ATLAS Level-1 Calorimeter Trigger

HUB/ROD DCS

Working document

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Document Change Record

Version	Issue	Date	Comment
0	0	21 February 2019	Initial document layout
0	1	6 March 2019	Input from Dan
0	2	15 March 2019	ROD added

This document describes the HUB/ROD DCS implementation. The initial input to this document is provided in hub_hardware_monitoring_notes.txt and hub_0_ab_power_system.txt.

For the ROD: https://indico.cern.ch/event/724217/

It will serve the base for the google document TDAQ Phase-I DCS - Project Planning.

Link for the CERN WinCCOA course: https://readthedocs.web.cern.ch/display/ICKB/PVSS+Service+Training+PVSS-JCOPFw+Course+Downloads - the slide 129 part 1 contains basic WinCCOA concepts.

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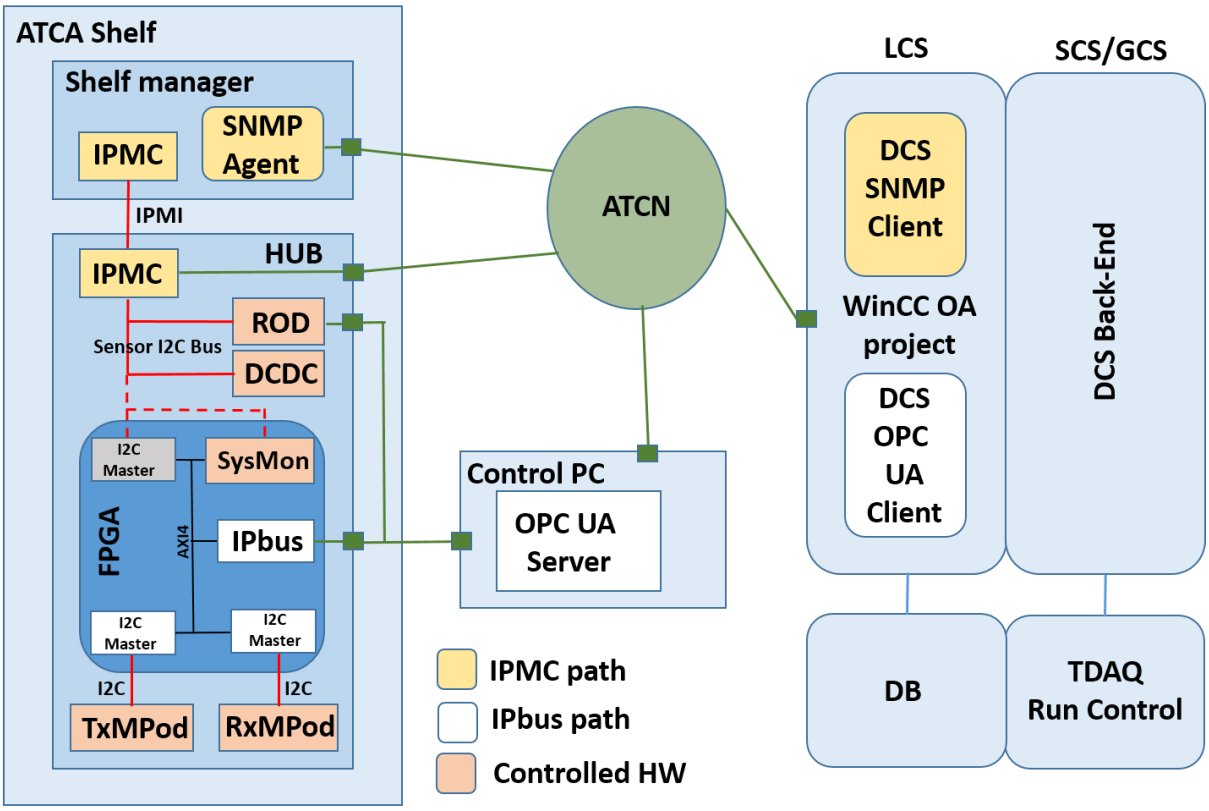
1. INTRODUCTION

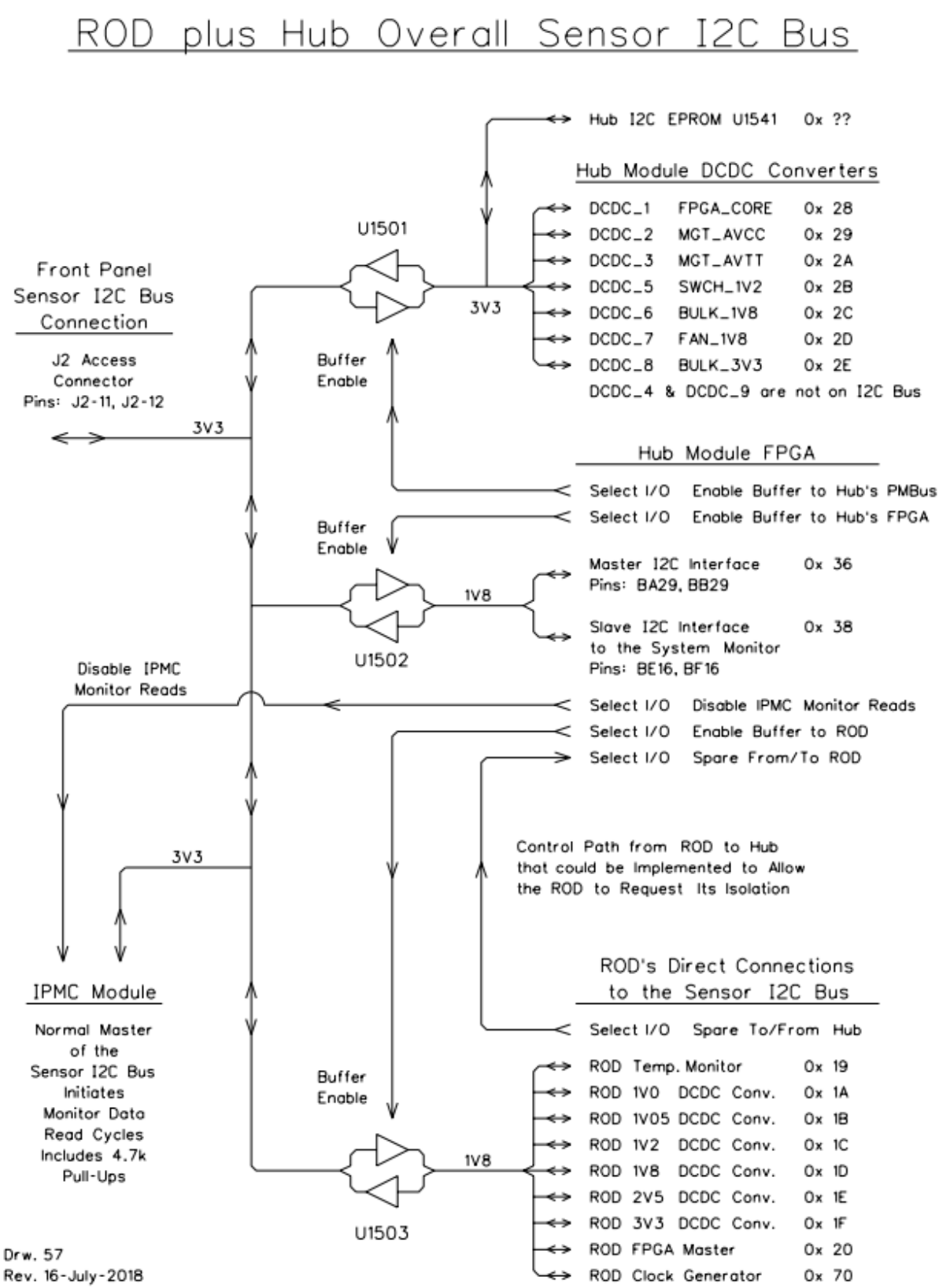
The general diagram of the DCS (Detector Control System) for the Off-detector electronics and the HUB/ROD position in it is presented below:



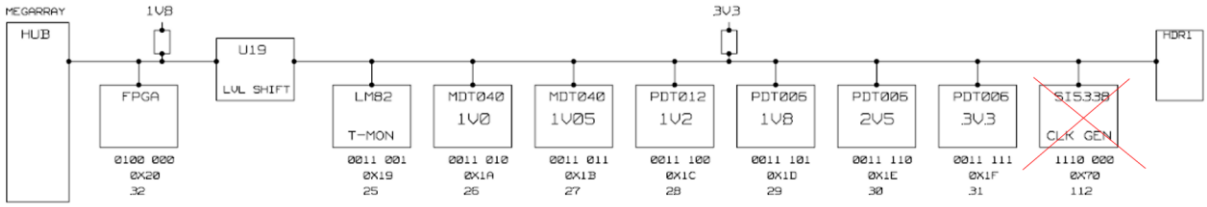
The controlled hardware components of the HUB/ROD module in the ATCA shelf are accessible for DCS control and monitoring via two path:

- Via on-board IPMC card connected via IPMI bus to the SNMP Agent in the ATCA shelf manager and then via ATCN – to the DCS SNMP Client in the WinCC-OA project running on the Local Control Station (LCS).
  The IPMC card via the Sensor I2C Bus can access the 7 DCDC converters and the ROD on the HUB module. The I2C bus slave interface of the HUB FPGA System Monitor may be connected to the Sensor I2C Bus to provide access from the IPMC card during HUB tests but disconnected during normal HUB operation.

- Via IPbus interfaces in the HUB FPGA and in the ROD FPGA connected via local Ethernet network to the OPC UA Server in the Control PC and then via ATCN – to the DCS OPC UA Client in the WinCC-OA project running on the Local Control Station (LCS).
  The IPbus interface in the HUB FPGA has direct access to the HUB FPGA System Monitor and two MiniPODs (via I2C master interfaces and point-to-point connection). One master I2C interface (grey) may be connected to the Sensor I2C Bus to access the DCDC converters from the IPbus during HUB tests but disconnected during normal HUB operation.
  The IPbus interface in the ROD FPGA has direct access to the ROD FPGA XADC and four MiniPODs.


ROD plus Hub Overall Sensor I2C Bus
Hub I2C EPROM U1541 0x ??
Hub Module DCDC Converters
DCDC_1 FPGA_CORE 0x 28
DCDC_2 MGT_AVCC 0x 29
DCDC_3 MGT_AVTT 0x 2A
DCDC_5 SWCH_1V2 0x 2B
DCDC_6 BULK_1V8 0x 2C
DCDC_7 FAN_1V8 0x 2D
DCDC_8 BULK_3V3 0x 2E
DCDC_4 & DCDC_9 are not on I2C Bus
U1501
3V3
Front Panel Sensor I2C Bus Connection
J2 Access Connector
Pins: J2-11, J2-12
3V3
Buffer Enable
Hub Module FPGA
Select I/O Enable Buffer to Hub's PMBus
Select I/O Enable Buffer to Hub's FPGA
Buffer Enable
Master I2C Interface 0x 36
Pins: BA29, BB29
1V8
Slave I2C Interface 0x 38
to the System Monitor
Pins: BE16, BF16
U1502
Disable IPMC Monitor Reads
Select I/O Disable IPMC Monitor Reads
Select I/O Enable Buffer to ROD
Select I/O Spare From/To ROD
Control Path from ROD to Hub
that could be Implemented to Allow
the ROD to Request Its Isolation
3V3
ROD's Direct Connections to the Sensor I2C Bus
IPMC Module
Normal Master of the Sensor I2C Bus Initiates Monitor Data Read Cycles Includes 4.7k Pull-Ups
Select I/O Spare To/From Hub
Buffer Enable
ROD Temp. Monitor 0x 19
ROD 1V0 DCDC Conv. 0x 1A
ROD 1V05 DCDC Conv. 0x 1B
ROD 1V2 DCDC Conv. 0x 1C
ROD 1V8 DCDC Conv. 0x 1D
ROD 2V5 DCDC Conv. 0x 1E
ROD 3V3 DCDC Conv. 0x 1F
ROD FPGA Master 0x 20
ROD Clock Generator 0x 70
1V8
U1503
Drw. 57
Rev. 16-July-2018

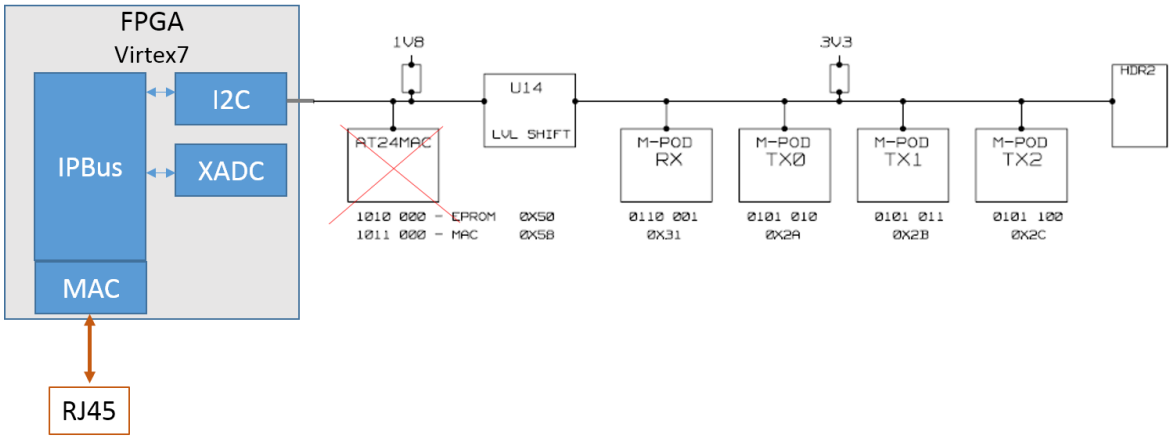
ROD Sensor I2C bus structure for IPMC Monitoring is shown below:



The IPMC card on the HUB via the Sensor I2C Bus (on the left side on the above diagram) can access an LM82 temperature sensor and six DCDC converters (temperature and voltage). The clock chip on the Sensor I2C bus can be ignored by DCS monitoring.

The ROD FPGA master I2C interface may be connected to the Sensor I2C Bus to access the temperature sensor and the DCDC converters from the IPbus during ROD tests but disconnected during normal HUB/ROD operation.

ROD IPBus Monitoring is shown below:



The ROD IPbus monitoring targets include the ROD FPGA XADC, one Rx and three Tx MiniPODs (temperature and voltage) sharing one I2C bus. The novo memory chip on the I2C bus can be ignored by DCS.

2. HUB/ROD HARDWARE PARAMETERS THAT CAN BE MONITORED

ROC - Recommended Operating Conditions, AMR - Absolute Maximum Rating.

2.1. HUB POWER ENTRY MODULE PARAMETERS

This information is included in this document for information only. For now proposal is NOT monitor any data from the HUB's Power Entry Module.

The HUB Power Entry Module SynQor IQ65033QMA10SNF-G accessible via IPMC Management I2C Bus. The data-sheet for this component is available here (see pages 12 and 13).

Parameter	Scaling Factor	ROC	AMR	Register address
Status bits	N/A			0x1E
HU_CAP	0.398 V/bit	50 - 95 V	100 V	0x1F
-48V_Current	0.094 A/bit			0x21
-48V_A	0.325 V/bit			0x22
-48V_B	0.325 V/bit			0x23
Temperature	(1.961 ºC/bit) – 50 ºC	-40 - 100 °C		0x28

2.2. HUB/ROD DCDC CONVERTERS PARAMETERS

The Hub Module uses seven GE (Lineage Power) DCDC Converters and the ROD card on the HUB uses six GE (Lineage Power) DCDC converters that can be monitored from the IPMC Sensor I2C Bus.

The details of the I2C read cycles to access the raw binary monitoring data from these converters and the arithmetic that is required to convert this data into engineering units can be found here:

- ge_mega__d_lynx_40_amp_pmbus_MDT040A0X.pdf
- ge_micro_d_lynx_20_amp_pmbus_UDT020A0X.pdf
- ge_pico__d_lynx_12_amp_pmbus_PDT012A0X.pdf
- ti_pmbus_buck_controller_tps40400.pdf

There are many registers that we could read and monitor in these DCDC converters. Reading some of this information requires doing I2C write cycles to clear (or reset) certain status bits in some registers. Because the operation of these converters (e.g. their output voltage) is controlled by information that is stored in these I2C Bus visible registers, we ever want the IPMC doing any write cycles or poking around on the I2C Bus more than is necessary to carry out a minimum rational DCS monitoring.

The DCDC Converters report their temperature only by indicating whether it is above pre-programmed warning and fault levels.

In addition, note that the ISO_12V supply (12.000 V) can only be indirectly monitored from the I2C Sensor Bus by reading the input voltage to the DCDC Converters that are feed by it (e.g. DCDC1).

HUB DCDC1 (FPGA-CORE): GE MDT040A0X3-SRPHZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vin	12.000 V	4.5 – 14.4 V	15 V	hub_dcdc1_vin
Vout	0.950 V	-1% - +1%	-3% - +3%	hub_dcdc1_vout
Iout	20.8 A	< 30 A	40 A	hub_dcdc1_iout
Temperature	xx °C		-40 - 105 °C	hub_dcdc1_temp

HUB DCDC2 (MGT_AVCC): GE UDT020A0X3-SRZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.000 V			hub_dcdc2_vout
Iout	10.8 A	< 15 A	20 A	hub_dcdc2_iout
Temperature	xx °C			hub_dcdc2_temp

HUB DCDC3 (MGT_AVTT): GE UDT020A0X3-SRZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.200 V			hub_dcdc3_vout
Iout	10.0 A	< 15 A	20 A	hub_dcdc3_iout
Temperature	xx °C			hub_dcdc3_temp

HUB DCDC5 (MGT_AVTT): GE PDT012A0X3-SRZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.200 V			hub_dcdc5_vout
Iout	4.0 A	< 5 A	12 A	hub_dcdc5_iout
Temperature	xx °C			hub_dcdc5_temp

HUB DCDC6 (BULK_1V8): GE PDT012A0X3-SRZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.800 V			hub_dcdc6_vout
Iout	3.0 A	< 5 A	12 A	hub_dcdc6_iout
Temperature	xx °C			hub_dcdc6_temp

HUB DCDC7 (FAN_1V8): GE UDT020A0X3-SRZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vin	12.000 V			dcdc7_vin
Vout	1.800 V			hub_dcdc7_vout
Iout	13.0 A	< 15 A	20 A	hub_dcdc7_iout
Temperature	xx °C			hub_dcdc7_temp

HUB DCDC8 (BULK_3V3): GE PDT012A0X3-SRZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	3.300 V			dcdc8_vout
Iout	4.6 A	< 5 A	12 A	hub_dcdc8_iout
Temperature	xx °C			hub_dcdc8_temp

ROD DCDC1: GE MDT040

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.000 V			rod_dcdc1_vout
Iout	10.75 A	< 30 A	40 A	rod_dcdc1_iout
Temperature	xx °C	< 95 °C		rod_dcdc1_temp

ROD DCDC2: GE MDT040

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.050 V			rod_dcdc2_vout
Iout	18.3 A	< 30 A	40 A	rod_dcdc2_iout
Temperature	xx °C	< 95 °C		rod_dcdc2_temp

ROD DCDC3: GE PDT012

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.200 V			rod_dcdc3_vout
Iout	4.2 A	< 10 A	12 A	rod_dcdc3_iout
Temperature	xx °C	< 95 °C		rod_dcdc3_temp

ROD DCDC4: GE PDT006

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	1.800 V			rod_dcdc4_vout
Iout	0.3 A	< 5 A	6 A	rod_dcdc4_iout
Temperature	xx °C	< 95 °C		rod_dcdc4_temp

ROD DCDC5: GE PDT006

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	2.500 V			rod_dcdc5_vout
Iout	1.4 A	< 5 A	6 A	rod_dcdc5_iout
Temperature	xx °C	< 95 °C		rod_dcdc5_temp

ROD DCDC6: GE PDT006

Parameter	Nominal	ROC	AMR	Variable (DPE)
Vout	3.300 V			rod_dcdc6_vout
Iout	1.3 A	< 5 A	6 A	rod_dcdc6_iout
Temperature	xx °C	< 95 °C		rod_dcdc6_temp

2.3. ROD TEMPERATURE SENSOR PARAMETERS

The IPMC card on the HUB via the Sensor I2C Bus can access an LM82 temperature sensor on the ROD mezzanine card.

ROD Temperature Sensor: LM82

Parameter	Nominal	ROC	AMR	Variable (DPE)
Local Temperature	xx °C	-40 - 125 °C	-65 - 150 °C	rod_lm82_local
Remote Temperature	xx °C	-40 - 125 °C	-65 - 150 °C	rod_lm82_remote

2.4. HUB/ROD FPGA PARAMETERS

From the HUB FPGA SysMon only the FPGA's Si Temperature is read via the FPGA IPbus interface.

HUB FPGA SysMon: XCVU125-1FLVC2104C

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature	50 °C	-40 - 100 °C	125 °C	hub_fpga_temp
Vccint	0.95 V	0.922 - 0.979 V	-0.50 - 1.10 V	*
Vccaux	1.80 V	1.746 - 1.854	-0.50 - 2.00 V	**

Note that the other voltage monitors available in the FPGA SysMon (e.g. VBRAM) are just copies of the above supply voltages and do not need to be repeated in the HUB monitoring.
* - can be read from DCDC1 (FPGA_CORE) as “hub_dcdc1_vout” Data Point
** - can be read from DCDC6 (BULK_1V8) as “hub_dcdc6_vout” Data Point

There is also status information in the HUB's FPGA that might be of interest to the DCS system. This is hardware level information that indicates whether the HUB Module is operating normally. The following items could be made visible for the DCS via IPbus interface:

- Locked Status of the 2 PLLs on the Hub Module
- Status of the Power Control signals between the HUB and ROD
- Status of the “All Power Good” signal on the HUB Module.

The ROD IPbus monitoring targets include the ROD FPGA XADC.

ROD FPGA XADC: XC7VX550T-2 (XC7VX690T)

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature	60 °C	-40 - 100 °C	125 °C	rod_fpga_temp
Vccint	1.00 V	0.97 - 1.03 V	-0.50 - 1.10 V	rod_fpga_vccint
Vccaux	1.80 V	1.71 - 1.89 V	-0.50 - 2.00 V	rod_fpga_vccaux

2.5. HUB/ROD MINIPOD PARAMETERS

Only four of the 12 channels from the Receiver MiniPOD are connected to MGT receivers in the Hub’s FPGA. The connected Receiver MiniPOD fibres are 2, 4, 6, 8.

HUB Rx MiniPOD: AFBR-821VxyZ (10 Gbps)

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature		0 – 70 °C	85 °C	hub_mp_rx_temp
Vcc25	2.500 V	2.375 - 2.625 V	–0.500 - 3.000 V	hub_mp_rx_vcc25
Vcc33	3.300 V	3.135 - 3.465 V	–0.500 - 4.000 V	hub_mp_rx_vcc33
Icc25		350 - 525 mA		hub_mp_rx_icc25
Icc33		48 – 90 mA		hub_mp_rx_icc33
OMA		max +3 dBm		hub_mp_rx_oma

Only eight of the 12 channels in the Transmitter MiniPOD are connected to MGT transmitters in the Hub's FPGA. The connected Transmitter MiniPOD fibres are 0, 1, 2, 4, 6, 8, 10, 11.

HUB Tx MiniPOD: AFBR-811VxyZ (10 Gbps)

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature		0 – 70 °C	85 °C	hub_mp_tx_temp
Vcc25	2.500 V	2.375 - 2.625 V	–0.500 - 3.000 V	hub_mp_tx_vcc25
Vcc33	3.300 V	3.135 - 3.465 V	–0.500 - 4.000 V	hub_mp_tx_vcc33
Icc25		280 - 365 mA		hub_mp_tx_icc25
Icc33		105 – 185 mA		hub_mp_tx_icc33
$P_{O\ AVE}$		-7.6 – 2.4 dBm		hub_mp_tx_poave

ROD Rx MiniPOD: AFBR-821VxyZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature		0 – 70 °C	85 °C	rod_mp_rx_temp
Vcc25	2.500 V	2.375 - 2.625 V	–0.500 - 3.000 V	rod_mp_rx_vcc25
Vcc33	3.300 V	3.135 - 3.465 V	–0.500 - 4.000 V	rod_mp_rx_vcc33
Icc25		350 - 525 mA		rod_mp_rx_icc25
Icc33		48 – 90 mA		rod_mp_rx_icc33
OMA		max +3 dBm		rod_mp_rx_oma

ROD Tx1 MiniPOD: AFBR-811VxyZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature		0 – 70 °C	85 °C	rod_mp_tx1_temp
Vcc25	2.500 V	2.375 - 2.625 V	–0.500 - 3.000 V	rod_mp_tx1_vcc25
Vcc33	3.300 V	3.135 - 3.465 V	–0.500 - 4.000 V	rod_mp_tx1_vcc33
Icc25		280 - 365 mA		rod_mp_tx1_icc25
Icc33		105 – 185 mA		rod_mp_tx1_icc33
$P_{O\ AVE}$		-7.6 – 2.4 dBm		rod_mp_tx1_poave

ROD Tx2 MiniPOD: AFBR-811VxyZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature		0 – 70 °C	85 °C	rod_mp_tx2_temp
Vcc25	2.500 V	2.375 - 2.625 V	–0.500 - 3.000 V	rod_mp_tx2_vcc25
Vcc33	3.300 V	3.135 - 3.465 V	–0.500 - 4.000 V	rod_mp_tx2_vcc33
Icc25		280 - 365 mA		rod_mp_tx2_icc25
Icc33		105 – 185 mA		rod_mp_tx2_icc33
$P_{O\ AVE}$		-7.6 – 2.4 dBm		rod_mp_tx2_poave

ROD Tx3 MiniPOD: AFBR-811VxyZ

Parameter	Nominal	ROC	AMR	Variable (DPE)
Temperature		0 – 70 °C	85 °C	rod_mp_tx3_temp
Vcc25	2.500 V	2.375 - 2.625 V	–0.500 - 3.000 V	rod_mp_tx3_vcc25
Vcc33	3.300 V	3.135 - 3.465 V	–0.500 - 4.000 V	rod_mp_tx3_vcc33
Icc25		280 - 365 mA		rod_mp_tx3_icc25
Icc33		105 – 185 mA		rod_mp_tx3_icc33
$P_{O\ AVE}$		-7.6 – 2.4 dBm		rod_mp_tx3_poave

3. DATA POINTS AND DATA POINT ELEMENTS

Old-style control systems used flat namespaces of variables ("tags") to represent the physical quantities being monitored and controlled. Experience showed that these systems were very difficult to maintain.

"Device Orientation" means that variables can be grouped, allocated in memory and used collectively. The group description is the "Data Point Type" (DPT), an instance in memory is a "Data Point" (DP) and the individual variables themselves are now referred to as "Data Point Elements" (DPEs).

Therefore, for the HUB/ROD, the DPTs are DCDC, FPGA, RXMPOD, TXMPOD, LM82 – the physical components on the board.

The Data Point Elements are individual variables for the DPTs (see tables in chapter 2). For the DCS operation, the range of the values for the DPE (min – max) is set in order to define the status of the DPE and to trigger different actions by the DCS.

The following table extracted from the page 7 of the ATLAS DCS FSM Integration Guideline:

STATUS	
OK	System working fine.
WARNING	Low severity. The system can go on working. To fix in the following working hours.
ERROR	High severity. Serious error for the functioning of the system. To be fixed ASAP.
FATAL	Very high severity. The system cannot work. Run away!!!

For the HUB/ROD we will use only "OK", "WARNING" and "ERROR". The range of the values (min – max) is derived from the Nominal value and the Recommended Operating Conditions (ROC) for the components.

- **OK** – this is the normal operation condition, generally ± (5-10)% around the nominal value.
- **WARNING** - outside of OK range and close to problematic range, yet still safe but indicate a problem might be coming.
- **ERROR** - outside of safe range, the component may not be operational and the system is not functioning (like temperature sensor in DCDC or so...).

Data Points can be accessed via IPMC card Sensor I2C Bus or via the IPbus interface in the FPGA.

During the normal operation, data points shall be in the "OK" value range and should not require any specific actions. Upon data point coming to the "WARNING" or "ERROR" value range, an action may require.

- **OK** – normal operation, no actions required
- **WARNING** – go on, an expert intervention is foreseen.
- **ERROR** – power-off the module.

3.1. DP AND DPE ACCESSIBLE VIA HUB IPMC

DPE for HUB_DCDC1 DP (MDT040)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc1_vin	12.00 V	< 4.5	< 10.8	10.80 - 13.20	> 13.2 V	> 14.4
hub_dcdc1_vout	0.95 V	< 0.92	< 0.93	0.93 - 0.97	> 0.97	> 0.98
hub_dcdc1_iout	20.8 A	< xx	<	20.0 - 21.0	> 21.0	> 30
hub_dcdc1_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for HUB_DCDC2 DP (GE UDT020)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc2_vout	1.00 V	< 0.95	< 0.97	0.97 - 1.03	> 1.03	> 1.05
hub_dcdc2_iout	10.8 A	<	<10.0	10.0 - 15.0	> 15.0	> 18
hub_dcdc2_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for HUB_DCDC3 DP (GE UDT020)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc3_vout	1.20 V	< 1.14	< 1.16	1.16 - 1.24	> 1.24	> 1.26
hub_dcdc3_iout	10.0 A	<	< 9.5	9.5 - 15.0	> 15.0	> 18
hub_dcdc3_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for HUB_DCDC5 DP (GE PDT012)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc5_vout	1.20 V	< 1.12	< 1.14	1.14 - 1.26	> 1.26	> 1.28
hub_dcdc5_iout	4.0 A	<	< 3.5	3.5 - 5.0	> 5.0	> 10
hub_dcdc5_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for HUB_DCDC6 DP (GE PDT012)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc6_vout	1.80 V	< 1.69	< 1.71	1.71 - 1.89	> 1.89	> 1.91
hub_dcdc6_iout	3.0 A	<	< 2.5	2.5 - 5.0	> 5.0	> 10
hub_dcdc6_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for HUB_DCDC7 DP (GE UDT020)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc7_vin	12.00 V	< 4.5	< 10.8	10.80 - 13.20	> 13.2 V	> 14.4
hub_dcdc7_vout	1.80 V	< 1.69	< 1.71	1.71 - 1.89	> 1.89	> 1.91
hub_dcdc7_iout	13.0 A	<	< 12.0	12.0 - 15.0	> 15.0	> 18
hub_dcdc7_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for HUB_DCDC8 DP (GE PDT012)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_dcdc8_vout	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
hub_dcdc8_iout	4.6 A	<	< 3.6	3.6 - 5.0	> 5.0	> 10
hub_dcdc8_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_DCDC1 DP (GE MDT040)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_dcdc1_vout	1.00 V	< 0.95	< 0.97	0.97 - 1.03	> 1.03	> 1.05
rod_dcdc1_iout	10.75 A	<	< 7.0	7.0 - 13.0	> 13.0	> 30
rod_dcdc1_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_DCDC2 DP (GE MDT040)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_dcdc2_vout	1.05 V	< 1.00	< 1.02	1.02 - 1.08	> 1.08	> 1.10
rod_dcdc2_iout	18.3 A	<	< 17.0	17.0 - 20.0	> 20.0	> 30
rod_dcdc2_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_DCDC3 DP (GE PDT012)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_dcdc3_vout	1.20 V	< 1.14	< 1.16	1.16 - 1.24	> 1.24	> 1.26
rod_dcdc3_iout	4.2 A	<	< 7.0	4.0 - 5.0	> 5.0	> 10
rod_dcdc3_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_DCDC4 DP (GE PDT006)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_dcdc4_vout	1.80 V	< 1.69	< 1.71	1.71 - 1.89	> 1.89	> 1.91
rod_dcdc4_iout	0.3 A	<	< 0.2	0.2 - 1.0	> 1.0	> 5
rod_dcdc4_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_DCDC5 DP (GE PDT006)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_dcdc5_vout	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
rod_dcdc5_iout	1.4 A	<	< 1.0	1.0 - 2.0	> 2.0	> 5
rod_dcdc5_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_DCDC6 DP (GE PDT006)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_dcdc6_vout	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
rod_dcdc6_iout	1.3 A	<	< 1.0	1.0 - 2.0	> 2.0	> 5
rod_dcdc6_temp	°C	< 20	< 60	60 – 80	> 90	> 100

DPE for ROD_LM82 DP (LM82)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_lm82_local	°C	<	<	1.0 - 2.0	> 2.0	> 100
rod_lm82_remote	°C	<	<	60 – 80	> 90	> 100

3.2. DP AND DPE ACCESSIBLE VIA HUB/ROD IPBUS

DPE for HUB_FPGA DP (HUB FPGA SysMon)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_fpga_temp	50 °C	< 30	< 45	45.0 - 65.0	> 65.0	> 80

DPE for ROD_FPGA DP (ROD FPGA XADC)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_fpga_temp	60 °C	< 30	< 50	50.0 - 70.0	> 70.0	> 90
rod_fpga_vccint	1.00 V	< 1.69	< 1.71	1.71 - 1.89	> 1.89	> 1.91
rod_fpga_vccaux	1.80 V	< 0.95	< 0.97	0.97 - 1.03	> 1.03	> 1.05

DPE for HUB_RXMPOD DP (HUB Rx MiniPOD AFBR-821VxyZ)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_rxmpod_temp	50 °C	< 30	< 40	40.0 - 70.0	> 70.0	> 80
hub_rxmpod_vcc25	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
hub_rxmpod_vcc33	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
hub_rxmpod_icc25	400 mA	<	< 350	350 – 525	> 525	>
hub_rxmpod_icc33	60 mA	<	< 48	48 - 90	> 90	>
hub_rxmpod_oma	? dBm					

DPE for HUB_TXMPOD DP (HUB Tx MiniPOD AFBR-811VxyZ)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
hub_txmpod_temp	50 °C	< 30	< 40	40.0 - 70.0	> 70.0	> 80
hub_txmpod_vcc25	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
hub_txmpod_vcc33	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
hub_txmpod_icc25	320 mA	<	< 280	280 - 365	> 365	>
hub_txmpod_icc33	145 mA	<	< 105	105 – 185	> 185	>
hub_txmpod_poave	? dBm					

DPE for ROD_RXMPOD DP (HUB Rx MiniPOD AFBR-821VxyZ)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_rxmpod_temp	50 °C	< 30	< 40	40.0 - 70.0	> 70.0	> 80
rod_rxmpod_vcc25	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
rod_rxmpod_vcc33	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
rod_rxmpod_icc25	400 mA	<	< 350	350 – 525	> 525	>
rod_rxmpod_icc33	60 mA	<	< 48	48 - 90	> 90	>
rod_rxmpod_oma	? dBm					

DPE for ROD_TX1MPOD DP (HUB Tx MiniPOD1 AFBR-811VxyZ)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_tx1mpod_temp	50 °C	< 30	< 40	40.0 - 70.0	> 70.0	> 80
rod_tx1mpod_vcc25	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
rod_tx1mpod_vcc33	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
rod_tx1mpod_icc25	320 mA	<	< 280	280 - 365	> 365	>
rod_tx1mpod_icc33	145 mA	<	< 105	105 – 185	> 185	>
rod_tx1mpod_poave	? dBm					

DPE for ROD_TX2MPOD DP (HUB Tx MiniPOD2 AFBR-811VxyZ)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_tx2mpod_temp	50 °C	< 30	< 40	40.0 - 70.0	> 70.0	> 80
rod_tx2mpod_vcc25	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
rod_tx2mpod_vcc33	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
rod_tx2mpod_icc25	320 mA	<	< 280	280 - 365	> 365	>
rod_tx2mpod_icc33	145 mA	<	< 105	105 – 185	> 185	>
rod_tx2mpod_poave	? dBm					

DPE for ROD_TX3MPOD DP (HUB Tx MiniPOD3 AFBR-811VxyZ)

DPE	Nominal	ERROR	WARNING	OK	WARNING	ERROR
rod_tx3mpod_temp	50 °C	< 30	< 40	40.0 - 70.0	> 70.0	> 80
rod_tx3mpod_vcc25	2.50 V	< 2.00	< 2.20	2.20 - 2.80	> 2.80	> 3.00
rod_tx3mpod_vcc33	3.30 V	< 3.10	< 3.14	3.14 - 3.46	> 3.46	> 3.50
rod_tx3mpod_icc25	320 mA	<	< 280	280 - 365	> 365	>
rod_tx3mpod_icc33	145 mA	<	< 105	105 – 185	> 185	>
rod_tx3mpod_poave	? dBm					

4. FSM ACTIONS ON THE HUB/ROD HARDWARE

The ATLAS detector control system will be represented by means of a finite state machine (FSM) hierarchy, which is operated by a DCS operator through an FSM and alarm screen.

The ATLAS DCS FSM Integration Guideline.

The bottom level of the hierarchy is made up of the FSM in the Local Control Stations (LCSs), which handle the low level monitoring and control of instrumentation and services belonging to the L1Calo trigger. The FSM execute the commands received from the layer above, but may also trigger predefined actions autonomously if required.

The FSM in the LCS is a part of the WinCC-OA project. It executes required actions upon power-on:

- power-cycle the shelf, shutdown the shelf,
- set the fan-speeds in the shelf,
- power-cycle the modules (blades) in the shelf,

After shelf initialisation, the FSM may set required parameters in the modules and then continue periodical reading the data points (parameters) from modules and taking necessary actions.

The FSM interaction with the HUB module – after power-on the module via IPMC - can be represented in the FMS hierarchy plan. There two approaches:

- To loop over similar parameters (voltage current, etc,) reading from different components.
- To loop over components reading different parameters.

The following FMS hierarchy plan represents the second approach:

- DCDC1
  - dcdc1_vout, dcdc1_iout, dcdc1_temperature
- DCDC2
  - dcdc2_vout, dcdc2_iout, dcdc2_temperature
- DCDC3
  - dcdc3_vout, dcdc3_iout, dcdc3_temperature
- DCDC5
  - …
- DCDC6
  - …
- DCDC7
  - …
- DCDC8
  - …
- FPGA System Monitor
  - fpga_vccint, …
- RX MiniPOD
  - Voltage, current, temperature, optical power
- TX MiniPOD
  - Voltage, current, temperature, optical power

5. IPMC

https://web.pa.msu.edu/hep/atlas/l1calo/hub/hardware/details/hub_0_ab_ipmc_connections.txt

Two versions of the IPMC card are available: LAPP IPMC and CERN IPMC.