



Atacama Large Millimeter Array

Interface Control Document

Between:

Front End

And:

Control Software

ALMA-40.00.00.00-70.35.25.00-B-ICD

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1 Description

1.1 Purpose

This ICD describes the interface between the ALMA Front End and the computing control software. It describes the monitor and control points for all the subsystems installed in the Front End.

1.2 Scope

This document describes the monitor and control points on for the Front End System.

2 Referenced documents

2.1 Applicable documents

The following documents are included as part of this document to the extent specified herein. If not explicitly stated differently, the latest issue of the document is valid.

<i>Reference</i>	<i>Document title</i>	<i>Date</i>	<i>Document ID</i>
[AD1]	ALMA Monitor and Control Bus Standard Interface 1 (AMBSI1) Design Description	2005-05-13	ALMA-70.35.10.01-001-A-MAN
[AD2]	Front-End Sub-System for the 12 m-Antenna Array Technical Specifications	2007-04-17	ALMA-40.00.00.00-001-A-SPE
[AD3]	ALMA Monitor and Control Bus Interface Specification	2001-09-07	ALMA-70.35.10.03-001-A-SPE
[AD4]	Front End embedded software description	2007-05-11	FEND-40.04.03.03-002-A-DSN
[AD5]	Front End Monitor and Control System - Bulkhead Break-out board	2007-02-05	FEND-40.05.02.03-003-A-DWG
[AD6]	Can Break-Out board suggested layout	2007-03-14	FEND-40.05.02.03-002-A-DWG
[AD7]	Front End Operation Manual	2009-08-12	FEND-40.00.00.00-173-A-MAN

2.2 Reference documents

The following documents contain additional information and are referenced in this document.

<i>Reference</i>	<i>Document title</i>	<i>Date</i>	<i>Document ID</i>
[RD1]	Wolfhard Lawrenz, CAN System Engineering, 1997 Springer-Verlag New York Inc.	1997	ISBN-0-387-94939-9



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[RD2]	ALMA Acronyms and Abbreviations List	2005-07-14	ALMA-80.02.00.00-004-A-LIS
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2.3 Abbreviations and Acronyms

A limited set of basic acronyms used in this document is given below. A complete set of acronyms used in the ALMA project can be found in [RD2].

ALMA	Atacama Large Millimeter Array
AMBSI	AMB Standard Interface
AMC	Active Multiplier Chain
CAN	Controller Area Network
ESN	Electronic Serial Number
FE	Front End
HW	Hardware
ICD	Interface Control Document
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LO	Local Oscillator
LSB	Lower Side Band
M&C	Monitor and Control
PA	Power Amplifier
PLL	Phase Locked Loop
POL	Polarization
RCA	Relative CAN Address
SB	Sideband
SIS	Superconductor-Insulator-Superconductor
ST	Stage
USB	Upper Side Band
WCA	Warm Cartridge Assembly
YIG	Yttrium Iron Garnet
YTO	YIG Tuned Oscillator

2.4 Verb Convention

Shall is used whenever a specification expresses a provision that is binding. The verbs *should* and *may* express non-mandatory provisions.

Will is used to express a declaration of purpose on the part of the design activity.

3 Interface Design

3.1 Physical System Interface

The physical interface is the CAN bus connector as described in [AD5] and [AD6].

3.2 Mechanical Interface

The mechanical interface is at the CAN bus connectors as described in [AD5] and [AD6].



The location of this connector is on the cabling bulkhead of the Front End assembly in the receiver cabin of each antenna.

3.3 Electronic Interface

The electronic interface is an AMBSII type interface. The node id is **0x13**.

The CAN bus connectors on the Front End connector bulkhead are DB9, one male and one female as in [AD5] and [AD6].

3.4 Software/Control Function Interface

The Front End is a complex subsystem consisting of several assemblies. The configuration of assemblies within a given FE may change over time as maintenance is performed. Additionally a given FE may be moved from one antenna to another. The control and configuration database scheme for the front end and its subassemblies must take its configurability into account. The configuration data will be downloaded via an Ethernet connection at configuration time (only in maintenance mode if the configuration of the installed hardware has changed). The transfer protocol is **TBD**. The following table shows the presence and configuration possibilities for the front end subsystems plus the short names to be used for each assembly. The short names are used in the detailed monitor and command descriptions in this document.

Assembly	Short name	Always installed	ESN	Configuration data
AMBSI & FE M&C module	FEMC	Y	Y	N
Cold Cartridge bands 1-10	COLDCART	N	Y	Y
WCA bands 1-10	WCA	N	Y	Y
Cryostat	CRYOSTAT	Y	Y	Y
Cartridge power distribution subsystem	CPDS	Y	N	N
IF switch	IFSWITCH	Y	N	N
LO photonic receiver	LPR	Y	Y	Y

Each of the above sub-assemblies has its own collection of monitor and control points. All of the monitor and control points share a common CAN node address but appear offset at various base addresses.



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3.4.1 Operating modes

The operating modes described here are a subset of the modes given in the FE technical spec. [AD2]. Only the modes where DC power is provided to the front end are given.

3.4.1.1 Front end operating modes

At any given time, the front end as a whole can be in one of the following operating modes. Modes may be changed in response to a control command, or may be derived from specific conditions as they present themselves during regular operation.

Available modes are:

Operational: This is the normal mode for observing use. The following conditions must be met for the front end to be in the Operational mode:

- Electrical power is provided to the FE by the FE power supply.
- The cryostat is evacuated and cold.

When in this mode, the FEMC will implement the limits check and hardware subsystem protection mechanism according to requirements provided by the subsystems manufacturers. Further information about the error handling are available in the following sections of this ICD.

Troubleshooting: This mode is for development and debugging of the underlying hardware and firmware. Characteristics of Troubleshooting mode are:

- Single Stepping – Procedures which might normally be fully automatic are bypassed in favor of allowing the operator to execute individual steps of a procedure one at a time and observe outcomes after each step.
- Suppress actions on Errors or Exceptions – Values for control parameters and monitor points may be set or seen without triggering actions due to error reporting or exception handling code. For example: Normally no more than three cartridges may be powered, however in troubleshooting mode, this might be allowed: the error code will still be reported, but no action will be taken by the FEMC.

Maintenance: This mode allows the execution of certain periodic or occasional maintenance procedures:

- Warm-up and cool-down – Restoration of the vacuum within the OVC.
- Power on self test – Procedure which is automatically executed by the FE firmware when power is applied.
- Power on configuration – Procedure whereby the FE firmware determines what sub-assemblies are installed.
- Configuration data exchange – Procedure for downloading the configuration for one or more sub-assemblies to the FE firmware.



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Therefore, in normal use when the Front End is powered on:

- It will enter maintenance mode, perform power-on self tests, and gather information about the installed hardware. It will then await a command before entering Operational mode.
- If problems are detected, it will remain in maintenance mode and await relevant commands.
- From Operational or Maintenance mode it may be placed into Troubleshooting mode via the command SET_FE_MODE.
- From Operational or Troubleshooting mode, it may be placed into Maintenance mode via the command SET_FE_MODE.
- From Maintenance or Troubleshooting mode, it may be placed into Operational mode, if necessary conditions are met, via the command SET_FE_MODE.

3.4.1.2 Cartridge operating modes

Each cartridge can be in one of the following states:

Cartridge OFF: the cartridge is not powered

Cartridge ON: the cartridge is powered but not initialized

Cartridge READY: the cartridge is powered on and initialized and is ready to be used. In order to be in this state, any configuration data specific to the cartridge must be present in-memory of the FE M&C module.

Cartridge STAND-BY: is essentially the same as the ready state except that it implies that the cartridge is properly biased and is warming up. If already warm, it could potentially be placed in OBSERVING mode within 1.5s.

Cartridge OBSERVING: means that the cartridge is selected in both the IF switch and the LO photonic receiver. Its LO is locked and its IF outputs are routed to the front end's IF outputs.



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3.4.2 Monitor & Control Functions

The RCAs described in this document can be separated into a few categories according to the ranges specified in Table 1.

Function	Base Address	Range
<i>Standard Monitor</i>	<i>0x00000</i>	<i>0x0FFFF</i>
<i>Standard Control</i>	<i>0x10000</i>	<i>0x0FFFF</i>
<i>Special Monitor</i>	<i>0x20000</i>	<i>0x00FFF</i>
<i>Special Control</i>	<i>0x21000</i>	<i>0x00FFF</i>
<i>AMBSII</i>	<i>0x30000</i>	<i>0x0FFFF</i>

Table 1 - RCAs ranges

The base addresses and the ranges for standard and special points are chosen arbitrarily.

These monitor and control points and their usage are described in detail within this document.

For more information about the

AMBSII monitor and control points and specification, please refer to [AD1].

A preliminary measurement of the maximum required time to reply to an incoming monitor request has returned a value of 500 μ s for the worst case scenario. This is mainly due to hardware latencies requiring multiple and asynchronous readouts to be implemented in the FEMC since this requirement could not be accommodated by the control software due to its architecture. This value was determined by measurement on a beta release of revision 2.2.0 of the FEMC firmware which incorporates the hardware requirements known to date.



3.4.2.1 SPECIAL

These are “special” functions used to perform monitor and control activities not directly related to the front end hardware. These functions are used, for example, to setup the CAN addressing ranges, check for errors in the link between the ARCOM and the AMBSII board and so on.

3.4.2.1.1 SPECIAL MONITOR POINTS

All SPECIAL monitor points belong to the FEMC assembly.

3.4.2.1.1.1 Summary of SPECIAL Monitor Points (Base address: 0x20000)

<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
GET_AMBSII_VERSION_INFO	0x0000	3	No
GET_SETUP_INFO	0x0001	1	No
GET_VERSION_INFO	0x0002	3	No
GET_SPECIAL_MONITOR_RCAS	0x0003	8	No
GET_SPECIAL_CONTROL_RCAS	0x0004	8	No
GET_MONITOR_RCAS	0x0005	8	No
GET_CONTROL_RCAS	0x0006	8	No
GET_PPCOMM_TIME	0x0007	8	No
GET_FPGA_VERSION_INFO	0x0008	3	No
GET_CONSOLE_ENABLE	0x0009	1	No
GET_ESNS_FOUND	0x000A	1	No
GET_ESNS	0x000B	8	No
GET_ERRORS_NUMBER	0x000C	2	No
GET_NEXT_ERROR	0x000D	2	No
GET_FE_MODE	0x000E	1	No

3.4.2.1.1.2 SPECIAL Monitor Points in detail

3.4.2.1.1.2.1 GET_AMBSII_VERSION_INFO

Assembly	FEMC
Name	GET_AMBSII_VERSION_INFO
RCA Offset	0x0000
Description	Returns the version information for the AMBSII firmware
Suggested Interval	
TE Related	No
Data	3 byte (uchar): Byte 0: Major Version Byte 1: Minor Version Byte 2: Patch Version



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3.4.2.1.1.2.2 GET_SETUP_INFO

Assembly	FEMC
Name	GET_SETUP_INFO
RCA Offset	0x0001
Description	<p>This monitor point will cause the AMBSII to check for if the connection is ready and then to perform a series of communications with the ARCOM board to query the following information:</p> <ul style="list-style-type: none">- Lowest and highest RCAs of the special monitor functions- Lowest and highest RCAs of the special control functions- Lowest and highest RCAs of the monitor functions- Lowest and highest RCAs of the control functions <p>After performing these queries, the AMBSII will try to register the monitor and control functions associated with the RCAs. This monitor request has to be issued before any other monitor or control request otherwise there will be no function register apart from the intrinsic AMBSII RCAs starting at 0x30000. This requirement might be removed in future development to allow for self initialization.</p>
Suggested Interval	Once at startup
TE Related	No
Data	<p>1 byte (uchar):</p> <ul style="list-style-type: none">0x00 no error, communication established0x01 error in registering the special monitor functions0x02 error in registering the special control functions0x03 error in registering the monitor functions0x04 error in registering the control functions0x05 warning: this function has already been called0x06 communication between ARCOM and AMBSI not yet established0x07 Timeout while forwarding CAN message to the ARCOM board0x08 The FEMC is booting up: wait until ready

3.4.2.1.1.2.3 GET_VERSION_INFO

Assembly	FEMC
Name	GET_VERSION_INFO
RCA Offset	0x0002
Description	Returns the version information for the ARCOM Pegasus firmware
Suggested Interval	
TE Related	No
Data	3 byte (uchar):



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Byte 0: Major Version
Byte 1: Minor Version
Byte 2: Patch Version

3.4.2.1.1.2.4 GET_SPECIAL_MONITOR_RCA

Assembly FEMC
Name GET_SPECIAL_MONITOR_RCA
RCA Offset 0x0003
Description Returns the RCA range for the special monitor points
Suggested Interval
TE Related No
Data 8 byte (2 ulong):
Byte 7->4: the last addressable special monitor point
Byte 3->0: the first addressable special monitor point

3.4.2.1.1.2.5 GET_SPECIAL_CONTROL_RCA

Assembly FEMC
Name GET_SPECIAL_CONTROL_RCA
RCA Offset 0x0004
Description Returns the RCA range for the special control points
Suggested Interval
TE Related No
Data 8 byte (2 ulong):
Byte 7->4: the last addressable special control point
Byte 3->0: the first addressable special control point

3.4.2.1.1.2.6 GET_MONITOR_RCA

Assembly FEMC
Name GET_MONITOR_RCA
RCA Offset 0x0005
Description Returns the RCA range for the monitor points
Suggested Interval
TE Related No
Data 8 byte (2 ulong):
Byte 7->4: the last addressable monitor point
Byte 3->0: the first addressable monitor point

3.4.2.1.1.2.7 GET_CONTROL_RCA

Assembly FEMC
Name GET_CONTROL_RCA
RCA Offset 0x0006
Description Returns the RCA range for the control points



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Suggested Interval

TE Related No

Data 8 byte (2 ulong):
Byte 7->4: the last addressable control point
Byte 3->0: the first addressable control point

3.4.2.1.1.2.8 GET_PPCOMM_TIME

Assembly FEMC

Name GET_PPCOMM_TIME

RCA Offset 0x0007

Description *Intended for debug purposes only, this message doesn't perform any operation. When called it will fill up a message payload with 8 0xFF and return. This will give an estimate on the longest time necessary to acknowledge and respond to the largest monitor request without performing any operation: it is a measure of the longest communication time between the ARCOM and the AMBSII board.*

Suggested Interval

TE Related No

Data 8 bytes (uchars):
All the bytes should be 0xFF

3.4.2.1.1.2.9 GET_FPGA_VERSION_INFO

Assembly FEMC

Name GET_FPGA_VERSION_INFO

RCA Offset 0x0008

Description *Returns information about the revision level of the FPGA code.*

Suggested Interval

TE Related No

Data 3 byte (uchar):
Byte 0: Major Version
Byte 1: Minor Version
Byte 2: Patch Version

3.4.2.1.1.2.10 GET_CONSOLE_ENABLE

Assembly FEMC

Name GET_CONSOLE_ENABLE

RCA Offset 0x0009

Description *Returns the current state of the FEMC console. The console is enabled by default at startup. This allows for debug operation. When enable, the console adds about 50 μ s to the CAN communication time.*

Suggested Interval



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TE Related No
Data 1 byte (uchar):
0 -> console disabled
1 -> console enabled

3.4.2.1.1.2.11 GET_ESNS_FOUND

Assembly FEMC
Name GET_ESNS_FOUND
RCA Offset 0x000A
Description Return the number of Electronic Serial Numbers found in the system.
A monitor request to this address will reset the index, used by GET_ESNS, to the first device found.

Suggested Interval

TE Related No
Data 1 byte (uchar):
0 -> Possible problems with the ESNs
Otherwise -> Number of found devices

3.4.2.1.1.2.12 GET_ESNS

Assembly FEMC
Name GET_ESNS
RCA Offset 0x000B
Description Return list of electronic serial numbers found.
This is monitoring a cyclic buffer that stores the found ESNs. Once the buffer has been fully read, 8 bytes (0x00) will be returned then the buffer will be returned once more from the beginning.
If no devices were found, 8 bytes (0xFF) payload will be returned.

Suggested Interval

TE Related No
Data 8 bytes (uchar)

3.4.2.1.1.2.13 GET_ERRORS_NUMBER

Assembly FEMC
Name GET_ERRORS_NUMBER
RCA Offset 0x000C
Description Return the number of errors not read in the error buffer.
Suggested Interval 10s
TE Related No
Data 2 bytes (uint):
The number of unread errors in the buffer.



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3.4.2.1.1.2.14 GET_NEXT_ERROR

Assembly FEMC
Name GET_NEXT_ERROR
RCA Offset 0x000D
Description Returns the next error available in the buffer.
The error report buffer is organized as a FIFO (First In, First Out) buffer.
If there are no errors to report and a request is received on this address, the reported value for each byte will be 0xFF.
Suggested Interval 10s
TE Related No
Data 2 bytes (uchar):
byte0 -> indicates the module where the error occurred
byte1 -> is the error that occurred
For a detailed description of the error codes see Appendix A.

3.4.2.1.1.2.15 GET_FE_MODE

Assembly FEMC
Name GET_FE_MODE
RCA Offset 0x000E
Description Returns the mode in which the front end is currently operating.
Suggested Interval 10s
TE Related No
Data 1 bytes (uchar):
0 -> Operational
1 -> Troubleshooting
2 -> Maintenance



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3.4.2.1.2 SPECIAL CONTROL POINTS

All SPECIAL control commands are handled by the FEMC assembly.

3.4.2.1.2.1 Summary of SPECIAL Control Points (Base address: 0x21000)

<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
SET_EXIT_PROGRAM	0x0000	1	No
SET_REBOOT	0x0001	1	No
SET_CONSOLE_ENABLE	0x0009	1	No
SET_FE_MODE	0x000E	1	No

3.4.2.1.2.2 SPECIAL Control Points in detail

3.4.2.1.2.2.1 SET_EXIT_PROGRAM

Assembly FEMC
Name SET_EXIT_PROGRAM
RCA Offset 0x0000
Description *Intended for debug purposes only, causes the entire program running on the ARCOM board to come to a "graceful" end. After this command the ARCOM board will not acknowledge any incoming message from the AMBSII.*
Suggested Interval
TE Related No
Data 1 byte (ubyte):
Dummy

3.4.2.1.2.2.2 SET_REBOOT

Assembly FEMC
Name SET_REBOOT
RCA Offset 0x0001
Description *Intended for debug purposes only, causes a reboot of the ARCOM board. During the execution of the reboot, the ARCOM board will not acknowledge any incoming message from the AMBSII. With the current firmware the AMBSII has no way of knowing if a reboot occurred.*
Suggested Interval
TE Related No
Data 1 byte (ubyte):
Dummy



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3.4.2.1.2.2.3 SET_CONSOLE_ENABLE

Assembly FEMC
Name SET_CONSOLE_ENABLE
RCA Offset 0x0009
Description Sets the current state of the FEMC console. The console is enabled by default at startup. This allows for debug operation. When enable, the console adds about 50 μ s to the CAN communication time.
Suggested Interval
TE Related No
Data 1 byte (uchar):
0 -> console disabled
1 -> console enabled

3.4.2.1.2.2.4 SET_FE_MODE

Assembly FEMC
Name SET_FE_MODE
RCA Offset 0x000E
Description Set the mode in which the front end is currently operating.
Suggested Interval
TE Related No
Data 1 bytes (uchar):
0 -> Operational
1 -> Troubleshooting
2 -> Maintenance



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3.4.2.2 STANDARD

	Supercartridge				Supersymmetric cartridge			
	Polarization0		Polarization1		Polarization0		Polarization1	
	SBand1	SBand2	SBand1	SBand2	SBand1	SBand2	SBand1	SBand2
SIS Mixers	1	1	1	1	1	1	1	1
SIS Magnets	1	1	1	1	1	1	1	1
LNA Stages	6	3	6	3	6	6	6	6
SIS Heaters	1	0	1	0	1	1	1	1
LNA LEDs	1	0	1	0	1	1	1	1
Schottky Mixers	1	0	1	0	1	1	1	1
PA	1	0	1	0	1	1	1	1
Temperature Sensors	3	0	3	0	6	6	6	6
YTO	1	0	0	0	1	1	1	1
Photomixer	1	0	0	0	1	1	1	1
PLL	1	0	0	0	1	1	1	1
AMC	1	0	0	0	1	1	1	1

Sideband Level
 Polarization Level
 Cartridge Level

Table 2 - Super and supersymmetric cartridge [AD4]

To increase flexibility in the use of the receiver and maintenance of the software, the concept of *supercartridge* was introduced (Table 2).

A supercartridge represents a theoretical cartridge containing all the devices that are present in at least one of the ALMA cartridge. The usage of this definition greatly diminishes the complexity and increases the maintainability of the embedded firmware controlling the front

end.

To allow for even more flexibility the concept of supercartridge was extended to the one of *supersymmetric* cartridge (Table 2).

In this scheme software symmetry is achieved by equalizing the number of devices in sidebands and polarizations.

Using the supersymmetric cartridge concept we have de facto replaced in the software the ten different ALMA cartridges with ten copies of the same supersymmetric one.

A well defined structure will keep track of which device is installed in which cartridge in the front end subsystem.

For more information about refer to [AD4]



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Abbreviations and Naming

The following abbreviations are used throughout this ICD to specify the numbering of elements. The possible ranges for each element are also given. Where one of these abbreviations appears it may be textually substituted with a value from the given range, for example CARTRIDGE[3] could become CARTRIDGE3.

Abbrev.	Refers to	Range	Note
Ca	Cartridge	1-10	same as cartridge band
Po	Polarization	0, 1	
Sb	Index to SIS and LNA bias channels	0, 1	Sb shall be considered as an index and not an indication of the actual sideband.
St	LNA Stage	1-6	
Te	Cartridge temperature sensor	0-5	
Se	Cryostat temperature sensor	0-12	
Ch	Power distribution channel	1-10	same as cartridge band
Ps	Cryogenic pressure sensor	0-1	
Sn	LPR temperature sensor	0-1	

Table 3 - List of abbreviations

Sideband mapping

Table 4 provides the “mapping” between the values of Sb and USB and LSB where this is applicable. Wiring and RF design within the bands varies and in certain cases this makes the definition mapping of Sb to USB and LSB meaningless (for example in the case mixers and/or amplifiers controlled by Sb are placed before the hybrid, in which case changing either Sb will cause a change in both USB and LSB). In these cases, the mapping will be identified by *N/A*. In case the configuration is not yet known, the mapping will be identified by *N/D*.

Bands →	1	2	3	4	5	6	7	8	9	10
Sb: 0	<i>N/D</i>	<i>N/D</i>	LSB	USB	<i>N/D</i>	<i>N/A</i>	LSB	USB	<i>N/A</i>	<i>N/D</i>
Sb: 1	<i>N/D</i>	<i>N/D</i>	USB	LSB	<i>N/D</i>	<i>N/A</i>	USB	LSB	<i>N/A</i>	<i>N/D</i>

Table 4 - Sideband mapping

Property Names

The RCA of each monitor and control point described here is obtained by a unique combination of a base and relative address. The standard naming in this document is to use GET_... for monitor points and SET_... for control commands. When these are translated to “properties” in the control software, the GET_ and SET_ prefixes may be



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dropped. The corresponding names are given in The Property Names row in each detailed monitor and command description.

Errors handling and reporting

When monitoring the several subsystem of the front end, the FEMC software will check the monitored values against ranges provided by the subsystems manufacturers. This check will determine if the hardware is working properly.

Where immediate actions are needed, according to requirements presented by the subsystems manufacturer, the FEMC software will act and return the relative code in the status byte. This ICD will identify the few cases where this is necessary and what action was taken by the FEMC software.

If an immediate action is required and the subsystem is NOT under control of the FEMC software, then this ICD will specify the action required based on the returned status code.

During normal operation, the expected number of actions required of either the FEMC software or the control software is very small.

The basic philosophy behind this scheme is to act if hardware is in danger. In this case one of the following scenarios will apply:

- The FEMC will take immediate action and notify the control software via the status byte. The action taken is described in this ICD next to the status code.
- The FEMC will notify the control software via the status byte that an action is required. The action required is described in this ICD next to the status code.

The ranges provided by the manufacturer will be stored in configuration files within the FEMC subsystem.

If no status codes are listed in the detailed descriptions of the RCAs, then, if any is returned, it should be intended only as debug information.

This ICD will cover exclusively situations in which the hardware requires immediate attention.

Information about long term analysis or trends that might indicate deterioration of the hardware is not covered by this ICD.



STANDARD MONITOR POINTS

A scheme to assign monitor RCAs was developed based on a logical block division of the front end [AD4].

This scheme is based on a 4+12 bit addressing method. The first four bits describe which subsystem of the front end is addressed while the following twelve allow the selection of particular monitor points within that subsystem.

On the left side of the table is a list of the element of the *frontend* variable. These elements are associated through a many-to-one mapping to monitor RCAs. (The ‘many’ in the previous sentence is due to the fact that the bits indicated with an ‘x’ can have any value).

In the right table is the 4+12 bits binary representation of the front end as well as the key to the computation of the appropriate RCA to use to retrieve the desired data (Note: the binary numbering starts at 0).

For example if we are interested in the drain voltage of stage three of the LNA in sideband one of polarization one in cartridge five (band 6), then the correct RCA offset respect to the monitor base address (see Table 1) to use is:

	<i>Cartridge</i> (<i>Ca = 5</i>)				<i>Subsystem</i> <i>Selector</i> ¹	<i>Polarization</i> (<i>Po = 1</i>)	<i>Sideband</i> (<i>Sb = 1</i>)			<i>LNA</i>		<i>Stage</i> (<i>St = 3</i>)			<i>Drain</i> <i>Voltage</i>		<i>RCA</i>
<i>Bit</i>	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
	0	1	0	1	0	1	0	0	1	1	0	0	1	0	0	0	<i>0x054C8</i>

Every monitor point returns a certain number of bytes as described in the detail description. In addition to this payload, an extra byte is added at the end of the message including debugging information about the result of the monitor operation. Only the last occurred error during the monitor process error will be returned with the monitored payload.

Every error occurring during the monitor process is stored in the error FIFO circular buffer and can be retrieved through the appropriate special monitor messages.

The code has the following value:

<i>Value</i>	<i>Summary</i>	<i>Description</i>
0	No Error	No error during the monitor operation.
-1	Error	Error during the monitor operation. This error is returned when there is a problem of communication between the monitor and control module and one of the peripherals.
-2	Hardware Error Range	This error is returned in operation mode when the addressed hardware is not installed.

¹ The *Subsystem Selector* bits are one or more bits necessary to address particular subsets of a selected device.



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-3	Hardware Blocked Error	This error is returned in operation mode when trying to perform operation restricted by hardware manufacturer directives.
-4	Hardware UpdateWarning	This warning is returned in operation mode when the properties of the addressed hardware are not fully encoded or have changed. This usually is a result of lack of information at the time the current software was released. When the information is provided, a new version of the software is released and the warning is removed.
-5	Hardware Conversion Error	This error is returned when the monitor data is outside the range of a lookup table, a fitting curve or if during the conversion operation a range error occurs in the math library.
-6	Hardware Readout Retry	The monitor message should be read again. This is returned for monitor entities which require a certain time to stabilize.
-10	Monitor in Error Range	The monitor operation returned a value that is in the error range according to the configuration data. In the few cases where an action is required as consequence of this error, the detailed description of the monitor point explains the required action.
-11	Monitor in Warning Range	The monitor operation returned a value that is in the warning range according to the configuration data. In the few cases where an action is required as consequence of this warning, the detailed description of the monitor point explains the required action.
-12	Monitor message on non existing RCA	The monitor message is directed to a RCA that is not defined.
-13	Monitor in Error Range and action	The monitor operation returned a



	taken by FEMC	value that is in the error range according to the configuration data. The hardware manufacturer required an immediate action to be taken due to this error. In the very few cases when this type of error occurs, the detailed description of the monitor point explains what action was taken by the FEMC.
-14	Monitor in Warning Range and action taken by FEMC	The monitor operation returned a value that is in the warning range according to the configuration data. The hardware manufacturer required an immediate action to be taken due to this warning. In the very few cases when this type of error occurs, the detailed description of the monitor point explains what action was taken by the FEMC.
-15	Feature marked as future implementation.	This error is returned when the monitor feature is already implemented in software but the hardware has not been upgraded to the latest version yet.

Table 5 – Monitor error messages

3.4.2.2.1.1 Summary of Monitor Points (Base address: 0x00000)

<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_OPEN_LOOP	See [AD4]	1	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_VOLTAGE	See [AD4]	4	No



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<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_GATE_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ENABLE	See [AD4]	1	No
GET_CARTRIDGE[Ca]_POL[Po]_LNA_LED_ENABLE	See [AD4]	1	No
GET_CARTRIDGE[Ca]_POL[Po]_SIS_HEATER_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_YTO_COARSE_TUNE	See [AD4]	2	No
GET_CARTRIDGE[Ca]_LO_PHOTOMIXER_ENABLE	See [AD4]	1	No
GET_CARTRIDGE[Ca]_LO_PHOTOMIXER_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PHOTOMIXER_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PLL_LOCK_DETECT_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PLL_CORRECTION_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PLL_ASSEMBLY_TEMP	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_YIG_HEATER_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PLL_REF_TOTAL_POWER	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PLL_IF_TOTAL_POWER	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PLL_UNLOCK_DETECT_LATCH	See [AD4]	1	No
GET_CARTRIDGE[Ca]_LO_PLL_LOOP_BANDWIDTH_SELECT	See [AD4]	1	No
GET_CARTRIDGE[Ca]_LO_PLL_SB_LOCK_POLARITY_SELECT	See [AD4]	1	No
GET_CARTRIDGE[Ca]_LO_PLL_NULL_LOOP_INTEGRATOR	See [AD4]	1	No
GET_CARTRIDGE[Ca]_LO_AMC_GATE_A	See [AD4]	4	No



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<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
VOLTAGE			
GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_A_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_A_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_GATE_B_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_GATE_E_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_VOLTAGE	See [AD4]	1	No
GET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_COUNTS	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PA_POL[Po]_GATE_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_VOLTAGE	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_CURRENT	See [AD4]	4	No
GET_CARTRIDGE[Ca]_LO_AMC(PA)_SUPPLY_VOLTAGE_(5)V	See [AD4]	4	No
GET_CARDTRIGE[Ca]_CARTRIDGE_TEMP[Te]_TEMP	See [AD4]	4	No
GET_POWER_DISTRIBUTION_MODULE[Ca]_CHANNEL[Ch]_CURRENT	See [AD4]	4	No
GET_POWER_DISTRIBUTION_MODULE[Ca]_CHANNEL[Ch]_VOLTAGE	See [AD4]	4	No
GET_POWER_DISTRIBUTION_MODULE[Ca]_ENABLE	See [AD4]	1	No
GET_POWER_DISTRIBUTION_POWERED_	See [AD4]	1	No



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MODULES			
GET_IF_SWITCH_CARTRIDGE	See [AD4]	1	No
GET_IF_SWITCH_CHANNEL[Po][Sb]_ATTENUATION	See [AD4]	1	No
GET_IF_SWITCH_CHANNEL[Po][Sb]_ASSEMBLY_TEMP	See [AD4]	4	No
GET_IF_SWITCH_CHANNEL[Po][Sb]_TEMP_SERVO_ENABLE	See [AD4]	1	No
GET_CRYOSTAT_TEMP[Se]_TEMP	See [AD4]	4	No
GET_CRYOSTAT_BACKING_PUMP_ENABLE	See [AD4]	1	No
GET_CRYOSTAT_TURBO_PUMP_ENABLE	See [AD4]	1	No
GET_CRYOSTAT_TURBO_PUMP_STATE	See [AD4]	1	No
GET_CRYOSTAT_TURBO_PUMP_SPEED	See [AD4]	1	No
GET_CRYOSTAT_GATE_VALVE_STATE	See [AD4]	1	No
GET_CRYOSTAT_SOLENOID_VALVE_STATE	See [AD4]	1	No
GET_CRYOSTAT_VACUUM_GAUGE_SENSOR[Ps]_PRESSURE	See [AD4]	4	No
GET_CRYOSTAT_VACUUM_GAUGE_ENABLE	See [AD4]	1	No
GET_CRYOSTAT_VACUUM_GAUGE_STATE	See [AD4]	1	No
GET_CRYOSTAT_SUPPLY_CURRENT_230V	See [AD4]	4	No
GET_LPR_TEMP[Sn]_TEMP	See [AD4]	4	No
GET_LPR_OPT_SWITCH_PORT	See [AD4]	1	No
GET_LPR_OPT_SWITCH_SHUTTER	See [AD4]	1	No
GET_LPR_OPT_SWITCH_STATE	See [AD4]	1	No
GET_LPR_OPT_SWITCH_BUSY	See [AD4]	1	No
GET_LPR_EDFA_LASER_PUMP_TEMP	See [AD4]	4	No
GET_LPR_EDFA_LASER_DRIVE_CURRENT	See [AD4]	4	No
GET_LPR_EDFA_LASER_PHOTO_DETECT_CURRENT	See [AD4]	4	No
GET_LPR_EDFA_PHOTO_DETECTOR_CURRENT	See [AD4]	4	No
GET_LPR_EDFA_PHOTO_DETECTOR_PO	See [AD4]	4	No



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<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
WER			
GET_LPR_EDFA_MODULATION_INPUT_V ALUE	See [AD4]	4	No

3.4.2.2.1.2 Standard Monitor Points in detail

This general note applies to all the property starting with CARTRIDGE[CA].

If the addressed cartridge is not installed, every monitor point will return the **hardware error range (-2)** error (see Table 5). This error will be returned also when addressing a cartridge subsystem that is not installed in the cartridge according to the configuration database. For example, if an attempt is made to monitor SIS magnet bias in a cartridge that doesn't have the SIS magnet installed, this error will be returned.

If the addressed cartridge is installed but not yet powered, every monitor point will return the **hardware blocked (-3)** error (see Table 5).

Some of the listed monitor points refer to future hardware implementation. If any of these is addressed, a **future implementation (-15)** error (see Table 5) will be inserted in the status byte.

3.4.2.2.1.2.1 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE

Assembly COLDCART
Property Names CARTIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE
RCA Offset See[AD4]
Description Get the SIS mixer voltage for:
 Cartridge Ca
 Polarization Po
 Sideband Sb
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
 SIS mixer voltage in mV

3.4.2.2.1.2.2 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_CURRENT

Assembly COLDCART
Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_CURRENT
RCA Offset See [AD4]
Description Get the SIS mixer current for:
 Cartridge Ca
 Polarization Po
 Sideband Sb
Suggested Interval 5 seconds



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TE Related No
Data 4 bytes (float) + 1 status byte:
SIS mixer current in mA

3.4.2.2.1.2.3 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_OPEN_LOOP

Assembly COLDCART
Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_OPEN_LOOP
RCA Offset See [AD4]
Description Get the SIS mixer operation mode for:

Cartridge Ca
Polarization Po
Sideband Sb

Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
Operation mode:
0 -> Close Loop (power up state)
1 -> Open Loop

3.4.2.2.1.2.4 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET__VOLTAGE

Assembly COLDCART
Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET__VOLTAGE
RCA Offset See [AD4]
Description Get the SIS magnet voltage for:

Cartridge Ca
Polarization Po
Sideband Sb

Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
SIS magnet voltage in V

3.4.2.2.1.2.5 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_CURRENT

Assembly COLDCART
Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_CURRENT
RCA Offset See [AD4]
Description Get the SIS magnet current for:

Cartridge Ca



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Polarization *Po*
Sideband *Sb*

Suggested Interval 5 seconds

TE Related No

Data 4 bytes (float) + 1 status byte:
SIS magnet current in mA

3.4.2.2.1.2.6 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_VOLTAGE

Assembly COLDCART

Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_VOLTAGE

RCA Offset See [AD4]

Description Get the drain voltage for:
Cartridge *Ca*
Polarization *Po*
Sideband *Sb*
Stage *St*

Suggested Interval 5 seconds

TE Related No

Data 4 bytes (float) + 1 status byte:
Drain voltage in V

3.4.2.2.1.2.7 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_CURRENT

Assembly COLDCART

Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_CURRENT

RCA Offset See [AD4]

Description Get the drain current for:
Cartridge *Ca*
Polarization *Po*
Sideband *Sb*
Stage *St*

Suggested Interval 5 seconds

TE Related No

Data 4 bytes (float) + 1 status byte:
Drain current in mA

3.4.2.2.1.2.8 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_GATE_VOLTAGE

Assembly COLDCART



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Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_GATE_VOLTAGE

RCA Offset See [AD4]

Description Get the gate voltage for:
Cartridge Ca
Polarization Po
Sideband Sb
Stage St

Suggested Interval 5 seconds

TE Related No

Data 4 bytes (float) + 1 status byte:
Gate voltage in V

3.4.2.2.1.2.9 GET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ENABLE

Assembly COLDCART

Property Names CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ENABLE

RCA Offset See [AD4]

Description Get the LNA enabled status for:
Cartridge Ca
Polarization Po
Sideband Sb
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none

TE Related No

Data 1 bytes (uchar)+ 1 status byte:
Status:
0 -> LNA OFF (power up state)
1 -> LNA ON

3.4.2.2.1.2.10 GET_CARTRIDGE[Ca]_POL[Po]_LNA_LED_ENABLE

Assembly COLDCART

Property Names CARTRIDGE[Ca]_POL[Po]_LNA_LED_ENABLE

RCA Offset See [AD4]

Description Get the LNA LED enabled status for:
Cartridge Ca
Polarization Po
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none

TE Related No

Data 1 bytes (uchar)+ 1 status byte:



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Status:

0 -> LED OFF (power up state)

1 -> LED ON

3.4.2.2.1.2.11 GET_CARTRIDGE[Ca]_POL[Po]_SIS_HEATER_CURREN

T

Assembly

COLDCART

Property Names

CARTRIDGE[Ca]_POL[Po]_SIS_HEATER_CURRENT

RCA Offset

See [AD4]

Description

Get the SIS heater current for:

Cartridge Ca

Polarization Po

When the heater is off, the monitor will report some small amount of current. This is because of the way the monitoring hardware behaves. Few milliamps will be shown even if no current is actually flowing to the heater.

Suggested Interval

0.2 seconds when heater is enabled.

TE Related

No

Data

4 bytes (float) + 1 status byte:

SIS heater current in mA



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3.4.2.2.1.2.12 GET_CARTRIDGE[Ca]_LO_YTO_COARSE_TUNE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_YTO_COARSE_TUNE
RCA Offset See [AD4]
Description Get the LO YTO coarse tuning value for:
Cartridge Ca
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval none
TE Related No
Data 2 bytes (uint) + 1 status byte:
YTO coarse tune in counts.
Power up state: 0x0000
Range: 0...4095

3.4.2.2.1.2.13 GET_CARTRIDGE[Ca]_LO_PHOTOMIXER_ENABLE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PHOTOMIXER_ENABLE
RCA Offset See [AD4]
Description Get the Photomixer enabled status for:
Cartridge Ca
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval none
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
Status:
0 -> Photomixer OFF (power up state)
1 -> Photomixer ON

3.4.2.2.1.2.14 GET_CARTRIDGE[Ca]_LO_PHOTOMIXER_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PHOTOMIXER_VOLTAGE
RCA Offset See [AD4]
Description Get the LO photomixer voltage for the WCA installed in:
Cartridge Ca
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Photomixer voltage in V



3.4.2.2.1.2.15 GET_CARTRIDGE[Ca]_LO_PHOTOMIXER_CURRENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PHOTOMIXER_CURRENT
RCA Offset See [AD4]
Description Get the LO photomixer current for the WCA installed in:
Cartridge Ca
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Photomixer current in mA

3.4.2.2.1.2.16 GET_CARTRIDGE[Ca]_LO_PLL_LOCK_DETECT_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_LOCK_DETECT_VOLTAGE
RCA Offset See [AD4]
Description Get the PLL lock detect voltage for:
Cartridge Ca
The PLL is considered locked if this voltage is > 3V.
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Lock detect voltage in V

3.4.2.2.1.2.17 GET_CARTRIDGE[Ca]_LO_PLL_CORRECTION_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_CORRECTION_VOLTAGE
RCA Offset See [AD4]
Description Get the PLL correction voltage for:
Cartridge Ca
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Correction voltage in V

3.4.2.2.1.2.18 GET_CARTRIDGE[Ca]_LO_PLL_ASSEMBLY_TEMP

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_ASSEMBLY_TEMP
RCA Offset See [AD4]
Description Get the PLL assembly temperature for:



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Cartridge Ca
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Assembly temperature °C

3.4.2.2.1.2.19 GET_CARTRIDGE[Ca]_LO_YIG_HEATER_CURRENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_YIG_HEATER_CURRENT
RCA Offset See [AD4]
Description Get the YIG heater current for:
Cartridge Ca
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Supply voltage in mA

3.4.2.2.1.2.20 GET_CARTRIDGE[Ca]_LO_PLL_REF_TOTAL_POWER

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_REF_TOTAL_POWER
RCA Offset See [AD4]
Description Get the PLL reference total power for:
Cartridge Ca
This voltage gives an indication of the power level of the FLOOG signal when the PLL is locked.
Suggested Interval 1 second when searching for LO lock. 30 seconds otherwise.
TE Related No
Data 4 bytes (float) + 1 status byte:
REF total power in V

3.4.2.2.1.2.21 GET_CARTRIDGE[Ca]_LO_PLL_IF_TOTAL_POWER

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_IF_TOTAL_POWER
RCA Offset See [AD4]
Description Get the PLL IF total power for:
Cartridge Ca
This voltage gives an indication of the power level of the photomixer output when the PLL is locked.
Suggested Interval 1 second when searching for LO lock. 30 seconds otherwise.
TE Related No
Data 4 bytes (float) + 1 status byte:
REF(IF) total power in V



3.4.2.2.1.2.22 GET_CARTRIDGE[Ca]_LO_PLL_UNLOCK_DETECT_LATCH

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_UNLOCK_DETECT_LATCH
RCA Offset See [AD4]
Description Get the PLL state of the latched unlock detect bit for:
Cartridge Ca
Indicates that the LO lock is lost or has been lost since the last clear unlock detect latch command.
Suggested Interval 5 seconds
TE Related No
Data 1 byte (uchar):
Status:
0 -> PLL lock OK
1 -> PLL unlock

3.4.2.2.1.2.23 GET_CARTRIDGE[Ca]_LO_PLL_LOOP_BANDWIDTH_SELECT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_LOOP_BANDWIDTH_SELECT
RCA Offset See [AD4]
Description Get the state of the selection bit for the bandwidth for:
Cartridge Ca
Range:

Band	1	2	3	4	5	6	7	8	9	10
Value	ND	ND	1	0	ND	1	1	0	0	ND

Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval none
TE Related No
Data 1 byte (uchar):
Status:
0 -> 7.5MHz/V (Band 4,8,9)
1 -> 15MHz/V (Band 3,6,7)

3.4.2.2.1.2.24 GET_CARTRIDGE[Ca]_LO_PLL_SB_LOCK_POLARITY_SELECT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_SB_LOCK_POLARITY_SELECT
RCA Offset See [AD4]



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Description Get the state of the select bit for the sideband polarity for:
Cartridge Ca
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none

TE Related No

Data 1 byte (uchar):
Status:
0 -> Lock Below Reference (LSB)
1 -> Lock Above Reference (USB)

3.4.2.2.1.2.25 GET_CARTRIDGE[Ca]_LO_PLL_NULL_LOOP_INTEGRATOR

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PLL_NULL_LOOP_INTEGRATOR
RCA Offset See [AD4]
Description Get the state of the select bit for the loop integrator operation for:
Cartridge Ca
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none

TE Related No

Data 1 byte (uchar):
Status:
0 -> Disables zeroing, normal PLL operation
1 -> Enables zeroing and dumps integrator

3.4.2.2.1.2.26 GET_CARTRIDGE[Ca]_LO_AMC_GATE_A_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_GATE_A_VOLTAGE
RCA Offset See [AD4]
Description Get the AMC gate A voltage for:
Cartridge Ca
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots.

Suggested Interval 30 seconds

TE Related No

Data 4 bytes (float) + 1 status byte:
AMC gate voltage in V



3.4.2.2.1.2.27 GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_A_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_DRAIN_A_VOLTAGE
RCA Offset See [AD4]
Description Get the AMC drain A voltage for:
Cartridge Ca
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots.
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC drain voltage in V

3.4.2.2.1.2.28 GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_A_CURRENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_DRAIN_A_CURRENT
RCA Offset See [AD4]
Description Get the AMC drain A current for:
Cartridge Ca
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC drain current in mA

3.4.2.2.1.2.29 GET_CARTRIDGE[Ca]_LO_AMC_GATE_B_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_GATE_B_VOLTAGE
RCA Offset See [AD4]
Description Get the AMC gate B voltage for:
Cartridge Ca
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots.
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC gate voltage in V

3.4.2.2.1.2.30 GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_DRAIN_B_VOLTAGE



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RCA Offset See [AD4]
Description Get the AMC drain B voltage for:
Cartridge Ca
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots.
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC drain voltage in V

3.4.2.2.1.2.31 GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_CURRENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_DRAIN_B_CURRENT
RCA Offset See [AD4]
Description Get the AMC drain B current for:
Cartridge Ca
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC drain current in mA

3.4.2.2.1.2.32 GET_CARTRIDGE[Ca]_LO_AMC_GATE_E_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_GATE_E_VOLTAGE
RCA Offset See [AD4]
Description Get the AMC gate E voltage for:
Cartridge Ca
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots.
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC gate voltage in V

3.4.2.2.1.2.33 GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_DRAIN_E_VOLTAGE
RCA Offset See [AD4]
Description Get the AMC drain E voltage for:
Cartridge Ca



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Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots.

Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC drain voltage in V

3.4.2.2.1.2.34 GET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_CURRENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_DRAIN_E_CURRENT
RCA Offset See [AD4]
Description Get the AMC drain E current for:
Cartridge Ca
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC drain current in mA

3.4.2.2.1.2.35 GET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_COUNTS

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_COUNTS
RCA Offset See [AD4]
Description Get the AMC multiplier D voltage in counts for:
Cartridge Ca
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued. The returned value is in counts that are somehow proportional to the actual voltage.
Suggested Interval 30 seconds
TE Related No
Data 1 bytes (uchar) + 1 status byte:
AMC multiplier voltage in counts

3.4.2.2.1.2.36 GET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_CURRENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_CURRENT
RCA Offset See [AD4]
Description Get the AMC multiplier D current for:
Cartridge Ca



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Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC multiplier current in mA

3.4.2.2.1.2.37 GET_CARTRIDGE[Ca]_LO_PA_POL[Po]_GATE_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PA_POL[Po]_GATE_VOLTAGE
RCA Offset See [AD4]
Description Get the PA gate voltage for:
Polarization Po
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots. The gate voltage is automatically set to 0V during the initialization of the WCA that is performed every time the corresponding band is powered up.
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
PA gate voltage in V

3.4.2.2.1.2.38 GET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_VOLTAGE

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_VOLTAGE
RCA Offset See [AD4]
Description Get the PA drain voltage for:
Polarization Po
Note: While it is possible to read back the bias voltage and currents produced by these pots, it is not possible to read back the actual setting of the pots. The drain voltage is automatically set to 0V during the initialization of the WCA that is performed every time the corresponding band is powered up.
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
PA drain voltage in V



3.4.2.2.1.2.39 GET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_CURR ENT

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_CURRENT
RCA Offset See [AD4]
Description Get the PA drain current for:
Polarization Po
Suggested Interval 5 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
PA drain current in mA

3.4.2.2.1.2.40 GET_CARTRIDGE[Ca]_LO_AMC(PA)_SUPPLY_VOLTAGE_5V GE_(5)V

Assembly WCA
Property Names CARTRIDGE[Ca]_LO_AMC_SUPPLY_VOLTAGE_5V
CARTRIDGE[Ca]_LO_PA_SUPPLY_VOLTAGE_5V
RCA Offset See [AD4]
Description Get the AMC or PA supply voltage for:
Cartridge Ca
Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
AMC(PA) supply voltage in V



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3.4.2.2.1.2.41 GET_CARTRIDGE[Ca]_CARTRIDGE_TEMP[Te]_TEMP

Assembly COLDCART
Property CARTRIDGE[Ca]_CARTRIDGE_TEMP[Te]_TEMP

Names

RCA Offset See [AD4]

Description Get the temperature for:
Cartridge Ca
Sensor Te

The temperature sensor number is associated with a particular location according to the following table:

Sensor Number	0	1	2	3	4	5
Location	4K stage	110K stage	Mixer pol0	Spare	15K stage	Mixer poll

Suggested Interval 30 seconds

TE Related Data No

4 bytes (float) + 1 status byte:
Temperature in K.



3.4.2.2.1.2.42 GET_POWER_DISTRIBUTION_MODULE[Ca]_CHANNEL[Ch]_CURRENT

Assembly CPDS
Property POWER_DISTRIBUTION_MODULE[Ca]_CHANNEL[Ch]_CURRENT
Names
RCA Offset See [AD4]
Description Get the power supply current output for:
Cartridge Ca
Channel Ch
The channels are assigned according to the following table:

Ch	0	1	2	3	4	5
Voltage	+6V	-6V	+15V	-15V	+24	+8

Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Current in A

3.4.2.2.1.2.43 GET_POWER_DISTRIBUTION_MODULE[Ca]_CHANNEL[Ch]_VOLTAGE

Assembly CPDS
Property POWER_DISTRIBUTION_MODULE[Ca]_CHANNEL[Ch]_VOLTAGE
Names
RCA Offset See [AD4]
Description Get the power supply voltage output for:
Cartridge Ca
Channel Ch
The channels are assigned according to the following table:

Ch	0	1	2	3	4	5
Voltage	+6V	-6V	+15V	-15V	+24	+8

Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
Voltage in V

3.4.2.2.1.2.44 GET_POWER_DISTRIBUTION_MODULE[Ca]_ENABLE

Assembly CPDS
Property Names POWER_DISTRIBUTION_MODULE[Ca]_ENABLE
RCA Offset See [AD4]



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Description Get the current supply state for:
Cartridge Ca
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none

TE Related No

Data 1 bytes (uchar)+ 1 status byte:
Status:
0 -> Power OFF (power up state)
1 -> Power ON

3.4.2.2.1.2.45 GET_POWER_DISTRIBUTION_POWERED_MODULES

Assembly CPDS

Property Name POWER_DISTRIBUTION_POWERED_MODULES

RCA Offset See [AD4]

Description Get the current number of powered up modules.
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none

TE Related No

Data 1 bytes (uchar)+ 1 status byte:
Number of powered modules



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3.4.2.2.1.2.46 GET_IF_SWITCH_CARTRIDGE

Assembly IFSWITCH
Property Name IF_SWITCH_CARTRIDGE
RCA Offset See [AD4]
Description Get the current cartridge selected by the IF switch
Suggested Interval none
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
 Selected cartridge band – 1.

3.4.2.2.1.2.47 GET_IF_SWITCH_CHANNEL[Po][Sb]_ATTENUATION

Assembly IFSWITCH
Property Names IF_SWITCH_CHANNEL[Po][Sb]_ATTENUATION
RCA Offset See [AD4]
Description Get the attenuation for:
 Polarization Po
 Sideband Sb
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval none
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
 Attenuation in dB.

3.4.2.2.1.2.48 GET_IF_SWITCH_CHANNEL[Po][Sb]_ASSEMBLY_TEMP
P

Assembly IFSWITCH
Property Names IF_SWITCH_CHANNEL[Po][Sb]_ASSEMBLY_TEMP
RCA Offset See [AD4]
Description Get the assembly temperature for:
 Polarization Po
 Sideband Sb

Errors:	HARDW_BLKD_ERR (-3)	If the corresponding temperature servo is disabled.
----------------	---------------------	---

Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
 Assembly temperature in °C



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3.4.2.2.1.2.49 GET_IF_SWITCH_CHANNEL[Po][Sb]_TEMP_SERVO_ENABLE

Assembly IFSWITCH
Property Names IF_SWITCH_CHANNEL[Po][Sb]_TEMP_SERVO_ENABLE
RCA Offset See [AD4]
Description Get the state of the IF switch temperature servo for:
Polarization Po
Sideband Sb
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval none
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
Status:
0 -> Servo OFF (power up state)
1 -> Servo ON



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3.4.2.2.1.2.50 GET_CRYOSTAT_TEMP[Se]_TEMP

Assembly CRYOSTAT
Property CRYOSTAT_TEMP[Se]_TEMP
Names
RCA Offset See [AD4]
Description Get the dewar temperature for:

Sensor Se

The temperature sensor number is associated with a particular location according to the following table:

Se	0	1	2	3	4
Location	4K cryocooler	4K plate near link1	4K plate near link2	4K plate far side1	4K plate far side2

Se	5	6	7	8
Location	15K cryocooler	15K plate near link	15K plate far side	15K shield top

Se	9	10	11	12
Location	110K cryocooler	110K plate near link	110K plate far side	110K shield top

Errors:

HARDW_BLKD_ERR (-3)	If the asynchronous readout is disabled and until is enabled again. The state of the asynchronous readout can be toggled using the console.
----------------------------	---

Suggested Interval 30 seconds
TE Related No
Data 4 bytes (float) + 1 status byte:
 Temperature in K

3.4.2.2.1.2.51 GET_CRYOSTAT_BACKING_PUMP_ENABLE

Assembly CRYOSTAT
Property Name CRYOSTAT_BACKING_PUMP_ENABLE
RCA Offset See [AD4]
Description Get the current state for the backing pump.

Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval none
TE Related No



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Data 1 bytes (uchar)+ 1 status byte:
Status:
0 -> Power OFF (power up state)
1 -> Power ON

3.4.2.2.1.2.52 GET_CRYOSTAT_TURBO_PUMP_ENABLE

Assembly CRYOSTAT
Property Name CRYOSTAT_TURBO_PUMP_ENABLE
RCA Offset See [AD4]
Description Get the current enable state for the turbo pump.

Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Errors:

HARDW_BLKD_ERR (-3)

If the backing pump is not enabled since, in this condition, the turbo pump is not powered and cannot be accessed.

Suggested Interval none

TE Related No

Data 1 bytes (uchar)+ 1 status byte:
Status:
0 -> Power OFF (power up state)
1 -> Power ON

3.4.2.2.1.2.53 GET_CRYOSTAT_TURBO_PUMP_STATE

Assembly CRYOSTAT
Property Name CRYOSTAT_TURBO_PUMP_STATE
RCA Offset See [AD4]
Description Get the current error state for the turbo pump.

Errors:

HARDW_BLKD_ERR (-3)

If the backing pump is not enabled since, in this condition, the turbo pump is not powered and cannot be accessed.

Suggested Interval 5 seconds when the backing pump is enabled, none otherwise.

TE Related No

Data 1 bytes (uchar)+ 1 status byte:
Error:
0 -> OK
1 -> Error

3.4.2.2.1.2.54 GET_CRYOSTAT_TURBO_PUMP_SPEED

Assembly CRYOSTAT



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Property Name CRYOSTAT_TURBO_PUMP_SPEED

RCA Offset See [AD4]

Description Get the current speed state for the turbo pump.

Errors:	HARDW_BLKD_ERR (-3)	If the backing pump is not enabled since, in this condition, the turbo pump is not powered and cannot be accessed.
----------------	---------------------	--

Suggested Interval 5 seconds when the turbo pump is enabled, none otherwise.

TE Related No

Data 1 bytes (uchar)+ 1 status byte:

Error:
 0 -> Speed low
 1 -> Speed OK

3.4.2.2.1.2.55 GET_CRYOSTAT_GATE_VALVE_STATE

Assembly CRYOSTAT

Property Name CRYOSTAT_GATE_VALVE_STATE

RCA Offset See [AD4]

Description Get the current state for the gate valve.

Errors:	HARDW_BLKD_ERR (-3)	If the backing pump is not enabled since, in this condition, the turbo pump is not powered and cannot be accessed.
----------------	---------------------	--

Suggested Interval 5 seconds when the backing pump is enabled, none otherwise.

TE Related No

Data 1 bytes (uchar)+ 1 status byte:

State:
 0 -> Close
 1 -> Open
 2 -> Unknown (in transition between states)
 3 -> Error

3.4.2.2.1.2.56 GET_CRYOSTAT_SOLENOID_VALVE_STATE

Assembly CRYOSTAT

Property Name CRYOSTAT_SOLENOID_VALVE_STATE

RCA Offset See [AD4]

Description Get the current state for the solenoid valve.

Errors:	HARDW_BLKD_ERR (-3)	If the backing pump is not enabled since, in this condition, the turbo pump is not powered and cannot be accessed.
----------------	---------------------	--



Suggested Interval 5 seconds when the backing pump is enabled, none otherwise.

TE Related No

Data 1 bytes (uchar)+ 1 status byte:

State:

0 -> Close

1 -> Open

2 -> Unknown (in transition between states)

3 -> Error

3.4.2.2.1.2.57 GET_CRYOSTAT_VACUUM_GAUGE_SENSOR[Ps]_PRESSURE

Assembly CRYOSTAT

Property CRYOSTAT_VACUUM_GAUGE_SENSOR[Ps]_PRESSURE

Name

RCA Offset See [AD4]

Description Get the cryostat and vacuum port pressure.

Errors:

HARDW_BLKD_ERR (-3)	If the asynchronous readout is disabled and until is enabled again. The state of the asynchronous readout can be toggled using the console.
----------------------------	---

Suggested Interval 30 seconds for cryostat.

Interval 30 seconds for vacuum port when the solenoid valve is open.

TE Related No

Data 4 bytes (float) + 1 status byte:

Vacuum pressure in mbar

3.4.2.2.1.2.58 GET_CRYOSTAT_VACUUM_GAUGE_ENABLE

Assembly CRYOSTAT

Property Name CRYOSTAT_VACUUM_GAUGE_ENABLE

RCA Offset See [AD4]

Description Get the current enable state for the vacuum controller.

Suggested Interval none

TE Related No

Data 1 bytes (uchar)+ 1 status byte:

Error:

0 -> ON (default startup state)

1 -> OFF

3.4.2.2.1.2.59 GET_CRYOSTAT_VACUUM_GAUGE_STATE

Assembly CRYOSTAT



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Property Name CRYOSTAT_VACUUM_GAUGE_STATE
RCA Offset See [AD4]
Description Get the current error state for the vacuum controller.
Suggested Interval 30 seconds
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
 Error:
 0 -> OK
 1 -> Error

3.4.2.2.1.2.60 GET_CRYOSTAT_SUPPLY_CURRENT_230V

Assembly CRYOSTAT
Property Name CRYOSTAT_SUPPLY_CURRENT_230V
RCA Offset See [AD4]
Description Get the 230V AC current level.
Errors:

<p><i>HARDW_BLKD_ERR (-3)</i></p>	<p><i>If the backing pump is not enabled since, in this condition, the turbo pump is not powered and cannot be accessed.</i></p> <p><i>If the asynchronous readout is disabled and until is enabled again. The state of the asynchronous readout can be toggled using the console.</i></p>
-----------------------------------	--

Suggested Interval 5 seconds when the backing pump is enabled, none otherwise.
TE Related No
Data 4 bytes (float) + 1 status byte:
 Current in A



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3.4.2.2.1.2.61 GET_LPR_TEMP[Sn]_TEMP

Assembly LPR
Property Names LPR_TEMP[Sn]_TEMP
RCA Offset See [AD4]
Description Get the LPR temperature for:
Sensor Sn
Suggested Interval 30 sec
TE Related No
Data 4 bytes (float) + 1 status byte:
Temperature in K

3.4.2.2.1.2.62 GET_LPR_OPT_SWITCH_PORT

Assembly LPR
Property Name LPR_OPT_SWITCH_PORT
RCA Offset See [AD4]
Description Get the current port selected by the optical switch.
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval 30 sec
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
Selected LPR switch port (Current encoding: port = cartridge band – 1).
A readout of 0xFF means that the shutter is ON and the output is disabled.

3.4.2.2.1.2.63 GET_LPR_OPT_SWITCH_SHUTTER

Assembly LPR
Property Name LPR_OPT_SWITCH_SHUTTER
RCA Offset See [AD4]
Description Get the current state of the shutter in the optical switch.
Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.
Suggested Interval 30 sec
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
0 -> Shutter off (laser enable)
1 -> Shutter on (laser disable)(startup state)

3.4.2.2.1.2.64 GET_LPR_OPT_SWITCH_STATE

Assembly LPR



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Property Name LPR_OPT_SWITCH_STATE
RCA Offset See [AD4]
Description Get the current error state for the optical switch in the LPR.
Suggested Interval 5 sec
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
Error:
0 -> OK
1 -> Error

3.4.2.2.1.2.65 GET_LPR_OPT_SWITCH_BUSY

Assembly LPR
Property Name LPR_OPT_SWITCH_BUSY
RCA Offset See [AD4]
Description Get the current busy state for the optical switch in the LPR.
Suggested Interval 5 sec
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
Error:
0 -> Idle
1 -> Switching

3.4.2.2.1.2.66 GET_LPR_EDFA_LASER_PUMP_TEMP

Assembly LPR
Property Names LPR_EDFA_LASER_PUMP_TEMP
RCA Offset See [AD4]
Description Get the EDFA temperature for the pump.
This temperature is obtained applying a 6th order polynomial fit which is valid only between 280.0K and 315.0K.
Suggested Interval 30 sec
TE Related No
Data 4 bytes (float) + 1 status byte:
Temperature in K

3.4.2.2.1.2.67 GET_LPR_EDFA_LASER_DRIVE_CURRENT

Assembly LPR
Property Name LPR_EDFA_LASER_DRIVE_CURRENT
RCA Offset See [AD4]
Description Get the EDFA laser drive current
Suggested Interval 5 sec
TE Related No
Data 4 bytes (float) + 1 status byte:



Current in μ A

3.4.2.2.1.2.68 GET_LPR_EDFA_LASER_PHOTO_DETECT_CURRENT

Assembly LPR
Property Name LPR_EDFA_LASER_PHOTO_DETECT_CURRENT
RCA Offset See [AD4]
Description Get the EDFA laser photo detector current
Errors:

<i>MON_HARDW_FUT (-15)</i>	<i>This monitor point refers to hardware that is not working properly. As long as this is the case, this error will be returned.</i>
----------------------------	--

Suggested Interval 5 sec
TE Related No
Data 4 bytes (float) + 1 status byte:
Current in mA

3.4.2.2.1.2.69 GET_LPR_EDFA_PHOTO_DETECTOR_CURRENT

Assembly LPR
Property Name LPR_EDFA_PHOTO_DETECTOR_CURRENT
RCA Offset See [AD4]
Description Get the LPR EDFA photo detector current
Suggested Interval 5 sec
TE Related No
Data 4 bytes (float) + 1 status byte:
Current in mA

3.4.2.2.1.2.70 GET_LPR_EDFA_PHOTO_DETECTOR_POWER

Assembly LPR
Property Name LPR_EDFA_PHOTO_DETECTOR_POWER
RCA Offset See [AD4]
Description Get the LPR EDFA photo detector power
Suggested Interval 5 sec
TE Related No
Data 4 bytes (float) + 1 status byte:
Power in mW

3.4.2.2.1.2.71 GET_LPR_EDFA_MODULATION_INPUT_VALUE

Assembly LPR
Property Name LPR_EDFA_MODULATION_INPUT_VALUE
RCA Offset See [AD4]
Description Get the LPR EDFA modulation input port value



Note: this is not a hardware read back. The returned value is the one stored by the software after a control command has been issued.

Suggested Interval 30 sec
TE Related No
Data 4 bytes (float) + 1 status byte:
 Voltage in V

3.4.2.2.1.2.1 GET_LPR_EDFA_DRIVER_TEMPERATURE_ALARM

Assembly LPR
Property Name LPR_EDFA_DRIVER_ERROR_TEMPERATURE_ALARM
RCA Offset See [AD4]
Description Get the LPR EDFA laser pump temperature alarm.
 This is triggered when the temperature, which can be monitored by GET_LPR_EDFA_LASER_PUMP_TEMP, rises above a determined limit (37-40°C). When this alarm is triggered, the optical output power is switched off by the LPR hardware. The firmware will set the modulation input to 0.0 to prevent ON/OFF oscillation.

Errors:	MON_ERROR_ACT (-13)	When this alarm is triggered, the optical output power is switched off by the LPR hardware. The optical power will be restored automatically once the pump laser cools down. To prevent possible oscillation, the firmware will automatically set the modulation input to 0.0.
----------------	---------------------	--

Suggested Interval 30 sec
TE Related No
Data 1 bytes (uchar)+ 1 status byte:
 Error:
 0 -> OK
 1 -> Error



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3.4.2.2.2 STANDARD CONTROL POINTS

An equivalent algorithm to the one described for the monitor points RCA assignment is used for the control point RCA assignment. For more information on the logical blocks division see [AD4].

Monitor requests on Control RCAs

For every Control RCA, a monitor request may be sent which will return the last value set to the control point, plus a status byte indicating the outcome of the setting. This facility is especially useful for control parameters which have a setting range which is identical for all cartridge bands, but where the allowable range varies from band to band according to the cartridge configuration database.

The status bytes for monitoring on a control RCA are defined as follows:

<i>Value</i>	<i>Summary</i>	<i>Description</i>
0	No Error	No error during the monitor operation.
-1	Error	Error during the monitor operation. This error is returned when there is a problem of communication between the monitor and control module and one of the peripherals.
-2	Hardware Error Range	This error is returned in operation mode when the addressed hardware is not installed.
-3	Hardware Blocked Error	This error is returned in operation mode when trying to perform operation restricted by hardware manufacturer directives.
-4	Hardware Update Warning	This warning is returned in operation mode when the properties of the addressed hardware are not fully encoded. This usually is a result of lack of information at the time the current software was released. When the information are provided, a new release of the software and the warning is removed.
-10	Control in Error Range	The control operation is trying to set a value that is in the error range according to the configuration



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		database. In this case the value is left unchanged.
--	--	---

Table 6 – Control error messages

For example: SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE has an allowable range of -25 to +25 mV, however for band 3, only the range 0 to 20 mV is allowed. Therefore in the monitor point details section below, the min and max range for the parameter specifies the former range and the configuration data for band 3 will specify the latter. After a setting command has been sent for SET_CARTRIDGE3_POL0_SB1_SIS_VOLTAGE, the control software may then monitor the exact same RCA and read back the value that was sent plus the status byte as described above. A monitor request issued to a control RCA will return the payload of the last control message issued even if out of range values were commanded. This is done to allow debug of the control routines. An extra code will be returned added at the end of the message payload containing either the no error code or, if any occurred, the error code as specified in Table 6.

3.4.2.2.1 Summary of Control Points (Base address: 0x10000)

<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE	See [AD4]	4	No
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_OPEN_LOOP	See [AD4]	1	No
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_CURRENT	See [AD4]	4	No
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_VOLTAGE	See [AD4]	4	No
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_CURRENT	See [AD4]	4	No
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ENABLE	See [AD4]	1	No
SET_CARTRIDGE[Ca]_POL[Po]_LNA_LED_ENABLE	See [AD4]	1	No
SET_CARTRIDGE[Ca]_POL[Po]_SIS_HEATER_ENABLE	See [AD4]	1	No
SET_CARTRIDGE[Ca]_POL[Po]_SPECIAL_DAC[Da]_RESET(CLEAR)_STROBE	See [AD4]	1	No
SET_CARTRIDGE[Ca]_LO_YTO_COARSE_TUNE	See [AD4]	2	No
SET_CARTRIDGE[Ca]_LO_PHOTOMIXER_	See [AD4]	1	No



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<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
ENABLE			
SET_CARTRIDGE[Ca]_LO_PLL_CLEAR_UNLOCK_DETECT_LATCH	See [AD4]	1	No
SET_CARTRIDGE[Ca]_LO_PLL_LOOP_BANDWIDTH_SELECT	See [AD4]	1	No
SET_CARTRIDGE[Ca]_LO_PLL_SB_LOCK_POLARITY_SELECT	See [AD4]	1	No
SET_CARTRIDGE[Ca]_LO_PLL_NULL_LOOP_INTEGRATOR	See [AD4]	1	No
SET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_VOLTAGE	See [AD4]	4	No
SET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_VOLTAGE	See [AD4]	1	No
SET_CARTRIDGE[Ca]_LO_AMC_GATE_E_VOLTAGE	See [AD4]	4	No
SET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_VOLTAGE	See [AD4]	4	No
SET_CARTRIDGE[Ca]_LO_PA_POL[Po]_GATE_VOLTAGE	See [AD4]	4	No
SET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_VOLTAGE	See [AD4]	4	No
SET_POWER_DISTRIBUTION_MODULE[Ca]_ENABLE	See [AD4]	1	No
SET_IF_SWITCH_CARTRIDGE	See [AD4]	1	No
SET_IF_SWITCH_CHANNEL[Po][Sb]_ATTENUATION	See [AD4]	1	No
SET_IF_SWITCH_CHANNEL[Po][Sb]_TEMP_SERVO_ENABLE	See [AD4]	1	No
SET_CRYOSTAT_BACKING_PUMP_ENABLE	See [AD4]	1	No
SET_CRYOSTAT_TURBO_PUMP_ENABLE	See [AD4]	1	No
SET_CRYOSTAT_GATE_VALVE_STATE	See [AD4]	1	No
SET_CRYOSTAT_SOLENOID_VALVE_STATE	See [AD4]	1	No
SET_CRYOSTAT_VACUUM_GUAGE_ENABLE	See [AD4]	1	No
SET_LPR_OPT_SWITCH_PORT	See [AD4]	1	No
SET_LPR_OPT_SWITCH_SHUTTER	See [AD4]	1	No



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<i>Name</i>	<i>RCA Offset (hex)</i>	<i>Data Size (bytes)</i>	<i>Timing Event Related</i>
SET_LPR_OPT_SWITCH_FORCE_SHUTTER	See [AD4]	1	No
SET_LPR_EDFA_MODULATION_INPUT_VALUE	See [AD4]	4	No
SET_LPR_EDFA_MODULATION_INPUT_SPECIAL_DAC_RESET_STROBE	See [AD4]	1	No

3.4.2.2.2 Standard Control Points in detail

3.4.2.2.2.1 SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE

Assembly COLDCART
Name SET_CARTIDGE[Ca]_POL[Po]_SB[Sb]_SIS_VOLTAGE
RCA Offset See [AD4]
Description Set the SIS mixer voltage for:
 Cartridge Ca
 Polarization Po
 Sideband Sb
TE Related No
Data 4 bytes (float):
 SIS mixer voltage in mV

3.4.2.2.2.2 SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_OPEN_LOOP

Assembly COLDCART
Name SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_OPEN_LOOP
RCA Offset See [AD4]
Description Get the SIS mixer operation mode for:
 Cartridge Ca
 Polarization Po
 Sideband Sb
TE Related No
Data 1 bytes (uchar):
 Operation mode:
 0 -> Close Loop (power up state)
 1 -> Open Loop

3.4.2.2.2.3 SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_CURRENT

Assembly COLDCART
Name SET_CARTIDGE[Ca]_POL[Po]_SB[Sb]_SIS_MAGNET_CURRENT
RCA Offset See [AD4]
Description Set the SIS magnet current for:



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Cartridge *Ca*
Polarization *Po*
Sideband *Sb*
TE Related *No*
Data *4 bytes (float):*
SIS magnet current in mA

3.4.2.2.2.2.4 SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_VOLTAGE

Assembly Name COLDCART
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_VOLTAGE
RCA Offset Description *See [AD4]*
Set the drain voltage for:
Cartridge *Ca*
Polarization *Po*
Sideband *Sb*
Stage *St*
TE Related *No*
Data *4 bytes (float):*
Drain voltage in V

3.4.2.2.2.2.5 SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_CURRENT

Assembly Name COLDCART
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ST[St]_DRAIN_CURRENT
RCA Offset Description *See [AD4]*
Set the drain current for:
Cartridge *Ca*
Polarization *Po*
Sideband *Sb*
Stage *St*
TE Related *No*
Data *4 bytes (float):*
Drain current in mA

3.4.2.2.2.2.6 SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ENABLE

Assembly Name COLDCART
SET_CARTRIDGE[Ca]_POL[Po]_SB[Sb]_LNA_ENABLE
RCA Offset Description *See [AD4]*
Set the state of the LNA for:



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*To prevent this from being accidentally applied to Band 9, a timer was added to allow Band 9 heater to be turned ON only once every 10 second. If this timing is violated, a monitor request on the control RCA will return the **hardware blocked error (-3)** status.*

TE Related No
Data 1 bytes (uchar):
Status:
0 -> SIS heater OFF (power up state)
1 -> SIS heater ON

3.4.2.2.2.9 SET_CARTRIDGE[Ca]_POL[Po]_DAC[Da]_RESET(CLEAR)_STROBE

Assembly Name COLDCART
SET_CARTRIDGE[Ca]_POL[Po]_DAC[Da]_RESET(CLEAR)_STROBE
RCA Offset Description See [AD4]
Send a reset(clear) strobe to:
Cartridge Ca
Polarization Po
DAC Da
Note: This is implemented for debug purposes only.
TE Related No
Data 1 bytes (uchar):
Dummy

3.4.2.2.2.10 SET_CARTRIDGE[Ca]_LO_YTO_COARSE_TUNE

Assembly Name WCA
SET_CARTRIDGE[Ca]_LO_YTO_COARSE_TUNE
RCA Offset Description See [AD4]
Set the LO YTO coarse tune for:
Cartridge Ca
TE Related No
Data 2 bytes (uint):
YTO coarse tune in counts.
Power up state: 0x0000

3.4.2.2.2.11 SET_CARTRIDGE[Ca]_LO_PHOTOMIXER_ENABLE

Assembly Name WCA
SET_CARTRIDGE[Ca]_LO_PHOTOMIXER_ENABLE
RCA Offset Description See [AD4]
Set the LO photomixer status for:



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TE Related Cartridge Ca
 No
Data 1 bytes (uchar):
 Status:
 0 -> Photomixer OFF (power up state)
 1 -> Photomixer ON

3.4.2.2.2.12 SET_CARTRIDGE[Ca]_LO_PLL_CLEAR_UNLOCK_DETECT_LATCH

Assembly Name WCA
 SET_CARTRIDGE[Ca]_LO_PLL_CLEAR_UNLOCK_DETECT_LATCH
RCA Offset Description See [AD4]
 Set the state of the clear bit for the latched unlock detect bit for:
 Cartridge Ca
TE Related No
Data 1 byte (uchar):
 dummy
 A control command issued to this address will toggle the control to 0 to clear the latch then toggle it back to 1 for normal operation.

3.4.2.2.2.13 SET_CARTRIDGE[Ca]_LO_PLL_LOOP_BANDWIDTH_SELECT

Assembly Name WCA
 GET_CARTRIDGE[Ca]_LO_PLL_LOOP_BANDWIDTH_SELECT
RCA Offset Description See [AD4]
 Set the state of the selection bit for the bandwidth for:
 Cartridge Ca
TE Related No
Data 1 byte (uchar):
 Status:
 0 -> 7.5MHz/V
 1 -> 15MHz/V
 Range:

Band	1	2	3	4	5	6	7	8	9	10
Value	ND	ND	1	0	ND	1	1	0	0	ND

Even though this control point is available, the correct value will be set up automatically by the software when the corresponding band is turned on and initialized.



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3.4.2.2.2.2.14 SET_CARTRIDGE[Ca]_LO_PLL_SB_LOCK_POLARITY_SELECT

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_PLL_SB_LOCK_POLARITY_SELECT
RCA Offset See [AD4]
Description Set the state of the select bit for the sideband polarity for:
Cartridge Ca
TE Related No
Data 1 byte (uchar):
Status:
0 -> Lock below reference (LSB)
1 -> Lock above reference (USB)

3.4.2.2.2.2.15 SET_CARTRIDGE[Ca]_LO_PLL_NULL_LOOP_INTEGRATOR

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_PLL_NULL_LOOP_INTEGRATOR
RCA Offset See [AD4]
Description Set the state of the select bit for the loop integrator operation for:
Cartridge Ca
TE Related No
Data 1 byte (uchar):
Status:
0 -> Operate (Disables the zeroing for normal PLL operation)
1 -> Null/Zero (Enables the zeroing and dumps the integrator)

3.4.2.2.2.2.16 SET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_VOLTAGE

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_AMC_DRAIN_B_VOLTAGE
RCA Offset See [AD4]
Description Set the AMC(PA) drain voltage for:
Cartridge Ca
Gate Ga
TE Related No
Data 4 bytes (float):
AMC(PA) drain voltage in V

3.4.2.2.2.2.17 SET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_COUNTS

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_AMC_MULTIPLIER_D_COUNTS
RCA Offset See [AD4]



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Description Set the AMC multiplier voltage in counts for:
Cartridge Ca
The returned value is in counts that are proportional to the actual voltage.

TE Related No
Data 1 byte (uchar):
AMC multiplier voltage in counts

3.4.2.2.2.18 SET_CARTRIDGE[Ca]_LO_AMC_GATE_E_VOLTAGE

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_AMC_GATE_E_VOLTAGE
RCA Offset See [AD4]
Description Set the AMC gate voltage for:
Cartridge Ca
Gate Ga

TE Related No
Data 4 bytes (float):
AMC gate voltage in V

3.4.2.2.2.19 SET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_VOLTAGE

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_AMC_DRAIN_E_VOLTAGE
RCA Offset See [AD4]
Description Set the AMC gate voltage for:
Cartridge Ca
Gate Ga

TE Related No
Data 4 bytes (float):
AMC gate voltage in V

3.4.2.2.2.20 SET_CARTRIDGE[Ca]_LO_PA_POL[Po]_GATE_VOLTAGE

Assembly WCA
Name SET_CARTRIDGE[Ca]_LO_PA_POL[Po]_GATE_VOLTAGE
RCA Offset See [AD4]
Description Set the PA gate voltage for:
Channel Po

TE Related No
Data 4 bytes (float):
PA gate voltage in V



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3.4.2.2.2.21 SET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_VOLTAGE_SCALE

Assembly Name	WCA SET_CARTRIDGE[Ca]_LO_PA_POL[Po]_DRAIN_VOLTAGE_SCALE
RCA Offset Description	See [AD4] Set the PA scaling factor. This is a unitless scale factor varying from 0 to 5 where 0 corresponds to a drain voltage of 0V while 5 corresponds to the maximum drain voltage:
	Channel Po
TE Related Data	No 4 bytes (float): PA drain voltage scaling factor.



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3.4.2.2.2.22 SET_POWER_DISTRIBUTION_MODULE[Ca]_ENABLE

Assembly

CPDS

Name

SET_POWER_DISTRIBUTION_MODULE[Ca]_ENABLE

RCA Offset

See [AD4]

Description

Set the power for:

Cartridge Ca

If the front end is in **operational** or **maintenance mode** only 3 bands can be powered at any given time. In this case the software will prevent the user from turning on more than the 3 allowed cartridges. The **hardware blocked** error will be stored in the control message status.

When in **troubleshooting mode** any number of bands can be turned on. In every mode, the power up initialization of a band requires 5 milliseconds to complete. During this time, no messages can be acknowledge by the FEMC.

TE Related

No

Data

1 bytes (uchar):

Status:

0 -> Power OFF (power up state)

1 -> Power ON



3.4.2.2.2.2.23 SET_IF_SWITCH_CARTRIDGE

Assembly IFSWITCH
Name SET_IF_SWITCH_CARTRIDGE
RCA Offset See [AD4]
Description Set the cartridge selected by the IF switch.
TE Related No
Data 1 bytes (uchar):
 Selected cartridge band - 1

3.4.2.2.2.2.24 SET_IF_SWITCH_CHANNEL[Po][Sb]_ATTENUATION

Assembly IFSWITCH
Name SET_IF_SWITCH_CHANNEL[Po][Sb]_ATTENUATION
RCA Offset See [AD4]
Description Set the attenuation for:
 Polarization Po
 Sideband Sb
 The sideband is assign according to the following table:

Sb	0	1
Sideband	Upper	Lower

TE Related No
Data 1 bytes (uchar):
 Attenuation in dB

3.4.2.2.2.2.25 SET_IF_SWITCH_CHANNEL[Po][Sb]_TEMP_SERVO_ENABLE

Assembly IFSWITCH
Name SET_IF_SWITCH_CHANNEL[Po][Sb]_TEMP_SERVO_ENABLE
RCA Offset See [AD4]
Description Set the state of the IF switch temperature servo for:
 Polarization Po
 Sideband Sb
 The sideband is assign according to the following table:

Sb	0	1
Sideband	Upper	Lower

TE Related No
Data 1 bytes (uchar):
 Status:
 0 -> Servo OFF (power up state)
 1 -> Servo ON



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3.4.2.2.2.26 SET_CRYOSTAT_BACKING_PUMP_ENABLE

Assembly CRYOSTAT
Name SET_CRYOSTAT_BACKING_PUMP_ENABLE
RCA Offset See [AD4]
Description Enable power to the backing pump.
TE Related No
Data 1 bytes (uchar):
Status:
0 -> Power OFF (power up state)
1 -> Power ON

3.4.2.2.2.27 SET_CRYOSTAT_TURBO_PUMP_ENABLE

Assembly CRYOSTAT
Name SET_CRYOSTAT_TURBO_PUMP_ENABLE
RCA Offset See [AD4]
Description Enable power to the turbo pump.
If the backing pump is not enabled nothing happens and the Hardware Blocked Error (See Table 6) is returned if a monitor request is sent to this RCA since, in this condition, the turbo pump cannot be accessed.
TE Related No
Data 1 bytes (uchar):
Status:
0 -> Power OFF (power up state)
1 -> Power ON

3.4.2.2.2.28 SET_CRYOSTAT_GATE_VALVE_STATE

Assembly CRYOSTAT
Name SET_CRYOSTAT_GATE_VALVE_STATE
RCA Offset See [AD4]
Description Open or close the gate valve.
If the backing pump is not enabled nothing happens and the Hardware Blocked Error (See Table 6) is returned if a monitor request is sent to this RCA since, in this condition, the gate valve cannot be accessed.
TE Related No
Data 1 bytes (uchar):
Status:
0 -> Close (power up state)
1 -> Open

3.4.2.2.2.29 SET_CRYOSTAT_SOLENOID_VALVE_STATE

Assembly CRYOSTAT



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Name SET_CRYOSTAT_SOLENOID_VALVE_STATE
RCA Offset See [AD4]
Description Open or close the solenoid valve.
If the backing pump is not enabled nothing happens and the Hardware Blocked Error (See Table 6) is returned if a monitor request is sent to this RCA since, in this condition, the solenoid valve cannot be accessed.
TE Related No
Data 1 bytes (uchar):
Status:
0 -> Close (power up state)
1 -> Open

3.4.2.2.2.30 SET_CRYOSTAT_VACUUM_GAUGE_ENABLE

Assembly CRYOSTAT
Name SET_CRYOSTAT_VACUUM_GAUGE_ENABLE
RCA Offset See [AD4]
Description Enable power to the vacuum gauge.
TE Related No
Data 1 bytes (uchar):
Status:
1 -> Power ON (power up state)
0 -> Power OFF



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3.4.2.2.2.2.31 SET_LPR_OPT_SWITCH_PORT

Assembly LPR
Name SET_LPR_OPT_SWITCH_PORT
RCA Offset See [AD4]
Description Set the port selected by the LPR optical switch.
TE Related No
Data 1 bytes (uchar):
Current mapping: Selected cartridge band – 1.
Selecting a port will automatically disable the shutter.

3.4.2.2.2.2.32 SET_LPR_OPT_SWITCH_SHUTTER

Assembly LPR
Name SET_LPR_OPT_SWITCH_SHUTTER
RCA Offset See [AD4]
Description Disable the output from LPR optical switch.
TE Related No
Data 1 bytes (uchar):
Dummy payload. A message to this RCA will disable the output. After this the readout of the port state should return 0xFF. The shutter can only be enabled. To disable the shutter is necessary to select a port with the SET_LPR_OPT_SWITCH_PORT command.

3.4.2.2.2.2.33 SET_LPR_OPT_SWITCH_FORCE_SHUTTER

Assembly LPR
Name SET_LPR_OPT_SWITCH_FORCE_SHUTTER
RCA Offset See [AD4]
Description Disable the output from LPR optical switch (forced mode)..
TE Related No
Data 1 bytes (uchar):
Dummy payload. A message to this RCA will disable the output. The forced mode will ignore the busy state of the optical switch. After this the readout of the port state should return 0xFF. The shutter can only be enabled. To disable the shutter is necessary to select a port with the SET_LPR_OPT_SWITCH_PORT command.

3.4.2.2.2.2.34 SET_LPR_EDFA_MODULATION_INPUT_VALUE

Assembly LPR
Name SET_LPR_EDFA_MODULATION_INPUT_VALUE
RCA Offset See [AD4]
Description Set the modulation input value for the EDFA.
TE Related No



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Data *4 bytes (float):*
 Modulation input in V

3.4.2.2.2.35 SET_LPR_MODULATION_INPUT_SPECIAL_DAC_RESET_STROBE

Assembly LPR
Name SET_LPR_MODULATION_INPUT_SPECIAL_DAC_RESET_STROBE
RCA Offset See [AD4]
Description Send a reset strobe to the LPR DAC
 Note: This is implemented for debug purposes only.
TE Related No
Data *1 bytes (uchar):*
 Dummy



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4 Safety

No monitor and control activity addressed to the FE shall cause incorrect or dangerous conditions in the FE equipment.



5 Appendix A – Error codes description

The following table describes the meaning of the Module and Error codes that will be returned when using the relative special monitor messages.

Module	Module Description	Error	Error Description
0x00	Error library	0x01	Warning: not enough memory for error reporting. Error reporting disabled.
		0x02	Warning: error redirecting stderr.
0x01	CPU AMD ELAN SC520	0x01	Error: The aliasing of MMCR is not enabled. The SSI configuration registers cannot be addressed.
		0x02	Error: The aliasing of MMCR is out of the Real Mode range (>1MB)
0x02	Parallel Port	0x01	Warning: The IRQ for the parallel port was disable.
		0x02	Error: The IRQ number for the parallel port is out of range
		0x03	Warning: Waiting for AMBSI to get ready for parallel communication
0x03	CAN	0x01	Error: The required RCA class is outside the allowed range
		0x02	Error: The addressed Front End module is outside the allowed range
		0x03	Warning: The RCA of the received monitor message is out of the defined range
		0x04	Warning: The RCA of the received control message is out of the defined range
		0x05	Warning: The RCA of the received special monitor message is out of the defined range
		0x06	Warning: The RCA of the received special control message is out of the defined range
0x04	Cartridge	0x01	Error: The addressed cartridge is not installed in the Dewar
		0x02	Error: The addressed subsystem is out of the defined range
		0x03	Error: The addressed LO and cartridge temperature module is out of the defined range
		0x04	Error: The addressed Cartridge temperature module is out of the defined range
		0x05	Error: The addressed BIAS module is out of the defined range



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		0x06	Error: The addressed cartridge is not powered
0x05	Cartridge Temperature Sensor	0x01	Error: The addressed cartridge temperature sensor is not installed
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored cartridge temperature is in the error range
		0x05	Warning: The monitored cartridge temperature is in the warning range
0x06	LO	0x01	Error: The LO in the cartridge is not installed
		0x02	Error: The addressed LO submodule is out of range
		0x03	Warning: The addressed hardware is not properly defined yet. Firmware needs updating.
0x07	PLL	0x01	Error: The addressed PLL submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored PLL lock detect voltage is in the error range
		0x05	Warning: The monitored PLL lock detect voltage is in the warning range
		0x06	Error: The monitored PLL correction voltage is in the error range
		0x07	Warning: The monitored PLL correction voltage is in the warning range
		0x08	Error: The monitored PLL assembly temperature is in the error range
		0x09	Warning: The monitored PLL assembly temperature is in the warning range
		0x0A	Error: The monitored YIG heater current is in the error range
		0x0B	Warning: The monitored YIG heater current is in the warning range
		0x0C	Error: The monitored PLL reference total power is in the error range
		0x0D	Warning: The monitored PLL reference total power is in the warning range
0x0E	Error: The monitored PLL if total power is in the error range		



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		0x0F	Warning: The monitored PLL if total power is in the warning range
		0x10	Error: The monitored unlock detect latch bit is in the error range
		0x11	Warning: The monitored unlock detect latch bit is in the warning range
0x08	YTO	0x01	Error: The commanded YTO coarse tune set point is out of the allowed range
		0x02	Error: The monitored YTO coarse tune is in the error range
		0x03	Warning: The monitored YTO coarse tune is in the warning range
0x09	Photomixer	0x01	Error: The addressed Photomixer submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored photomixer voltage is in the error range
		0x05	Warning: The monitored photomixer voltage is in the warning range
		0x06	Error: The monitored photomixer current is in the error range
		0x07	Warning: The monitored photomixer current is in the warning range
0x0A	AMC	0x01	Error: The addressed AMC submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored AMC gate A voltage is in the error range
		0x05	Warning: The monitored AMC gate A voltage is in the warning range
		0x06	Error: The monitored AMC drain A voltage is in the error range
		0x07	Warning: The monitored AMC drain A voltage is in the warning range
		0x08	Error: The monitored AMC drain A current is in the error range
		0x09	Warning: The monitored AMC drain A current is in the warning range
		0x0A	Error: The monitored AMC gate B voltage is



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			in the error range
	0x0B	Warning: The monitored AMC gate B voltage is in the warning range	
	0x0C	Error: The commanded AMC drain B voltage set point is out of the allowed range	
	0x0D	Error: The monitored AMC drain B voltage is in the error range	
	0x0E	Warning: The monitored AMC drain B voltage is in the warning range	
	0x0F	Error: The monitored AMC drain B current is in the error range	
	0x10	Warning: The monitored AMC drain B current is in the warning range	
	0x11	Error: The commanded AMC multiplier D voltage set point is out of the allowed range	
	0x12	Error: The monitored AMC multiplier D current is in the error range	
	0x13	Warning: The monitored AMC multiplier D current is in the warning range	
	0x14	Error: The commanded AMC gate E voltage set point is out of the allowed range	
	0x15	Error: The monitored AMC gate E voltage is in the error range	
	0x16	Warning: The monitored AMC gate E voltage is in the warning range	
	0x17	Error: The commanded AMC drain E voltage set point is out of the allowed range	
	0x18	Error: The monitored AMC drain E voltage is in the error range	
	0x19	Warning: The monitored AMC drain E voltage is in the warning range	
	0x1A	Error: The monitored AMC drain E current is in the error range	
	0x1B	Warning: The monitored AMC drain E current is in the warning range	
	0x1C	Error: The monitored AMC 3V supply voltage is in the error range	
	0x1D	Warning: The monitored AMC 3V supply voltage is in the warning range	
	0x1E	Error: The monitored AMC 5V supply voltage is in the error range	



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		0x1F	Warning: The monitored AMC 5V supply voltage is in the warning range
0x0B	PA	0x01	Error: The addressed PA submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored PA 3V power supply voltage is in the error range
		0x05	Warning: The monitored PA 5V power supply voltage is in the warning range
0x0C	PA Channel	0x01	Error: The addressed PA channel submodule is out of range
		0x02	Error: The commanded PA gate voltage set point is out of the allowed range
		0x03	Error: The monitored PA channel gate voltage is in the error range
		0x04	Warning: The monitored PA channel gate voltage is in the warning range
		0x05	Error: The commanded PA drain voltage set point is out of the allowed range
		0x06	Error: The monitored PA channel drain voltage is in the error range
		0x07	Warning: The monitored PA channel drain voltage is in the warning range
		0x08	Error: The control message is out of range
		0x09	Error: The monitor message is out of range
		0x0A	Error: The monitored PA channel drain current is in the error range
		0x0B	Warning: The monitored PA channel drain current is in the warning range
		0x0C	Warning: The addressed hardware is not properly defined yet. Firmware needs updating.
		0x0D	Polarization
0x02	Error: The addressed polarization submodule is out of range		
0x0E	Sideband	0x01	Error: The required sideband is not installed
		0x02	Error: The addressed sideband submodule is out of range
0x0F	LNA led	0x01	Error: The required LNA led is not installed
0x10	SIS Heater	0x01	Error: The required SIS Heater is not installed



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		0x02	Error: The addressed SIS heater submodule is out of range
		0x03	Error: The monitored SIS heater current is in the error range
		0x04	Warning: The monitored SIS heater current is in the warning range
		0x05	Error: The control message is out of range
		0x06	Error: The monitor message is out of range
		0x07	Error: The heater on band9 cannot be turned on until the timer has expired
0x11	Schottky Mixer	0x01	Error: The required Schottky Mixer is not installed
0x12	SIS	0x01	Error: The required SIS is not installed
		0x02	Error: The addressed SIS submodule is out of range
		0x03	Error: The commanded SIS voltage set point is out of the allowed range
		0x04	Error: The monitored SIS voltage is in the error range
		0x05	Warning: The monitored SIS voltage is in the warning range
		0x06	Error: The monitored SIS current is in the error range
		0x07	Warning: The monitored SIS current is in the warning range
		0x08	Error: The control message is out of range
		0x09	Error: The monitor message is out of range
0x13	SIS magnet	0x01	Error: The required SIS magnet is not installed
		0x02	Error: The addressed SIS magnet submodule is out of range
		0x03	Error: The monitored SIS Magnet voltage is in the error range
		0x04	Warning: The monitored SIS Magnet voltage is in the warning range
		0x05	Error: The monitored SIS Magnet current is in the error range
		0x06	Warning: The monitored SIS Magnet current is in the warning range
		0x07	Error: The commanded SIS Magnet current set point is out of the allowed range
		0x08	Error: The control message is out of range



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		0x09	Error: The monitor message is out of range
0x14	LNA	0x01	Error: The required LNA is not installed
		0x02	Error: The addressed LNA submodule is out of range
		0x01	Error: The required LNA stage is not installed
0x15	LNA stage	0x02	Error: The addressed LNA stage submodule is out of range
		0x03	Error: The monitored LNA stage gate voltage is in the error range
		0x04	Warning: The monitored LNA stage gate voltage is in the warning range
		0x05	Error: The monitored LNA stage drain voltage is in the error range
		0x06	Warning: The monitored LNA stage drain voltage is in the warning range
		0x07	Error: The monitored LNA stage drain current is in the error range
		0x08	Warning: The monitored LNA stage drain current is in the warning range
		0x09	Error: The commanded LNA stage drain voltage set point is out of the allowed range
		0x0A	Error: The commanded LNA stage drain current set point is out of the allowed range
		0x10	Error: The control message is out of range
		0x11	Error: The monitor message is out of range
		0x16	Polarization Special Messages
0x17	Polarization DAC	0x01	Error: The addressed polarization DAC submodule is out of range
		0x02	Error: The addressed polarization DAC submodule doesn't accept clear strobes
		0x03	Error: The monitor message is out of range
0x18	Serial Interface	0x01	Error: The selected command word is out of range
0x19	Serial Mux Board	0x01	Error: The selected data length is out of range
		0x02	Error: Timeout while waiting for the board to become ready
		0x03	Error: The FPGA is not ready for communication
0x1A	Timer Module	0x01	Error: The asynchronous timer is already running



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		0x02	Error: The required asynchronous timer is out of range
0x1B	Bias Serial Interface Module	0x01	Error: Timeout while waiting for the BIAS ADC to become ready
		0x02	Error: Timeout while waiting for the BIAS DAC1 to become ready
0x1C	LO Serial Interface Module	0x01	Error: Timeout while waiting for the LO ADC to become ready
0x1D	Power distribution	0x01	Error: The addressed power distribution submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
0x1E	Power distribution module	0x01	Error: The addressed power distribution module submodule is out of range
		0x02	Error: The cartridge corresponding to the addressed power distribution module is not installed in the Dewar
		0x03	Error: The maximum allowed number of powered cartridges is already turned on
0x1F	Power distribution channel	0x01	Error: The addressed power distribution channel submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored power distribution channel voltage is in the error range
		0x05	Warning: The monitored power distribution channel voltage is in the warning range
		0x06	Error: The monitored power distribution channel current is in the error range
		0x07	Warning: The monitored power distribution current is in the warning range
0x20	PD Serial Interface Module	0x01	Error: Timeout while waiting for the PD ADC to become ready
0x21	IF Channel	0x01	Error: The addressed IF channel submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored IF channel assembly temperature is in the error range
		0x05	Warning: The monitored IF channel assembly temperature is in the warning range



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		0x06	Error: The commanded IF channel attenuation set point is out of the allowed range
		0x07	Error: The temperature servo is OFF: Monitoring of temperature disabled.
0x22	IF Switch	0x01	Error: The addressed IF Switch submodule is out of range
		0x02	Error: The commanded IF switch band select is out of the allowed range
0x23	IF Switch Serial Interface Module	0x01	Error: Timeout while waiting for the IF Switch ADC to become ready
0x24	Cryostat	0x01	Error: The addressed Cryostat submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored 230V supply current is in the error range
		0x05	Warning: The monitored 230V supply current is in the warning range
		0x06	Warning: The backing pump is OFF. Supply current monitoring disabled.
0x25	Turbo Pump	0x01	Error: The addressed Turbo Pump submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored turbo pump state is in the error range
		0x05	Warning: The monitored turbo pump state is in the warning range
		0x06	Error: The monitored turbo pump speed is in the error range
		0x07	Warning: The monitored turbo pump speed is in the warning range
		0x08	Warning: The backing pump is OFF. Turbo pump disabled.
0x26	Vacuum Controller	0x01	Error: The addressed Vacuum Controller submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored vacuum controller state is in the error range
		0x05	Warning: The monitored vacuum controller



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			state is in the warning range
0x27	Gate Valve	0x01	Error: The monitored gate valve state is in the error range
		0x02	Warning: The monitored gate valve state is in the warning range
		0x03	Warning: The backing pump is OFF. Gate valve disabled.
0x28	Solenoid Valve	0x01	Error: The monitored solenoid valve state is in the error range
		0x02	Warning: The monitored solenoid valve state is in the warning range
		0x03	Warning: The backing pump is OFF. Solenoid valve disabled.
		0x04	Warning: The solenoid valve is controlled by the interlock system and closed.
0x29	Vacuum Sensor	0x01	Error: The control message is out of range
		0x02	Error: The monitor message is out of range
		0x03	Error: The monitored vacuum sensor pressure is in the error range
		0x04	Warning: The monitored vacuum sensor pressure is in the warning range
0x2A	Cryostat temperature	0x01	Error: The control message is out of range
		0x02	Error: The monitor message is out of range
		0x03	Error: The monitored cryostat temperature is in the error range
		0x04	Warning: The monitored cryostat temperature is in the warning range
0x2B	Cryostat Serial Interface Module	0x01	Error: Timeout while waiting for the Cryostat ADC to become ready
0x2C	EDFA Modulation Input	0x01	Error: The commanded EDFA modulation input value is out of the allowed range
		0x02	Error: The addressed modulation input submodule is out of range
0x2D	EDFA detector Photo	0x01	Error: The addressed EDFA photo detector submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored EDFA photodetector current is in the error range
		0x05	Warning: The monitored EDFA photodetector current is in the warning range



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		0x06	Error: The monitored EDFA photodetector power is in the error range
		0x07	Warning: The monitored EDFA photodetector power is in the warning range
0x2E	EDFA Laser	0x01	Error: The addressed EDFA laser submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored pump temperature is in the error range
		0x05	Warning: The monitored pump temperature is in the warning range
		0x06	Error: The commanded laser drive current set point is out of the allowed range
		0x07	Error: The monitored laser drive current is in the error range
		0x08	Warning: The monitored laser drive current is in the warning range
		0x09	Error: The monitored laser photo detector current is in the error range
		0x0A	Warning: The monitored laser photo detector current is in the warning range
0x2F	EDFA	0x01	Error: The addressed EDFA submodule is out of range
		0x02	Error: The control message is out of range
		0x03	Error: The monitor message is out of range
		0x04	Error: The monitored EDFA driver status is in the error range
		0x05	Warning: The monitored EDFA driver status is in the warning range
0x30	Optical switch	0x01	Error: The addressed Optical Switch submodule is out of range
		0x02	Error: The commanded Optical Switch port is out of the allowed range
		0x03	Error: The control message is out of range
		0x04	Error: The monitor message is out of range
		0x05	Error: The monitored optical switch state is in the error range
		0x06	Warning: The monitored optical switch state is in the warning range
		0x07	Error: The monitored optical switch busy state



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			is in the error range
		0x08	Warning: The monitored optical switch busy state is in the warning range
		0x09	Timed out while waiting for ready signal during initialization
0x31	LPR	0x01	Error: The addressed LPR submodule is out of range
0x32	LPR temperature	0x01	Error: The control message is out of range
		0x02	Error: The monitor message is out of range
		0x03	Error: The monitored LPR temperature is in the error range
		0x04	Warning: The monitored LPR temperature is in the warning range
0x33	LPR Serial Interface Module	0x01	Error: Timeout while waiting for the LPR ADC to become ready
		0x02	Error: Optical switch busy
0x34	Modulation Input DAC	0x01	Error: The monitor message is out of range
0x35	INI file access	0x01	Error: The required data was not found in the configuration file.
		0x02	Error: There was an error while opening the required configuration file.
		0x03	Error: The number of returned items doesn't match the required ones.
		0x04	Error: There was an error while handling the required configuration file.
		0x05	Error: There was an error while closing the required configuration file.
		0x06	Error: There was an error while updating the required configuration file.
0x36	One wire bus	0x01	Error: Time out waiting for IRQ
		0x02	Error: Presence pulse not detected
		0x03	Error: Maximum number of devices reached. Check the bus for problems!
		0x04	Error: Time out while resetting the bus.