)
-----:      6              1 : +8     PTOLEMY active (0/1)

-----:      7      LANDER STATUS (binary coded)
-----:      7      digit 3 2 1 0 : Value
-----:      7              : x      no assessment
-----:      7              1 : +1     Lander detached/attached (0/1)
-----:      7              2 : +2     ROMAP data available(0/1)
-----:      7              4 : +4     LANDER off/on (0/1)
-----:      7              8 : +8     Separation ongoing (0/1)

----:      8      BOOM DEPLOYMENT:
----:      8      x = no assessment
----:      8      0 = boom deployed
----:      8      1 = boom stowed
----:      8      2 = boom deployment ongoing. Data only valid
----:      8      in instrument coordinates
----:      8      3 = pyros fired for boom release

--:      9      IMPACT OF WHEEL OFFLOADING MANOEUVRE (WOL)
--:      9      x = no assessment
--:      9      0 = WOL not active
--:      9      1 = WOL active, no disturbance visible
--:      9      2 = Start of WOL not visible
--:      9      3 = End of WOL not visible
--:      9      4 = WOL completely visible

--:      A      IMPACT OF ORBITAL CORRECTION MANOEUVRE (OCM)
--:      A      x = no assessment
--:      A      0 = OCM not active
--:      A      1 = OCM active, no disturbance visible
--:      A      2 = Jump visible (in B and/or dB/dt)
--:      A      3 = Comb-disturbance visible (in B and/or dB/dt)
--:      A      4 = Jump and comb visible
--:      A      5 = no data during OCM

:      B      PLASMA ENVIRONMENT
:      B      x = no assessment
:      B      0 = Cavity
:      B      1 = pure solar wind
:      B      2 = cometary influenced solar wind
:      B      3 = pure cometary environment, sw not present
:      B      4 = Earth swing-by
:      B      5 = Mars swing-by

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:          B      6 = Steins fly-by  
:  
"          B      7 = Lutetia fly-by  
END_OBJECT      = COLUMN  
END_OBJECT      = TABLE  
END
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