

Graduation Internship Project :

**The Quality Control Setup and Characterization of Silicon Pixel
Detector Loaded Modules for the Inner Tracker of the ATLAS
Experiment at the High Luminosity Large Hadron Collider**

By: **ACHAQ Mariam**

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Academic year : 2023/2024

Summary

Organism presentation and project context

Installation and connection of Cell Loaded QC Setup

Site qualification for interlock system of the QC Setup

Perspectives & Upcoming Tasks

CERN

Mission

- Provide a unique range of particle accelerator facilities.
- Perform world-class research in fundamental physics.
- Unite people from all over the world to push the frontiers of science and technology.

Governance

- CERN council
- Scientific Policy Committee
- Finance Committee
- Directorates
- Heads of departments

Achievements

- LHC.
- Higgs Boson discovery.
- The birth of the web.
- Antimatter.
- HL-LHC.

Experiments

CERN is home to a wide range of experiments:

- **ATLAS** **A Toroidal LHC Apparatus**
- CMS Compact Muon Solenoid
- LHCb LHC-beauty
- ALICE A Large Ion Collider Experiment

People at CERN

- 17 500 people from around the world
- 2 500 staff members
- 12 500 scientists of 110 nationalities

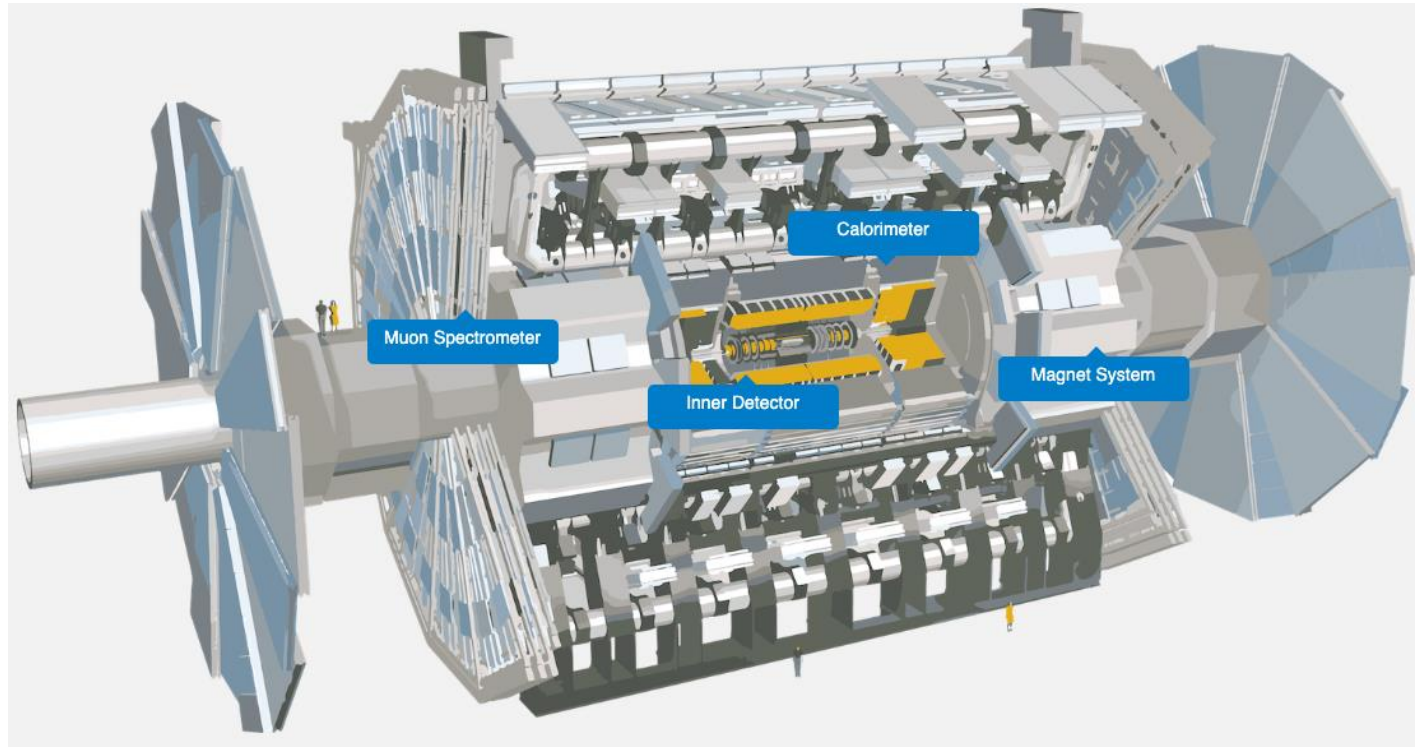
ATLAS (A Toroidal LHC ApparatuS) Experiment

Mission

- Discovering and Studying the Higgs Boson
- Looking for new particles and forces that could explain mysteries like dark matter.
- Making very accurate measurements of known particles and forces to see if they match current theories.

Inner Detector

- The first part of ATLAS to see the decay products of the collisions
- Very compact and highly sensitive.
- Consists of three different systems of sensors all immersed in a magnetic field parallel to the beam axis.
- The Inner Detector measures the direction, momentum, and charge of electrically-charged particles produced in each proton-proton collision.



Main components

- The main components of the Inner Detector are:
 - **Pixel Detector**
 - **Semiconductor Tracker (SCT)**
 - **Transition Radiation Tracker (TRT).**

The new silicon Inner Tracker (ITK)

Construction and Role of the ITk

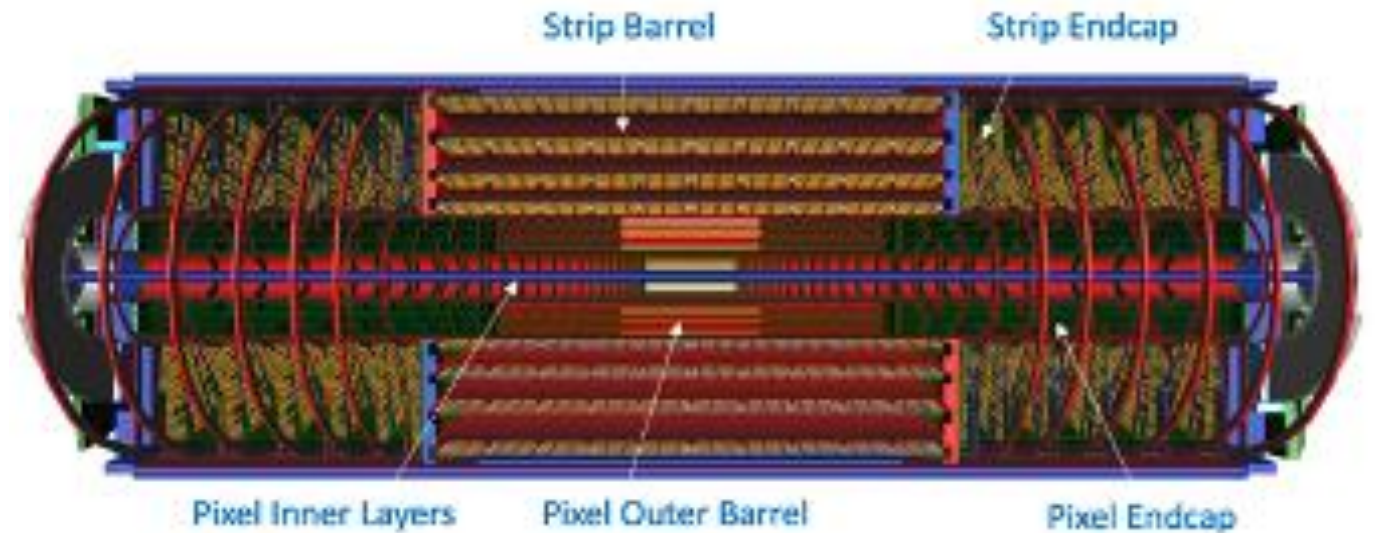
- The ATLAS detector at the LHC is undergoing a major upgrade with the construction of a new silicon Inner Tracker (ITk) that will operate at High Luminosity.
- The new silicon Inner Tracker (ITk) is a crucial upgrade, aimed at reconstructing charged particle tracks with high precision.

Pixel Detector Details

The ITk's pixel detector, located closest to the collision point, will consist of around 10,000 **pixel modules**, each including:

- Four front-end chips,
- Silicon sensor,
- Wire-bond protection,

All mounted on carbon cooling structures.



Project objectives

◆The project involves:

- **Installing** and **commissioning** a system for testing the electrical properties of loaded quad modules, which includes both hardware and software tasks,

- **Optimizing** the infrastructure with an interlock unit and cooling system.

◆Performance Evaluation:

- **Testing** and **Evaluating** the performance of the loaded modules.



Summary

Organism presentation and project context

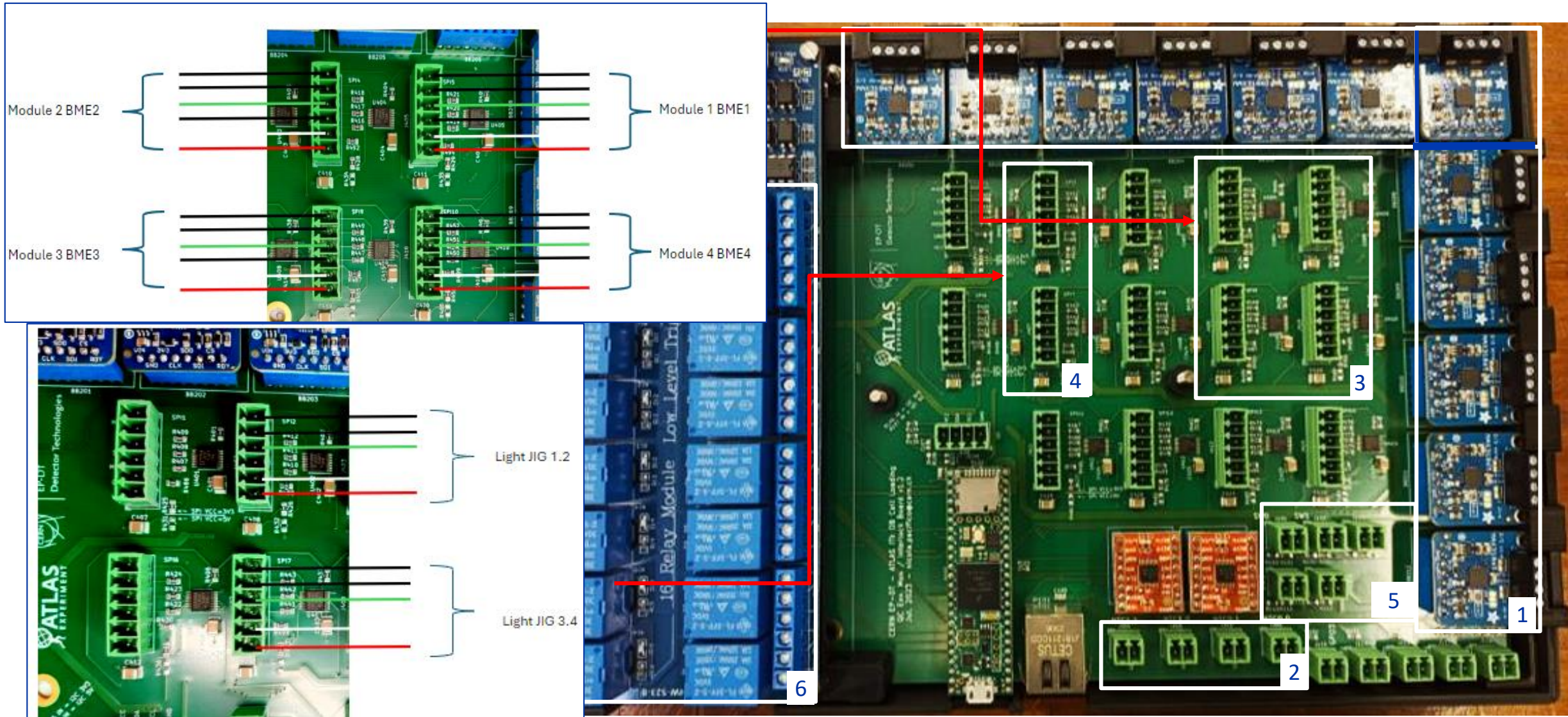
Installation and connection of Cell Loaded QC Setup

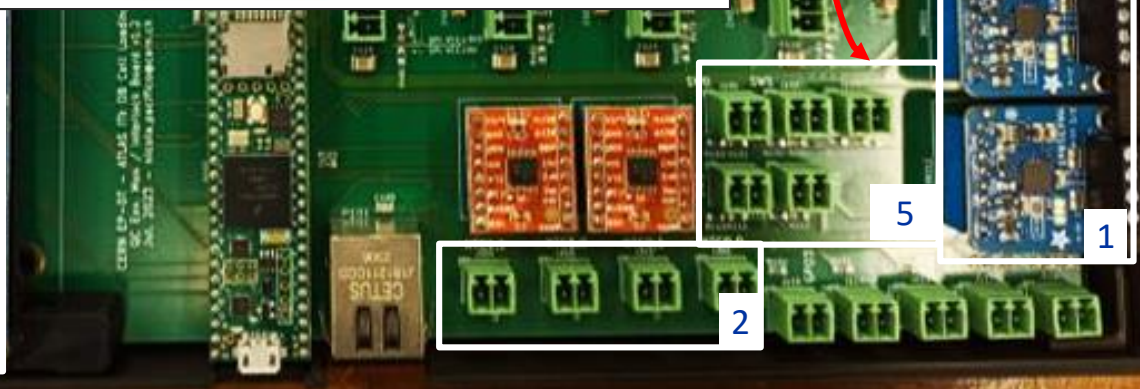
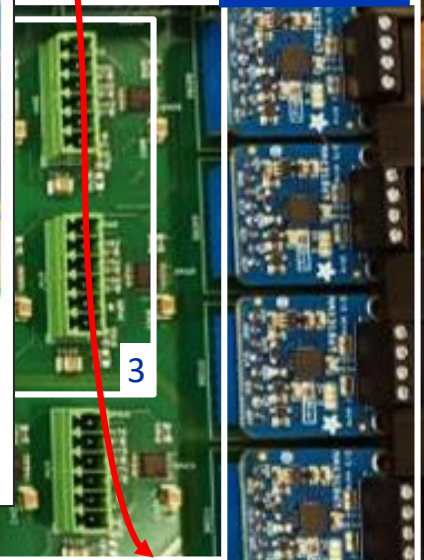
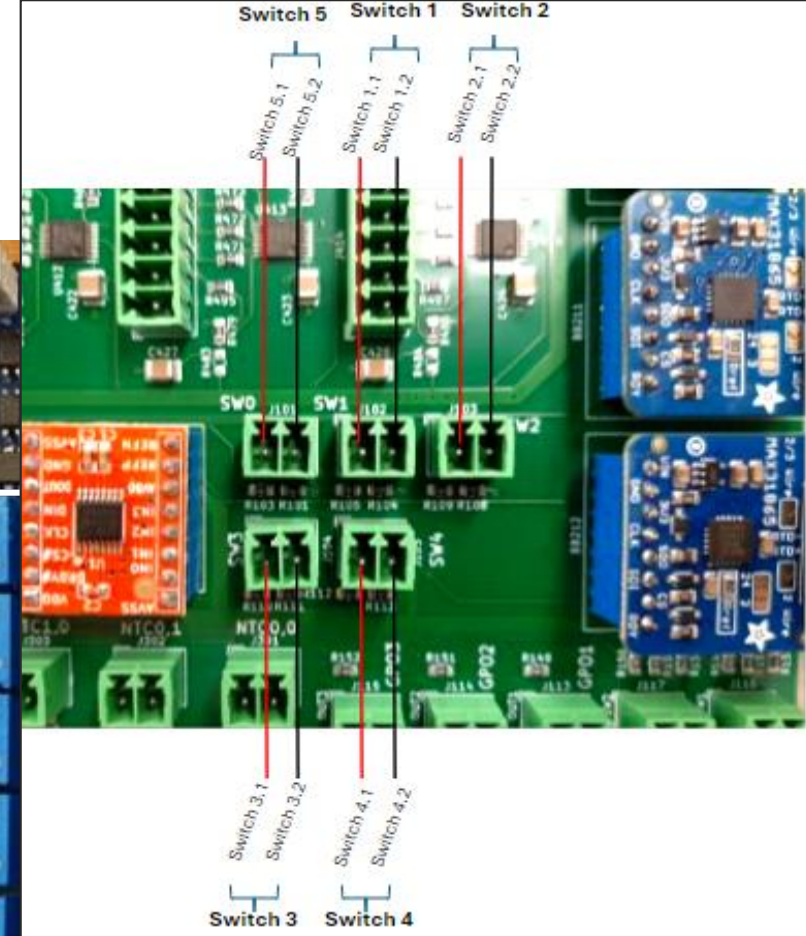
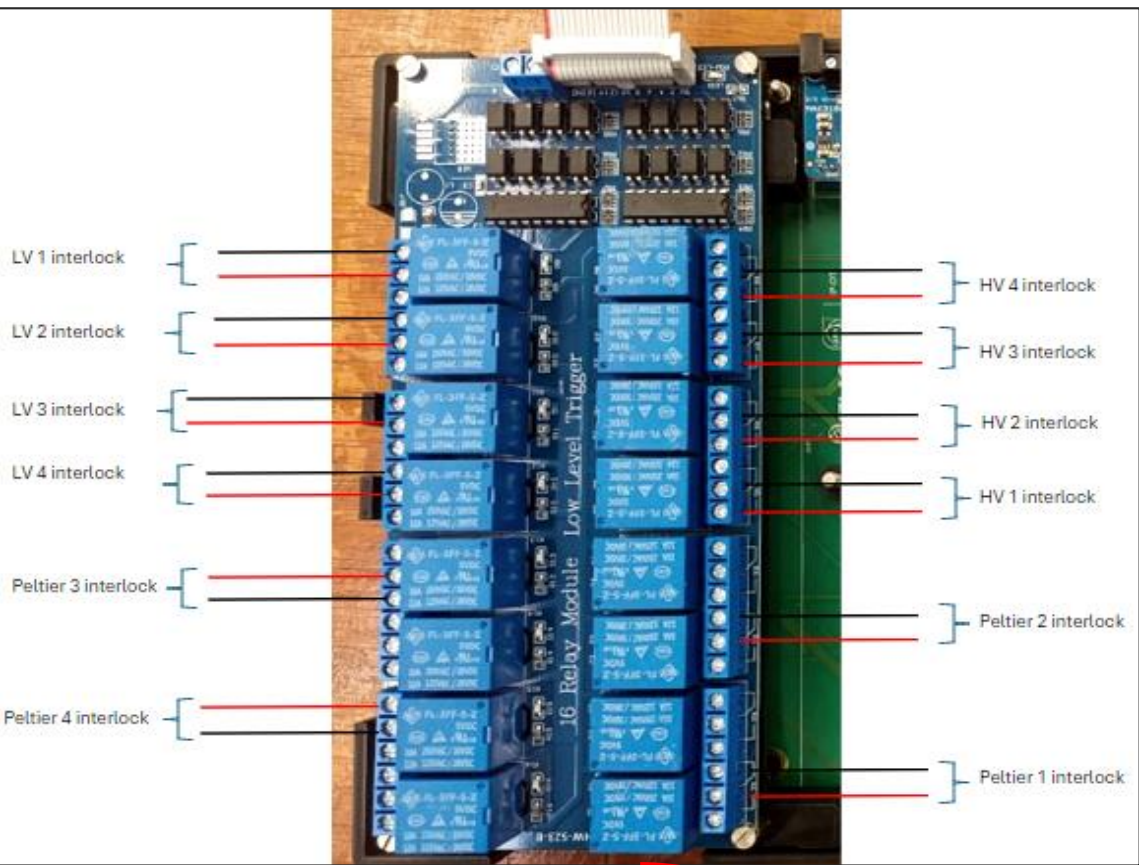
Site qualification for intrlock system of the QC Setup

Perspectives & Upcoming Tasks

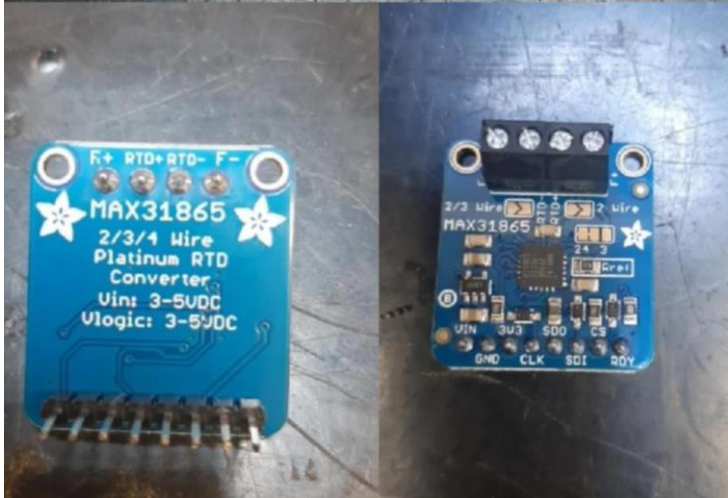
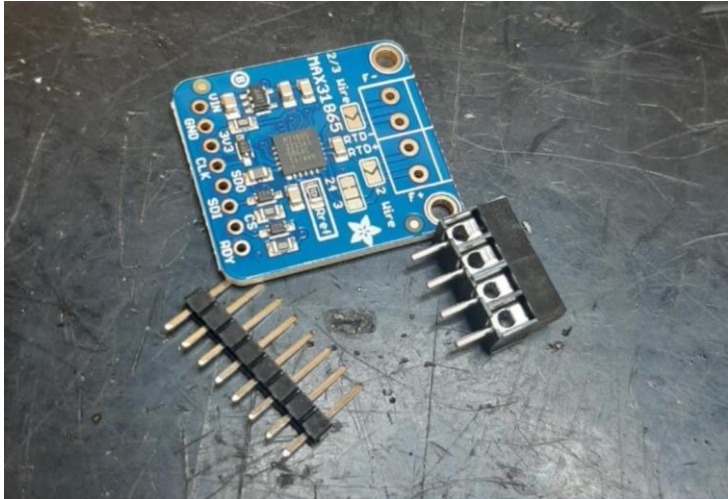
Hardware Tasks : Installation and connection of Cell Loaded Quality Control (QC) Setup

- ✓ [Technical procedure](#) to assemble the board developed for the interlocking and monitoring of the QC setup for ATLAS ITk OB Cells completed.

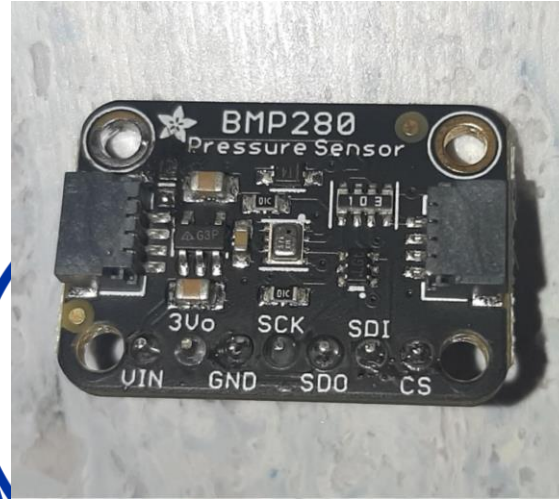




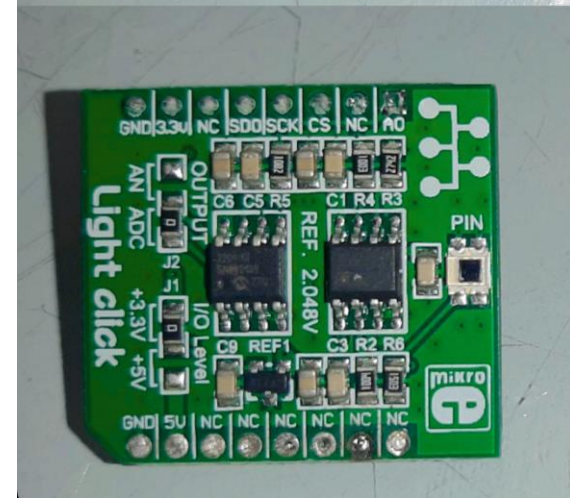
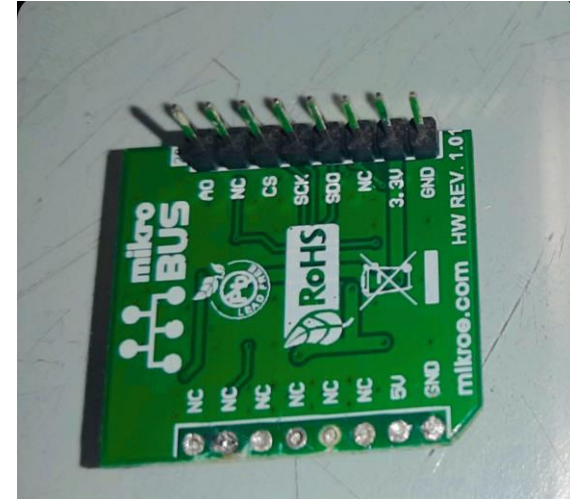
- ✓ Soldering the temperature sensors, humidity sensors, and light sensors completed



Temperature sensors



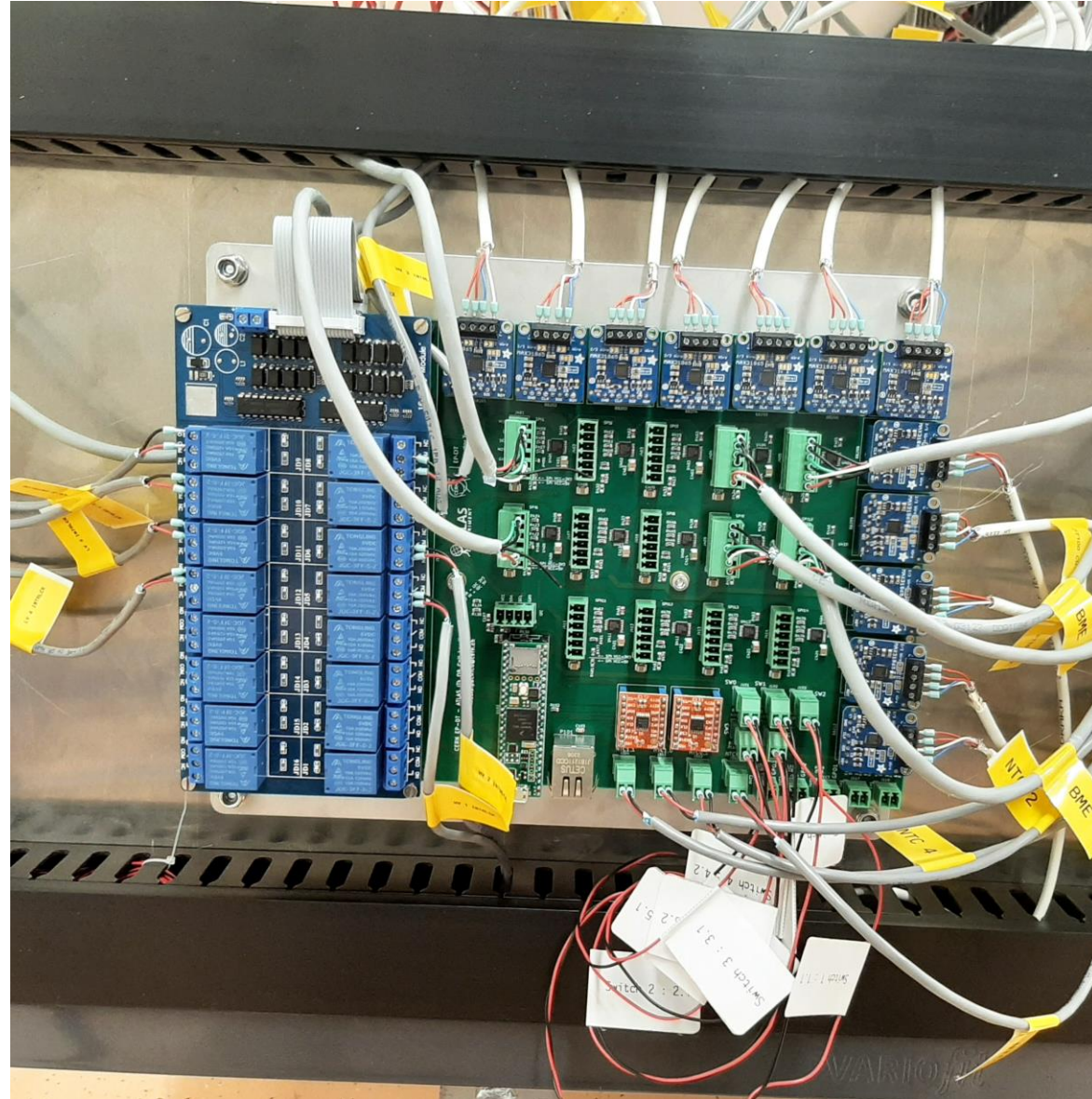
Humidity sensors



Light sensors

➤ Interlock board

- ✓ Temperature sensors are connected to the interlock board.
- ✓ Humidity sensors and light sensors are installed inside the box and connected to the interlock board.
- ✓ High Voltage PS cables are connected to the interlock board as well as Low Voltage PS cables.
- ✓ Wiring of the interlock board is completed.
- ✓ Cabling of Peltiers power supplies



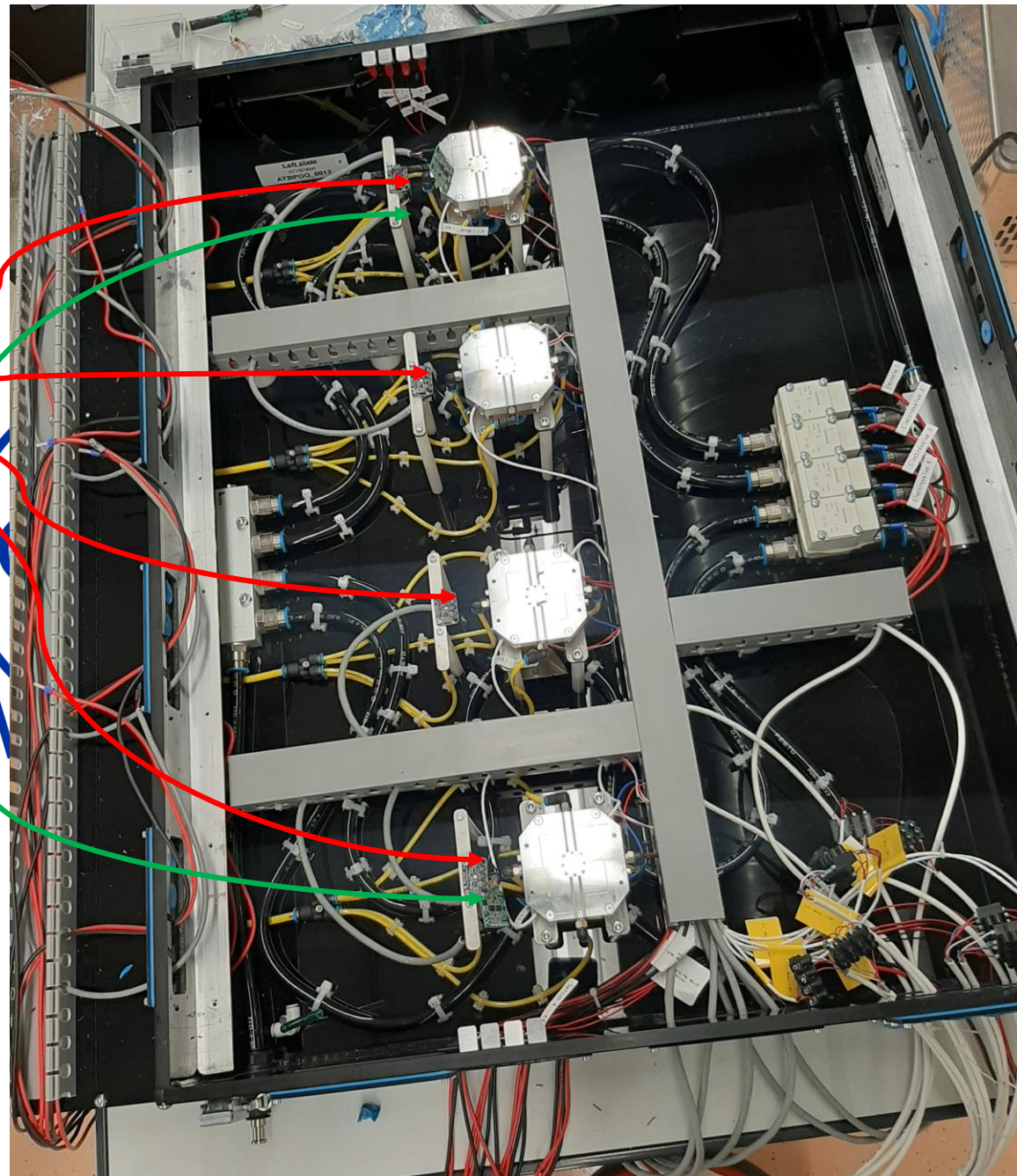
➤ Inside the QC box

✓ Humidity sensors installed

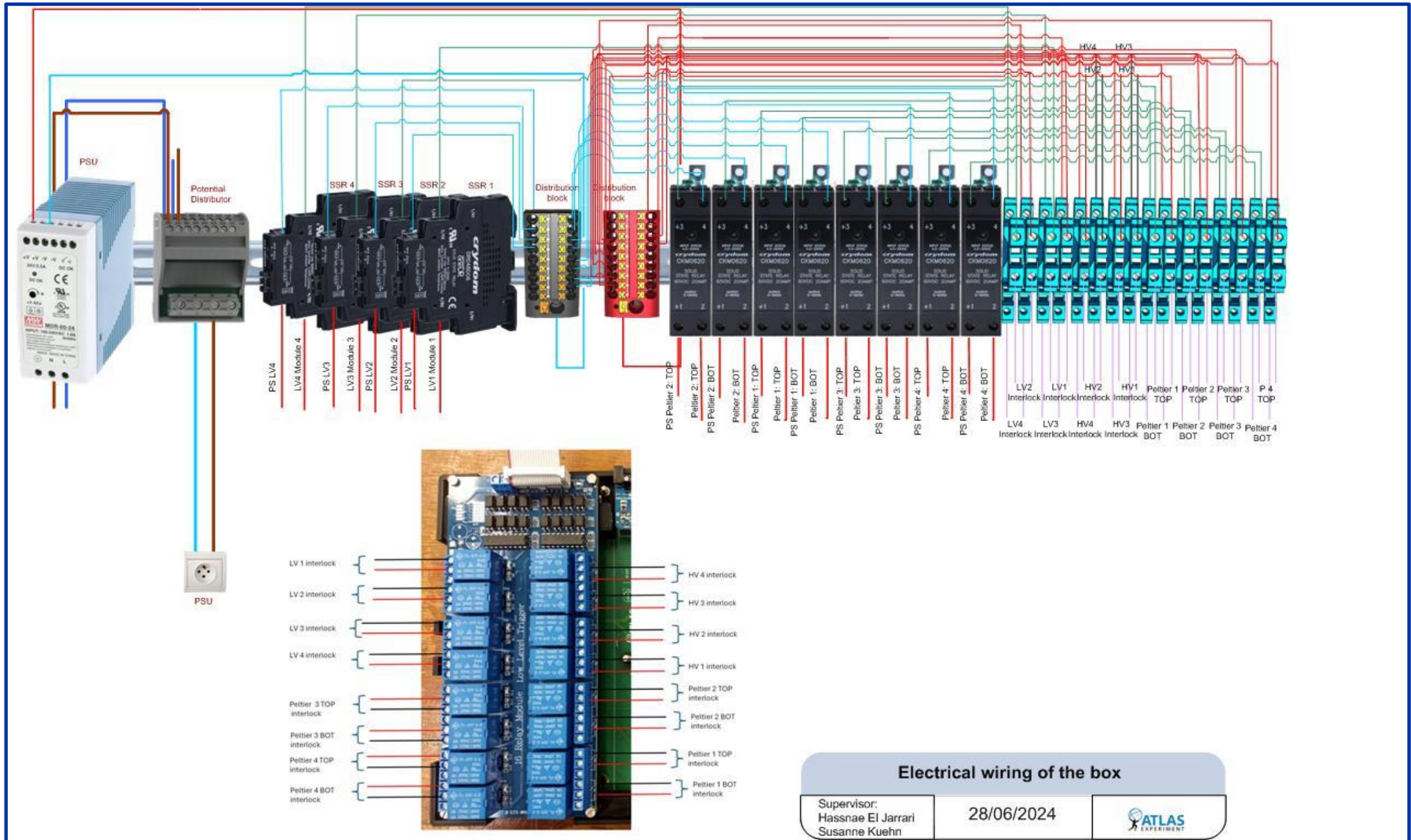
✓ Light sensors installed

✓ NTC cables connected

✓ Low Voltage PS cables connected



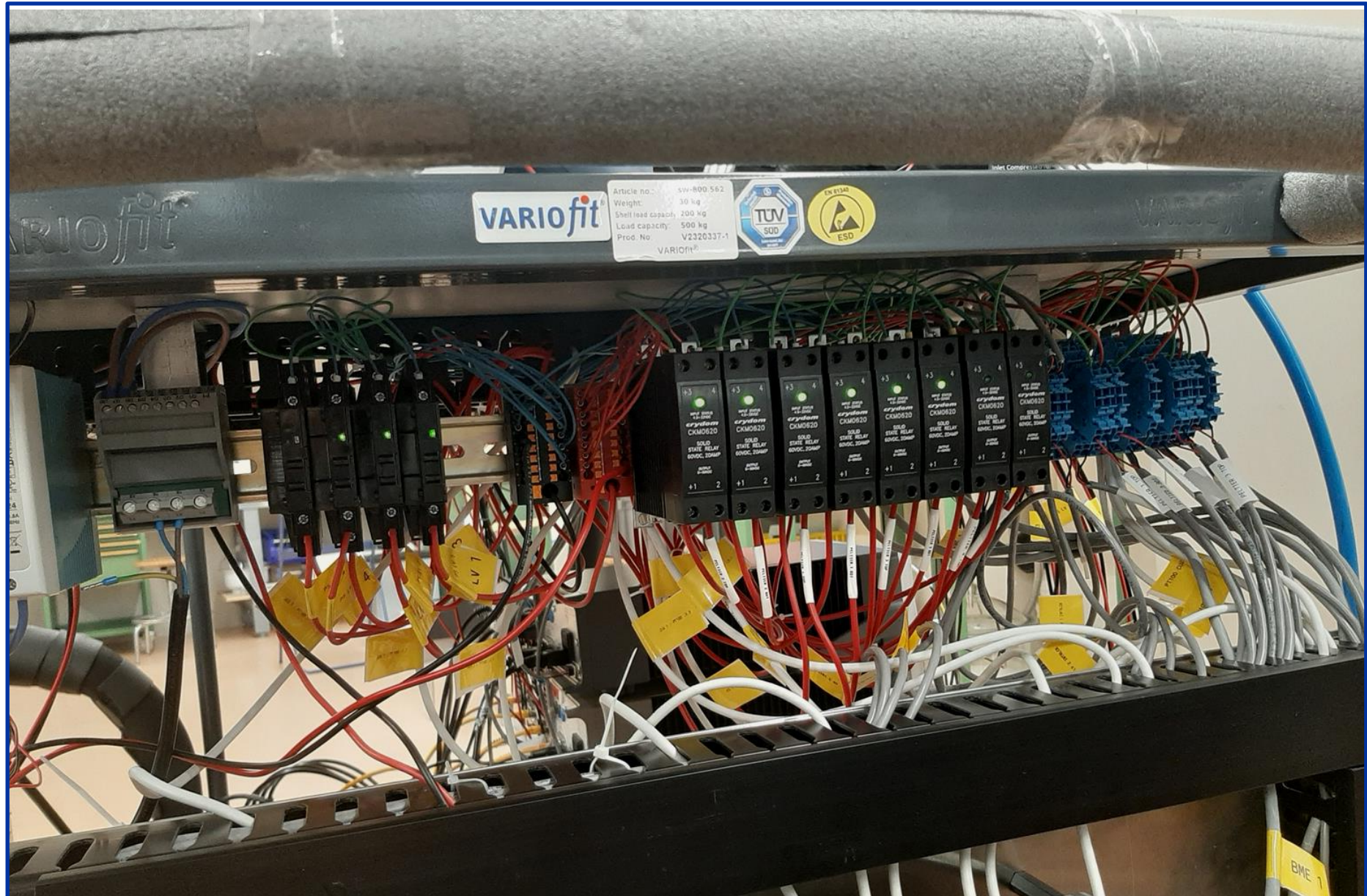
- Electrical Diagram for the QC setup electrical connection.



Electrical wiring of the box

Supervisor: Hassnae El Jarrari Susanne Kuehn	28/06/2024	
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- Electrical Diagram is completed.



Summary

Organism presentation and project context

Installation and connection of Cell Loaded QC Setup

Site Qualification for interlock system of the QC Setup

Perspectives & Upcoming Tasks

Software Tasks : Site qualification for interlock system of the QC Setup

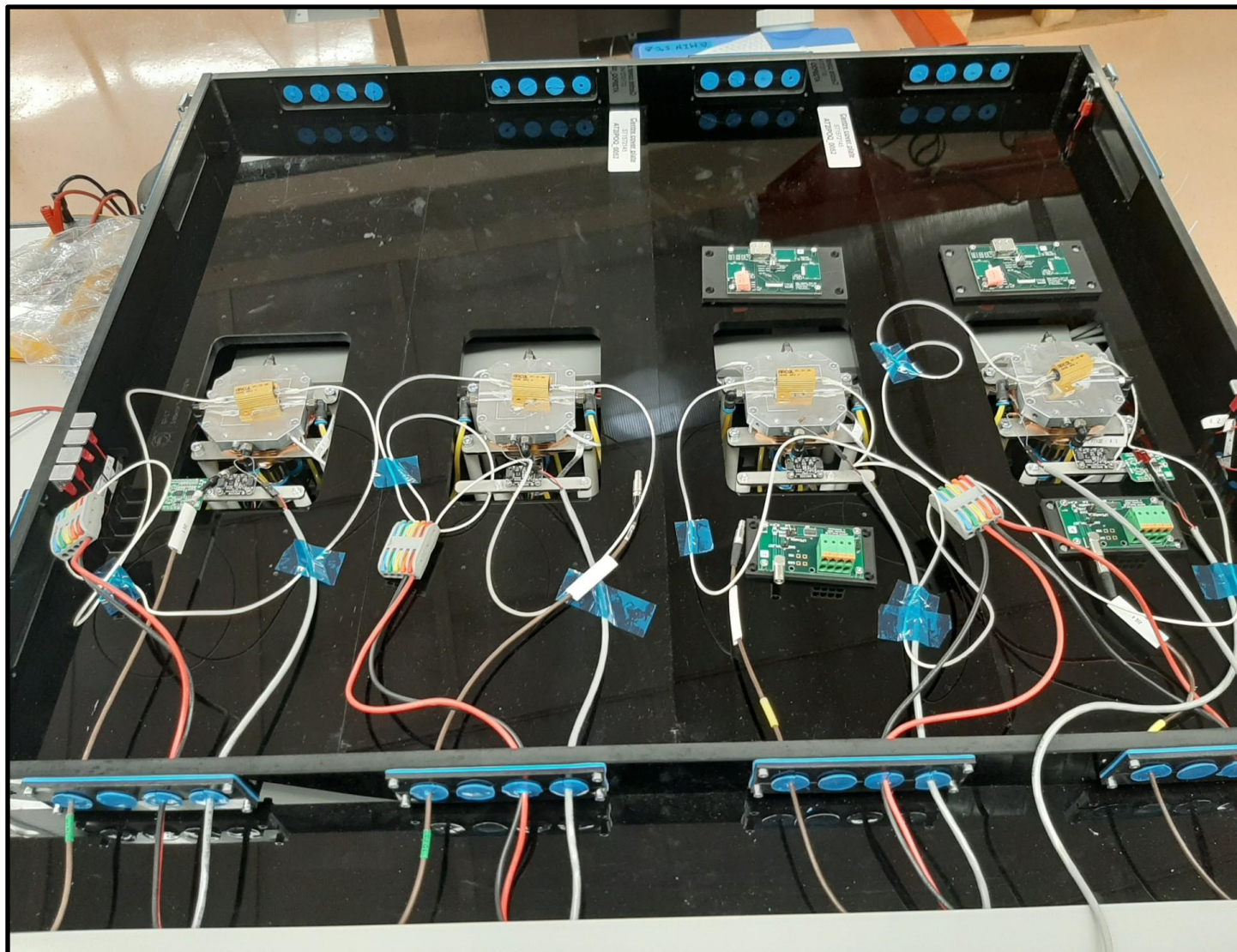
WARM TESTS

Warm tests for:

- Light sensors,
- Door Switches,
- NTC temperature sensors.

The initial conditions for the warm tests are:

- Dry air ON
- Box and lids closed
- Coolant Liquid circulation
- Peltiers PSUs ON



WARM TESTS

LIGHT SENSORS

Before putting the box in the initial state:

- The main cover open.
- Normal Environment light.

Values read by both light sensors: 99

The screenshot shows the 'qc-interlock GUI' interface. At the top, it displays the date and time: '6/20/2024, 3:02:22 PM [171888542027]'. A button labeled 'RESET LOCKED-IN INTERLOCKS' is visible. The main area is divided into several sections:

- NTC / Light sensors:** A table with columns for sensor ID, value, and status. Values for M1 through M4 are around 15-21, while M12 and M34 are 99.
- Door switches:** A table showing five switches (DSWITCH_1_OPEN to DSWITCH_5_OPEN) all in an 'OPEN' state.
- Dewpoints:** A table with columns for sensor ID, value, and status. Values for M1 through M4 range from 10.05 to 13.09.
- Interlocks (lock-in):** A table with columns for interlock ID, status, and controlled device. Statuses are red for 1, 2, 4, 5, and 11, and grey for 3 and 6.
- Log:** A table with columns for 'Time' and 'Message'. It shows three entries: '6/20/2024, 3:01:32 PM Legal TC received. Resetting all interlocks.', '6/20/2024, 2:53:30 PM Legal TC received. Resetting all interlocks.', and '6/20/2024, 2:29:09 PM Legal TC received. Resetting all interlocks.'

At the bottom left, version information is shown: 'W_SN: march-2024-1.1.0' and 'GUI_SN: february-2024-2.0.1'.

WARM TESTS

LIGHT SENSORS

Light source placed in proximity of the light sensor without lighting it:

- Dry air on
- Box and lids closed
- Liquid coolant circulation

Values read by both light sensors: 0

PT100		NTC / Light		TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	-0.02	M1_NTC_T	19.45	6/20/2024, 4:37:49 PM [1718894269509]			
M1_PT100_14_T	0.05	M2_NTC_T	21.74	Dangers (actual)	States	Interlocks (lock-in)	States
M2_PT100_21_T	-2.57	M3_NTC_T	21.51	1_LIGHT_DETECTED		1_LIGHT_DETECTED	
M2_PT100_24_T	-2.80	M4_NTC_T	20.99	2_DOOR_OPENED		2_DOOR_OPENED	
M3_PT100_31_T	-2.90	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT	
M3_PT100_34_T	-2.87	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT	
M4_PT100_41_T	-0.15	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT	
M4_PT100_44_T	-0.18		St...	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT	
M1_PT100_CB_T	15.09	DSWITCH_1_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT	
M2_PT100_CB_T	15.03	DSWITCH_2_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT	
M3_PT100_CB_T	15.13	DSWITCH_3_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT	
M4_PT100_CB_T	15.40	DSWITCH_4_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT	
		DSWITCH_5_OPEN	Closed	5_DEWPOINT_REACHED		5_DEWPOINT_REACHED	
Ambient				Dewpoints			
M1_ENV_T	18.83	M1_ENV_DEWT	-22.34	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE	
M2_ENV_T	19.05	M2_ENV_DEWT	-19.86	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART	
M3_ENV_T	18.97	M3_ENV_DEWT	-21.16	8_PC_COM_LOST		8_PC_COM_LOST	
M4_ENV_T	18.72	M4_ENV_DEWT	-21.56	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR	
M1_ENV_RH	4.71			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM	
M2_ENV_RH	5.78			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT	
M3_ENV_RH	5.18			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT	
M4_ENV_RH	5.08			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT	
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT	
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1			
				Time	Message		
				6/20/2024, 4:37:47 PM	Legal TC received. Resetting all interlocks.		
				6/20/2024, 4:36:51 PM	Legal TC received. Resetting all interlocks.		
				6/20/2024, 4:36:40 PM	Legal TC received. Resetting all interlocks.		

WARM TESTS

LIGHT SENSORS

Light source placed in proximity of the left light sensor:

- Dry air on
- Box and lids closed
- Liquid coolant circulation
- Light source ON

Result: Interlock is triggered

PT100		NTC / Light		TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS			
M1_PT100_11_T	11.79	M1_NTC_T	22.93	6/20/2024, 4:25:15 PM [1718893515385]					
M1_PT100_14_T	11.86	M2_NTC_T	21.76	Dangers (actual)	States	Interlocks (lock-in)	States	Controlled devices	States
M2_PT100_21_T	11.18	M3_NTC_T	21.65	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF	
M2_PT100_24_T	11.12	M4_NTC_T	21.00	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF	
M3_PT100_31_T	11.08	M12_LIGHT_ADC	44	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF	
M3_PT100_34_T	11.05	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF	
M4_PT100_41_T	12.60	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF	
M4_PT100_44_T	12.60	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF	
M1_PT100_CB_T	15.13	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF	
M2_PT100_CB_T	15.09	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF	
M3_PT100_CB_T	15.16	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF	
M4_PT100_CB_T	15.50	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF	
				5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF	
				6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF	
				7_WATCHDOG_RESTART		7_WATCHDOG_RESTART			
				8_PC_COM_LOST		8_PC_COM_LOST			
				9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR			
				10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
				11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
				11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
				11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT			
Ambient		Dewpoints		Time		Message			
M1_ENV_T	19.15	M1_ENV_DEWT	-23.71	6/20/2024, 4:25:14 PM	Legal TC received. Resetting all interlocks.				
M2_ENV_T	19.61	M2_ENV_DEWT	-20.56	6/20/2024, 4:25:10 PM	Legal TC received. Resetting all interlocks.				
M3_ENV_T	19.18	M3_ENV_DEWT	-22.95	6/20/2024, 4:24:01 PM	Legal TC received. Resetting all interlocks.				
M4_ENV_T	19.03	M4_ENV_DEWT	-23.02						
M1_ENV_RH	4.09								
M2_ENV_RH	5.25								
M3_ENV_RH	4.37								
M4_ENV_RH	4.38								
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1							

WARM TESTS

LIGHT SENSORS

Light source placed in proximity of the left light sensor:

- Dry air on
- Box and lids closed
- Liquid coolant circulation
- Light source OFF

Result:

PT100				NTC / Light				TM_RECEPTION_TIME					
V...	▲	V...	▲	V...	▲	V...	▲	6/20/2024, 4:28:19 PM [1718893699821]		RESET LOCKED-IN INTERLOCKS			
M1_PT100_11_T	▲	13.00	▲	M1_NTC_T	▲	20.39	▲	Dangers (actual)		Interlocks (lock-in)		Controlled devices	
M1_PT100_14_T	▲	13.14	▲	M2_NTC_T	▲	21.75	▲	1_LIGHT_DETECTED	▲	1_LIGHT_DETECTED	▲	M1_PEL_OFF	▲
M2_PT100_21_T	▲	12.13	▲	M3_NTC_T	▲	21.55	▲	2_DOOR_OPENED	▲	2_DOOR_OPENED	▲	M2_PEL_OFF	▲
M2_PT100_24_T	▲	11.72	▲	M4_NTC_T	▲	20.98	▲	3_M1_PT100_TOO_HOT	▲	3_M1_PT100_TOO_HOT	▲	M3_PEL_OFF	▲
M3_PT100_31_T	▲	12.16	▲	M12_LIGHT_ADC	▲	0	▲	3_M2_PT100_TOO_HOT	▲	3_M2_PT100_TOO_HOT	▲	M4_PEL_OFF	▲
M3_PT100_34_T	▲	12.43	▲	M34_LIGHT_ADC	▲	0	▲	3_M3_PT100_TOO_HOT	▲	3_M3_PT100_TOO_HOT	▲	M1_HV_OFF	▲
M4_PT100_41_T	▲	13.17	▲	Door switches				3_M4_PT100_TOO_HOT	▲	3_M4_PT100_TOO_HOT	▲	M2_HV_OFF	▲
M4_PT100_44_T	▲	13.37	▲	DSWITCH_1_OPEN	▲	Closed	▲	4_M1_NTC_SUPER_HOT	▲	4_M1_NTC_SUPER_HOT	▲	M3_HV_OFF	▲
M1_PT100_CB_T	▲	15.67	▲	DSWITCH_2_OPEN	▲	Closed	▲	4_M2_NTC_SUPER_HOT	▲	4_M2_NTC_SUPER_HOT	▲	M4_HV_OFF	▲
M2_PT100_CB_T	▲	15.63	▲	DSWITCH_3_OPEN	▲	Closed	▲	4_M3_NTC_SUPER_HOT	▲	4_M3_NTC_SUPER_HOT	▲	M1_LV_OFF	▲
M3_PT100_CB_T	▲	15.73	▲	DSWITCH_4_OPEN	▲	Closed	▲	4_M4_NTC_SUPER_HOT	▲	4_M4_NTC_SUPER_HOT	▲	M2_LV_OFF	▲
M4_PT100_CB_T	▲	15.97	▲	DSWITCH_5_OPEN	▲	Closed	▲	5_DEWPOINT_REACHED	▲	5_DEWPOINT_REACHED	▲	M3_LV_OFF	▲
Ambient				Dewpoints				6_LOW_BOARD_VOLTAGE	▲	6_LOW_BOARD_VOLTAGE	▲	M4_LV_OFF	▲
M1_ENV_T	▲	19.21	▲	M1_ENV_DEWT	▲	-27.22	▲	7_WATCHDOG_RESTART	▲	7_WATCHDOG_RESTART	▲		▲
M2_ENV_T	▲	19.65	▲	M2_ENV_DEWT	▲	-23.41	▲	8_PC_COM_LOST	▲	8_PC_COM_LOST	▲		▲
M3_ENV_T	▲	19.30	▲	M3_ENV_DEWT	▲	-25.64	▲	9_NOT_ENOUGH_DRY_AIR	▲	9_NOT_ENOUGH_DRY_AIR	▲		▲
M4_ENV_T	▲	19.15	▲	M4_ENV_DEWT	▲	-25.98	▲	10_NOT_ENOUGH_VACUUM	▲	10_NOT_ENOUGH_VACUUM	▲		▲
M1_ENV_RH	▲	2.96	▲		▲		▲	11_M1_COPPER_TOO_HOT	▲	11_M1_COPPER_TOO_HOT	▲		▲
M2_ENV_RH	▲	4.07	▲		▲		▲	11_M2_COPPER_TOO_HOT	▲	11_M2_COPPER_TOO_HOT	▲		▲
M3_ENV_RH	▲	3.40	▲		▲		▲	11_M3_COPPER_TOO_HOT	▲	11_M3_COPPER_TOO_HOT	▲		▲
M4_ENV_RH	▲	3.33	▲		▲		▲	11_M4_COPPER_TOO_HOT	▲	11_M4_COPPER_TOO_HOT	▲		▲
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time		Message			
								6/20/2024, 4:28:11 PM	Legal TC received. Resetting all interlocks.				
								6/20/2024, 4:27:53 PM	Legal TC received. Resetting all interlocks.				
								6/20/2024, 4:26:39 PM	Legal TC received. Resetting all interlocks.				

WARM TESTS

LIGHT SENSORS

Light source placed in proximity of the right light sensor:

- Dry air on
- Box and lids closed
- Liquid coolant circulation
- Light source ON

Result: Interlock is triggered

PT100				NTC / Light				TM_RECEPTION_TIME								
V...	▲	V...	▲	V...	▲	V...	▲	6/20/2024, 4:45:14 PM	RESET LOCKED-IN INTERLOCKS							
M1_PT100_11_T	12.97	M1_NTC_T	22.82					Dangers (actual)		States	Interlocks (lock-in)		States	Controlled devices		States
M1_PT100_14_T	12.94	M2_NTC_T	21.78					1_LIGHT_DETECTED			1_LIGHT_DETECTED			M1_PEL_OFF		
M2_PT100_21_T	12.06	M3_NTC_T	21.65					2_DOOR_OPENED			2_DOOR_OPENED			M2_PEL_OFF		
M2_PT100_24_T	11.99	M4_NTC_T	21.07					3_M1_PT100_TOO_HOT			3_M1_PT100_TOO_HOT			M3_PEL_OFF		
M3_PT100_31_T	12.06	M12_LIGHT_ADC	0					3_M2_PT100_TOO_HOT			3_M2_PT100_TOO_HOT			M4_PEL_OFF		
M3_PT100_34_T	12.06	M34_LIGHT_ADC	7					3_M3_PT100_TOO_HOT			3_M3_PT100_TOO_HOT			M1_HV_OFF		
M4_PT100_41_T	13.91	Door switches		St...		3_M4_PT100_TOO_HOT			3_M4_PT100_TOO_HOT			M2_HV_OFF				
M4_PT100_44_T	13.95	DSWITCH_1_OPEN		Closed		4_M1_NTC_SUPER_HOT			4_M1_NTC_SUPER_HOT			M3_HV_OFF				
M1_PT100_CB_T	15.09	DSWITCH_2_OPEN		Closed		4_M2_NTC_SUPER_HOT			4_M2_NTC_SUPER_HOT			M4_HV_OFF				
M2_PT100_CB_T	15.06	DSWITCH_3_OPEN		Closed		4_M3_NTC_SUPER_HOT			4_M3_NTC_SUPER_HOT			M1_LV_OFF				
M3_PT100_CB_T	15.23	DSWITCH_4_OPEN		Closed		4_M4_NTC_SUPER_HOT			4_M4_NTC_SUPER_HOT			M2_LV_OFF				
M4_PT100_CB_T	15.50	DSWITCH_5_OPEN		Closed		5_DEWPOINT_REACHED			5_DEWPOINT_REACHED			M3_LV_OFF				
Ambient				Dewpoints				6_LOW_BOARD_VOLTAGE			6_LOW_BOARD_VOLTAGE			M4_LV_OFF		
M1_ENV_T	18.83	M1_ENV_DEWT	-20.08					7_WATCHDOG_RESTART			7_WATCHDOG_RESTART					
M2_ENV_T	18.89	M2_ENV_DEWT	-18.43					8_PC_COM_LOST			8_PC_COM_LOST					
M3_ENV_T	19.08	M3_ENV_DEWT	-18.55					9_NOT_ENOUGH_DRY_AIR			9_NOT_ENOUGH_DRY_AIR					
M4_ENV_T	18.91	M4_ENV_DEWT	-19.25					10_NOT_ENOUGH_VACUUM			10_NOT_ENOUGH_VACUUM					
M1_ENV_RH	5.74					11_M1_COPPER_TOO_HOT			11_M1_COPPER_TOO_HOT							
M2_ENV_RH	6.60					11_M2_COPPER_TOO_HOT			11_M2_COPPER_TOO_HOT							
M3_ENV_RH	6.45					11_M3_COPPER_TOO_HOT			11_M3_COPPER_TOO_HOT							
M4_ENV_RH	6.14					11_M4_COPPER_TOO_HOT			11_M4_COPPER_TOO_HOT							
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time		Message						
								6/20/2024, 4:44:57		Legal TC received. Resetting all interlocks. PM						
								6/20/2024, 4:44:53		Legal TC received. Resetting all interlocks. PM						
								6/20/2024, 4:44:15		Legal TC received. Resetting all interlocks. PM						

WARM TESTS

LIGHT SENSORS

Light source placed in proximity of the right light sensor:

- Dry air on
- Box and lids closed
- Liquid coolant circulation
- Light source OFF

Result:

PT100		NTC / Light		TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	14.65	M1_NTC_T	21.53	6/20/2024, 4:48:06 PM [1718894886356]			
M1_PT100_14_T	14.65	M2_NTC_T	21.85	Dangers (actual)	Status	Interlocks (lock-in)	Status
M2_PT100_21_T	13.88	M3_NTC_T	21.59	1_LIGHT_DETECTED		1_LIGHT_DETECTED	
M2_PT100_24_T	13.68	M4_NTC_T	21.18	2_DOOR_OPENED		2_DOOR_OPENED	
M3_PT100_31_T	14.01	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT	
M3_PT100_34_T	14.12	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT	
M4_PT100_41_T	15.16	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT	
M4_PT100_44_T	15.30	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT	
M1_PT100_CB_T	15.30	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT	
M2_PT100_CB_T	15.26	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT	
M3_PT100_CB_T	15.36	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT	
M4_PT100_CB_T	15.73	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT	
Ambient		Dewpoints		5_DEWPOINT_REACHED		5_DEWPOINT_REACHED	
M1_ENV_T	18.91	M1_ENV_DEWT	-26.56	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE	
M2_ENV_T	18.91	M2_ENV_DEWT	-23.41	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART	
M3_ENV_T	19.19	M3_ENV_DEWT	-24.58	8_PC_COM_LOST		8_PC_COM_LOST	
M4_ENV_T	19.06	M4_ENV_DEWT	-25.24	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR	
M1_ENV_RH	3.20			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM	
M2_ENV_RH	4.27			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT	
M3_ENV_RH	3.77			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT	
M4_ENV_RH	3.58			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT	
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT	
				Time			
				6/20/2024, 4:48:03 Legal TC received. Resetting all interlocks. PM			
				6/20/2024, 4:47:56 Legal TC received. Resetting all interlocks. PM			
				6/20/2024, 4:45:48 Legal TC received. Resetting all interlocks.			
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1		Message			

WARM TESTS

DOOR SWITCHES

- Dry air on
- **Cover 1 opened**
- **The main cover, cover 2, 3, and 4 closed**
- Liquid coolant circulation

Result: Interlock is triggered

PT100				NTC / Light				TM_RECEPTION_TIME							
V...		V...		V...		V...		6/20/2024, 5:06:02 PM [1718895962237]	RESET LOCKED-IN INTERLOCKS						
M1_PT100_11_T	0.42	M1_NTC_T	22.63					Dangers (actual)	States	Interlocks (lock-in)	States	Controlled devices	States		
M1_PT100_14_T	0.42	M2_NTC_T	21.75					1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF			
M2_PT100_21_T	-2.30	M3_NTC_T	21.65					2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF			
M2_PT100_24_T	-2.47	M4_NTC_T	21.00					3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF			
M3_PT100_31_T	-2.57	M12_LIGHT_ADC	99					3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF			
M3_PT100_34_T	-2.70	M34_LIGHT_ADC	0					3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF			
M4_PT100_41_T	0.96	Door switches		St...						3_M4_PT100_TOO_HOT		M2_HV_OFF			
M4_PT100_44_T	0.82	DSWITCH_1_OPEN	OPEN					4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF			
M1_PT100_CB_T	14.99	DSWITCH_2_OPEN	Closed					4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF			
M2_PT100_CB_T	14.93	DSWITCH_3_OPEN	Closed					4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF			
M3_PT100_CB_T	14.99	DSWITCH_4_OPEN	Closed					4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF			
M4_PT100_CB_T	15.20	DSWITCH_5_OPEN	Closed					5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF			
Ambient				Dewpoints											
M1_ENV_T	18.25	M1_ENV_DEWT	-5.90					6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF			
M2_ENV_T	18.66	M2_ENV_DEWT	-3.86					7_WATCHDOG_RESTART		7_WATCHDOG_RESTART					
M3_ENV_T	18.26	M3_ENV_DEWT	-9.90					8_PC_COM_LOST		8_PC_COM_LOST					
M4_ENV_T	18.21	M4_ENV_DEWT	-7.19					9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR					
M1_ENV_RH	18.88									10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
M2_ENV_RH	21.48									11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
M3_ENV_RH	13.82									11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
M4_ENV_RH	17.14									11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
												11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT	
												Time		Message	
												6/20/2024, 5:05:58 PM	Legal TC received. Resetting all interlocks.		
												6/20/2024, 5:05:56 PM	Legal TC received. Resetting all interlocks.		
												6/20/2024, 5:04:19 PM	Legal TC received. Resetting all interlocks.		
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1											

WARM TESTS

DOOR SWITCHES

- Dry air on
- **Cover 2 opened**
- **The main cover, cover 1, 3, and 4 closed**
- Liquid coolant circulation

Result: Interlock is triggered

PT100		NTC / Light		TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	8.09	M1_NTC_T	22.53	6/20/2024, 5:09:06 PM [1718896146672]			
M1_PT100_14_T	8.02	M2_NTC_T	21.84	Dangers (actual)	States	Interlocks (lock-in)	States
M2_PT100_21_T	6.20	M3_NTC_T	21.65	1_LIGHT_DETECTED		1_LIGHT_DETECTED	
M2_PT100_24_T	6.07	M4_NTC_T	21.18	2_DOOR_OPENED		2_DOOR_OPENED	
M3_PT100_31_T	6.13	M12_LIGHT_ADC	4	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT	
M3_PT100_34_T	6.17	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT	
M4_PT100_41_T	8.66	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT	
M4_PT100_44_T	8.59	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT	
M1_PT100_CB_T	15.23	DSWITCH_2_OPEN	OPEN	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT	
M2_PT100_CB_T	15.20	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT	
M3_PT100_CB_T	15.26	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT	
M4_PT100_CB_T	15.53	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT	
Ambient				Dewpoints			
M1_ENV_T	18.44	M1_ENV_DEWT	-22.36	5_DEWPOINT_REACHED		5_DEWPOINT_REACHED	
M2_ENV_T	18.64	M2_ENV_DEWT	-20.03	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE	
M3_ENV_T	18.52	M3_ENV_DEWT	-20.49	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART	
M4_ENV_T	18.53	M4_ENV_DEWT	-21.38	8_PC_COM_LOST		8_PC_COM_LOST	
M1_ENV_RH	4.82			9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR	
M2_ENV_RH	5.84			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM	
M3_ENV_RH	5.65			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT	
M4_ENV_RH	5.22			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT	
				11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT	
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT	
				Time			
				Message			
				6/20/2024, 5:09:05 PM Legal TC received. Resetting all interlocks.			
				6/20/2024, 5:08:48 PM Legal TC received. Resetting all interlocks.			
				6/20/2024, 5:07:36 PM Legal TC received. Resetting all interlocks.			
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1					

WARM TESTS

DOOR SWITCHES

- Dry air on
- **Cover 3 opened**
- **The main cover, cover 1, 2, and 4 closed**
- Liquid coolant circulation

Result: Interlock is triggered

PT100				NTC / Light				TM RECEPTION TIME			
M1_PT100_11_T	V...	10.17	▲	M1_NTC_T	V...	23.04	▲	6/20/2024, 5:10:03 PM [1718896203016]			
M1_PT100_14_T	V...	10.14	▲	M2_NTC_T	V...	21.85	▲	RESET LOCKED-IN INTERLOCKS			
M2_PT100_21_T	V...	8.69	▲	M3_NTC_T	V...	21.66	▲	Dangers (actual) ▲ States			
M2_PT100_24_T	V...	8.62	▲	M4_NTC_T	V...	21.18	▲	Interlocks (lock-in) ▲ States			
M3_PT100_31_T	V...	8.69	▲	M12_LIGHT_ADC	V...	0	▲	Controlled devices ▲ States			
M3_PT100_34_T	V...	8.62	▲	M34_LIGHT_ADC	V...	2	▲	1_LIGHT_DETECTED			
M4_PT100_41_T	V...	10.88	▲	Door switches ▲ St... ▲				2_DOOR_OPENED			
M4_PT100_44_T	V...	10.88	▲	DSWITCH_1_OPEN	V...	Closed	▲	3_M1_PT100_TOO_HOT			
M1_PT100_CB_T	V...	15.06	▲	DSWITCH_2_OPEN	V...	Closed	▲	3_M2_PT100_TOO_HOT			
M2_PT100_CB_T	V...	14.99	▲	DSWITCH_3_OPEN	V...	OPEN	▲	3_M3_PT100_TOO_HOT			
M3_PT100_CB_T	V...	15.13	▲	DSWITCH_4_OPEN	V...	Closed	▲	3_M4_PT100_TOO_HOT			
M4_PT100_CB_T	V...	15.43	▲	DSWITCH_5_OPEN	V...	Closed	▲	4_M1_NTC_SUPER_HOT			
Ambient ▲ V... ▲				Dewpoints ▲ V... ▲				5_DEWPOINT_REACHED			
M1_ENV_T	V...	18.47	▲	M1_ENV_DEWT	V...	-19.21	▲	6_LOW_BOARD_VOLTAGE			
M2_ENV_T	V...	18.65	▲	M2_ENV_DEWT	V...	-18.59	▲	7_WATCHDOG_RESTART			
M3_ENV_T	V...	18.60	▲	M3_ENV_DEWT	V...	-14.48	▲	8_PC_COM_LOST			
M4_ENV_T	V...	18.62	▲	M4_ENV_DEWT	V...	-18.98	▲	9_NOT_ENOUGH_DRY_AIR			
M1_ENV_RH	V...	6.33	▲					10_NOT_ENOUGH_VACUUM			
M2_ENV_RH	V...	6.60	▲					11_M1_COPPER_TOO_HOT			
M3_ENV_RH	V...	9.35	▲					11_M2_COPPER_TOO_HOT			
M4_ENV_RH	V...	6.40	▲					11_M3_COPPER_TOO_HOT			
								11_M4_COPPER_TOO_HOT			
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time Message			
								6/20/2024, 5:09:56 PM Legal TC received. Resetting all interlocks.			
								6/20/2024, 5:09:05 PM Legal TC received. Resetting all interlocks.			
								6/20/2024, 5:08:48 PM Legal TC received. Resetting all interlocks.			

WARM TESTS

DOOR SWITCHES

- Dry air on
- **Cover 4 opened**
- **The main cover, cover 1, 2, and 3 closed**
- Liquid coolant circulation

Result: Interlock is triggered

PT100				NTC / Light				TM_RECEPTION_TIME						
M1_PT100_11_T	12.06	M1_NTC_T	22.27	6/20/2024, 5:11:10 PM [1718896270642]				RESET LOCKED-IN INTERLOCKS						
M1_PT100_14_T	12.03	M2_NTC_T	21.85	Dangers (actual)		States	Interlocks (lock-in)		States	Controlled devices		States		
M2_PT100_21_T	10.85	M3_NTC_T	21.64	1_LIGHT_DETECTED			1_LIGHT_DETECTED			M1_PEL_OFF				
M2_PT100_24_T	10.81	M4_NTC_T	21.18	2_DOOR_OPENED			2_DOOR_OPENED			M2_PEL_OFF				
M3_PT100_31_T	10.85	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT			3_M1_PT100_TOO_HOT			M3_PEL_OFF				
M3_PT100_34_T	10.88	M34_LIGHT_ADC	99	3_M2_PT100_TOO_HOT			3_M2_PT100_TOO_HOT			M4_PEL_OFF				
M4_PT100_41_T	12.77	Door switches		3_M3_PT100_TOO_HOT			3_M3_PT100_TOO_HOT			M1_HV_OFF				
M4_PT100_44_T	12.80	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT			3_M4_PT100_TOO_HOT			M2_HV_OFF				
M1_PT100_CB_T	15.13	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT			4_M1_NTC_SUPER_HOT			M3_HV_OFF				
M2_PT100_CB_T	15.09	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT			4_M2_NTC_SUPER_HOT			M4_HV_OFF				
M3_PT100_CB_T	15.20	DSWITCH_4_OPEN	OPEN	4_M3_NTC_SUPER_HOT			4_M3_NTC_SUPER_HOT			M1_LV_OFF				
M4_PT100_CB_T	15.67	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT			4_M4_NTC_SUPER_HOT			M2_LV_OFF				
Ambient				Dewpoints				5_DEWPOINT_REACHED			5_DEWPOINT_REACHED		M3_LV_OFF	
M1_ENV_T	18.53	M1_ENV_DEWT	-13.15	6_LOW_BOARD_VOLTAGE			6_LOW_BOARD_VOLTAGE			6_LOW_BOARD_VOLTAGE		M4_LV_OFF		
M2_ENV_T	18.69	M2_ENV_DEWT	-13.11	7_WATCHDOG_RESTART			7_WATCHDOG_RESTART			7_WATCHDOG_RESTART				
M3_ENV_T	18.84	M3_ENV_DEWT	2.17	8_PC_COM_LOST			8_PC_COM_LOST			8_PC_COM_LOST				
M4_ENV_T	18.69	M4_ENV_DEWT	-9.96	9_NOT_ENOUGH_DRY_AIR			9_NOT_ENOUGH_DRY_AIR			9_NOT_ENOUGH_DRY_AIR				
M1_ENV_RH	10.48			10_NOT_ENOUGH_VACUUM			10_NOT_ENOUGH_VACUUM			10_NOT_ENOUGH_VACUUM				
M2_ENV_RH	10.40			11_M1_COPPER_TOO_HOT			11_M1_COPPER_TOO_HOT			11_M1_COPPER_TOO_HOT				
M3_ENV_RH	33.03			11_M2_COPPER_TOO_HOT			11_M2_COPPER_TOO_HOT			11_M2_COPPER_TOO_HOT				
M4_ENV_RH	13.40			11_M3_COPPER_TOO_HOT			11_M3_COPPER_TOO_HOT			11_M3_COPPER_TOO_HOT				
							11_M4_COPPER_TOO_HOT			11_M4_COPPER_TOO_HOT				
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time		Message				
								6/20/2024, 5:11:09 PM		Legal TC received. Resetting all interlocks.				
								6/20/2024, 5:09:56 PM		Legal TC received. Resetting all interlocks.				
								6/20/2024, 5:09:05 PM		Legal TC received. Resetting all interlocks.				

WARM TESTS

DOOR SWITCHES

- Dry air on
- **The main cover opened, cover 1, 2, 3, and 4 closed**
- Liquid coolant circulation

Result: Interlock is triggered

PT100				NTC / Light				TM_RECEPTION_TIME									
V...	V...	V...	V...	V...	V...	V...	V...	6/20/2024, 5:13:52 PM	RESET LOCKED-IN INTERLOCKS	6/20/2024, 5:13:52 PM	6/20/2024, 5:13:52 PM	6/20/2024, 5:13:52 PM	6/20/2024, 5:13:52 PM				
M1_PT100_11_T	11.32	M1_NTC_T	22.79	Dangers (actual)				States	Interlocks (lock-in)	States	Controlled devices						
M1_PT100_14_T	11.35	M2_NTC_T	21.77	1_LIGHT_DETECTED					1_LIGHT_DETECTED		M1_PEL_OFF						
M2_PT100_21_T	10.31	M3_NTC_T	21.65	2_DOOR_OPENED					2_DOOR_OPENED		M2_PEL_OFF						
M2_PT100_24_T	10.24	M4_NTC_T	21.03	3_M1_PT100_TOO_HOT					3_M1_PT100_TOO_HOT		M3_PEL_OFF						
M3_PT100_31_T	10.34	M12_LIGHT_ADC	99	3_M2_PT100_TOO_HOT					3_M2_PT100_TOO_HOT		M4_PEL_OFF						
M3_PT100_34_T	10.34	M34_LIGHT_ADC	99	3_M3_PT100_TOO_HOT					3_M3_PT100_TOO_HOT		M1_HV_OFF						
M4_PT100_41_T	11.79	Door switches		St...		3_M4_PT100_TOO_HOT					3_M4_PT100_TOO_HOT		M2_HV_OFF				
M4_PT100_44_T	11.82	DSWITCH_1_OPEN	OPEN	4_M1_NTC_SUPER_HOT					4_M1_NTC_SUPER_HOT		M3_HV_OFF						
M1_PT100_CB_T	15.20	DSWITCH_2_OPEN	OPEN	4_M2_NTC_SUPER_HOT					4_M2_NTC_SUPER_HOT		M4_HV_OFF						
M2_PT100_CB_T	15.09	DSWITCH_3_OPEN	OPEN	4_M3_NTC_SUPER_HOT					4_M3_NTC_SUPER_HOT		M1_LV_OFF						
M3_PT100_CB_T	15.16	DSWITCH_4_OPEN	OPEN	4_M4_NTC_SUPER_HOT					4_M4_NTC_SUPER_HOT		M2_LV_OFF						
M4_PT100_CB_T	15.40	DSWITCH_5_OPEN	OPEN	5_DEWPOINT_REACHED					5_DEWPOINT_REACHED		M3_LV_OFF						
Ambient				Dewpoints				6_LOW_BOARD_VOLTAGE					6_LOW_BOARD_VOLTAGE		M4_LV_OFF		
M1_ENV_T	18.75	M1_ENV_DEWT	8.99	7_WATCHDOG_RESTART					7_WATCHDOG_RESTART								
M2_ENV_T	18.87	M2_ENV_DEWT	9.45	8_PC_COM_LOST					8_PC_COM_LOST								
M3_ENV_T	19.17	M3_ENV_DEWT	10.86	9_NOT_ENOUGH_DRY_AIR					9_NOT_ENOUGH_DRY_AIR								
M4_ENV_T	19.02	M4_ENV_DEWT	10.11	10_NOT_ENOUGH_VACUUM					10_NOT_ENOUGH_VACUUM								
M1_ENV_RH	53.34			11_M1_COPPER_TOO_HOT					11_M1_COPPER_TOO_HOT								
M2_ENV_RH	54.62			11_M2_COPPER_TOO_HOT					11_M2_COPPER_TOO_HOT								
M3_ENV_RH	58.91			11_M3_COPPER_TOO_HOT					11_M3_COPPER_TOO_HOT								
M4_ENV_RH	56.59			11_M4_COPPER_TOO_HOT					11_M4_COPPER_TOO_HOT								
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time				Message					
								6/20/2024, 5:13:28				Legal TC received. Resetting all interlocks. PM					
								6/20/2024, 5:13:20				Legal TC received. Resetting all interlocks. PM					
								6/20/2024, 5:12:38				Legal TC received. Resetting all interlocks. PM					

WARM TESTS

DOOR SWITCHES

- Dry air on
- **Box and lids closed**
- Liquid coolant circulation

Result:

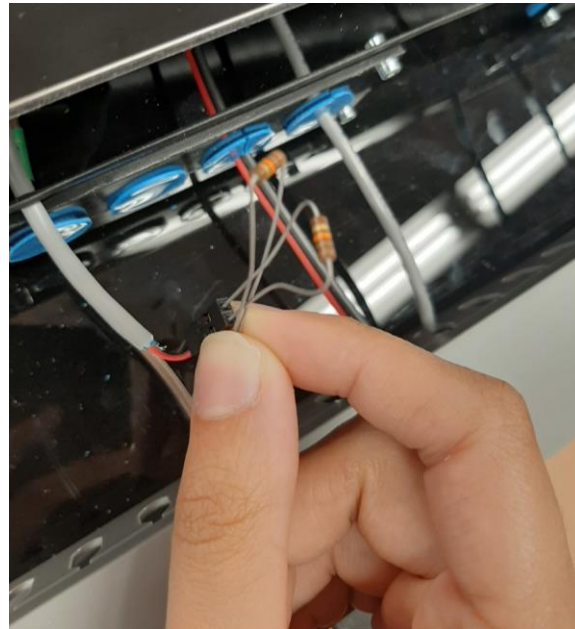
PT100				NTC / Light				TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS		
M1_PT100_11_T	V...	13.14	M1_NTC_T	V...	22.92	6/20/2024, 5:12:42 PM [1718896362858]						
M1_PT100_14_T	V...	13.27	M2_NTC_T	V...	21.85	Dangers (actual)	Status	Interlocks (lock-in)	Status	Controlled devices	Status	
M2_PT100_21_T	V...	12.03	M3_NTC_T	V...	21.65	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF		
M2_PT100_24_T	V...	11.79	M4_NTC_T	V...	21.18	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF		
M3_PT100_31_T	V...	12.16	M12_LIGHT_ADC	V...	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF		
M3_PT100_34_T	V...	12.33	M34_LIGHT_ADC	V...	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF		
M4_PT100_41_T	V...	13.68	Door switches			3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF		
M4_PT100_44_T	V...	13.85	DSWITCH_1_OPEN	St...	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF		
M1_PT100_CB_T	V...	15.30	DSWITCH_2_OPEN	St...	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF		
M2_PT100_CB_T	V...	15.26	DSWITCH_3_OPEN	St...	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF		
M3_PT100_CB_T	V...	15.40	DSWITCH_4_OPEN	St...	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF		
M4_PT100_CB_T	V...	15.60	DSWITCH_5_OPEN	St...	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF		
Ambient				Dewpoints				5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		
M1_ENV_T	V...	18.59	M1_ENV_DEWT	V...	-6.80	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M3_LV_OFF		
M2_ENV_T	V...	18.75	M2_ENV_DEWT	V...	-6.38	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART		M4_LV_OFF		
M3_ENV_T	V...	19.05	M3_ENV_DEWT	V...	-5.95	8_PC_COM_LOST		8_PC_COM_LOST				
M4_ENV_T	V...	18.80	M4_ENV_DEWT	V...	-6.13	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR				
M1_ENV_RH	V...	17.25					10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
M2_ENV_RH	V...	17.64					11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
M3_ENV_RH	V...	17.90					11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
M4_ENV_RH	V...	17.93					11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
								11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT		
								Time		Message		
								6/20/2024, 5:12:38	Legal TC received. Resetting all interlocks.			
								6/20/2024, 5:11:09	Legal TC received. Resetting all interlocks.			
								6/20/2024, 5:09:56	Legal TC received. Resetting all interlocks.			
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1								

WARM TESTS

NTC Temperature sensors

Before putting the box in the initial state:

- NTC connectors pulled out of the box.
- Box closed.
- 10 kOhm resistor shorted with a further resistor having a value of 10-15 kOhm. The parallel provides a temperature reading > 40 deg which trigger the interlock.



WARM TESTS

NTC Temperature sensors

NTC temperature sensor 1:

PT100		V...	NTC / Light		V...	TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	1.29	M1_NTC_T	41.26	6/21/2024, 11:33:25 AM [1718962405935]					
M1_PT100_14_T	1.29	M2_NTC_T	21.71	Dangers (actual)		Interlocks (lock-in)		Controlled devices	
M2_PT100_21_T	7.45	M3_NTC_T	21.59	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF	
M2_PT100_24_T	7.31	M4_NTC_T	20.96	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF	
M3_PT100_31_T	0.25	M2_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF	
M3_PT100_34_T	0.35	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF	
M4_PT100_41_T	1.97			3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF	
M4_PT100_44_T	1.83			3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF	
M1_PT100_CB_T	15.20	Door switches		4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF	
M2_PT100_CB_T	14.99	DSWITCH_1_OPEN Closed		4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF	
M3_PT100_CB_T	15.16	DSWITCH_2_OPEN Closed		4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF	
M4_PT100_CB_T	15.46	DSWITCH_3_OPEN Closed		4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF	
		DSWITCH_4_OPEN Closed		5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF	
		DSWITCH_5_OPEN Closed		6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF	
				7_WATCHDOG_RESTART		7_WATCHDOG_RESTART			
				8_PC_COM_LOST		8_PC_COM_LOST			
Ambient		Dewpoints		9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR			
M1_ENV_T	18.93	M1_ENV_DEWT	-24.75	10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
M2_ENV_T	18.85	M2_ENV_DEWT	-28.49	11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
M3_ENV_T	18.93	M3_ENV_DEWT	-26.57	11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
M4_ENV_T	18.77	M4_ENV_DEWT	-26.37	11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
M1_ENV_RH	3.78			11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT			
M2_ENV_RH	2.69								
M3_ENV_RH	3.20								
M4_ENV_RH	3.29								
				Time		Message			
				6/21/2024, 11:30:08 AM		Legal TC received. Resetting all interlocks.			
				6/21/2024, 11:29:33 AM		Legal TC received. Resetting all interlocks.			
				6/21/2024, 11:29:22 AM		Legal TC received. Resetting all interlocks.			
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1							

NTC temperature sensor 2:

PT100		V...	NTC / Light		V...	TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	2.60	M1_NTC_T	21.17	6/21/2024, 11:35:03 AM [1718962503250]					
M1_PT100_14_T	2.57	M2_NTC_T	41.60	Dangers (actual)		Interlocks (lock-in)		Controlled devices	
M2_PT100_21_T	5.43	M3_NTC_T	21.57	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF	
M2_PT100_24_T	5.23	M4_NTC_T	21.12	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF	
M3_PT100_31_T	1.16	M2_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF	
M3_PT100_34_T	1.26	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF	
M4_PT100_41_T	2.87			3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF	
M4_PT100_44_T	2.81			3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF	
M1_PT100_CB_T	15.09	Door switches		4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF	
M2_PT100_CB_T	15.26	DSWITCH_1_OPEN Closed		4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF	
M3_PT100_CB_T	15.16	DSWITCH_2_OPEN Closed		4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF	
M4_PT100_CB_T	15.50	DSWITCH_3_OPEN Closed		4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF	
		DSWITCH_4_OPEN Closed		5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF	
		DSWITCH_5_OPEN Closed		6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF	
				7_WATCHDOG_RESTART		7_WATCHDOG_RESTART			
				8_PC_COM_LOST		8_PC_COM_LOST			
Ambient		Dewpoints		9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR			
M1_ENV_T	18.93	M1_ENV_DEWT	-24.81	10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
M2_ENV_T	18.85	M2_ENV_DEWT	-28.63	11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
M3_ENV_T	18.98	M3_ENV_DEWT	-26.69	11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
M4_ENV_T	18.79	M4_ENV_DEWT	-26.46	11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
M1_ENV_RH	3.75			11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT			
M2_ENV_RH	2.65								
M3_ENV_RH	3.15								
M4_ENV_RH	3.26								
				Time		Message			
				6/21/2024, 11:34:40 AM		Legal TC received. Resetting all interlocks.			
				6/21/2024, 11:33:42 AM		Legal TC received. Resetting all interlocks.			
				6/21/2024, 11:30:08 AM		Legal TC received. Resetting all interlocks.			
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1							

WARM TESTS

NTC Temperature sensors

NTC temperature sensor 3:

PT100		V...	NTC / Light	V...	TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	2.77	M1_NTC_T	21.13	6/21/2024, 11:41:43 AM		[1718962903912]		
M1_PT100_14_T	2.77	M2_NTC_T	21.79	Dangers (actual)		Interlocks (lock-in)		
M2_PT100_21_T	2.13	M3_NTC_T	40.64	1_LIGHT_DETECTED	1_LIGHT_DETECTED	M1_PEL_OFF		
M2_PT100_24_T	1.90	M4_NTC_T	21.12	2_DOOR_OPENED	2_DOOR_OPENED	M2_PEL_OFF		
M3_PT100_31_T	4.18	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT	3_M1_PT100_TOO_HOT	M3_PEL_OFF		
M3_PT100_34_T	4.18	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT	3_M2_PT100_TOO_HOT	M4_PEL_OFF		
M4_PT100_41_T	3.68			3_M3_PT100_TOO_HOT	3_M3_PT100_TOO_HOT	M1_HV_OFF		
M4_PT100_44_T	3.58			3_M4_PT100_TOO_HOT	3_M4_PT100_TOO_HOT	M2_HV_OFF		
M1_PT100_CB_T	15.20	Door switches		4_M1_NTC_SUPER_HOT	4_M1_NTC_SUPER_HOT	M3_HV_OFF		
M2_PT100_CB_T	15.13	DSWITCH_1_OPEN	Closed	4_M2_NTC_SUPER_HOT	4_M2_NTC_SUPER_HOT	M4_HV_OFF		
M3_PT100_CB_T	15.09	DSWITCH_2_OPEN	Closed	4_M3_NTC_SUPER_HOT	4_M3_NTC_SUPER_HOT	M1_LV_OFF		
M4_PT100_CB_T	15.50	DSWITCH_3_OPEN	Closed	4_M4_NTC_SUPER_HOT	4_M4_NTC_SUPER_HOT	M2_LV_OFF		
		DSWITCH_4_OPEN	Closed	5_DEWPOINT_REACHED	5_DEWPOINT_REACHED	M3_LV_OFF		
		DSWITCH_5_OPEN	Closed	6_LOW_BOARD_VOLTAGE	6_LOW_BOARD_VOLTAGE	M4_LV_OFF		
				7_WATCHDOG_RESTART	7_WATCHDOG_RESTART			
				8_PC_COM_LOST	8_PC_COM_LOST			
				9_NOT_ENOUGH_DRY_AIR	9_NOT_ENOUGH_DRY_AIR			
				10_NOT_ENOUGH_VACUUM	10_NOT_ENOUGH_VACUUM			
				11_M1_COPPER_TOO_HOT	11_M1_COPPER_TOO_HOT			
				11_M2_COPPER_TOO_HOT	11_M2_COPPER_TOO_HOT			
				11_M3_COPPER_TOO_HOT	11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT	11_M4_COPPER_TOO_HOT			
Ambient		V...	Dewpoints	V...	Time			
M1_ENV_T	18.91	M1_ENV_DEWT	-25.05	6/21/2024, 11:38:06 AM				Legal TC received. Resetting all interlocks.
M2_ENV_T	18.83	M2_ENV_DEWT	-28.91	6/21/2024, 11:35:17 AM				Legal TC received. Resetting all interlocks.
M3_ENV_T	18.97	M3_ENV_DEWT	-26.92	6/21/2024, 11:34:40 AM				Legal TC received. Resetting all interlocks.
M4_ENV_T	18.81	M4_ENV_DEWT	-26.74					
M1_ENV_RH	3.68							
M2_ENV_RH	2.59							
M3_ENV_RH	3.09							
M4_ENV_RH	3.17							
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1						

NTC temperature sensor 4:

PT100		V...	NTC / Light	V...	TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	2.71	M1_NTC_T	21.10	6/21/2024, 11:45:19 AM		[1718963119087]		
M1_PT100_14_T	2.74	M2_NTC_T	21.75	Dangers (actual)		Interlocks (lock-in)		
M2_PT100_21_T	2.00	M3_NTC_T	21.46	1_LIGHT_DETECTED	1_LIGHT_DETECTED	M1_PEL_OFF		
M2_PT100_24_T	1.76	M4_NTC_T	40.44	2_DOOR_OPENED	2_DOOR_OPENED	M2_PEL_OFF		
M3_PT100_31_T	4.25	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT	3_M1_PT100_TOO_HOT	M3_PEL_OFF		
M3_PT100_34_T	4.39	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT	3_M2_PT100_TOO_HOT	M4_PEL_OFF		
M4_PT100_41_T	4.72			3_M3_PT100_TOO_HOT	3_M3_PT100_TOO_HOT	M1_HV_OFF		
M4_PT100_44_T	4.59			3_M4_PT100_TOO_HOT	3_M4_PT100_TOO_HOT	M2_HV_OFF		
M1_PT100_CB_T	15.23	Door switches		4_M1_NTC_SUPER_HOT	4_M1_NTC_SUPER_HOT	M3_HV_OFF		
M2_PT100_CB_T	15.13	DSWITCH_1_OPEN	Closed	4_M2_NTC_SUPER_HOT	4_M2_NTC_SUPER_HOT	M4_HV_OFF		
M3_PT100_CB_T	15.30	DSWITCH_2_OPEN	Closed	4_M3_NTC_SUPER_HOT	4_M3_NTC_SUPER_HOT	M1_LV_OFF		
M4_PT100_CB_T	15.43	DSWITCH_3_OPEN	Closed	4_M4_NTC_SUPER_HOT	4_M4_NTC_SUPER_HOT	M2_LV_OFF		
		DSWITCH_4_OPEN	Closed	5_DEWPOINT_REACHED	5_DEWPOINT_REACHED	M3_LV_OFF		
		DSWITCH_5_OPEN	Closed	6_LOW_BOARD_VOLTAGE	6_LOW_BOARD_VOLTAGE	M4_LV_OFF		
				7_WATCHDOG_RESTART	7_WATCHDOG_RESTART			
				8_PC_COM_LOST	8_PC_COM_LOST			
				9_NOT_ENOUGH_DRY_AIR	9_NOT_ENOUGH_DRY_AIR			
				10_NOT_ENOUGH_VACUUM	10_NOT_ENOUGH_VACUUM			
				11_M1_COPPER_TOO_HOT	11_M1_COPPER_TOO_HOT			
				11_M2_COPPER_TOO_HOT	11_M2_COPPER_TOO_HOT			
				11_M3_COPPER_TOO_HOT	11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT	11_M4_COPPER_TOO_HOT			
Ambient		V...	Dewpoints	V...	Time			
M1_ENV_T	18.90	M1_ENV_DEWT	-25.16	6/21/2024, 11:44:30 AM				Legal TC received. Resetting all interlocks.
M2_ENV_T	18.81	M2_ENV_DEWT	-29.06	6/21/2024, 11:42:57 AM				Legal TC received. Resetting all interlocks.
M3_ENV_T	18.96	M3_ENV_DEWT	-27.04	6/21/2024, 11:38:06 AM				Legal TC received. Resetting all interlocks.
M4_ENV_T	18.81	M4_ENV_DEWT	-26.78					
M1_ENV_RH	3.64							
M2_ENV_RH	2.55							
M3_ENV_RH	3.06							
M4_ENV_RH	3.16							
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1						

Cold TESTS

Copper Block temperature sensors

- Water flow switched off to the block 1.
- Temperature in the copper block sensor.

PT100	V...	NTC / Light	V...	IM_RECEPTION_TIME	RESET LOCKED-IN INTERLOCKS
M1_PT100_11_T	8.62	M1_NTC_T	21.24	6/21/2024, 5:19:26 PM [17189831662421]	
M1_PT100_14_T	8.62	M2_NTC_T	21.80	Dangers (actual)	Interlocks (lock-in)
M2_PT100_21_T	2.23	M3_NTC_T	21.66	1_LIGHT_DETECTED	1_LIGHT_DETECTED
M2_PT100_24_T	2.10	M4_NTC_T	21.06	2_DOOR_OPENED	2_DOOR_OPENED
M3_PT100_31_T	1.83	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT	3_M1_PT100_TOO_HOT
M3_PT100_34_T	1.90	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT	3_M2_PT100_TOO_HOT
M4_PT100_41_T	3.01			3_M3_PT100_TOO_HOT	3_M3_PT100_TOO_HOT
M4_PT100_44_T	2.87	Door switches	St...	3_M4_PT100_TOO_HOT	3_M4_PT100_TOO_HOT
M1_PT100_CB_T	40.31	DSWITCH_1_OPEN	Closed	4_M1_NTC_SUPER_HOT	4_M1_NTC_SUPER_HOT
M2_PT100_CB_T	15.09	DSWITCH_2_OPEN	Closed	4_M2_NTC_SUPER_HOT	4_M2_NTC_SUPER_HOT
M3_PT100_CB_T	15.26	DSWITCH_3_OPEN	Closed	4_M3_NTC_SUPER_HOT	4_M3_NTC_SUPER_HOT
M4_PT100_CB_T	15.57	DSWITCH_4_OPEN	Closed	4_M4_NTC_SUPER_HOT	4_M4_NTC_SUPER_HOT
		DSWITCH_5_OPEN	Closed	5_DEWPOINT_REACHED	5_DEWPOINT_REACHED
				6_LOW_BOARD_VOLTAGE	6_LOW_BOARD_VOLTAGE
				7_WATCHDOG_RESTART	7_WATCHDOG_RESTART
				8_PC_COM_LOST	8_PC_COM_LOST
Ambient	V...	Dewpoints	V...	9_NOT_ENOUGH_DRY_AIR	9_NOT_ENOUGH_DRY_AIR
M1_ENV_T	19.75	M1_ENV_DEWT	-27.19	10_NOT_ENOUGH_VACUUM	10_NOT_ENOUGH_VACUUM
M2_ENV_T	19.81	M2_ENV_DEWT	-32.42	11_M1_COPPER_TOO_HOT	11_M1_COPPER_TOO_HOT
M3_ENV_T	19.12	M3_ENV_DEWT	-29.53	11_M2_COPPER_TOO_HOT	11_M2_COPPER_TOO_HOT
M4_ENV_T	19.59	M4_ENV_DEWT	-29.00	11_M3_COPPER_TOO_HOT	11_M3_COPPER_TOO_HOT
M1_ENV_RH	2.87			11_M4_COPPER_TOO_HOT	11_M4_COPPER_TOO_HOT
M2_ENV_RH	1.74				
M3_ENV_RH	2.40				
M4_ENV_RH	2.45				
				Time	Message
				6/21/2024, 5:19:14 PM	Legal TC received. Resetting all interlocks.
				6/21/2024, 5:18:51 PM	Legal TC received. Resetting all interlocks.
				6/21/2024, 5:18:40	Legal TC received. Resetting all interlocks.
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1			

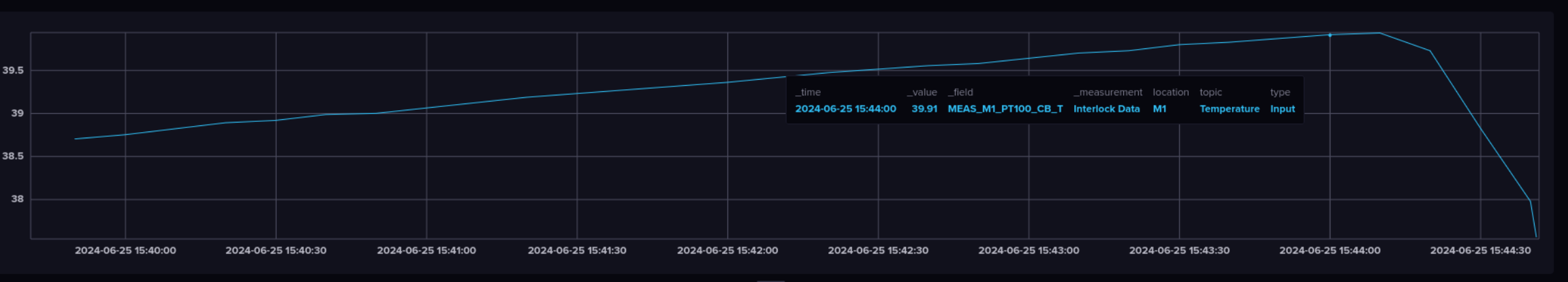
- Water flow switched off to the block 2.
- Temperature in the copper block sensor.

PT100	V...	NTC / Light	V...	IM_RECEPTION_TIME	RESET LOCKED-IN INTERLOCKS
M1_PT100_11_T	-4.25	M1_NTC_T	21.26	6/21/2024, 6:56:46 PM [17189890067381]	
M1_PT100_14_T	-4.25	M2_NTC_T	21.84	Dangers (actual)	Interlocks (lock-in)
M2_PT100_21_T	14.18	M3_NTC_T	21.67	1_LIGHT_DETECTED	1_LIGHT_DETECTED
M2_PT100_24_T	14.08	M4_NTC_T	21.11	2_DOOR_OPENED	2_DOOR_OPENED
M3_PT100_31_T	2.00	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT	3_M1_PT100_TOO_HOT
M3_PT100_34_T	2.03	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT	3_M2_PT100_TOO_HOT
M4_PT100_41_T	2.87			3_M3_PT100_TOO_HOT	3_M3_PT100_TOO_HOT
M4_PT100_44_T	2.74	Door switches	St...	3_M4_PT100_TOO_HOT	3_M4_PT100_TOO_HOT
M1_PT100_CB_T	15.06	DSWITCH_1_OPEN	Closed	4_M1_NTC_SUPER_HOT	4_M1_NTC_SUPER_HOT
M2_PT100_CB_T	40.04	DSWITCH_2_OPEN	Closed	4_M2_NTC_SUPER_HOT	4_M2_NTC_SUPER_HOT
M3_PT100_CB_T	15.23	DSWITCH_3_OPEN	Closed	4_M3_NTC_SUPER_HOT	4_M3_NTC_SUPER_HOT
M4_PT100_CB_T	15.50	DSWITCH_4_OPEN	Closed	4_M4_NTC_SUPER_HOT	4_M4_NTC_SUPER_HOT
		DSWITCH_5_OPEN	Closed	5_DEWPOINT_REACHED	5_DEWPOINT_REACHED
				6_LOW_BOARD_VOLTAGE	6_LOW_BOARD_VOLTAGE
				7_WATCHDOG_RESTART	7_WATCHDOG_RESTART
				8_PC_COM_LOST	8_PC_COM_LOST
Ambient	V...	Dewpoints	V...	9_NOT_ENOUGH_DRY_AIR	9_NOT_ENOUGH_DRY_AIR
M1_ENV_T	19.51	M1_ENV_DEWT	-28.26	10_NOT_ENOUGH_VACUUM	10_NOT_ENOUGH_VACUUM
M2_ENV_T	19.58	M2_ENV_DEWT	-33.83	11_M1_COPPER_TOO_HOT	11_M1_COPPER_TOO_HOT
M3_ENV_T	19.96	M3_ENV_DEWT	-30.41	11_M2_COPPER_TOO_HOT	11_M2_COPPER_TOO_HOT
M4_ENV_T	19.20	M4_ENV_DEWT	-30.09	11_M3_COPPER_TOO_HOT	11_M3_COPPER_TOO_HOT
M1_ENV_RH	2.64			11_M4_COPPER_TOO_HOT	11_M4_COPPER_TOO_HOT
M2_ENV_RH	1.54				
M3_ENV_RH	2.09				
M4_ENV_RH	2.26				
				Time	Message
				6/21/2024, 6:55:31 PM	Legal TC received. Resetting all interlocks.
				6/21/2024, 6:53:36 PM	Legal TC received. Resetting all interlocks.
				6/21/2024, 6:50:17	Legal TC received. Resetting all interlocks.
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1			

Cold TESTS

Copper Block temperature sensors

- Temperature in the copper block sensor 1.
- Time series plot of the block sensor centered around the interlock event



- Temperature in the copper block sensor 2.
- Time series plot of the block sensor centered around the interlock event



Cold TESTS

Copper Block temperature sensors

- Water flow switched off to the block 3.
- Temperature in the copper block sensor.

Result:

PT100		NTC / Light		TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	1.80	M1_NTC_T	21.35	6/24/2024, 4:32:52 PM [1719239572412]			
M1_PT100_14_T	1.86	M2_NTC_T	21.93	Dangers (actual)	States	Interlocks (lock-in)	States
M2_PT100_21_T	1.36	M3_NTC_T	21.78	1_LIGHT_DETECTED		1_LIGHT_DETECTED	
M2_PT100_24_T	1.16	M4_NTC_T	21.20	2_DOOR_OPENED		2_DOOR_OPENED	
M3_PT100_31_T	14.89	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT	
M3_PT100_34_T	14.99	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT	
M4_PT100_41_T	2.94	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT	
M4_PT100_44_T	2.81	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT	
M1_PT100_CB_T	15.23	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT	
M2_PT100_CB_T	15.16	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT	
M3_PT100_CB_T	40.01	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT	
M4_PT100_CB_T	15.53	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT	
Ambient		Dewpoints		5_DEWPOINT_REACHED		5_DEWPOINT_REACHED	
M1_ENV_T	19.72	M1_ENV_DEWT	-29.87	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE	
M2_ENV_T	19.59	M2_ENV_DEWT	-36.58	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART	
M3_ENV_T	19.96	M3_ENV_DEWT	-32.73	8_PC_COM_LOST		8_PC_COM_LOST	
M4_ENV_T	19.39	M4_ENV_DEWT	-31.71	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR	
M1_ENV_RH	2.24			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM	
M2_ENV_RH	1.17			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT	
M3_ENV_RH	1.67			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT	
M4_ENV_RH	1.91			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT	
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT	
				Time		Message	
				6/24/2024, 4:31:48 PM		Legal TC received. Resetting all interlocks.	
				6/24/2024, 4:30:44 PM		Legal TC received. Resetting all interlocks.	
				6/24/2024, 4:29:54 PM		Legal TC received. Resetting all interlocks.	
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1					

- Water flow switched off to the block 4.
- Temperature in the copper block sensor.

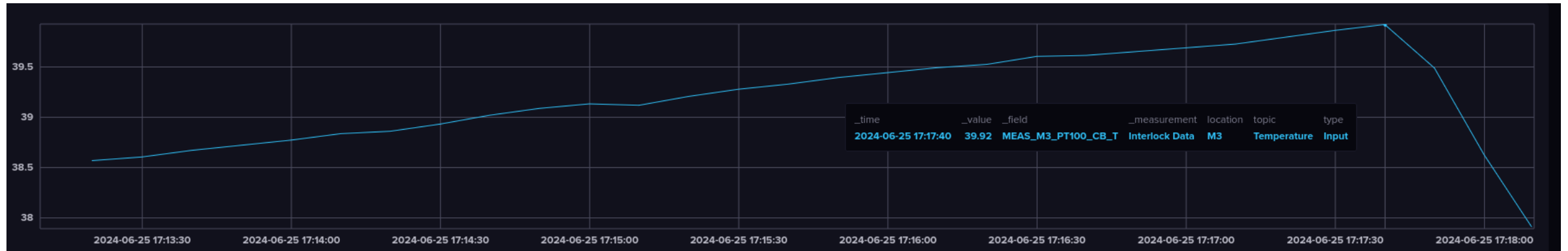
Result:

PT100		NTC / Light		TM_RECEPTION_TIME		RESET LOCKED-IN INTERLOCKS	
M1_PT100_11_T	1.90	M1_NTC_T	21.29	6/24/2024, 5:27:21 PM [1719242841997]			
M1_PT100_14_T	1.93	M2_NTC_T	21.95	Dangers (actual)	States	Interlocks (lock-in)	States
M2_PT100_21_T	1.36	M3_NTC_T	21.65	1_LIGHT_DETECTED		1_LIGHT_DETECTED	
M2_PT100_24_T	1.19	M4_NTC_T	21.22	2_DOOR_OPENED		2_DOOR_OPENED	
M3_PT100_31_T	1.73	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT	
M3_PT100_34_T	1.80	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT	
M4_PT100_41_T	16.04	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT	
M4_PT100_44_T	16.17	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT	
M1_PT100_CB_T	15.23	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT	
M2_PT100_CB_T	15.16	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT	
M3_PT100_CB_T	15.23	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT	
M4_PT100_CB_T	39.98	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT	
Ambient		Dewpoints		5_DEWPOINT_REACHED		5_DEWPOINT_REACHED	
M1_ENV_T	19.89	M1_ENV_DEWT	-30.02	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE	
M2_ENV_T	19.81	M2_ENV_DEWT	-37.03	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART	
M3_ENV_T	19.35	M3_ENV_DEWT	-33.06	8_PC_COM_LOST		8_PC_COM_LOST	
M4_ENV_T	20.55	M4_ENV_DEWT	-31.74	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR	
M1_ENV_RH	2.18			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM	
M2_ENV_RH	1.10			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT	
M3_ENV_RH	1.68			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT	
M4_ENV_RH	1.78			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT	
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT	
				Time		Message	
				6/24/2024, 5:25:50 PM		Legal TC received. Resetting all interlocks.	
				6/24/2024, 5:24:40 PM		Legal TC received. Resetting all interlocks.	
				6/24/2024, 5:23:11 PM		Legal TC received. Resetting all interlocks.	
FW_SN: march-2024-1.1.0		GUI_SN: february-2024-2.0.1					

Cold TESTS

Copper Block temperature sensors

- Temperature in the copper block sensor 3.
- Time series plot of the block sensor centered around the interlock event



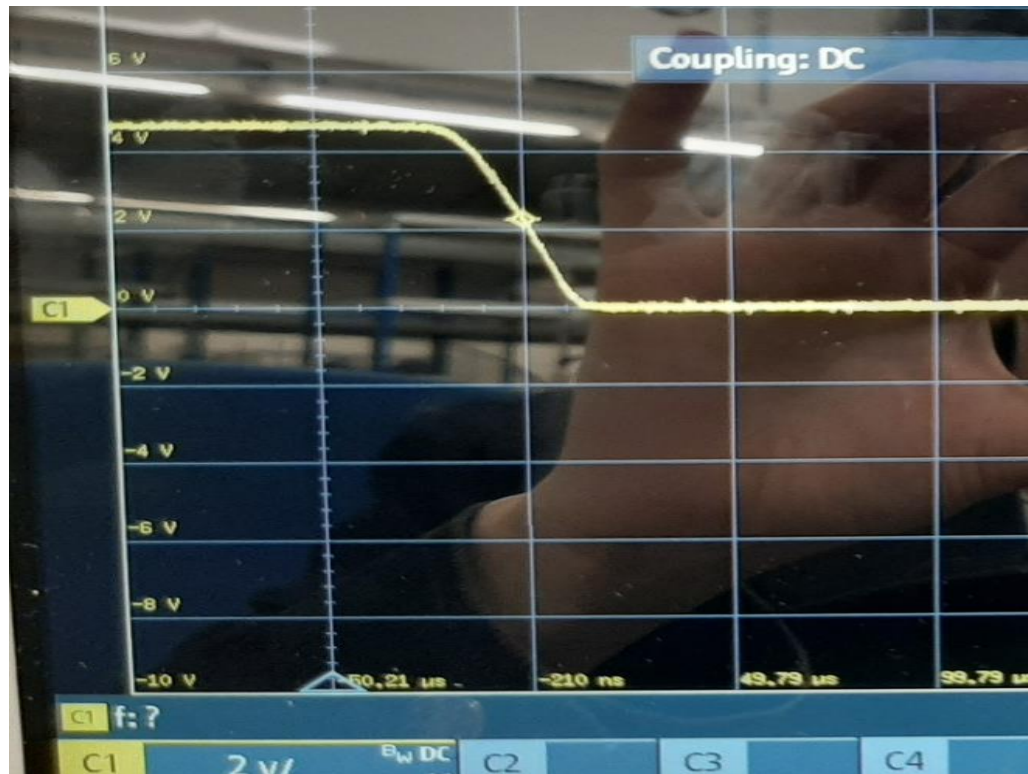
- Temperature in the copper block sensor 4.
- Time series plot of the block sensor centered around the interlock event



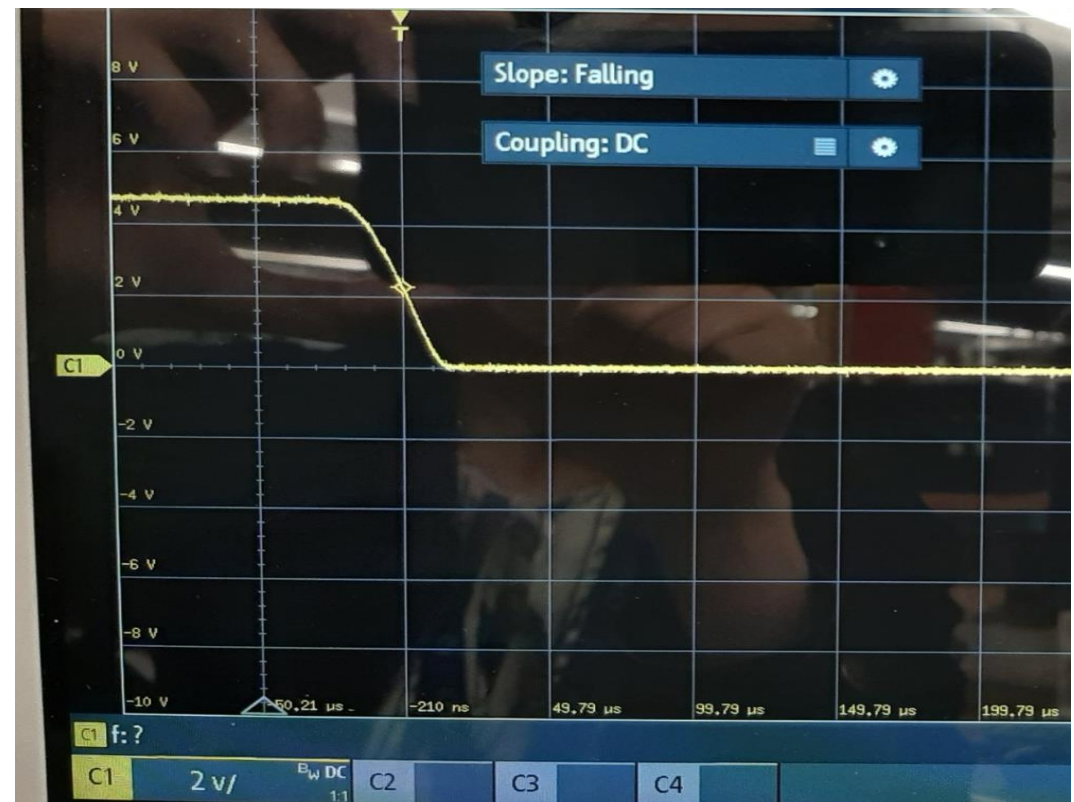
Cold TESTS

Low Voltage spikes check

- Water flow switched off to the block 1.



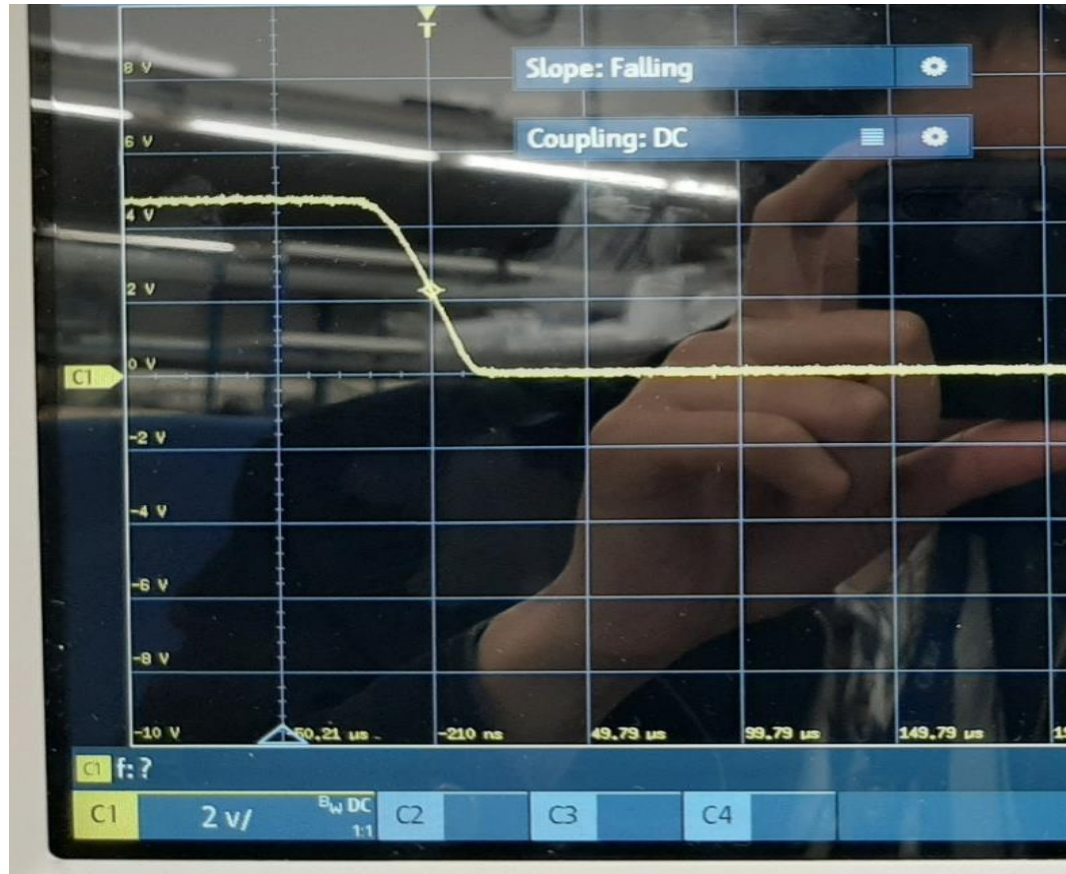
- Water flow switched off to the block 2.



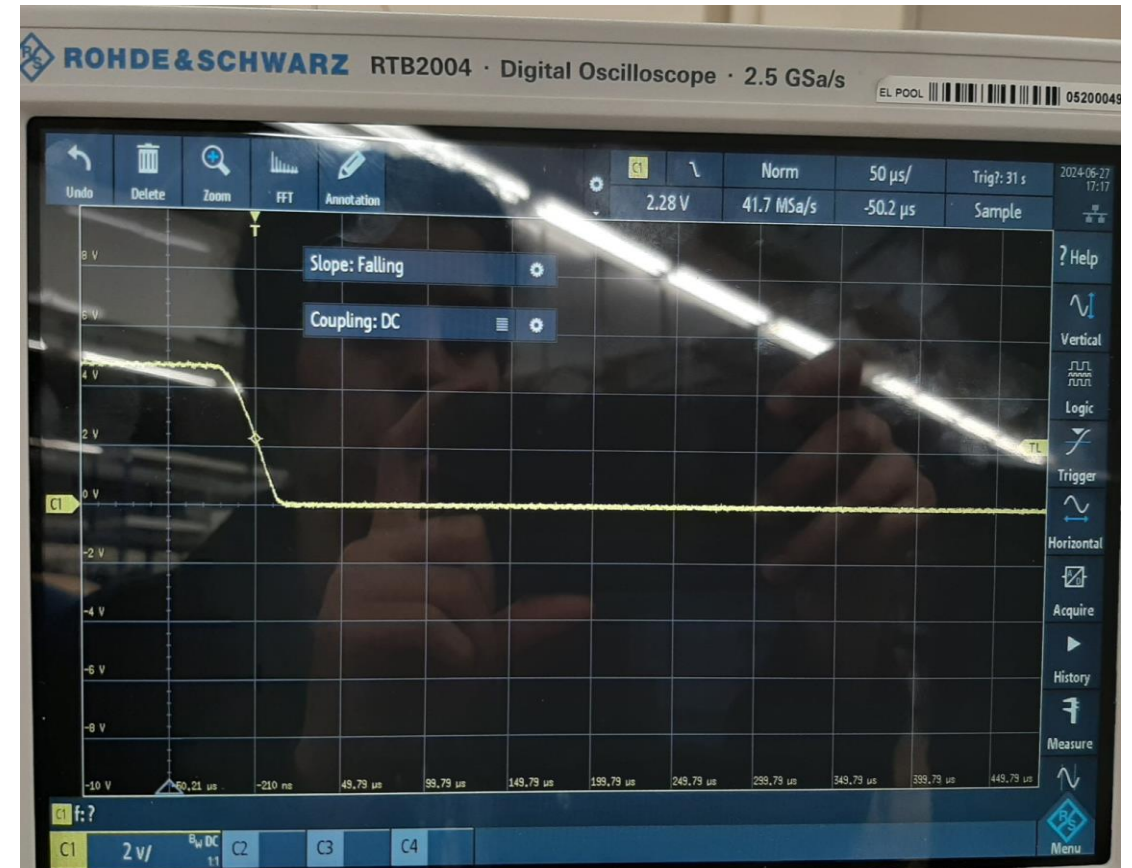
Cold TESTS

Low Voltage spikes check

- Water flow switched off to the block 3.



- Water flow switched off to the block 4.



Cold TESTS

Aluminium block temperature sensors

- Peltiers currents (both) of block 1 turned off.
- Aluminium block temperature sensor :

PT100		V...	NTC / Light	V...	TM_RECEPTION_TIME	RESET LOCKED-IN INTERLOCKS					
M1_PT100_11_T	30.10	M1_NTC_T	21.42	6/27/2024, 5:47:22 PM [1719503242144]							
M1_PT100_14_T	30.03	M2_NTC_T	22.04	Dangers (actual)	States	Interlocks (lock-in)	States	Controlled devices	States		
M2_PT100_21_T	3.04	M3_NTC_T	21.85	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF			
M2_PT100_24_T	2.74	M4_NTC_T	21.35	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF			
M3_PT100_31_T	3.04	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF			
M3_PT100_34_T	3.21	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF			
M4_PT100_41_T	-1.66			3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF			
M4_PT100_44_T	-1.90			3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF			
M1_PT100_CB_T	23.30	Door switches	St...	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF			
M2_PT100_CB_T	23.43	DSWITCH_1_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF			
M3_PT100_CB_T	23.43	DSWITCH_2_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF			
M4_PT100_CB_T	23.23	DSWITCH_3_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF			
		DSWITCH_4_OPEN	Closed	5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF			
		DSWITCH_5_OPEN	Closed	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF			
Ambient	V...	Dewpoints	V...	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART					
M1_ENV_T	23.67	M1_ENV_DEWT	-20.43	8_PC_COM_LOST		8_PC_COM_LOST					
M2_ENV_T	23.36	M2_ENV_DEWT	-23.99	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR					
M3_ENV_T	23.35	M3_ENV_DEWT	-22.61	10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM					
M4_ENV_T	23.04	M4_ENV_DEWT	-22.43	11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT					
M1_ENV_RH	4.15			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT					
M2_ENV_RH	3.09			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT					
M3_ENV_RH	3.50			11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT					
M4_ENV_RH	3.62										
FW_SN: march-2024-1.0		GUI_SN: february-2024-2.0.1		Time	Message						
				6/27/2024, 5:46:36 PM	Legal TC received. Resetting all interlocks.						
				6/27/2024, 5:46:19 PM	Legal TC received. Resetting all interlocks.						
				6/27/2024, 5:46:12	Legal TC received. Resetting all interlocks.						

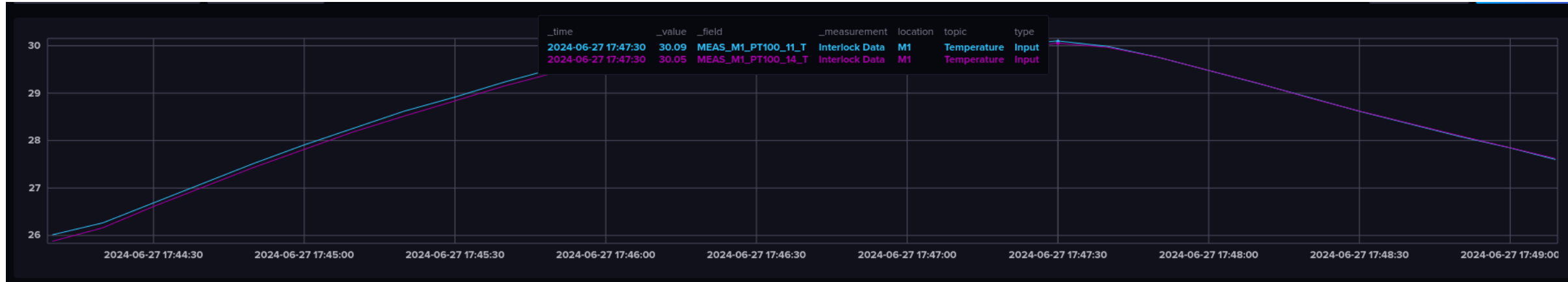
- Peltiers currents (both) of block 2 turned off.
- Aluminium block temperature sensor :

PT100		V...	NTC / Light	V...	TM_RECEPTION_TIME	RESET LOCKED-IN INTERLOCKS					
M1_PT100_11_T	6.71	M1_NTC_T	21.43	6/27/2024, 5:53:25 PM [1719503605910]							
M1_PT100_14_T	6.77	M2_NTC_T	22.05	Dangers (actual)	States	Interlocks (lock-in)	States	Controlled devices	States		
M2_PT100_21_T	30.10	M3_NTC_T	21.85	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF			
M2_PT100_24_T	30.14	M4_NTC_T	21.33	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF			
M3_PT100_31_T	5.66	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF			
M3_PT100_34_T	5.90	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF			
M4_PT100_41_T	0.62			3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF			
M4_PT100_44_T	0.35			3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF			
M1_PT100_CB_T	23.64	Door switches	St...	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF			
M2_PT100_CB_T	23.30	DSWITCH_1_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF			
M3_PT100_CB_T	23.57	DSWITCH_2_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF			
M4_PT100_CB_T	23.27	DSWITCH_3_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF			
		DSWITCH_4_OPEN	Closed	5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF			
		DSWITCH_5_OPEN	Closed	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF			
Ambient	V...	Dewpoints	V...	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART					
M1_ENV_T	23.64	M1_ENV_DEWT	-23.22	8_PC_COM_LOST		8_PC_COM_LOST					
M2_ENV_T	23.37	M2_ENV_DEWT	-27.67	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR					
M3_ENV_T	23.38	M3_ENV_DEWT	-25.66	10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM					
M4_ENV_T	23.15	M4_ENV_DEWT	-25.23	11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT					
M1_ENV_RH	3.26			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT					
M2_ENV_RH	2.21			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT					
M3_ENV_RH	2.65			11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT					
M4_ENV_RH	2.80										
FW_SN: march-2024-1.0		GUI_SN: february-2024-2.0.1		Time	Message						
				6/27/2024, 5:50:53 PM	Legal TC received. Resetting all interlocks.						
				6/27/2024, 5:49:43 PM	Legal TC received. Resetting all interlocks.						
				6/27/2024, 5:46:36	Legal TC received. Resetting all interlocks.						

Cold TESTS

Aluminium block temperature sensors

- Peltiers currents (both) of block 1 turned off.
- Time series plot of the block sensor centered around the interlock event



- Peltiers currents (both) of block 2 turned off.
- Time series plot of the block sensor centered around the interlock event



Cold TESTS

Aluminium block temperature sensors

- Peltiers currents (both) of block 3 turned off.
- Aluminium block temperature sensor :

PT100				TM_RECEPTION_TIME					
M1_PT100_11_T	3.01	M1_NTC_T	21.33	6/27/2024, 5:59:40 PM [1719503980914]					
M1_PT100_14_T	3.01	M2_NTC_T	21.97	RESET LOCKED-IN INTERLOCKS					
M2_PT100_21_T	5.26	M3_NTC_T	21.71	Dangers (actual)		Interlocks (lock-in)		Controlled devices	
M2_PT100_24_T	4.99	M4_NTC_T	21.22	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF	
M3_PT100_31_T	30.10	M12_LIGHT_ADC	0	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF	
M3_PT100_34_T	30.10	M34_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF	
M4_PT100_41_T	-1.43			3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF	
M4_PT100_44_T	-1.73			3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF	
M1_PT100_CB_T	23.57	Door switches		3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF	
M2_PT100_CB_T	23.47	DSWITCH_1_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF	
M3_PT100_CB_T	23.40	DSWITCH_2_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF	
M4_PT100_CB_T	23.30	DSWITCH_3_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF	
		DSWITCH_4_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF	
		DSWITCH_5_OPEN	Closed	5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF	
Ambient				Dewpoints					
M1_ENV_T	23.57	M1_ENV_DEWT	-24.79	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF	
M2_ENV_T	23.25	M2_ENV_DEWT	-29.98	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART			
M3_ENV_T	23.28	M3_ENV_DEWT	-27.45	8_PC_COM_LOST		8_PC_COM_LOST			
M4_ENV_T	22.94	M4_ENV_DEWT	-26.74	9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR			
M1_ENV_RH	2.84			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
M2_ENV_RH	1.79			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
M3_ENV_RH	2.26			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
M4_ENV_RH	2.47			11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT			
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1					
Time				Message					
6/27/2024, 5:57:02 PM				Legal TC received. Resetting all interlocks.					
6/27/2024, 5:55:46 PM				Legal TC received. Resetting all interlocks.					
6/27/2024, 5:54:05				Legal TC received. Resetting all interlocks.					

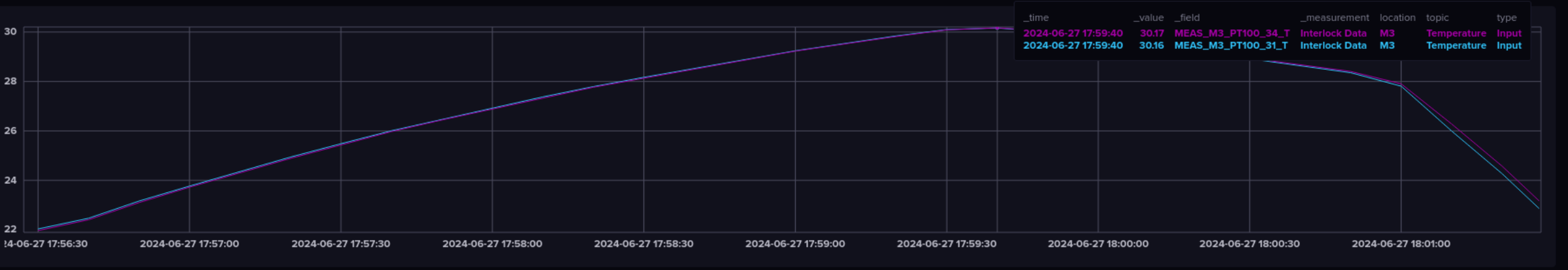
- Peltiers currents (both) of block 4 turned off.
- Aluminium block temperature sensor :

PT100				TM_RECEPTION_TIME					
M1_PT100_11_T	3.71	M1_NTC_T	21.47	6/28/2024, 4:52:07 PM [1719586327908]					
M1_PT100_14_T	3.68	M2_NTC_T	22.11	RESET LOCKED-IN INTERLOCKS					
M2_PT100_21_T	-4.82	M3_NTC_T	21.90	Dangers (actual)		Interlocks (lock-in)		Controlled devices	
M2_PT100_24_T	-5.32	M4_NTC_T	21.42	1_LIGHT_DETECTED		1_LIGHT_DETECTED		M1_PEL_OFF	
M3_PT100_31_T	3.28	M12_LIGHT_ADC	0	2_DOOR_OPENED		2_DOOR_OPENED		M2_PEL_OFF	
M3_PT100_34_T	3.44	M34_LIGHT_ADC	0	3_M1_PT100_TOO_HOT		3_M1_PT100_TOO_HOT		M3_PEL_OFF	
M4_PT100_41_T	29.97			3_M2_PT100_TOO_HOT		3_M2_PT100_TOO_HOT		M4_PEL_OFF	
M4_PT100_44_T	29.80	Door switches		3_M3_PT100_TOO_HOT		3_M3_PT100_TOO_HOT		M1_HV_OFF	
M1_PT100_CB_T	24.25	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT		3_M4_PT100_TOO_HOT		M2_HV_OFF	
M2_PT100_CB_T	24.01	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT		4_M1_NTC_SUPER_HOT		M3_HV_OFF	
M3_PT100_CB_T	24.18	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT		4_M2_NTC_SUPER_HOT		M4_HV_OFF	
M4_PT100_CB_T	24.08	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT		4_M3_NTC_SUPER_HOT		M1_LV_OFF	
		DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT		4_M4_NTC_SUPER_HOT		M2_LV_OFF	
Ambient				Dewpoints					
M1_ENV_T	23.11	M1_ENV_DEWT	-30.56	5_DEWPOINT_REACHED		5_DEWPOINT_REACHED		M3_LV_OFF	
M2_ENV_T	22.79	M2_ENV_DEWT	-40.29	6_LOW_BOARD_VOLTAGE		6_LOW_BOARD_VOLTAGE		M4_LV_OFF	
M3_ENV_T	22.77	M3_ENV_DEWT	-34.13	7_WATCHDOG_RESTART		7_WATCHDOG_RESTART			
M4_ENV_T	23.26	M4_ENV_DEWT	-32.56	8_PC_COM_LOST		8_PC_COM_LOST			
M1_ENV_RH	1.71			9_NOT_ENOUGH_DRY_AIR		9_NOT_ENOUGH_DRY_AIR			
M2_ENV_RH	0.66			10_NOT_ENOUGH_VACUUM		10_NOT_ENOUGH_VACUUM			
M3_ENV_RH	1.23			11_M1_COPPER_TOO_HOT		11_M1_COPPER_TOO_HOT			
M4_ENV_RH	1.39			11_M2_COPPER_TOO_HOT		11_M2_COPPER_TOO_HOT			
				11_M3_COPPER_TOO_HOT		11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT		11_M4_COPPER_TOO_HOT			
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1					
Time				Message					
6/28/2024, 4:12:08 PM				Legal TC received. Resetting all interlocks.					
6/28/2024, 4:08:10 PM				Legal TC received. Resetting all interlocks.					
6/28/2024, 4:07:35				Legal TC received. Resetting all interlocks.					

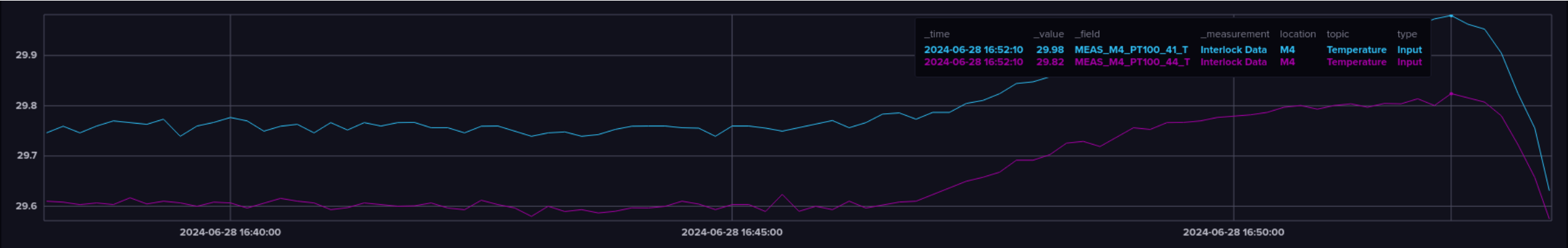
Cold TESTS

Aluminium block temperature sensors

- Peltiers currents (both) of block 3 turned off.
- Time series plot of the block sensor centered around the interlock event



- Peltiers currents (both) of block 4 turned off.
- Time series plot of the block sensor centered around the interlock event



Cold TESTS

Humidity sensors and Hermeticity of the box.

- Dry air switched off.
- Box left for 1h in this status.
- Interlock triggered the deactivation of the power supplies.

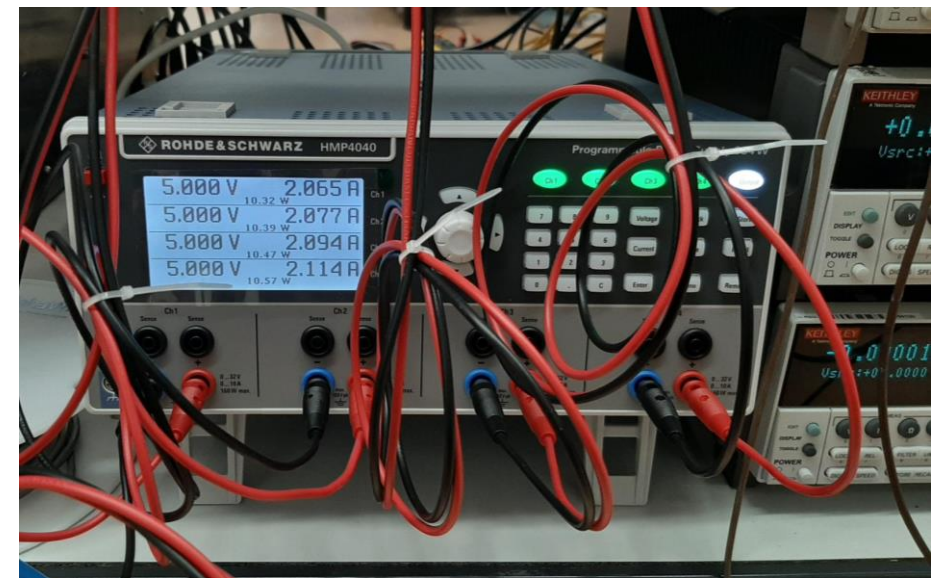
- Power supplies off.

PT100				NTC / Light				TM_RECEPTION_TIME			
M1_PT100_11_T	1.02	M1_NTC_T	21.37	6/27/2024, 10:38:16 AM [1719477496111]				RESET LOCKED-IN INTERLOCKS			
M1_PT100_14_T	0.93	M2_NTC_T	21.95	Dangers (actual)				Interlocks (lock-in)			
M2_PT100_21_T	1.09	M3_NTC_T	21.75	1_LIGHT_DETECTED				1_LIGHT_DETECTED			
M2_PT100_24_T	1.09	M4_NTC_T	21.19	2_DOOR_OPENED				2_DOOR_OPENED			
M3_PT100_31_T	1.50	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT				3_M1_PT100_TOO_HOT			
M3_PT100_34_T	1.60	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT				3_M2_PT100_TOO_HOT			
M4_PT100_41_T	0.86	Door switches		3_M3_PT100_TOO_HOT				3_M3_PT100_TOO_HOT			
M4_PT100_44_T	0.89	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT				3_M4_PT100_TOO_HOT			
M1_PT100_CB_T	14.79	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT				4_M1_NTC_SUPER_HOT			
M2_PT100_CB_T	14.82	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT				4_M2_NTC_SUPER_HOT			
M3_PT100_CB_T	14.89	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT				4_M3_NTC_SUPER_HOT			
M4_PT100_CB_T	14.82	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT				4_M4_NTC_SUPER_HOT			
Ambient				Dewpoints				5_DEWPOINT_REACHED			
M1_ENV_T	20.69	M1_ENV_DEWT	-9.63	6_LOW_BOARD_VOLTAGE				6_LOW_BOARD_VOLTAGE			
M2_ENV_T	20.22	M2_ENV_DEWT	-12.12	7_WATCHDOG_RESTART				7_WATCHDOG_RESTART			
M3_ENV_T	20.39	M3_ENV_DEWT	-11.88	8_PC_COM_LOST				8_PC_COM_LOST			
M4_ENV_T	20.44	M4_ENV_DEWT	-11.64	9_NOT_ENOUGH_DRY_AIR				9_NOT_ENOUGH_DRY_AIR			
M1_ENV_RH	12.16			10_NOT_ENOUGH_VACUUM				10_NOT_ENOUGH_VACUUM			
M2_ENV_RH	10.26			11_M1_COPPER_TOO_HOT				11_M1_COPPER_TOO_HOT			
M3_ENV_RH	10.35			11_M2_COPPER_TOO_HOT				11_M2_COPPER_TOO_HOT			
M4_ENV_RH	10.52			11_M3_COPPER_TOO_HOT				11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT				11_M4_COPPER_TOO_HOT			
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time			
								6/27/2024, 10:34:12 Legal TC received. Resetting all interlocks. AM			
								6/27/2024, 10:29:12 Legal TC received. Resetting all interlocks. AM			
								6/27/2024, 10:28:38 Legal TC received. Resetting all interlocks.			

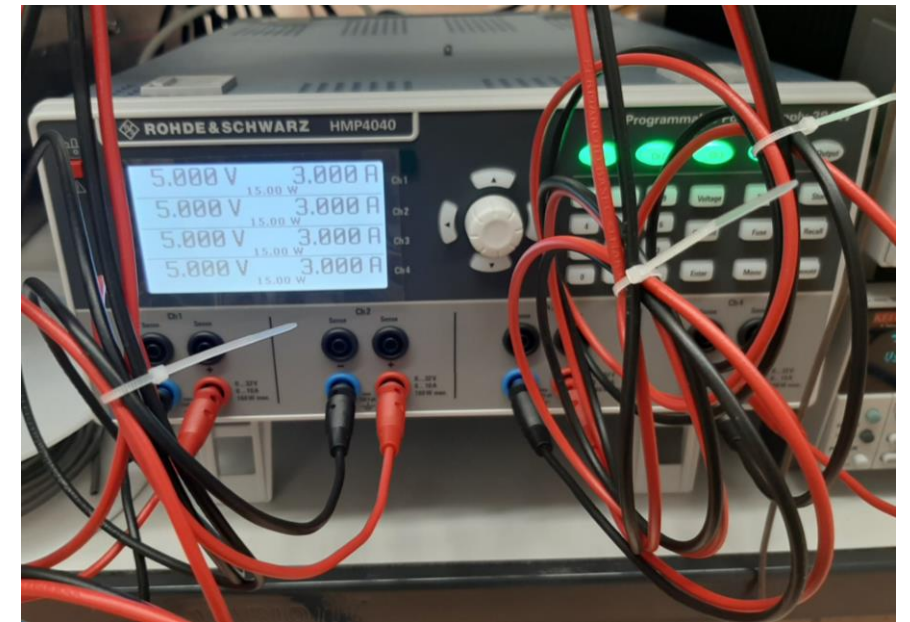
PT100				NTC / Light				TM_RECEPTION_TIME			
M1_PT100_11_T	13.74	M1_NTC_T	21.35	6/27/2024, 10:56:34 AM [1719478594577]				RESET LOCKED-IN INTERLOCKS			
M1_PT100_14_T	13.78	M2_NTC_T	22.07	Dangers (actual)				Interlocks (lock-in)			
M2_PT100_21_T	13.78	M3_NTC_T	21.73	1_LIGHT_DETECTED				1_LIGHT_DETECTED			
M2_PT100_24_T	13.74	M4_NTC_T	21.39	2_DOOR_OPENED				2_DOOR_OPENED			
M3_PT100_31_T	13.81	M12_LIGHT_ADC	0	3_M1_PT100_TOO_HOT				3_M1_PT100_TOO_HOT			
M3_PT100_34_T	13.88	M34_LIGHT_ADC	0	3_M2_PT100_TOO_HOT				3_M2_PT100_TOO_HOT			
M4_PT100_41_T	13.71	Door switches		3_M3_PT100_TOO_HOT				3_M3_PT100_TOO_HOT			
M4_PT100_44_T	13.78	DSWITCH_1_OPEN	Closed	3_M4_PT100_TOO_HOT				3_M4_PT100_TOO_HOT			
M1_PT100_CB_T	15.09	DSWITCH_2_OPEN	Closed	4_M1_NTC_SUPER_HOT				4_M1_NTC_SUPER_HOT			
M2_PT100_CB_T	15.06	DSWITCH_3_OPEN	Closed	4_M2_NTC_SUPER_HOT				4_M2_NTC_SUPER_HOT			
M3_PT100_CB_T	15.20	DSWITCH_4_OPEN	Closed	4_M3_NTC_SUPER_HOT				4_M3_NTC_SUPER_HOT			
M4_PT100_CB_T	15.26	DSWITCH_5_OPEN	Closed	4_M4_NTC_SUPER_HOT				4_M4_NTC_SUPER_HOT			
Ambient				Dewpoints				5_DEWPOINT_REACHED			
M1_ENV_T	20.87	M1_ENV_DEWT	-9.23	6_LOW_BOARD_VOLTAGE				6_LOW_BOARD_VOLTAGE			
M2_ENV_T	20.43	M2_ENV_DEWT	-11.65	7_WATCHDOG_RESTART				7_WATCHDOG_RESTART			
M3_ENV_T	20.62	M3_ENV_DEWT	-11.43	8_PC_COM_LOST				8_PC_COM_LOST			
M4_ENV_T	20.65	M4_ENV_DEWT	-11.13	9_NOT_ENOUGH_DRY_AIR				9_NOT_ENOUGH_DRY_AIR			
M1_ENV_RH	12.41			10_NOT_ENOUGH_VACUUM				10_NOT_ENOUGH_VACUUM			
M2_ENV_RH	10.52			11_M1_COPPER_TOO_HOT				11_M1_COPPER_TOO_HOT			
M3_ENV_RH	10.59			11_M2_COPPER_TOO_HOT				11_M2_COPPER_TOO_HOT			
M4_ENV_RH	10.82			11_M3_COPPER_TOO_HOT				11_M3_COPPER_TOO_HOT			
				11_M4_COPPER_TOO_HOT				11_M4_COPPER_TOO_HOT			
FW_SN: march-2024-1.1.0				GUI_SN: february-2024-2.0.1				Time			
								6/27/2024, 10:42:54 Legal TC received. Resetting all interlocks. AM			
								6/27/2024, 10:38:19 Legal TC received. Resetting all interlocks. AM			
								6/27/2024, 10:34:12 Legal TC received. Resetting all interlocks.			



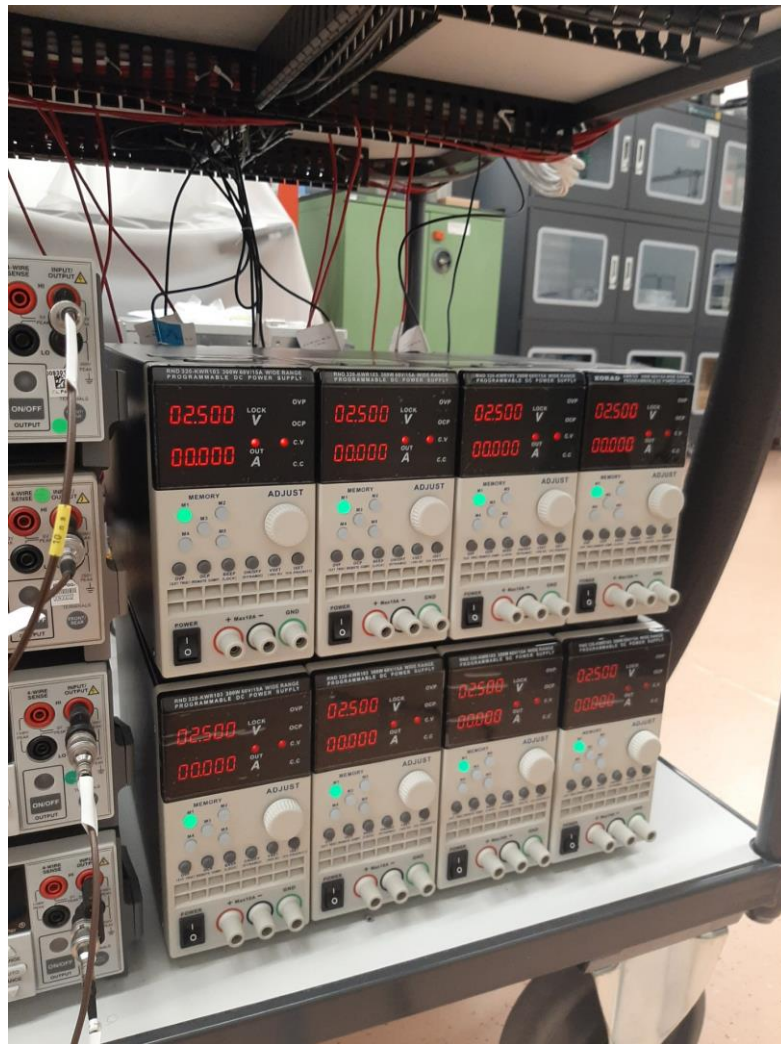
Quality Control setup



LV off when the interlock is triggered

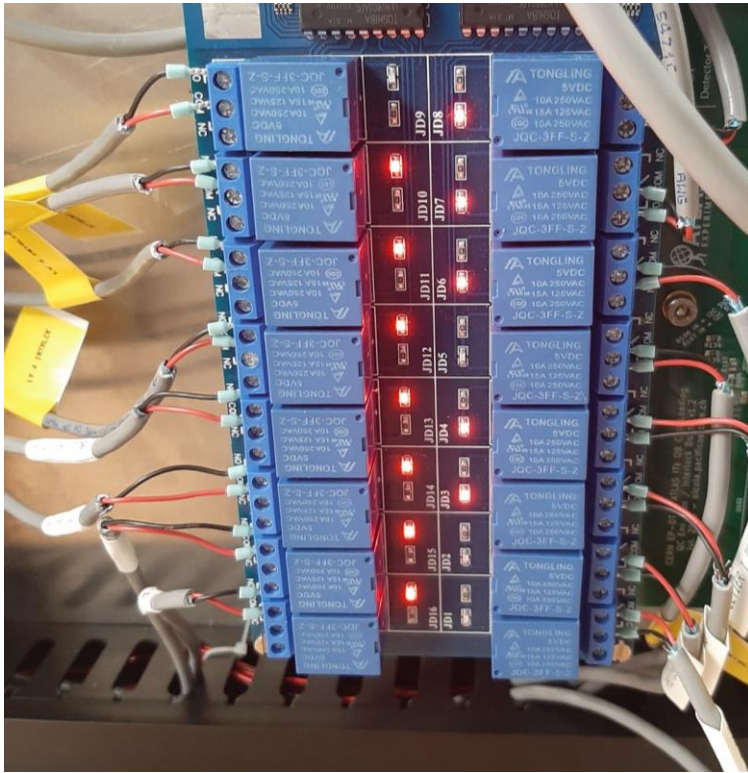


Peltiers Power Supplies off, when the interlock is triggered

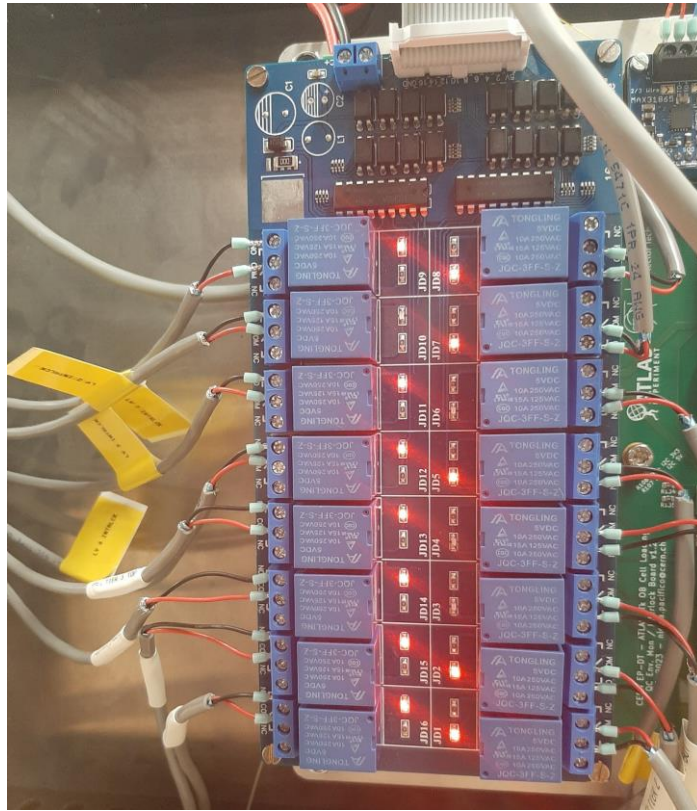


HV off when the interlock is triggered

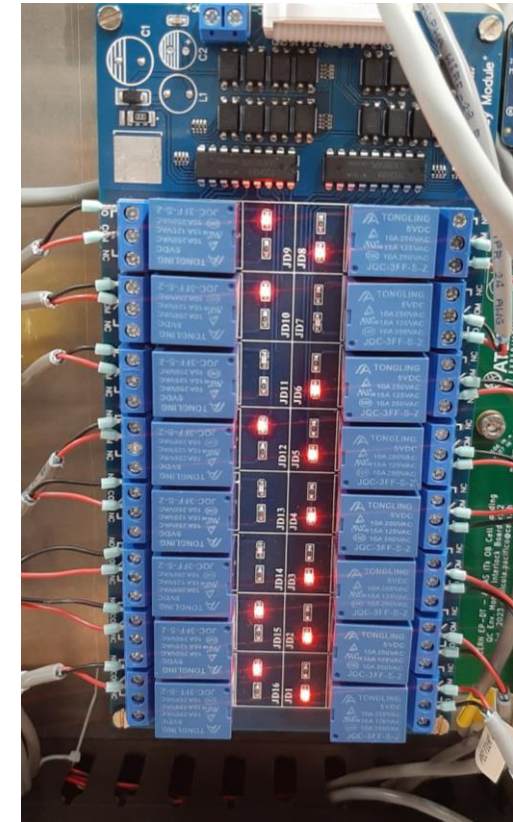




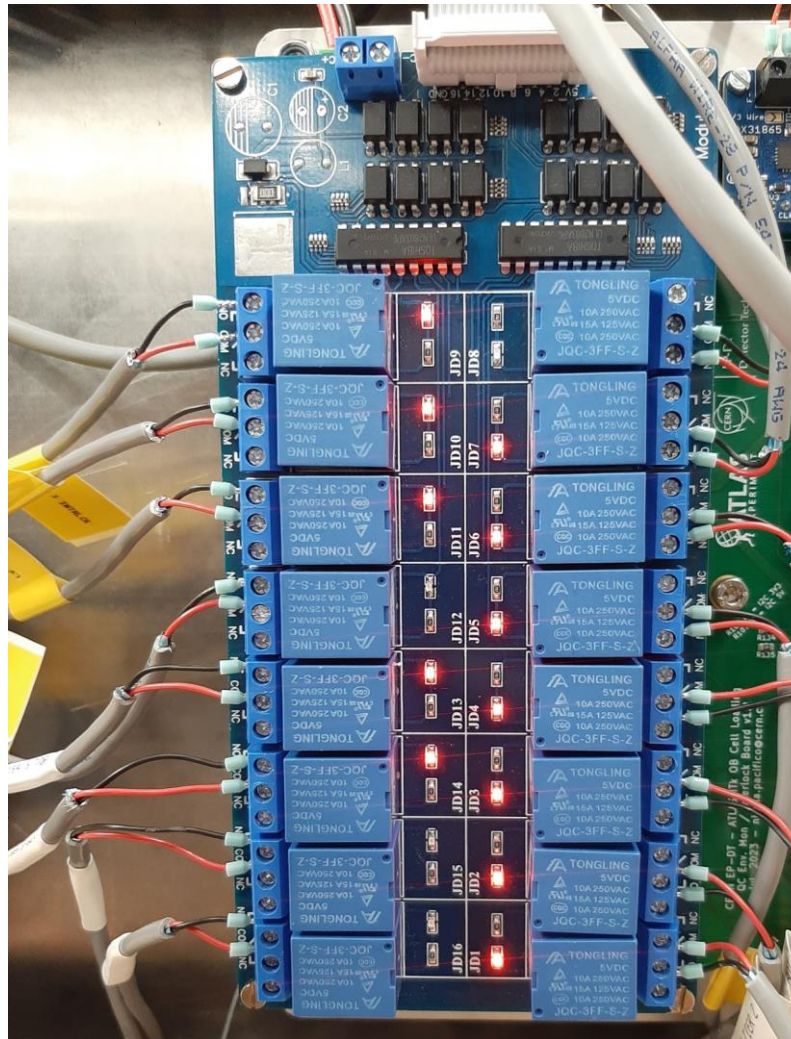
When the interlock is triggered
LV 1 OFF, HV 1 OFF , Peltiers 1 TOP &
1 BOT off.



When the interlock is triggered
LV 2 OFF, HV 2 OFF , Peltiers 2 TOP &
2 BOT off.



When the interlock is triggered
LV 3 OFF, HV 3 OFF , Peltiers 3 TOP &
3 BOT off.



When the interlock is triggered
LV 4 OFF, HV 4 OFF , Peltiers 4 TOP & 4 BOT off.

Summary

Organism presentation and project context

Installation and connection of Cell Loaded QC Setup

Site Qualification for interlock system of the QC Setup

Perspectives and Upcoming Tasks

PERSPECTIVES & UPCOMMING TASKS

- 1 The peltiers power supply should be controlled remotely using Ethernet communication protocol.

Transfert of the Quality Control (QC) Setup from B154 to B161 in order to start the second part of the qualification.

2

- 3 Commissioning of the QC Setup and testing of the performance of Loaded Cells Modules.



Thank you



Graduation Internship Project :

**The Quality Control Setup and Characterization of Silicon Pixel
Detector Loaded Modules for the Inner Tracker of the ATLAS
Experiment at the High Luminosity Large Hadron Collider**

By: **ACHAQ Mariam**

8th July, 2024

Pr. **REUNGOAT David**
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Dr. **KUEHN Susanne**

Academic supervisor
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Academic year : 2023/2024