SPACELAB.GOLDS-UFSC.2020.06.001 REV A. ISSUE 0.1

GOLDS-UFSC Documentation

GOLDS-UFSC Documentation
SpaceLab, Universidade Federal de Santa Catarina, Florianópolis - Brazil

June 2020

GOLDS-UFSC Documentation
June, 2020

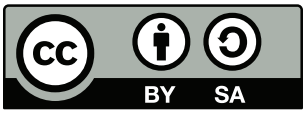
Project Chief:
Eduardo Augusto Bezerra

Authors:
Gabriel Mariano Marcelino
André Martins Pio de Mattos
Eduardo Augusto Bezerra

Contributing Authors:

Revision Control:

Version	Author	Changes	Date
0.1	Gabriel M. Marcelino	Document creation	2020/06/05



List of Figures

List of Tables

Contents

CHAPTER 1

Introduction

.

1.1 Mission Description

.

1.2 Mission Objectives

1. To serve as a host platform for the EDC payload.
2. Validate the EDC payload in orbit.
3. Validate EDC functionality in orbit.
4. Validate core-satellite functions in orbit.
5. Evaluate the behavior of the core modules.
6. Perform experiments on radiation effects in electronic components in orbit.
7. Serve as relay for amateur radio communications.

CHAPTER 2

Mission Requirements

1. The power system shall be able to harvest solar energy.
2. The power system shall be able to store energy for use when GOLDS-UFSC is eclipsed.
3. The power system shall supply energy to all other modules.
4. The data handling system shall communicate with the other modules and store their data.
5. The communications system shall send a beacon signal periodically using VHF radio.
6. The communications system shall send the CubeSat telemetry using UHF radio.
7. The communications system shall be able to receive telecommands and respond to them accordingly.
8. The attitude system shall be able to perform a 1-axis stabilization of the CubeSat.
9. GOLDS-UFSC shall have the capability to receive and execute a shutdown telecommand, therefore ceasing all transmissions.
10. The downlink transmissions shall be done once at a time, either telemetry or beacon.
11. The ground station shall operate under the proper radio frequency communication licenses.
12. GOLDS-UFSC shall comply with international and Brazilian radio license agreements and restrictions.
13. The team shall build and operate a ground station for full communication with GOLDS-UFSC.

CHAPTER 3

Mission Schedule

Phase/Activity	Period													
	2020												2021	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Flatsat test OBDH + EDC														
Protoflight - Design														
GS & RF regulation procedures														
Critical Design Review (CDR)														
Protoflight - Procurement														
Protoflight - Boards fabrication														
Flatsat test - Subsystems + EDC														
Protoflight - Stack integration														
Fit check														
Verification & validation														
Environmental tests (LIT														
Acceptance Review (AR)														
Export to launch country														
Flight Readiness Review (FRR)														
Integration to launch vehicle														
Launch														
Start commissioning														
End commissioning														
Start operation														

Table 3.1: Mission schedule.

CHAPTER 4

Overall Description

.

4.1 General Diagrams

.

4.2 General Behaviour

.

4.3 Orbit Parameters

.

4.4 Power Budget

.

4.5 Link Budget

4.5.1 VHF Link

- Direction: **Downlink**
- Frequency: **145,97 MHz**
- Modulation: **MSK**
- Datarate: **1200 bps**
- Output Power: **30 dBm (1 W)**
- Protocol: **NGHam**

4.5.2 UHF Links

Main UHF Link

- Direction: **Downlink and uplink**
- Frequency: **436,9 MHz**
- Modulation: **MSK**
- Datarate: **4800 bps**
- Output power: **30 dBm (1 W)**
- Protocol: **NGHam**

EDC UHF Link

- Direction: **Uplink**
- Frequency: **401.635 MHz**
- Modulation: ????
- Datarate: ???? **bps**

4.6 PC-104 Bus

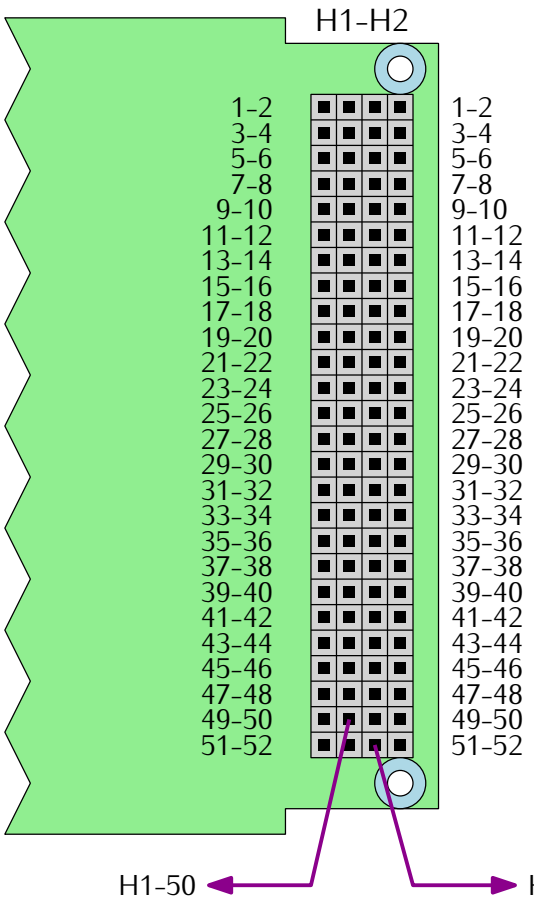


Figure 4.1: Reference diagram of the PC-104 bus.

Pin Row	H1 Odd	H1 Even	H2 Odd	H2 Even
1-2	-	-	-	-
3-4	-	-	EDC_1_EN	EDC_2_EN
5-6	-	-	BE_UART_RX	-
7-8	RA_GPIO_0	RA_GPIO_1	BE_UART_TX	-
9-10	RA_GPIO_2	-	-	-
11-12	RA_RESET	RA_EN	BE_SPI_MOSI	BE_SPI_CLK
13-14	-	-	BE_SPI_CS	BE_SPI_MISO
15-16	-	-	-	-
17-18	EDC_UART_RX/TX	PLX_EN	-	-
19-20	EDC_UART_TX/RX	-	-	-
21-22	-	-	-	-
23-24	-	-	-	-
25-26	-	-	-	-
27-28	-	-	-	-
29-30	GND	GND	GND	GND
31-32	GND	GND	GND	GND
33-34	-	-	-	-
35-36	RD_SPI_CLK	-	ANT_VCC	ANT_VCC
37-38	RD_SPI_MISO	-	-	-
39-40	RD_SPI_MOSI	RD_SPI_CS	-	-
41-42	PL_I2C_SDA	-	-	RES_GPIO
43-44	PL_I2C_SCL	-	-	-
45-46	OBDH_VCC	OBDH_VCC	BAT_VCC	BAT_VCC
47-48	EDC_VCC	EDC_VCC	-	-
49-50	RD_VCC	RD_VCC	EPS_I2C_SDA	-
51-52	BE_VCC	BE_VCC	EPS_I2C_SCL	-

Table 4.1: PC-104 bus pinout.

Signal	Pin(s)	Used By	Description
GND	H1-29, H1-30, H1-31, H1-32, H2-29, H2-30, H2-31, H2-32	All	Ground reference
BAT_VCC	H2-45, H2-46	EPS	Battery terminals (+)
ANT_VCC	H2-35, H2-36	EPS, ANT	Antenna power supply (3.3 V)
OBDH_VCC	H1-45, H1-46	EPS, OBDH	OBDH power supply (3.3 V)
EDC_VCC	H1-47, H1-48	EPS, EDC 1, EDC 2	EDC power supply (5 V)
RD_VCC	H1-49, H1-50	EPS, TTC	Main radio power supply (5 V)
BE_VCC	H1-51, H1-52	EPS, TTC	Beacon power supply (6 V)
RD_SPI_CLK	H1-35	OBDH, TTC	CLK signal of the main radio SPI bus
RD_SPI_MISO	H1-37	OBDH, TTC	MISO signal of the main radio SPI bus
RD_SPI_MOSI	H1-39	OBDH, TTC	MOS signal of the main radio SPI bus
RD_SPI_CS	H1-40	OBDH, TTC	CS signal of the main radio SPI bus
EPS_I2C_SDA	H2-49	OBDH, EPS	SDA signal of the EPS I2C bus
EPS_I2C_SCL	H2-51	OBDH, EPS	SCL signal of the EPS I2C bus
BE_UART_RX	H2-5	EPS, TTC	EPS TX, Beacon RX (UART bus)
BE_UART_TX	H2-7	EPS, TTC	EPS RX, Beacon TX (UART bus)
EDC_UART_TX/RX	H1-25	OBDH, EDC 1, EDC 2	OBDH TX, EDCs RX (UART bus)
EDC_UART_RX/TX	H1-27	OBDH, EDC 1, EDC 2	OBDH RX, EDCs TX (UART bus)
EDC_1_EN	H2-3	OBDH, EDC 1	EDC 1 enable signal
EDC_2_EN	H2-4	OBDH, EDC 2	EDC 2 enable signal
PLX_EN	H1-18	OBDH, Payload X	Payload X enable (GPIO)
PL_I2C_SDA	H1-41	OBDH, Payload X	SDA signal of the payload I2C bus
PL_I2C_SCL	H1-43	OBDH, Payload X	SCL signal of the payload I2C bus
RES_GPIO	H2-22	OBDH	Reserved GPIO pin
RES_GPIO	H2-42	OBDH	Reserved GPIO pin

Table 4.2: PC-104 bus signal description.

CHAPTER 5

Subsystems

.

5.1 On-Board Data Handling

OBDH [1]

5.2 Telemetry, Tracking and Command Module

TTC

5.3 Electrical Power System

EPS

5.4 Attitude Determination and Control System

ADCS

5.5 Mechanical Structure

.

5.6 Payloads

5.6.1 Environmental Data Collection

EDC [2]

CHAPTER 6

Ground Segment

.

CHAPTER 7

Operation Planning

.

Bibliography

[1] Space Technology Research Laboratory (SpaceLab). *OBDH 2.0 Documentation*, 2020. Available at <https://github.com/spacelab-ufsc/obdh2>.

[2] Instituto Nacional de Pesquisas Espaciais (INPE). *Environmental Data Collector User Guide*, October 2019. CNS-MNL-PY-00-002-V01.