cube-mag-4-control-program-deploy-1-api-reference

1.1 cube-mag-4-control-program-deploy-1

1.1.1 Telecommands

Table 1: List of Telecommands

ID	Name	Description	Length (bytes)
General			
1	Reset	Perform a soft reset - Table 2	1
2	Current Unix time	Current Unix time - Table 4	8
3	Error Log Index	Describes the index of the error log that will be read when calling GetErrorLogEntry - Table 5	5
4	Error Log Entry	Error Log Entry - Table 7	8
5	Error Log Clear	Clear the Error Log - Table 8	0
6	Error Log Settings	Error Log Settings - Table 9	1
7	Persist Config	Writes volatile config items to flash - Table 12	0
60	CubeMag Config	CubeMag Config Items - Table 13	4
61	MMC Magnetometer Config	MMC Magnetometer Specific Config - Table 15	12
62	PNI Calibration Parameters	PNI Magnetometer Calibration Parameters - Table 21	48
63	Deploy	Deploy CubeMag - Table 22	1
64	PNI Magnetometer Config	PNI Magnetometer Specific Config - Table 24	12
65	Sample Redundant	Trigger a single Sample the Redundant Magnetometer (auto-sample == OFF) - Table 25	0
66	Arm Deploy	Arm CubeMag for Deployment - Table 26	1

67	Sample Primary	Trigger a single Sample the Primary Magnetometer (auto-sample == OFF) - Table 28	0
68	MMC Calibration Parameters	MMC Magnetometer Calibration Parameters - Table 29	48

Table 2: Reset Command Format

ID	1		**Parameters Length (bytes)**		1
Description	Perform a soft reset				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Reset Type	ENUM	The type of reset to perform. Possible values are in Table 3

Table 3: ResetVal Enumeration Values

Numeric Value	**Name**	**Description**
0	Do Nothing	Dummy Value
55	Soft	Performs a list of final() operations before resetting
66	Hard	Performs reset immediately

Table 4: Current Unix time Command Format

ID	2		**Parameters Length (bytes)**		8
Description	Current Unix time				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Current Unix seconds	UINT	Current Unix time s. (Unit of measure is [s])

	32	32	Current Unix Nanoseconds	UINT	Current Unix time ns. (Unit of measure is [ns])

Table 5: Error Log Index Command Format

ID	3		**Parameters Length (bytes)**		5
Description	Describes the index of the error log that will be read when calling GetErrorLogEntry				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Error Log Index Reference	ENUM	0 = Head, 1 = Tail. Possible values are in Table 6
	8	16	Error Log Index Value	UINT	Error Log Index Val Relative to ErrorLogIndexRefe
	24	16	Error Log Entries	UINT	Number of Error Lo Entries Present

Table 6: ErrorLogSearch Enumeration Values

Numeric Value	**Name**	**Description**
0	ReferenceHead	ReferenceHead
1	ReferenceTail	ReferenceTail

Table 7: Error Log Entry Command Format

ID	4		**Parameters Length (bytes)**		8
Description	Error Log Entry				

Parameters	Offset (bits)	Length (bits)	Name	Data Type	Description
	0	32	Error Log Entry Timestamp	UINT	Timestamp of this Error Log Entry
	32	32	ErrorLogEntryErrorCode	UINT	ErrorCode of this Error Log Entry

Table 8: Error Log Clear Command Format

ID	5		**Parameters Length (bytes)**		0
Description	Clear the Error Log				

Table 9: Error Log Settings Command Format

ID	6		**Parameters Length (bytes)**		1
Description	Error Log Settings				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	1	Active State	ENUM	Error Logging Enabled state. Possible values are in Table 10
	1	1	Buffer Full Action	ENUM	Action to take when log is full. Possible values are in Table 11
	2	6	Reserved	PADDING	Reserved.

Table 10: ActiveState Enumeration Values

Numeric Value	Name	Description

0	Enabled	Logging is disabled
1	Disabled	Logging is enabled

Table 11: BufferFullAction Enumeration Values

Numeric Value	Name	Description
0	Ignore	Ignore new entries when buffer is full
1	Erase	Erase log and add new entry when buffer is full

Table 12: Persist Config Command Format

ID	7		**Parameters Length (bytes)**		0
Description	Writes volatile config items to flash				

Table 13: CubeMag Config Command Format

ID	60		**Parameters Length (bytes)**		4
Description	CubeMag Config Items				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	4	Prefered Primary Magnetometer	ENUM	The Prefered Primary Magnetometer. Possible values are in Table 14
	4	4	Current Primary Magnetometer	ENUM	The Magnetometer to set as the primary. Possible values are in Table 14
	8	16	Deploy Timeout	UINT	Depoyment Timeout. Applied to Burn Wire. (Unit of measure is [mS])

	24	1	Primary Auto-Select	BOOL	Allow the firmware to change the primary magnetometer based on error conditions

Table 14: MagType Enumeration Values

Numeric Value	Name	Description
0	PNI	PNI RM3100 Magnetometer
1	MMC	MMC5883 Magnetometer

Table 15: MMC Magnetometer Config Command Format

ID	61		**Parameters Length (bytes)**		12
Description	MMC Magnetometer Specific Config				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	1	MMC Auto-Sample	BOOL	MMC Auto-Sample Enable/Disable
	1	7	MMC Sample Period	ENUM	MMC Auto Sample Period. Possible values are in Table 16
	8	4	MMC Sample Filter Type	ENUM	MMC Sample Filter Type. Possible values are in Table 17
	12	4	MMC Sample Filter Order	ENUM	MMC Sample Butterworth filter order. Possible values are in Table 18
	16	8	MMC Sample Filter Depth	UINT	MMC Sample Filter Depth

					when using Simple Averaging
	24	5	MMC Single-Sample Time	ENUM	MMC Sample Duration when Auto-Sample is disabled. Possible values are in Table 19
	29	3	MMC Sample Busy Action	ENUM	MMC Action to take when sample is busy when requested. Possible values are in Table 20
	32	32	MMC Max Errors Magnetometer	UINT	MMC Maximum number of allowed megnetometer measurement errors
	64	32	MMC Max Errors Temperature	UINT	MMC Maximum number of allowed temperature measurement errors

Table 16: SamplePeriod Enumeration Values

Numeric Value	Name	Description
0	10ms	10ms
1	20ms	20ms
2	30ms	30ms
3	40ms	40ms
4	50ms	50ms
5	60ms	60ms
6	70ms	70ms
7	80ms	80ms
8	90ms	90ms

9	100ms	100ms

Table 17: FilterType Enumeration Values

Numeric Value	Name	Description
0	Average	Simple Averaging Filter
1	Butter	Butterworth Filter

Table 18: FilterOrder Enumeration Values

Numeric Value	Name	Description
0	2nd Order	Butterworth 2nd order low-pass
1	4th Order	Butterworth 4th order low-pass
2	6th Order	Butterworth 6th order low-pass
3	8th Order	Butterworth 8th order low-pass

Table 19: SampleDuration Enumeration Values

Numeric Value	Name	Description
0	Single Measurement	Single Measurement
4	20ms	20ms
5	30ms	30ms
6	40ms	40ms
7	50ms	50ms
8	60ms	60ms
9	100ms	100ms
10	150ms	150ms
11	200ms	200ms
12	400ms	400ms
13	800ms	800ms
14	3000ms	3000ms
15	5000ms	5000ms

Table 20: SampleBusy Enumeration Values

Numeric Value	Name	Description
0	Wait	Wait for the current sample to complete
1	Use Cached	Use the last cached sample and return

Table 21: PNI Calibration Parameters Command Format

ID	62		**Parameters Length (bytes)**		48
Description	PNI Magnetometer Calibration Parameters				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X-d1	FLOAT	X-Axis: d1
	32	32	X-d2	FLOAT	X-Axis: d2
	64	32	X-s1	FLOAT	X-Axis: s1
	96	32	X-s2	FLOAT	X-Axis: s2
	128	32	Y-d1	FLOAT	Y-Axis: d1
	160	32	Y-d2	FLOAT	Y-Axis: d2
	192	32	Y-s1	FLOAT	Y-Axis: s1
	224	32	Y-s2	FLOAT	Y-Axis: s2
	256	32	Z-d1	FLOAT	Z-Axis: d1
	288	32	Z-d2	FLOAT	Z-Axis: d2
	320	32	Z-s1	FLOAT	Z-Axis: s1
	352	32	Z-s2	FLOAT	Z-Axis: s2

Table 22: Deploy Command Format

ID	63		**Parameters Length (bytes)**		1
Description	Deploy CubeMag				

Parameters	Offset (bits)	Length (bits)	Name	Data Type	Description
	0	8	Magic number	ENUM	Magic number to make sure it is a valid command. Should equal enumeration options. Possible values are in Table 23

Table 23: MagicDeploy Enumeration Values

Numeric Value	Name	Description
22	Deploy	Deploy CubeMag

Table 24: PNI Magnetometer Config Command Format

ID	64		Parameters Length (bytes)		12
Description	PNI Magnetometer Specific Config				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	1	PNI Auto-Sample	BOOL	PNI Auto-Sample Enable/Disable
	1	7	PNI Sample Period	ENUM	PNI Auto Sample Period. Possible values are in Table 16
	8	4	PNI Sample Filter Type	ENUM	PNI Sample Filter Type. Possible values are in Table 17
	12	4	PNI Sample Filter Order	ENUM	PNI Sample Butterworth filter order. Possible values are in Table 18

	16	8	PNI Sample Filter Depth	UINT	PNI Sample Filter Depth when using Simple Averaging
	24	5	PNI Single-Sample Time	ENUM	PNI Sample Duration when Auto-Sample is disabled. Possible values are in Table 19
	29	3	PNI Sample Busy Action	ENUM	PNI Action to take when sample is busy when requested. Possible values are in Table 20
	32	32	PNI Max Errors Magnetometer	UINT	PNI Maximum number of allowed megnetometer measurement errors
	64	32	PNI Max Errors Temperature	UINT	PNI Maximum number of allowed temperature measurement errors

Table 25: Sample Redundant Command Format

ID	65		**Parameters Length (bytes)**		0
Description	Trigger a single Sample the Redundant Magnetometer (auto-sample == OFF)				

Table 26: Arm Deploy Command Format

ID	66		**Parameters Length (bytes)**		1
Description	Arm CubeMag for Deployment				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Magic number	ENUM	Magic number to make sure it is a valid command. Should equal enumeration options. Possible values are in Table 27

Table 27: MagicDeployArm Enumeration Values

Numeric Value	**Name**	**Description**
11	Arm	Magic number to Arm CubeMag for deployment

Table 28: Sample Primary Command Format

ID	67		**Parameters Length (bytes)**		0
Description	Trigger a single Sample the Primary Magnetometer (auto-sample == OFF)				

Table 29: MMC Calibration Parameters Command Format

ID	68		**Parameters Length (bytes)**		48
Description	MMC Magnetometer				

	Calibration Parameters				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X-d1	FLOAT	X-Axis: d1
	32	32	X-d2	FLOAT	X-Axis: d2
	64	32	X-s1	FLOAT	X-Axis: s1
	96	32	X-s2	FLOAT	X-Axis: s2
	128	32	Y-d1	FLOAT	Y-Axis: d1
	160	32	Y-d2	FLOAT	Y-Axis: d2
	192	32	Y-s1	FLOAT	Y-Axis: s1
	224	32	Y-s2	FLOAT	Y-Axis: s2
	256	32	Z-d1	FLOAT	Z-Axis: d1
	288	32	Z-d2	FLOAT	Z-Axis: d2
	320	32	Z-s1	FLOAT	Z-Axis: s1
	352	32	Z-s2	FLOAT	Z-Axis: s2

1.1.1 Telemetry

Table 30: List of Telemetry Frames

ID	**Name**	**Description**	**Length (bytes)**
General			
128	Identification	Identification information for this node (Legacy definition - use Identification2 instead) - Table 31	8
129	Serial Number	Unique serial number of the CubeSpace Component - Table 34	70
130	Error Log Index	Describes the index of the error log that will be read when calling GetErrorLogEntry - Table 37	5
131	Error Log Entry	Error Log Entry - Table 38	8
132	Error Log Settings	Error Log Settings - Table 39	1
133	Current Unix time	Current Unix time - Table 40	8
134	Persist Config Diagnostics	Diagnostics data for config persistence - Table 41	6

135	Communication Status	Communication Status - Table 44	32
136	Version	Firmware Version - Table 45	22
137	Boot Status	State information about the device boot process - Table 47	3
138	Telecommand Acknowledge	Used with the I2C protocol to receive Telecommand Ack/Nack - Table 50	4
139	Common Error Codes	Error codes common to all applications - Table 52	16
140	Identification2	Identification information for this node - Table 53	21
185	MMC Calibration Parameters	MMC Magnetometer Calibration Parameters - Table 54	48
186	CubeMag Config	CubeMag Config Items - Table 55	4
187	Primary Magnetometer Measurement Raw	Unfiltered last Primary Magnetometer Measurement - Table 56	13
188	State	All Service States - Table 57	3
189	PNI Calibration Parameters	PNI Magnetometer Calibration Parameters - Table 60	48
190	Deployment Status	Deployment Status. Only Applicable to CubeMag Deploy type - Table 61	5
191	Redundant Magnetometer Measurement Raw	Unfiltered last Redundant Magnetometer Measurement - Table 62	13
192	PNI Magnetometer Config	PNI Magnetometer Specific Config - Table 63	12
193	Redundant Magnetometer Measurement	Redundant Magnetometer Measurement - Table 64	13
194	Redundant Magnetometer Temperature	Redundant Magnetometer Measurement - Table 65	4
195	Redundant Magnetometer Diagnostics	Redundant Magnetometer Diagnostics - Table 66	16
196	MMC Magnetometer Config	MMC Magnetometer Specific Config - Table 67	12
197	Primary Magnetometer Measurement	Primary Magnetometer Measurement - Table 68	13

198	Primary Magnetometer Temperature	Main Magnetometer Measurement - Table 69	4
199	Primary Magnetometer Diagnostics	Primary Magnetometer Diagnostics - Table 70	16
254	Health Telemetry	Health Telemetry for CubeMagDeploy - Table 71	24

Table 31: Identification Telemetry Format

ID	128		**Frame Length (bytes)**		8
Description	Identification information for this node (Legacy definition - use Identification2 instead)				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	4	Node type identifier	ENUM	Node type identifier. Possible values are in Table 32
	4	4	Program type identifier	ENUM	Program type identifier. Possible values are in Table 33
	8	8	Interface version	UINT	Interface version
	16	8	Firmware version (Major)	UINT	Firmware version (Major)
	24	8	Firmware version (Minor)	UINT	Firmware version (Minor)
	32	16	Runtime (seconds)	UINT	Seconds since

					processor start-up
	48	16	Runtime (milliseconds)	UINT	Milliseconds (after the integer second) since processor start-up

Table 32: NodeTypeLegacy Enumeration Values

Numeric Value	**Name**	**Description**
0	Invalid	Invalid Node Type
1	CubeComputer	CubeComputer Type - version independant
2	CubeSense	CubeSense Type - version independant
3	CubeWheel	CubeWheel Type - version independant
4	CubeIr	CubeIR Type - version independant
5	CubeMag Deploy	CubeMag Deploy Type - version independant
6	CubeMag Compact	CubeMag Compact Type - version independant
7	CubeStar	CubeStar Type - version independant
8	CubeAuriga	CubeAuriga Type - version independant
9	CubeNode	CubeNode General Type - version independant
10	CubeNode-SLT	CubeNode SLT Type - version independant
11	CubeNode-PST3S	CubeNode PST3S Type - version independant
12	CubeNode-NSSRWL	CubeNode NSSRWL Type - version independant
15	NodeTypeLegacyExtended	Marks the end of the 4-bit legacy enum - Make use of a different telemetry that uses the NodeType enum (Identification2)

Table 33: ProgramType Enumeration Values

Numeric Value	Name	Description
0	Invalid	Invalid Program Type
1	control-program	control-program primary product application
4	flash-bootloader	cube-computer flash-bootloader Bootloader application
5	health-check	health-check Health Check application

Table 34: Serial Number Telemetry Format

ID	129		**Frame Length (bytes)**		70
Description	Unique serial number of the CubeSpace Component				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	256	OTP Serial	STRING	OTP ASCII string of chars denoting the serial number of this module
	256	256	Config Serial	STRING	Config ASCII string of chars denoting the serial number of this module
	512	8	Node type identifier	ENUM	Node type identifier sourced from active serial. Possible values are in Table 35
	520	32	Serial Integer	UINT	Integer representation of the integer portion the serial number of this module sourced from active serial

	552	8	Active Serial Number	ENUM	Which area the serial number (OTP/Config) is being used internally. Possible values are in Table 36

Table 35: NodeType Enumeration Values

Numeric Value	Name	Description
0	Invalid	Invalid Node Type
1	CubeComputer	CubeComputer Type - version independant
2	CubeSense	CubeSense Type - version independant
3	CubeWheel	CubeWheel Type - version independant
4	CubeIr	CubeIR Type - version independant
5	CubeMag Deploy	CubeMag Deploy Type - version independant
6	CubeMag Compact	CubeMag Compact Type - version independant
7	CubeStar	CubeStar Type - version independant
8	CubeAuriga	CubeAuriga Type - version independant
9	CubeNode	CubeNode General Type - version independant
10	CubeNode-SLT	CubeNode SLT Type - version independant
11	CubeNode-PST3S	CubeNode PST3S Type - version independant
12	CubeNode-NSSRWL	CubeNode NSSRWL Type - version independant
16	CubeNodeQuad	CubeNodeQuad General Type - version independant
17	CubeNodeQuad-PST3S	CubeNodeQuad PST3S Type - version independant
18	CubeNodeQuad-NSSRWL	CubeNodeQuad NSSRWL Type - version independant
19	CubeNodeQuad-LITEFUFORS	CubeNodeQuad LITEFUFORS Type - version independant

Table 36: SerialSource Enumeration Values

Numeric Value	Name	Description
0	OTP	Serial number sourced from OTP
1	Config	Serial number sourced from Config

Table 37: Error Log Index Telemetry Format

ID	130		**Frame Length (bytes)**		5
Description	Describes the index of the error log that will be read when calling GetErrorLogEntry				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Error Log Index Reference	ENUM	0 = Head, 1 = Tail. Possible values are in Table 6
	8	16	Error Log Index Value	UINT	Error Log Index Value Relative to ErrorLogIndexReferer
	24	16	Error Log Entries	UINT	Number of Error Log Entries Present

Table 38: Error Log Entry Telemetry Format

ID	131		**Frame Length (bytes)**		8
Description	Error Log Entry				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Error Log Entry Timestamp	UINT	Timestamp of this Error Log Entry

	32	32	ErrorLogEntryErrorCode	UINT	ErrorCode of this Error Log Entry

Table 39: Error Log Settings Telemetry Format

ID	132		**Frame Length (bytes)**		1
Description	Error Log Settings				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	1	Active State	ENUM	Error Logging Enabled state. Possible values are in Table 10
	1	1	Buffer Full Action	ENUM	Action to take when log is full. Possible values are in Table 11
	2	6	Reserved	PADDING	Reserved.

Table 40: Current Unix time Telemetry Format

ID	133		**Frame Length (bytes)**		8
Description	Current Unix time				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Current Unix seconds	UINT	Current Unix time s. (Unit of measure is [s])
	32	32	Current Unix Nanoseconds	UINT	Current Unix time ns. (Unit of measure is [ns])

Table 41: Persist Config Diagnostics Telemetry Format

ID	134		**Frame Length (bytes)**		6
Description	Diagnostics data for config persistence				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	State	ENUM	Config Persistence Task State. Possible values are in Table 42
	8	8	Last Result	ENUM	Config Persistence Last Result. Possible values are in Table 43
	16	32	Timestamp	UINT	Timestamp of last result. (Unit of measure is [s])

Table 42: ConfigPersistState Enumeration Values

Numeric Value	Name	Description
0	Idle	Config Persist task is IDLE
1	Busy	Config Persist task is BUSY

Table 43: ConfigPersistResult Enumeration Values

Numeric Value	Name	Description
0	None	No result yet for config persist
1	Success	Config Persist SUCCESSFUL
2	Error Param Lock	Config Persist failed due to a parameter mutex timeout
3	ErrorFlash	Config Persist failed due to faillure during flash operations

Table 44: Communication Status Telemetry Format

ID	135		**Frame Length (bytes)**		32
Description	Communication Status				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	16	UART Telecommand counter	UINT	UART No. of telecommands received
	16	16	UART Telemetry request counter	UINT	UART No. of telemetry requests received
	32	16	UART Errors reported in SW checks	UINT	UART Errors reported in SW checks
	48	16	UART Errors reported by HW Flags	UINT	UART Errors reported by HW Flags
	64	16	UART2 Telecommand counter	UINT	UART2 No. of telecommands received
	80	16	UART2 Telemetry request counter	UINT	UART2 No. of telemetry requests received
	96	16	UART2 Errors reported in SW checks	UINT	UART2 Errors reported in SW checks
	112	16	UART2 Errors reported by HW Flags	UINT	UART2 Errors reported by HW Flags
	128	16	CAN Telecommand counter	UINT	CAN No. of telecommands received
	144	16	CAN Telemetry request counter	UINT	CAN No. of telemetry requests received
	160	16	CAN Errors reported in	UINT	CAN Errors reported in SW

			SW checks		checks
	176	16	CAN Errors reported by HW Flags	UINT	CAN Errors reported by HW Flags
	192	16	I2C Telecommand counter	UINT	I2C No. of telecommands received
	208	16	I2C Telemetry request counter	UINT	I2C No. of telemetry requests received
	224	16	I2C Errors reported in SW checks	UINT	I2C Errors reported in SW checks
	240	16	I2C Errors reported by HW Flags	UINT	I2C Errors reported by HW Flags

Table 45: Version Telemetry Format

ID	136		**Frame Length (bytes)**		22
Description	Firmware Version				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Firmware version (Major)	UINT	Firmware version (Major)
	8	8	Firmware version (Minor)	UINT	Firmware version (Minor)
	16	16	Firmware version (Patch)	UINT	Firmware version (Patch)
	32	8	System version (Major)	UINT	System version (Major)
	40	8	System version (Minor)	UINT	System version (Minor)

	48	16	System version (Patch)	UINT	System version (Patch)
	64	8	Git Branch	ENUM	The git branch of the firmware build. Possible values are in Table 46
	72	32	Git Hash	UINT	Git has for the firmware build
	104	32	Build Hash	UINT	Build hash
	136	32	Build Time (seconds)	UINT	Timestamp of the firmware build. (Unit of measure is [s])
	168	8	Hardware version (Minor)	UINT	Hardware version (Minor)

Table 46: GitBranch Enumeration Values

Numeric Value	**Name**	**Description**
0	Master	master branch
1	Release	release branch
2	Other	all other informal/development branches - not expected for software bundle firmware

Table 47: Boot Status Telemetry Format

ID	137		**Frame Length (bytes)**		3
Description	State information about the device boot process				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	State	ENUM	Boot State. Possible values are

					in Table 48
	8	8	Reset Reason	ENUM	Cause of the last reset. Possible values are in Table 49
	16	1	Shared Params Error	BOOL	CRC check of shared parameters from bootloader failed - app will use its own config values
	17	1	Port Validation Error	BOOL	Port validation failed. Only applicable to CubeComputer.
	18	1	Port Discovery Error	BOOL	Auto-Discovery failed. Only applicable to CubeComputer.
	19	1	OTP Serial Number Error	BOOL	OTP serial number is invalid
	20	1	Config Serial Number Error	BOOL	Config serial number is invalid
	21	1	Serial Number Mismatch Error	BOOL	OTP/Config serial numbers do not match
	22	1	Config invalid error	BOOL	Set if the applications config is invalid and the default configuration is being used (if available).

Table 48: BootState Enumeration Values

Numeric Value	**Name**	**Description**

0	Application Initializing	Application is busy booting and initializing
1	Port Validation	CubeComputer control-program is running and performing port validation of connected nodes. Only applicable to CubeComputer
2	Auto-discovery	CubeComputer control-program is running and performing node auto discovery of connected nodes. Only applicable to CubeComputer
3	Application Running	Application is running after successful bootloader execution and initialization
4	ASSERT Error	Application has triggered an ASSERT and will immediately. This is transitory and is not expected to be read as the state. It will be reflected in the reset reason.

Table 49: BootResetReason Enumeration Values

Numeric Value	**Name**	**Description**
0	Unkown	Reset reason is unknown
1	Firewall	Firewall (Unused)
2	Option bytes reload	Option-byte reset. This will have a dedicated reset reason if commanded, otherwise, is signals that the bootloader reloaded option bytes automatically before exitting.
3	EXT Pin	External Pin reset (Unused)
4	Brown Out	Brown Out reset
5	Soft Reset	Software reset
6	WatchDog	WatchDog Reset
7	Low Power	Low Power Reset
8	ASSERT error	The running application triggered an ASSERT and reset - check error log for error code

Table 50: Telecommand Acknowledge Telemetry Format

ID	138		**Frame Length (bytes)**		4

Description	Used with the I2C protocol to receive Telecommand Ack/Nack				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	TCTLM ID	UINT	Last TcTlm ID
	8	8	Error	ENUM	Last TcTlm Error. Possible values are in Table 51
	16	8	ErrorIndex	UINT	Buffer index of error
	24	1	Read	BOOL	Flag indicating if this acknowledgement has been read sinc the last TCTLM

Table 51: TcTlmError Enumeration Values

Numeric Value	**Name**	**Description**
0	Ok	No Error
1	Invalid ID	Invalid TcTlm ID
2	Invalid Length	Invalid Length
3	Invalid Parameter	Invalid Parameter
4	CRC	CRC Check Failed
5	Not Implemented	TCTLM not implemented
6	Busy	Busy
7	Sequence	Error in sequence of commands
8	Internal	Internal error
9	Passthrough Timeout	Passthrough node timeout error
10	Passthrough Target	Passthrough target is invalid (passthrough is disabled)

Table 52: Common Error Codes Telemetry Format

ID	139		**Frame Length (bytes)**		16
Description	Error codes common to all applications				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Slave Service - CAN	UINT	Tctlm comms slave service error code for CAN interface (OBC comms).
	32	32	Slave Service - UART	UINT	Tctlm comms slave service error code for UART interface (OBC comms).
	64	32	Slave Service - I2C	UINT	Tctlm comms slave service error code for I2C interface (OBC comms).
	96	32	Error Log Service	UINT	Error-log service error code.

Table 53: Identification2 Telemetry Format

ID	140		**Frame Length (bytes)**		21
Description	Identification information for this node				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Node type identifier	ENUM	Node type identifier. Possible values are in Table 35
	8	8	Program type identifier	ENUM	Program type identifier. Possible values are in Table 33

	16	32	Serial Integer	UINT	Integer representation of the integer portion the serial number of this module sourced from active serial
	48	8	Interface version	UINT	Interface version
	56	8	Firmware version (Major)	UINT	Firmware version (Major)
	64	8	Firmware version (Minor)	UINT	Firmware version (Minor)
	72	16	Firmware version (Patch)	UINT	Firmware version (Patch)
	88	8	System version (Major)	UINT	System version (Major)
	96	8	System version (Minor)	UINT	System version (Minor)
	104	16	System version (Patch)	UINT	System version (Patch)
	120	8	Hardware version (Minor)	UINT	Hardware version (Minor)
	128	16	Runtime (seconds)	UINT	Seconds since processor start-up
	144	16	Runtime (milliseconds)	UINT	Milliseconds (after the integer second) since processor start-up
	160	8	Reserved	PADDING	Reserved.

Table 54: MMC Calibration Parameters Telemetry Format

ID	185		**Frame Length (bytes)**		48
Description	MMC Magnetometer Calibration Parameters				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X-d1	FLOAT	X-Axis: d1
	32	32	X-d2	FLOAT	X-Axis: d2
	64	32	X-s1	FLOAT	X-Axis: s1
	96	32	X-s2	FLOAT	X-Axis: s2
	128	32	Y-d1	FLOAT	Y-Axis: d1
	160	32	Y-d2	FLOAT	Y-Axis: d2
	192	32	Y-s1	FLOAT	Y-Axis: s1
	224	32	Y-s2	FLOAT	Y-Axis: s2
	256	32	Z-d1	FLOAT	Z-Axis: d1
	288	32	Z-d2	FLOAT	Z-Axis: d2
	320	32	Z-s1	FLOAT	Z-Axis: s1
	352	32	Z-s2	FLOAT	Z-Axis: s2

Table 55: CubeMag Config Telemetry Format

ID	186		**Frame Length (bytes)**		4
Description	CubeMag Config Items				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	4	Prefered Primary Magnetometer	ENUM	The Prefered Primary Magnetometer. Possible values are in Table 14
	4	4	Current Primary Magnetometer	ENUM	The Magnetometer to set as the primary. Possible

					values are in Table 14
	8	16	Deploy Timeout	UINT	Depoyment Timeout. Applied to Burn Wire. (Unit of measure is [mS])
	24	1	Primary Auto-Select	BOOL	Allow the firmware to change the primary magnetometer based on error conditions

Table 56: Primary Magnetometer Measurement Raw Telemetry Format

ID	187		**Frame Length (bytes)**		13
Description	Unfiltered last Primary Magnetometer Measurement				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X_axis	FLOAT	X_axis. (Unit of measure is [nT])
	32	32	Y_axis	FLOAT	Y_axis. (Unit of measure is [nT])
	64	32	Z_axis	FLOAT	Z_axis. (Unit of measure is [nT])
	96	1	Data Valid	BOOL	Is Data Valid

Table 57: State Telemetry Format

ID	188		**Frame Length (bytes)**		3

Description	All Service States				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	MagSvc State	ENUM	CubeMag Service State. Possible values are in Table 58
	8	8	Primary Mag State	ENUM	Primary Magnetometer State. Possible values are in Table 59
	16	8	Red Mag State	ENUM	Redundant Magnetometer State. Possible values are in Table 59

Table 58: MagState Enumeration Values

Numeric Value	**Name**	**Description**
0	Deploy Arm	CubeMag Svc is Armed to Deploy
1	Deploy	CubeMag Svc is Deploying
2	Idle	CubeMag Svc is Idle
3	Error	CubeMag Svc is in an error state

Table 59: MntState Enumeration Values

Numeric Value	**Name**	**Description**
0	Off	Mnt Svc is off
1	Init	Mnt Svc is Initializing
2	Idle	Mnt Svc is Idle
3	Auto	Mnt Svc is Auto Sampling
4	Sample	Mnt Svc is Sampling
5	Error	Mnt Svc is in an error state

Table 60: PNI Calibration Parameters Telemetry Format

ID	189		**Frame Length (bytes)**		48
Description	PNI Magnetometer Calibration Parameters				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X-d1	FLOAT	X-Axis: d1
	32	32	X-d2	FLOAT	X-Axis: d2
	64	32	X-s1	FLOAT	X-Axis: s1
	96	32	X-s2	FLOAT	X-Axis: s2
	128	32	Y-d1	FLOAT	Y-Axis: d1
	160	32	Y-d2	FLOAT	Y-Axis: d2
	192	32	Y-s1	FLOAT	Y-Axis: s1
	224	32	Y-s2	FLOAT	Y-Axis: s2
	256	32	Z-d1	FLOAT	Z-Axis: d1
	288	32	Z-d2	FLOAT	Z-Axis: d2
	320	32	Z-s1	FLOAT	Z-Axis: s1
	352	32	Z-s2	FLOAT	Z-Axis: s2

Table 61: Deployment Status Telemetry Format

ID	190		**Frame Length (bytes)**		5
Description	Deployment Status. Only Applicable to CubeMag Deploy type				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Burn Current	UINT	Burn Wire Current. (Unit of measure is [mA])

	32	1	Deployment Pin State	BOOL	Deployment Detection Pin State
	33	1	Burn Pin State	BOOL	Deployment Burn Wire Enable Pin State
	34	1	Burn UnderCurrent	BOOL	Burn Wire Under Current Flag
	35	1	Burn OverCurrent	BOOL	Burn Wire Over Current Flag
	36	1	Deployment Timeout	BOOL	CubeMag did not detect deployment before configured timeout

Table 62: Redundant Magnetometer Measurement Raw Telemetry Format

ID	191		**Frame Length (bytes)**		13
Description	Unfiltered last Redundant Magnetometer Measurement				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X_axis	FLOAT	X_axis. (Unit of measure is [nT])
	32	32	Y_axis	FLOAT	Y_axis. (Unit of measure is [nT])
	64	32	Z_axis	FLOAT	Z_axis. (Unit of measure is [nT])
	96	1	Data Valid	BOOL	Is Data Valid

Table 63: PNI Magnetometer Config Telemetry Format

ID	192		**Frame Length (bytes)**		12
Description	PNI Magnetometer Specific Config				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	1	PNI Auto-Sample	BOOL	PNI Auto-Sample Enable/Disable
	1	7	PNI Sample Period	ENUM	PNI Auto Sample Period. Possible values are in Table 16
	8	4	PNI Sample Filter Type	ENUM	PNI Sample Filter Type. Possible values are in Table 17
	12	4	PNI Sample Filter Order	ENUM	PNI Sample Butterworth filter order. Possible values are in Table 18
	16	8	PNI Sample Filter Depth	UINT	PNI Sample Filter Depth when using Simple Averaging
	24	5	PNI Single-Sample Time	ENUM	PNI Sample Duration when Auto-Sample is disabled. Possible values are in Table 19
	29	3	PNI Sample Busy Action	ENUM	PNI Action to take when sample is busy when requested. Possible values are in Table 20
	32	32	PNI Max Errors Magnetometer	UINT	PNI Maximum number of allowed

					megnetometer measurement errors
	64	32	PNI Max Errors Temperature	UINT	PNI Maximum number of allowed temperature measurement errors

Table 64: Redundant Magnetometer Measurement Telemetry Format

ID	193		**Frame Length (bytes)**		13
Description	Redundant Magnetometer Measurement				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X_axis	FLOAT	X_axis. (Unit of measure is [nT])
	32	32	Y_axis	FLOAT	Y_axis. (Unit of measure is [nT])
	64	32	Z_axis	FLOAT	Z_axis. (Unit of measure is [nT])
	96	1	Data Valid	BOOL	Is Data Valid

Table 65: Redundant Magnetometer Temperature Telemetry Format

ID	194		**Frame Length (bytes)**		4
Description	Redundant Magnetometer Measurement				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**

	0	32	Temperature	FLOAT	Temperature

Table 66: Redundant Magnetometer Diagnostics Telemetry Format

ID	195		**Frame Length (bytes)**		16
Description	Redundant Magnetometer Diagnostics				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Last Error Magnetometer	UINT	Last Error Code from magnetometer measurement
	32	32	Error Count Magnetometer	UINT	Error Counter for megnetometer measurement
	64	32	Last Error Temperature	UINT	Last Error Code from temperature measurement
	96	32	Error Count Temperature	UINT	Error Counter for temperature measurement

Table 67: MMC Magnetometer Config Telemetry Format

ID	196		**Frame Length (bytes)**		12
Description	MMC Magnetometer Specific Config				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	1	MMC Auto-Sample	BOOL	MMC Auto-Sample Enable/Disable

	1	7	MMC Sample Period	ENUM	MMC Auto Sample Period. Possible values are in Table 16
	8	4	MMC Sample Filter Type	ENUM	MMC Sample Filter Type. Possible values are in Table 17
	12	4	MMC Sample Filter Order	ENUM	MMC Sample Butterworth filter order. Possible values are in Table 18
	16	8	MMC Sample Filter Depth	UINT	MMC Sample Filter Depth when using Simple Averaging
	24	5	MMC Single-Sample Time	ENUM	MMC Sample Duration when Auto-Sample is disabled. Possible values are in Table 19
	29	3	MMC Sample Busy Action	ENUM	MMC Action to take when sample is busy when requested. Possible values are in Table 20
	32	32	MMC Max Errors Magnetometer	UINT	MMC Maximum number of allowed megnetometer measurement errors
	64	32	MMC Max Errors Temperature	UINT	MMC Maximum number of allowed temperature measurement errors

Table 68: Primary Magnetometer Measurement Telemetry Format

ID	197		**Frame Length (bytes)**		13
Description	Primary Magnetometer Measurement				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	X_axis	FLOAT	X_axis. (Unit of measure is [nT])
	32	32	Y_axis	FLOAT	Y_axis. (Unit of measure is [nT])
	64	32	Z_axis	FLOAT	Z_axis. (Unit of measure is [nT])
	96	1	Data Valid	BOOL	Is Data Valid

Table 69: Primary Magnetometer Temperature Telemetry Format

ID	198		**Frame Length (bytes)**		4
Description	Main Magnetometer Measurement				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	32	Temperature	FLOAT	Temperature

Table 70: Primary Magnetometer Diagnostics Telemetry Format

ID	199		**Frame Length (bytes)**		16
Description	Primary Magnetometer Diagnostics				

Channels	Offset (bits)	Length (bits)	Name	Data Type	Description
	0	32	Last Error Magnetometer	UINT	Last Error Code from magnetometer measurement
	32	32	Error Count Magnetometer	UINT	Error Counter for megnetometer measurement
	64	32	Last Error Temperature	UINT	Last Error Code from temperature measurement
	96	32	Error Count Temperature	UINT	Error Counter for temperature measurement

Table 71: Health Telemetry Telemetry Format

ID	254		Frame Length (bytes)		24
Description	Health Telemetry for CubeMagDeploy				
Channels	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	16	MCU Current	UINT	MCU current. (Unit of measure is [mA])
	16	16	MCU Temperature	INT	MCU temperature in deg C. (Unit of measure is [deg C])
	32	16	MCU Voltage	UINT	MCU supply voltage. (Unit of measure is [mV])
	48	32	Primary Mag Temperature	FLOAT	Primary Magnetometer

					Temperature
	80	32	Redundant Mag Temperature	FLOAT	Redundant Magnetometer Temperature
	112	32	Burn Current	UINT	Burn Wire Current. (Unit of measure is [mA])
	144	1	Deployment Pin State	BOOL	Deployment Detection Pin State
	145	1	Burn Pin State	BOOL	Deployment Burn Wire Enable Pin State
	146	1	Burn UnderCurrent	BOOL	Burn Wire Under Current Flag
	147	1	Burn OverCurrent	BOOL	Burn Wire Over Current Flag
	148	1	Deployment Timeout	BOOL	CubeMag did not detect deployment before configured timeout
	149	3		PADDING	Reserved.
	152	40	Watchdog Counters	ARRAY	Bitmask representing virtual watchdog region warning counters.

1.1.1 Configuration Messages

Table 72: List of Configuration Messages

Set ID	Get ID	Name	Description	Length (bytes)

1.1.1 Events

Table 73: List of Events

ID	Name	Description	Class
Info			
254	Reset Commanded	Soft reset has been commanded - Table 74	Info
253	Unix Time Change Commanded	Unix time change has been commanded - Table 75	Info
252	Config Persisted	Volatile config items were written to flash - Table 76	Info
WarnMajor			
251	Config Persist Error	Error occured while writing config items to flash - Table 77	WarnMajor
250	Virtual Watchdog Warning	A service protected by the virtual watchdog did not check in in time. - Table 78	WarnMajor
Critical			
249	Virtual Watchdog Error	A service protected by the virtual watchdog did not check for three successive warnings. - Table 79	Critical

Table 74: Reset Commanded Event Format

ID	254		**Class**		Info
Description	Soft reset has been commanded				

Table 75: Unix Time Change Commanded Event Format

ID	253		**Class**		Info
Description	Unix time change has been commanded				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**

	0	32	New Unix seconds	UINT	New Unix time s. (Unit of measure is [s])
	32	32	New Unix Nanoseconds	UINT	New Unix time ns. (Unit of measure is [ns])

Table 76: Config Persisted Event Format

ID	252		**Class**		Info
Description	Volatile config items were written to flash				

Table 77: Config Persist Error Event Format

ID	251		**Class**		WarnMajor
Description	Error occured while writing config items to flash				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	8	Persist Result	ENUM	Config Persistence Last Result. Possible values are in Table 43
	8	32	Error Code	UINT	Config Persistence Error Code

Table 78: Virtual Watchdog Warning Event Format

ID	250		**Class**		WarnMajor
Description	A service protected by the virtual watchdog did not check in in time.				

Parameters	Offset (bits)	Length (bits)	Name	Data Type	Description
	0	40	Region Mask	ARRAY	Bitmask representing the warning count of each region, if a flag is set, the region that was not refreshed. Please consult with CubeSpace as to the service that uses the specified region

Table 79: Virtual Watchdog Error Event Format

ID	249		Class		Critical
Description	A service protected by the virtual watchdog did not check for three successive warnings.				
Parameters	**Offset (bits)**	**Length (bits)**	**Name**	**Data Type**	**Description**
	0	40	Region Mask	ARRAY	Bitmask representing the warning count of each region, if a flag is set, the region that was not refreshed repeatedly and is presumed dead. Please consult with CubeSpace as to the service that uses the specified region