



SCORPYOS

Supervisor COnccept foR sPace sYstemS

Minimalistic Supervisor



ACCEDE | ESCCON

2025

Seville - Spain
25 to 27th March

ALTER



Presentation Topics



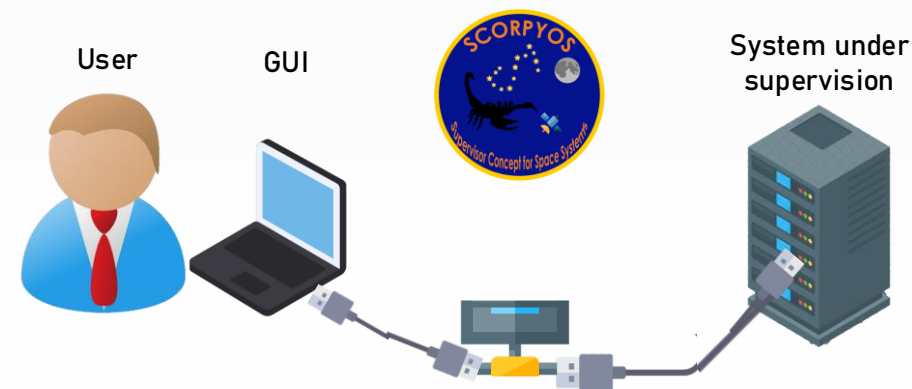
- SCORPYOS Overview
- Mechanical design
- Electrical design
- Firmware design
- Configuration Tool
- Send Data & Receive Alerts
- Tests performed



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SCORPYOS Overview

- ESA Contract #4000135813 under OSIP activity
- Supervisor Concept for Space Systems, alone or as a supporting unit
- Small subsystems, high simplicity of usage and LEO missions
- Aim to increase the availability of a COTS system under supervision



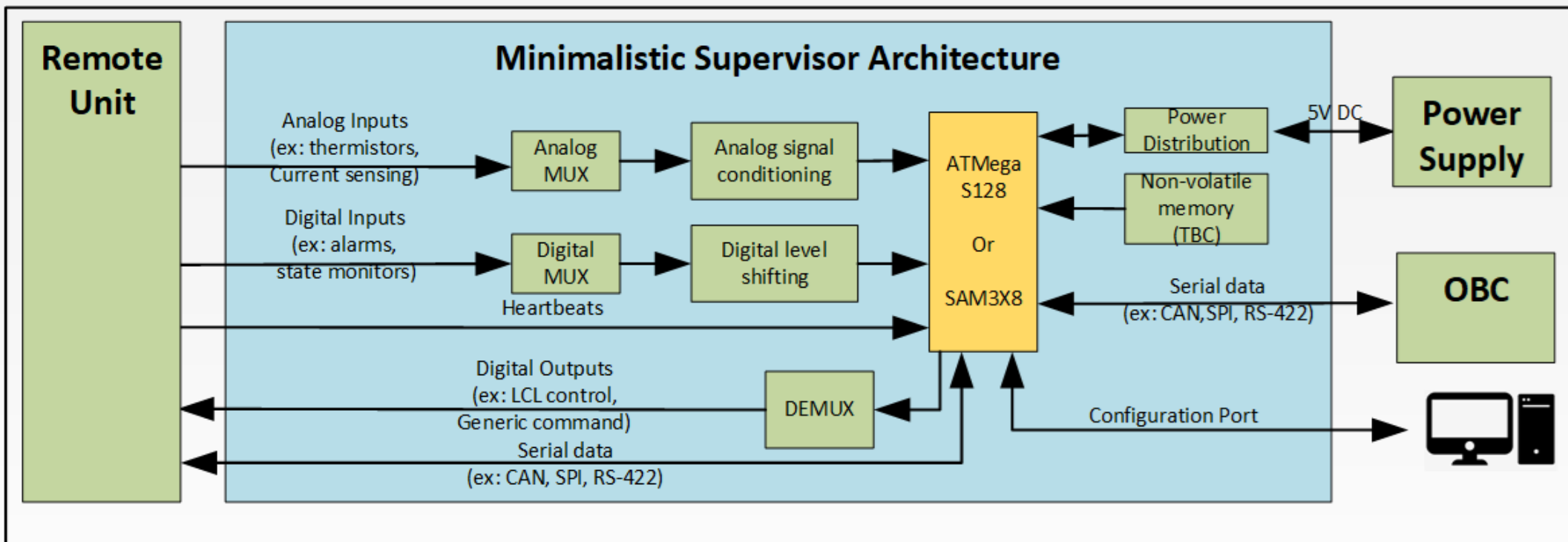
SCORPYOS Overview – Industry Questions

- Can we use this to **supervise Xilinx Versal and AI engines**?
- May be relevant to consider SCORPYOS as **basis for NewSpace PSDU**?
- Should there be **redundant supervisors**?
- Memory required to store and process all telemetries - **integrate OBC FDIR**
- Can we consider SCORPYOS for **hard/non - LEO** missions?

Summary

- Applicable to different generic equipment – **COTS and beyond LEO**
- **Protect SoC and AI engines** – Versal, Jetson, Myriad

SCORPYOS Overview



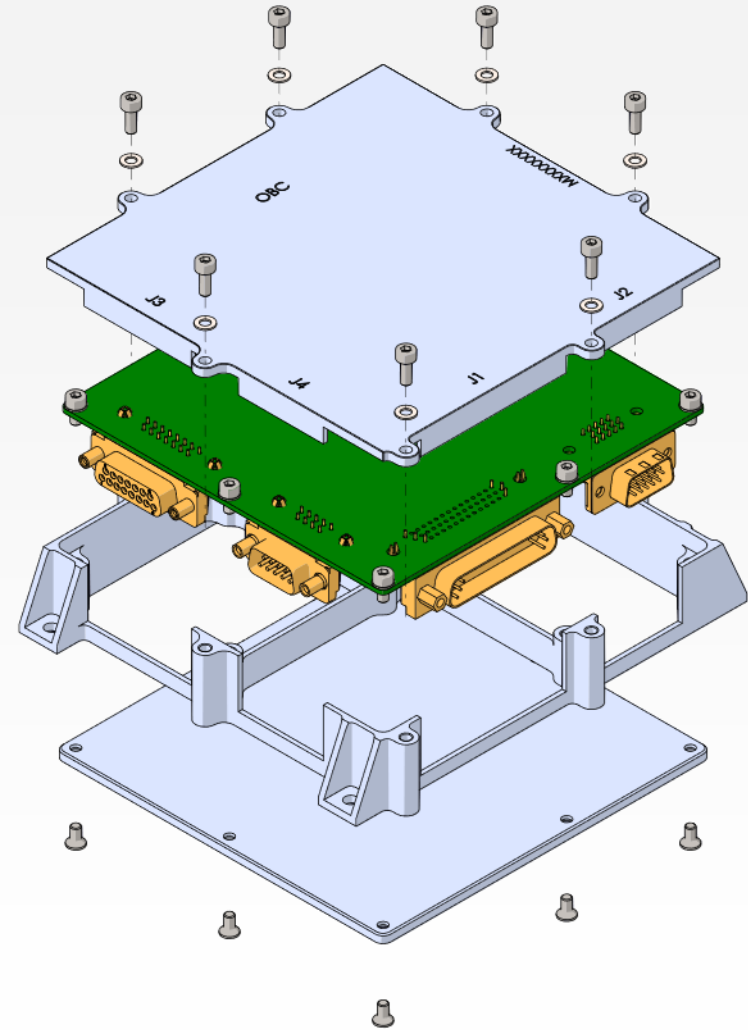
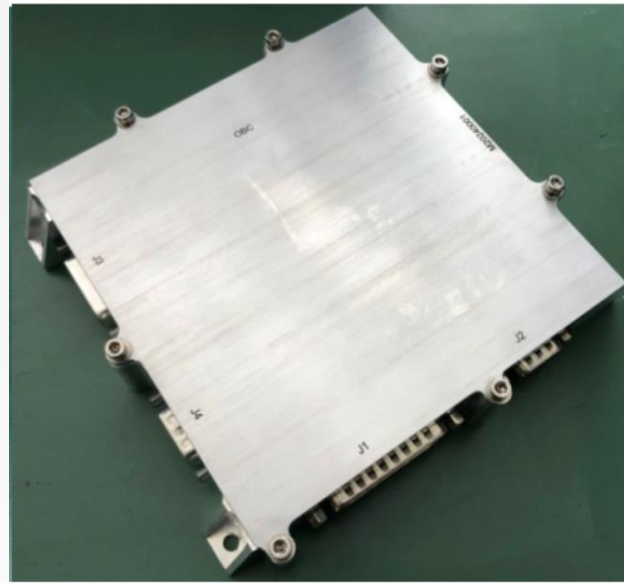
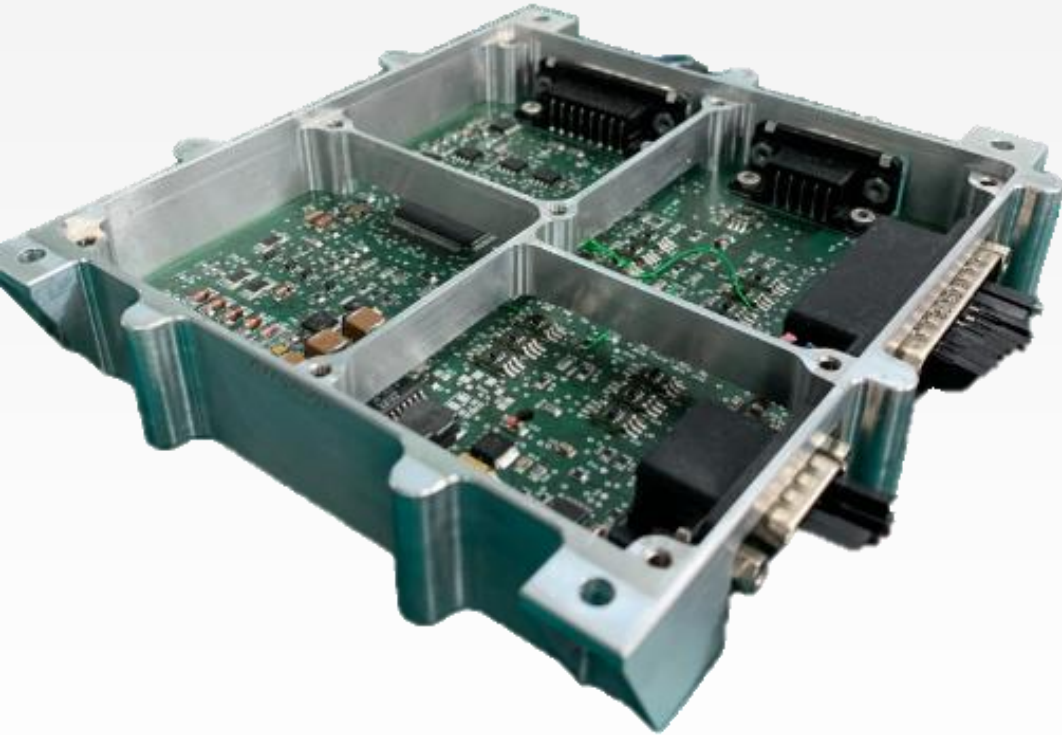
SCORPYOS Overview – Basic Specs

Processing	ARM-Cortex M7 @ 300MHz with FPU	Memory	2048Kb Flash
Power	Vin: 8-12V <1.2W		384Kb SRAM
Size	145 x 139 x 30 mm		256Mb SRAM (option)
Mass	390g		256Mb NOR Flash (option)
Ops Temp	-40°C – 100°C		ECC protected
Internal Protections	LCL protected UVP/OVP/OTP	I/F	2x Sub-HD connectors
Rad Tol	SEL > 40MeV-cm ² /mg TID > 20krad		4x RS-422 (1x used for conf.)
			2x CAN
			7x GPIO
			4x Digital inputs (5V Logic Level)
			4x Analog inputs (0-5V)
			1x SPI (3x Slave Select)



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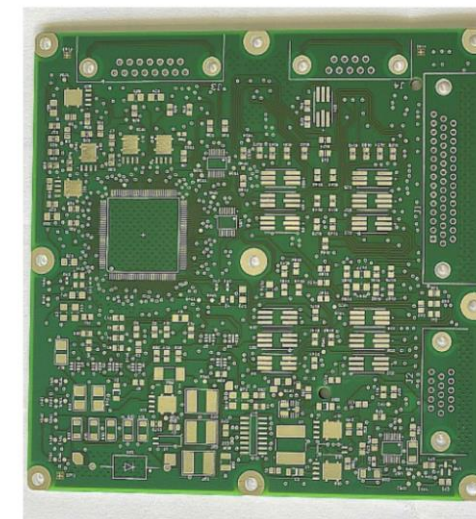
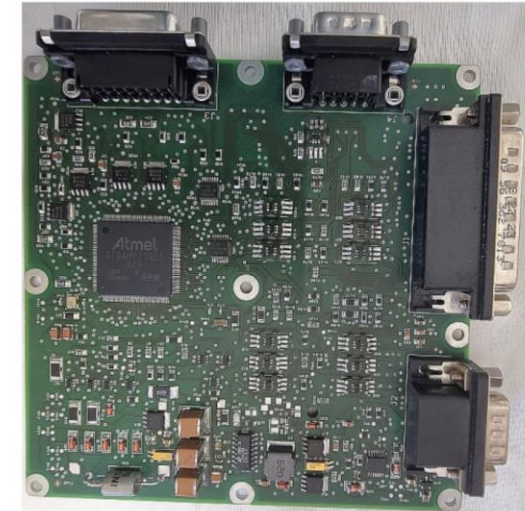
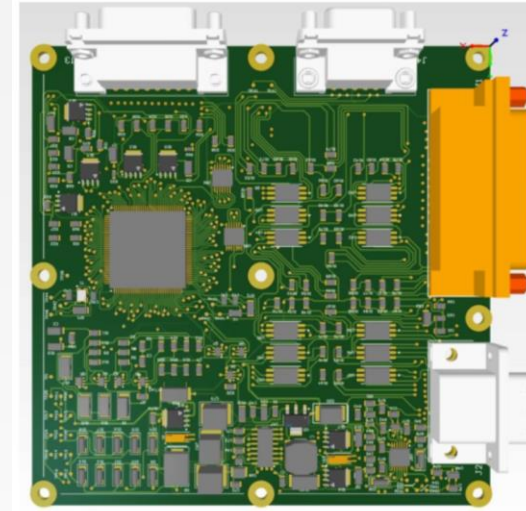
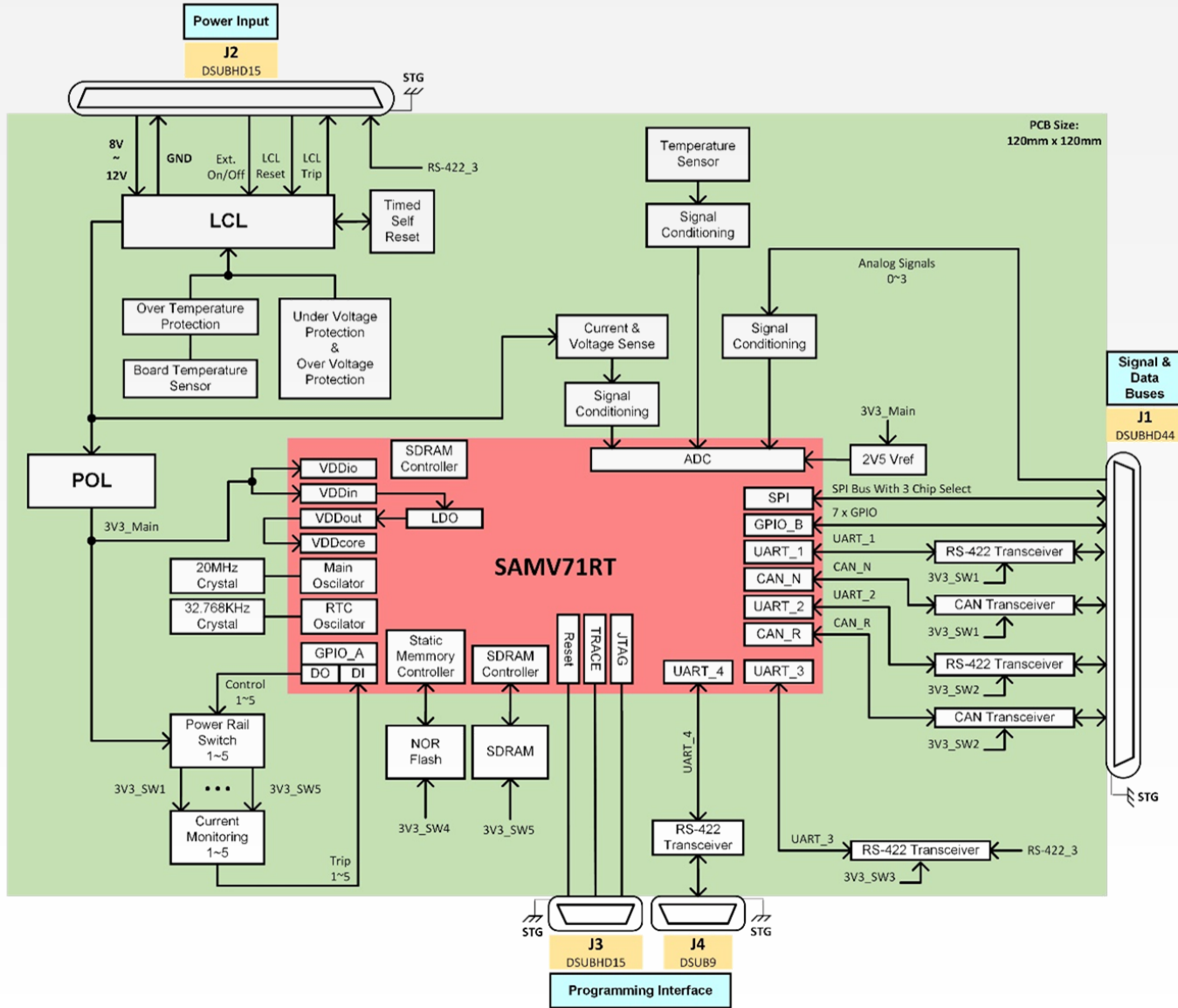
SCORPYOS - Mechanical





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SCORPYOS - Electrical



SCORPYOS – Electrical I/F

J1 – HD44 – Data and Control	
Type	Nº pins
RS-422-1	4
RS-422-2	4
CAN-N & CAN-R	4
SPI (3 x CS)	6
GPIO (I/O & interrupts)	7
Digital Inputs	4
Analog Inputs (Comparator & Sampling)	4
GND	8

J2 – HD15 – Power	
Type	Nº pins
Power IN	1
Power RTN	1
GND	5
LCL Reset	1
LCL Trip	1
RS-422-3	4
LCL Control	2

J3 – HD15 – Debug	
Type	Nº pins
Trace – Debug	5
GND	2
JTAG	5
Reset Test	2

J4 – DSUB9 – Program	
Type	Nº pins
RS-422-4	4
GND	5



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SCORPYOS – Firmware and TM/TC design

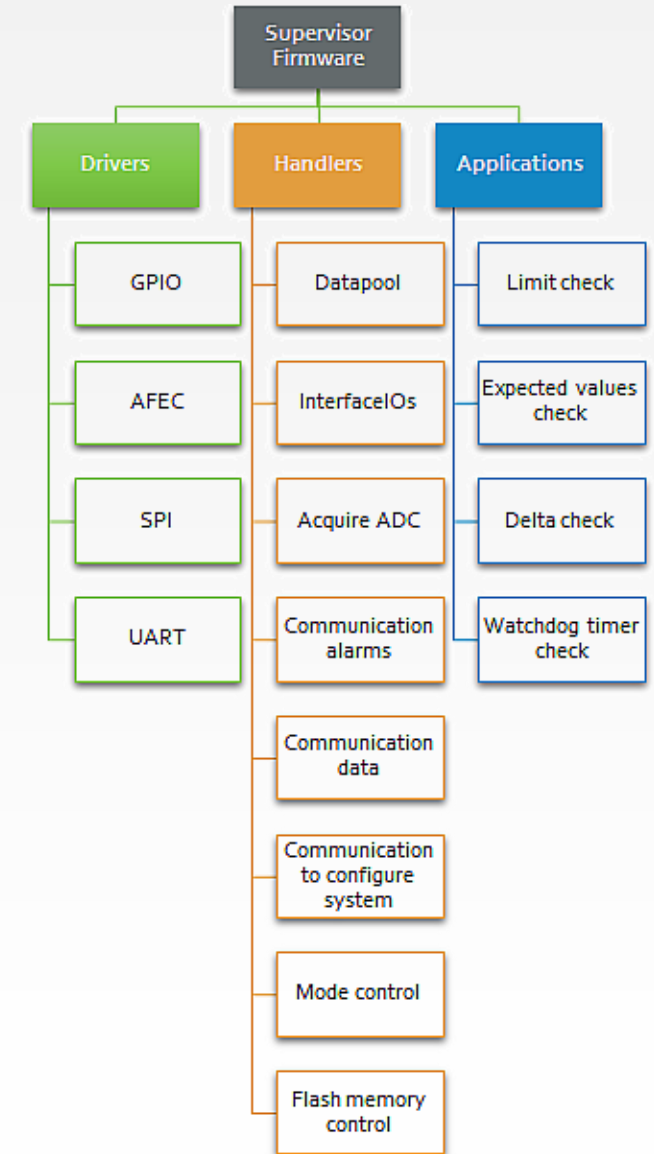
Start of Message	Message header	Cargo	CRC
1 Byte	2 Bytes	2-253 bytes	2 Bytes

Message header	
Header byte 1	Header byte 2
Instruction code	Length
8 bits	8 bits

Cargo		
CMD/RSP ID	SUB CMD/RSP ID	DATA
1 byte	1 byte	0-251 bytes

I	CMD	RSP
0	Command	Normal Response
1	Not used	Error Response
255...2	Not used	Not used

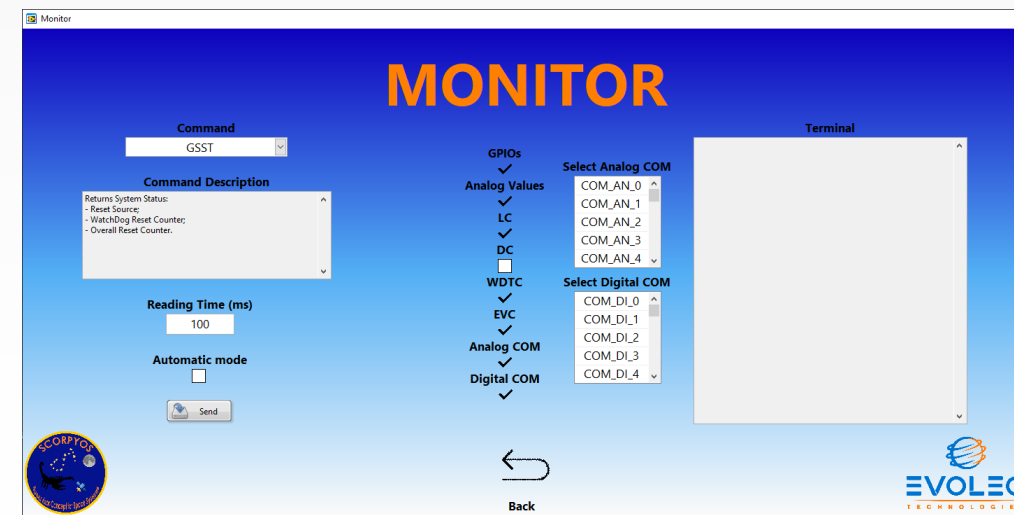
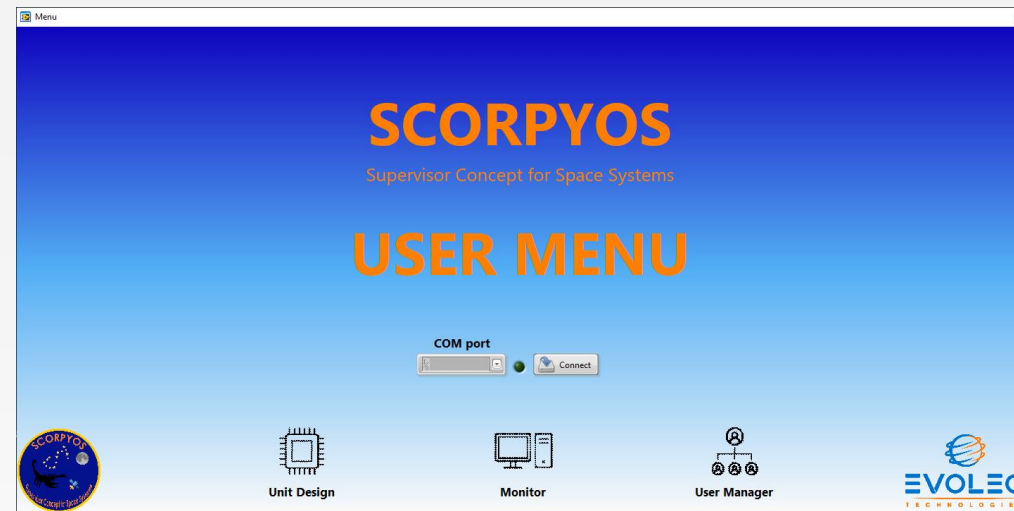
CMD ID	SUB ID	CMD / SUB Name	Description
1	0	GSST	Get SCORPYOS status
1	1	GSID	Get SCORPYOS Identification
2	0	CMOD	Change mode
2	1	GMOD	Get mode
3	0	CINT	Config Interfaces
3	1	GINT	Read config Interfaces
3	2	CVME	Config Verification Methods
3	3	GVME	Read config Verification Methods
4	0	GDPO	Read Datapool





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SCORPYOS – Configuration Tool Software





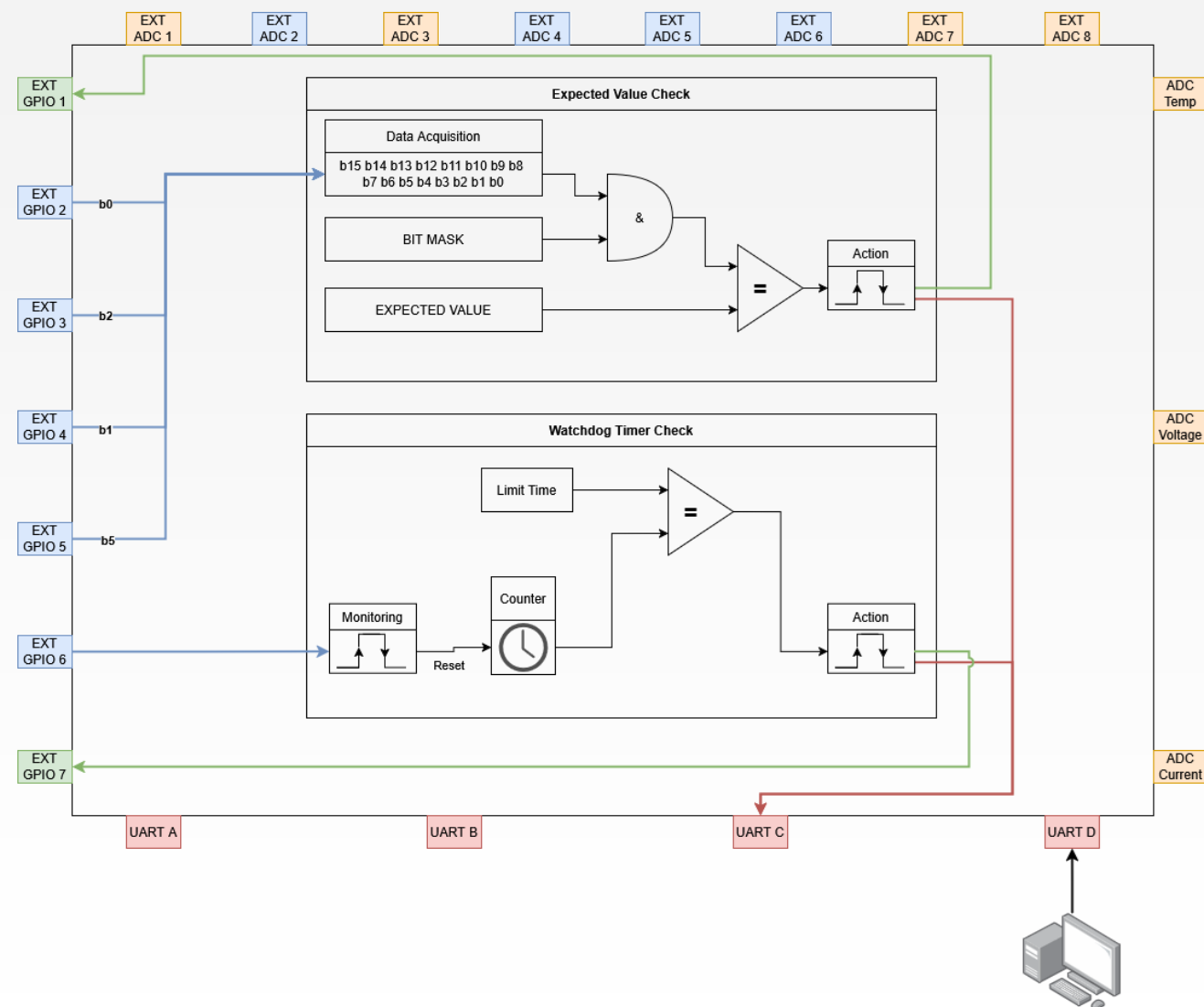
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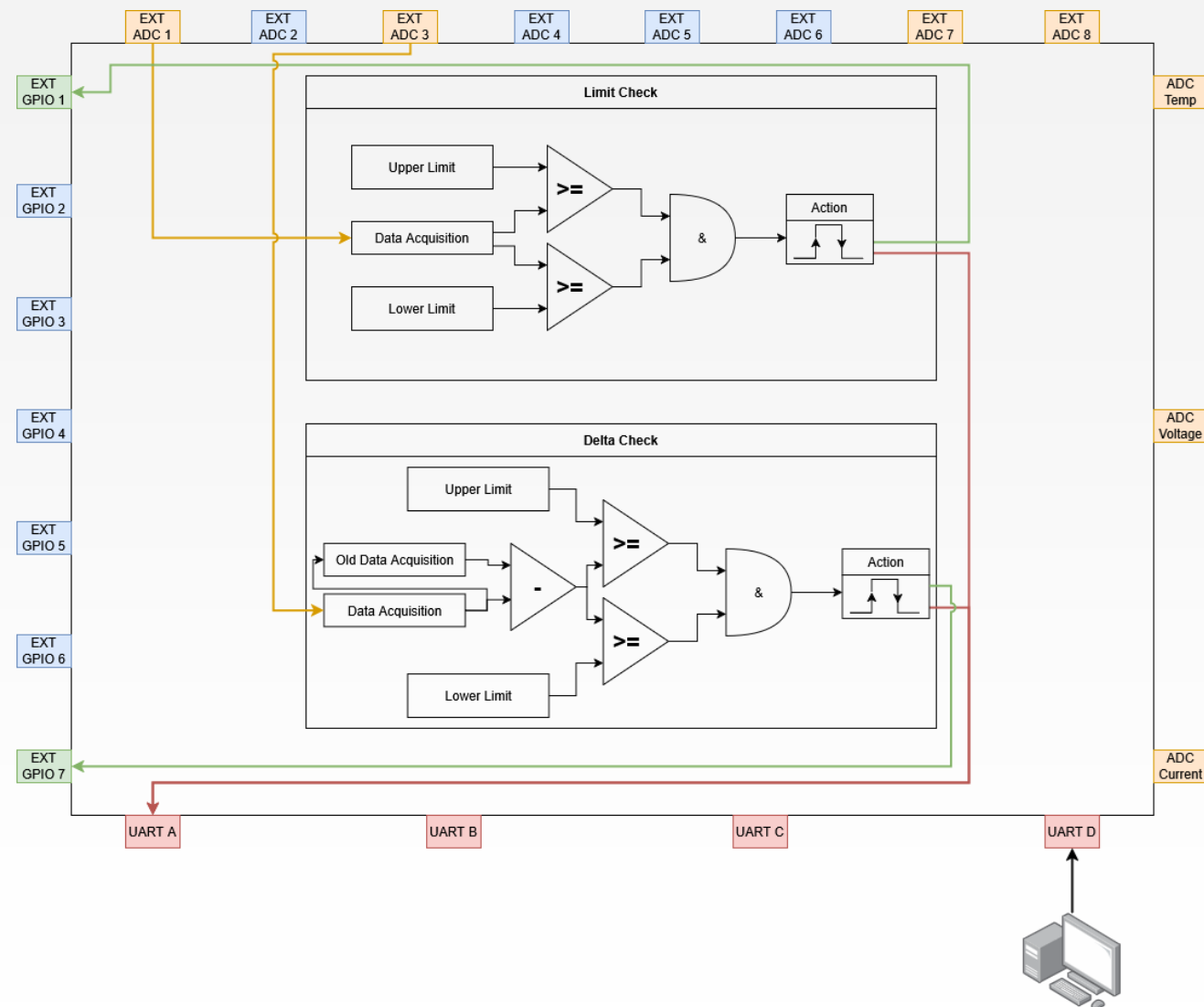
Tests – Use Case 1 – Monitoring Digital Inputs

- Using verification methods
 - Expected Value Check
 - Watchdog Timer Check
- Ability to interpret logical states and,
- To respond to specific patterns or absence of "heartbeat" signals.



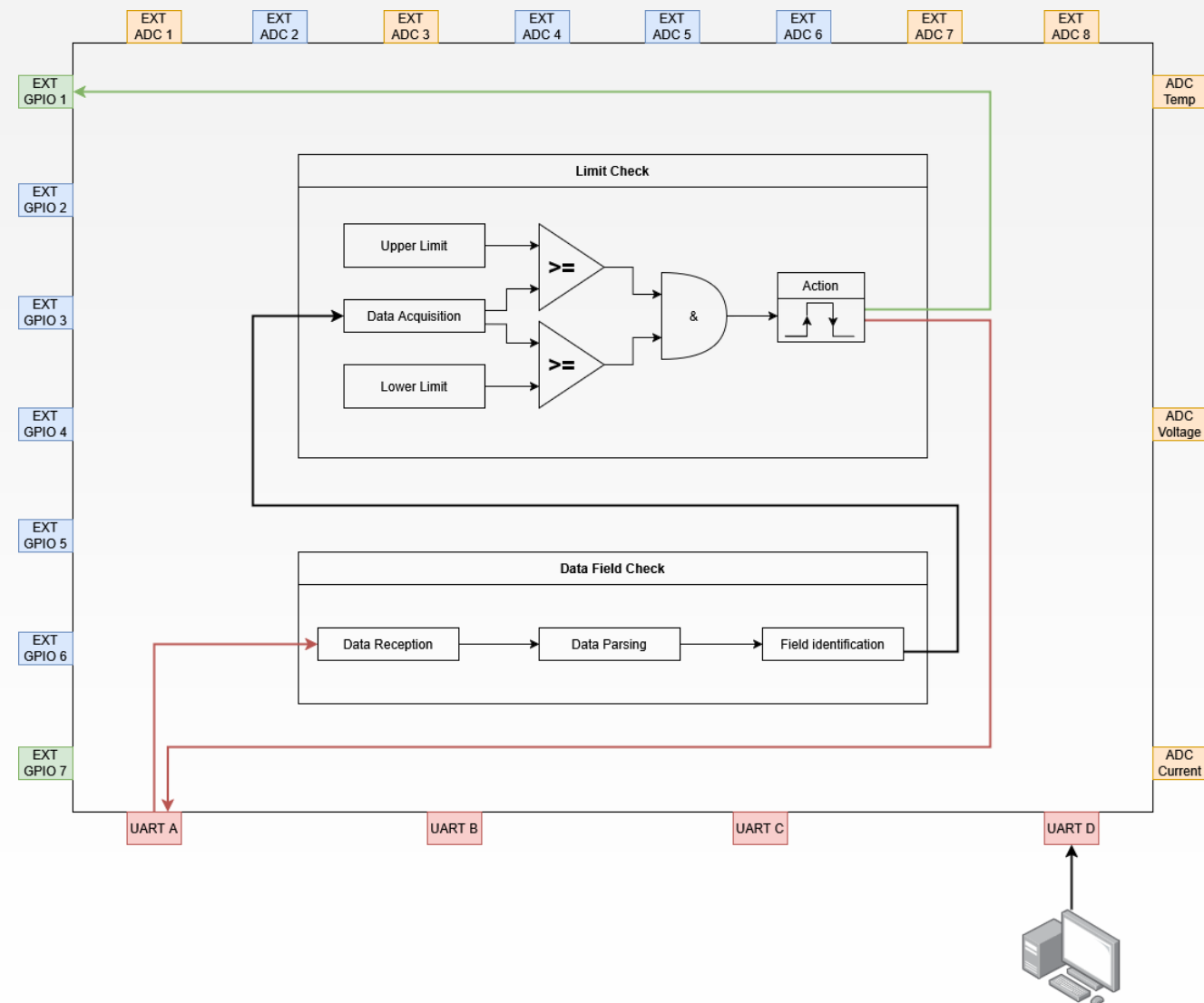
Tests – Use Case 2 – Monitoring Analog Signals

- Using methods as
 - Limit Check
 - Delta Check
- Ability to detect deviations from predefined values and,
- Significant variations between consecutive readings

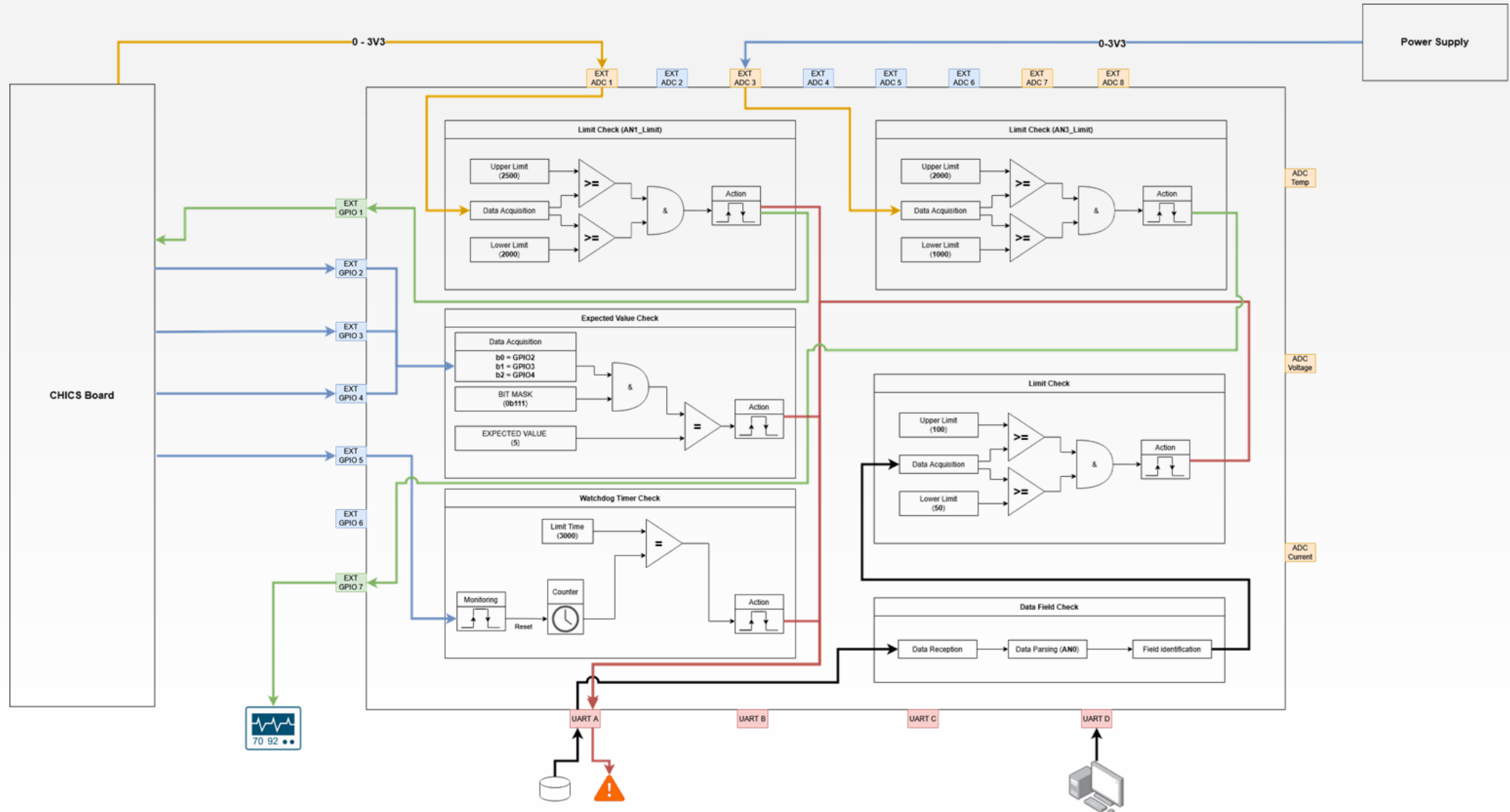


Tests – Use Case 3 – Monitoring data via comm I/F

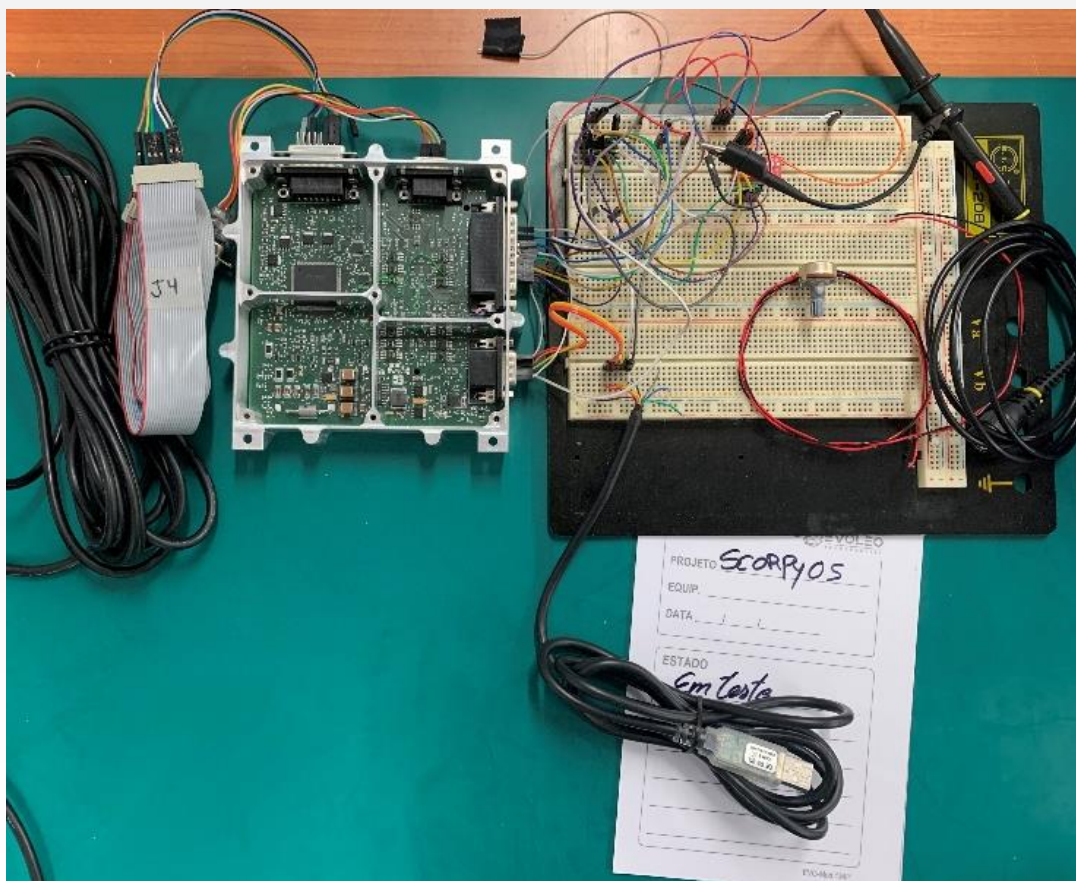
- Integration of message validation with content analysis
 - Data Field Check
 - Limit Check
- Ability to monitor and analyse data transmitted via communication interfaces, such as UART.



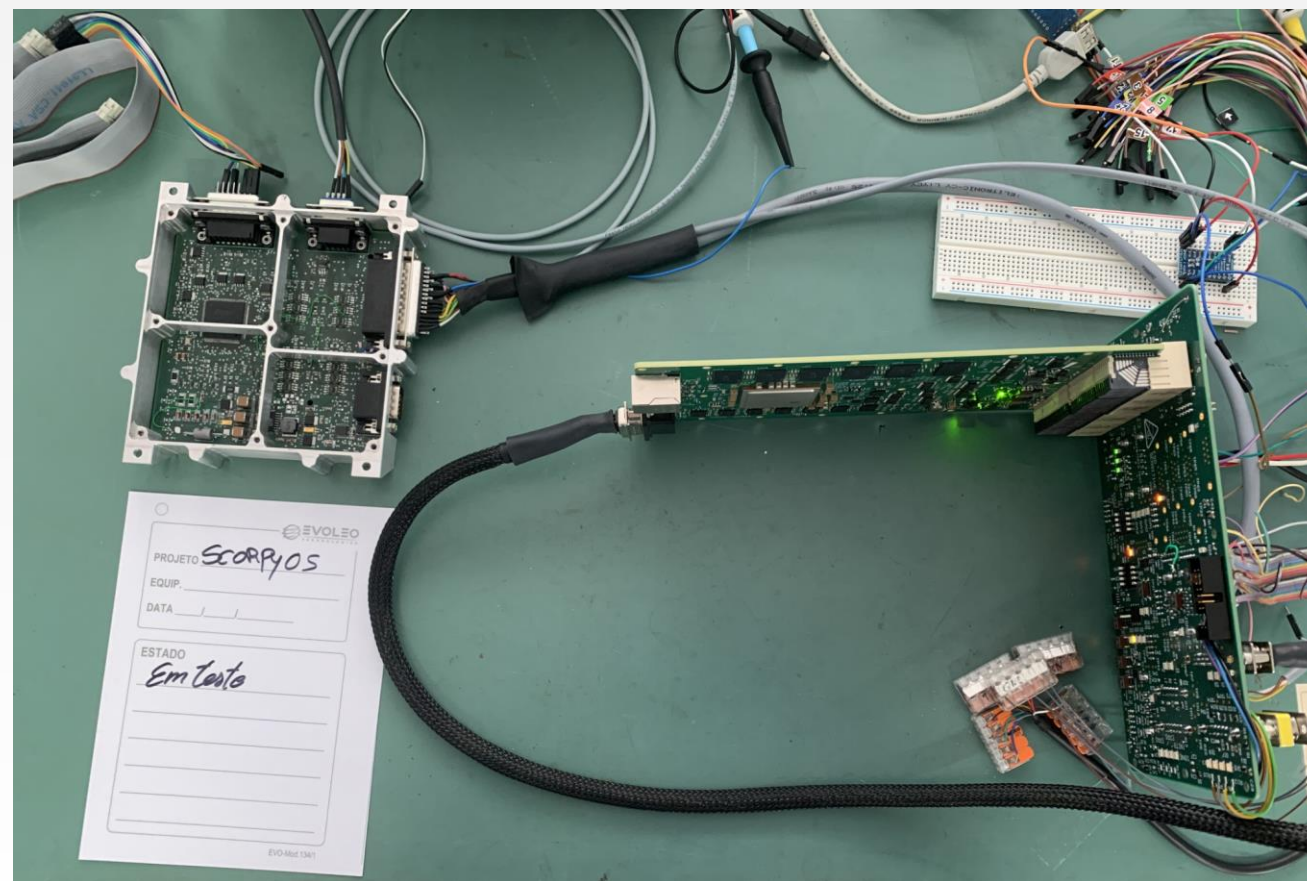
Tests – Processing Unit + DCDC Monitoring



Tests – Simple Lab Setup



Breadboard – Simple Use Cases



Monitor Processing Unit & DC/DC

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Thank You

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