Théo JULIEN

4th year

Report - Period abroad

From June to August 2024

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Introduction

As a work-study student at SNEF since September 2022, the engineering school's curriculum requires us to spend time abroad in a subsidiary or client company of our French company in order to improve our language skills and discover another culture. In my case, as SNEF is a global group with numerous subsidiaries on different continents, it was possible to do this internship within the group. Moreover, one of the group's largest subsidiaries was open to my coming. It was IMSAT, the Romanian subsidiary, based in Bucharest, with which I had already worked on a number of projects in France. This company is very important and well-known within the group, but also in Romania in general. Its field of study and action is the same as that of SNEF, i.e. electrical, instrumental and piping installations and studies...

After numerous discussions on the details of the exchange and the subjects of the work in Bucharest, the agreement was put in place for a period of 10 weeks, from 1 June to 9 August. So i Join for this internship the department of "Studies & Electrical Design" with Mihai IORDACHE as tutor and head of department. Before describing my various assignments in Romania, I'd like to introduce the company, its history and its current projects.

I. Company History

Created in 1962, the company was initially specialised in installation of electrical and automation systems only. After expanding rapidly in Romania, the company joined the SNEF group in 2007, thanks to the globalisation of its construction sites since the beginning of the 21st century. Today, IMSAT has more than 1,100 specialists and operates in more than 35 countries on 4 different continents, specialising in the engineering and assembly of electrical and mechanical installations, industrial processes, air conditioning and safety systems, automation, robotic systems and solutions, and preventive and predictive maintenance services.

I was already familiar with this subsidiary because I had the chance to work with them on various projects in France (the Ynsect insect farm and the FSRU LNG terminal). Of course, they also work on national projects, such as the installation of control cabinets and instruments for water pumping stations in the Alba Iulia region, or the installation of cables and electrical cabinets for a coal-fired power station.

II. My tasks at IMSAT

During the first two years of my work-study contract, I had the chance to work on two projects (Ynsect and FSRU, as described above), to work on costing and project management, and also to work on studies (producing calculation notes, fibre-optic bay diagrams and a study of the industrial pipe tracing system). Despite this wide range of actions, when I came to Romania, I asked to concentrate on the more technical aspect of the job, i.e. making electrical and instrumental studies. That's why, when I arrived at the agency, I started straight away on the electrical studies for a ventilation system project called ‘EDS-2’. To meet the specifications, I had to understand how the project worked, draw up the various electrical diagrams and studies and then carry out the instrumental studies.

1) Electrical studies and diagrams

Starting with a single-line diagram only, I began to draw up the diagram of the main distribution cabinet, known as the TGBT, which starts with the network transformers and supplies the various cabinets and components on the site. To do this, I used the single-line diagram below:

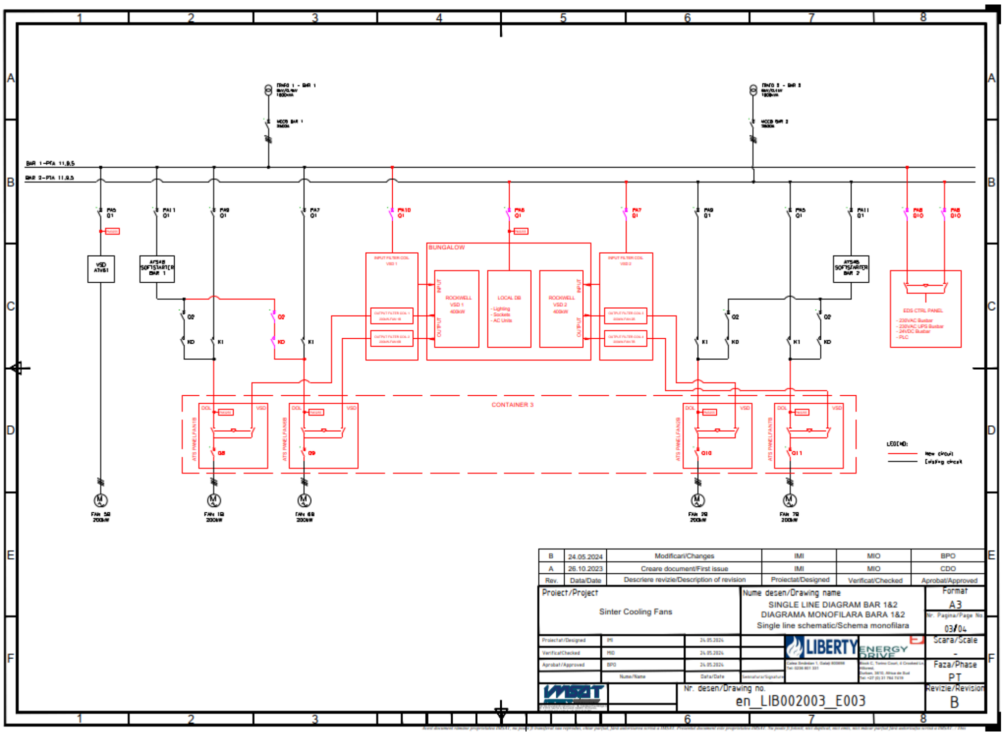


Figure 1 - Single-Line Diagram

Many different modules and devices are shown on this diagram and I didn't know what they were used for, so I had to do some research into these devices to understand that :

- VSD represents variable speed drives
- ATS represents the automatic power source alternators

To explain how it works in simple terms, the fan motors are powered via a variable speed drive (to avoid overloads on start-up) and the voltage source depends on the ATS. The power supplies are divided into 3 separate transformers, each with its own power rating. I therefore had to check whether the power specified by the customer for each transformer was sufficient for the consumers connected, using calculation note software (Schneider EcoStruxture Power Design). Similar to ElecCalc, we came up with an electrical distribution diagram representing the single-line diagram used to calculate the powers.

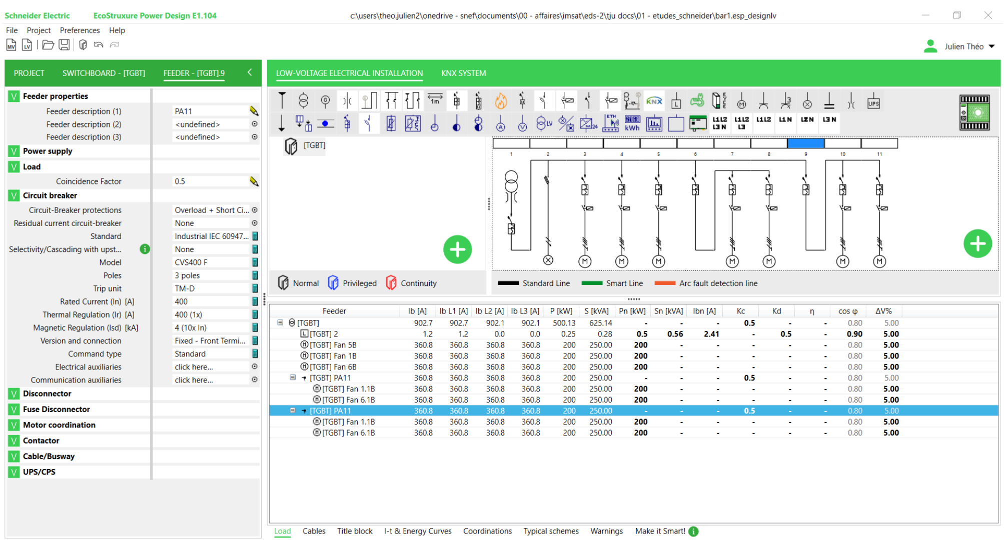


Figure 2 - Schneider EcoStruxture Power Design

Once the consumption had been calculated, we were able to plan the protection (relays, circuit-breakers and contactors) to be installed in the main LV panel. As we were working with Schneider software, only Schneider references were available. The diagram can therefore be created:

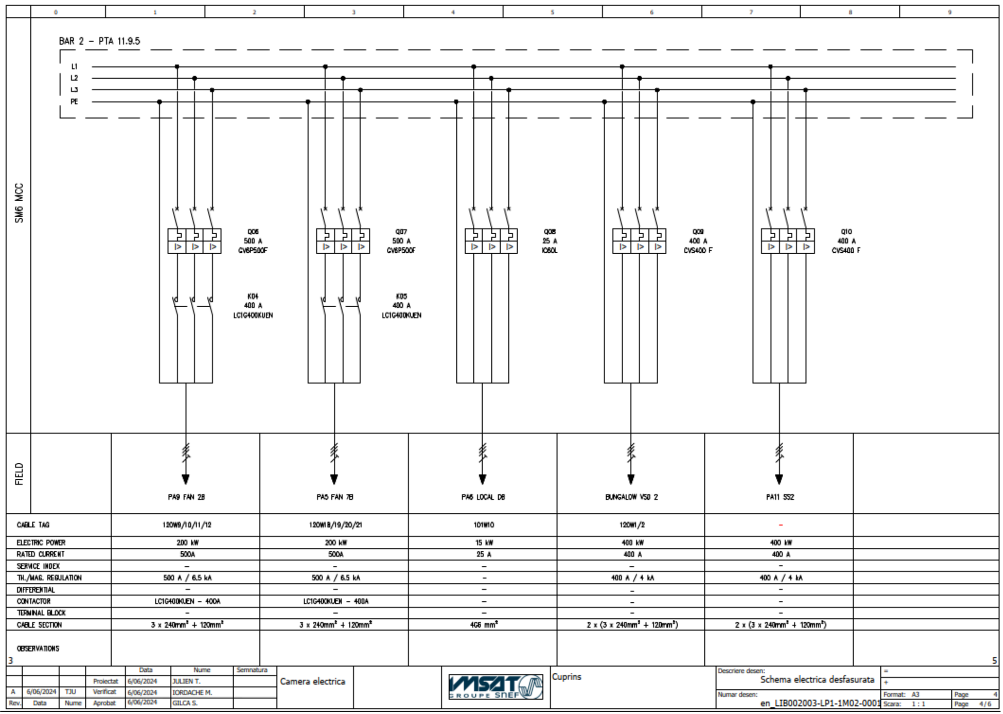


Figure 3 - Distribution Diagram (TGBT)

Once we had created this distribution diagram for the TGBT cabinet, we could move on to the sizing of the cabinet and its thermal study, in order to avoid excessive temperatures during operation. To do this, we used Rapsody and Ecodial software. The former enabled us to determine the dimensions of the cabinet to be purchased, in order to comply with the standard spacing between components, but also to allow for a 20% reserve space. The second enabled us to determine the right cooling/heating system for the cabinet, to avoid overheating and hence cabinet malfunction. These two studies were fairly short, but they showed the importance of the size and internal temperature of the cabinet.

Information ProClima Web (9.5)
Project Id: 20240613-083532002-09591-001
06/13/2024

Solution with fan

Classic ventilation solution Filter standard IP54 RAL7035 NSYCVF850M400PF (931 m^3/h)

REQUIRED FLOW	**438.68 m^3/h**
FLOW OBTAINED	**798.00 m^3/h**
% RESERVE PERCENTAGE	**82%**
TEMP. MAX. OF THE ENVELOPE WITHOUT THERMAL AUXILIARY (The international standard EN61439 recommends not exceeding 70°C)	**49.19°C**

Schneider Electric fans are designed to evacuate a significant quantity of heat from electrical panel components. Their lifespan is significantly extended, thus guaranteeing the durability and proper functioning of the installation.

Fans represent an effective solution, simple to implement and maintain and, moreover, economical, to the problem of temperature rise in electrical panels.
Thanks to its high degree of IP protection and its aesthetics, they can be used in both industrial and tertiary environments.
Classic ventilation solution
More information

List of references

Quantity	Reference	Description
1	NSYCVF850M400PF	FAN RAL7035
1	NSYCAG291LPF	GRID
1	NSYCCOTH230VID	Thermostat Electron 230V

Figure 4 - Report of Thermal Studies

As a result, the components of the low-voltage switchgear cabinet are known, all I had to do was list them in an Excel file so that the file could be sent to the buyer or the cabinet fitter. I also came to list the cables to be laid on site, as well as the types of signals. This stage is also important for the supply of the equipment, because once these lists have been drawn up, we can determine the delivery times and whether or not the customer's deadlines will be met. These initial stages enabled me to understand the importance of the main distribution cabinet and the ins and outs of such a study. In fact, this was the first time I'd carried out a study, from reading the specifications to drawing up the cable book for supplying a cabinet of this calibre.

Logically, a study of the main LV board alone would have been too short, so I had to design and study the cabinets downstream of the main LV board, essentially the motor power supply boards and the control panel . To start with the first one, I had to think about all the drive protection elements and the different power supplies needed to operate the motor and its control. To do this, I had to calculate the power consumption of the components in order to provide the right protection for the different feeders. The purpose of the second is to control all the instruments and devices and to be the brain of the process. This is why it contains all the fire safety relays, PLCs, I/O cards, 24VDC converters and routers or communication modules. Extracts from the control and command diagram are attached.

2. Les études instrumentales

Once these cabinet diagrams had been produced, we decided that I should do more instrumental studies, so I was asked to produce a steam production line equipped with instrumentation, to design it in terms of instrumentation and choice of equipment, to produce the P&ID and also to represent the various components added to the Control Panel diagram and the various lists produced previously.

To begin with, I studied the operation of a steam creation line so as not to create an illogical production line. To do this, a water inlet was logically necessary, through a pipe fitted with various instruments to measure pressure, flow rate or safety/isolation valves. The water is then injected into the boiler, which is also equipped with temperature and level sensors, to avoid overflow or extreme temperatures. The steam is then sent through a pipe fitted with a flow meter, valve and pressure sensor to prevent any operating problems, as well as a pump. The fan is connected to the boiler to regulate the temperature if necessary. With these ideas in place, I drew up the following P&ID diagram:

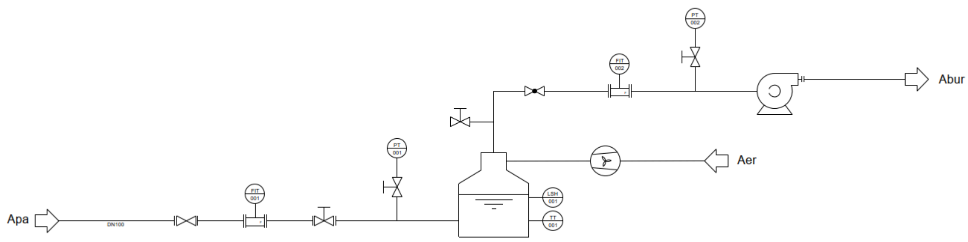


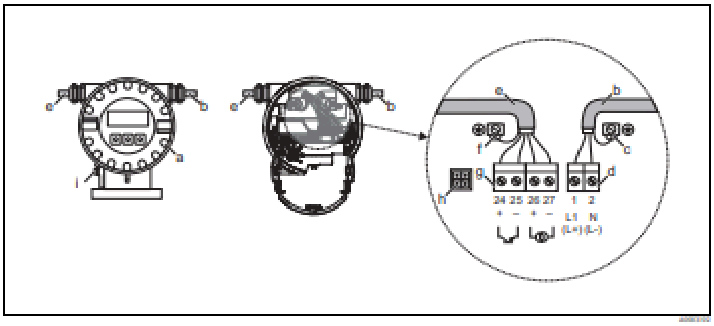
Figure 5 - P&ID Diagram

Once this diagram had been drawn up and validated, I began to study the different instruments to be installed, to understand why one type of measurement is used and not another and to find the references of the sensors concerned. For example, the flow-meter on the steam line couldn't be a conventional electromagnetic flowmeter because of the steam, so I chose a vortex flow-meter, which is better suited to this type of fluid. Similarly for the first valve, I decided to choose an electronic valve that could be controlled from the PLC to avoid constantly filling the boiler, which could prevent the water from evaporating. Once the references had been studied and chosen, we had to find out about the wiring and the type of communication of these instruments in order to plan the right PLC cards to be added to the Control Panel cabinet. Here's an example of a datasheet we studied:

Proline Promag 10W

Power supply

Electrical connection, measuring unit



Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)

- *a* — *Electronics compartment cover*
- *b* — *Power supply cable*
- *c* — *Ground terminal for power supply cable*
- *d* — *Terminal connector for power supply cable*
- *e* — *Signal cable*
- *f* — *Ground terminal for signal cable*
- *g* — *Terminal connector for signal cable*
- *h* — *Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)*
- *i* — *Ground terminal for potential equalization*

Electrical connection, terminal assignment

Order version	Terminal No.					
	24 (+)	25 (–)	26 (+)	27 (–)	1 (L1/L+)	2 (N/L–)
10***-***********A	Pulse/status output		HART current output		Power supply	
Functional values	See "Output signal"				See "Supply voltage"	

Figure 6 - Extract from a pressure sensor datasheet

With this information, we can modify the Control Panel diagram to integrate these instruments and the necessary PLC cards. To briefly list the modifications made, I had to modify the PLC to add extra boards (Analogue Inputs and Digital Outputs), add terminals for receiving wires and add the sensor design as follows:

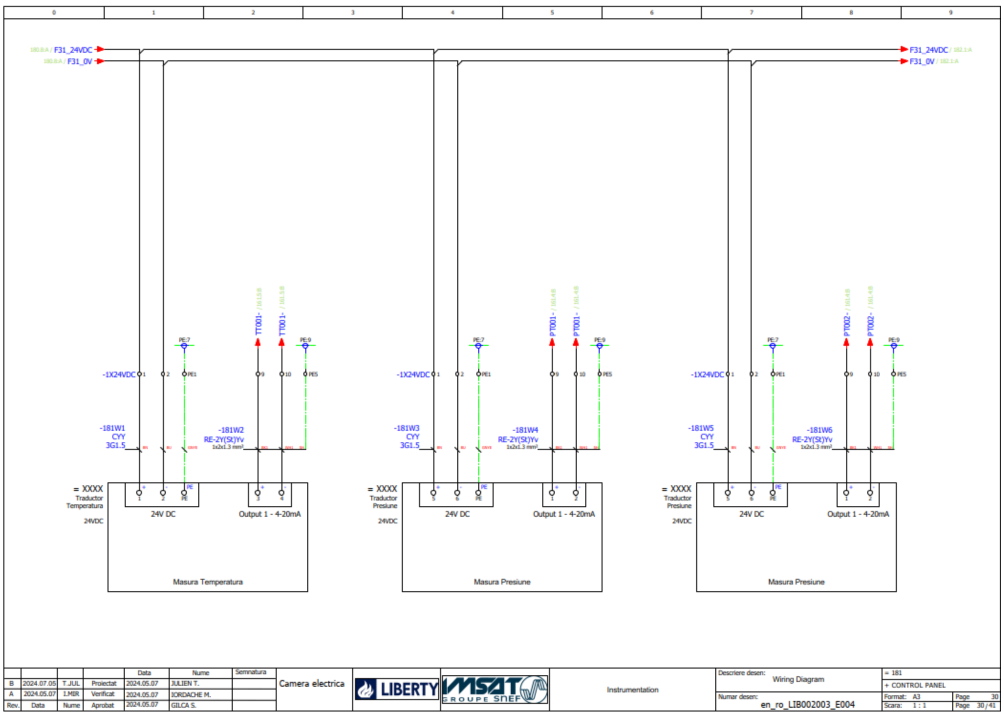


Figure 7 - Control Panel Diagram with sensors

In addition, to diversify the studies carried out during these 10 weeks, I travelled to the town of Alba Iulia to carry out commissioning on the cabinets of various stations. To introduce the project, a company called APA CTTA manages the water network in Alba Iulia and the surrounding area. There are therefore water distribution stations / chlorine measurement stations in various villages. IMSAT is responsible for building the cabinets and installing and connecting the instruments in these stations. So I was sent to Alba Iulia for 1 week with 2 colleagues from the agency to carry out the commissioning of the instruments and cabinets installed by the teams on site. This commissioning stage is one of the last steps in the installation process, as it's the moment when a visual check, a local functional check and a check with the control room are carried out.

Figure 8 - Sensor for chlorine content in water

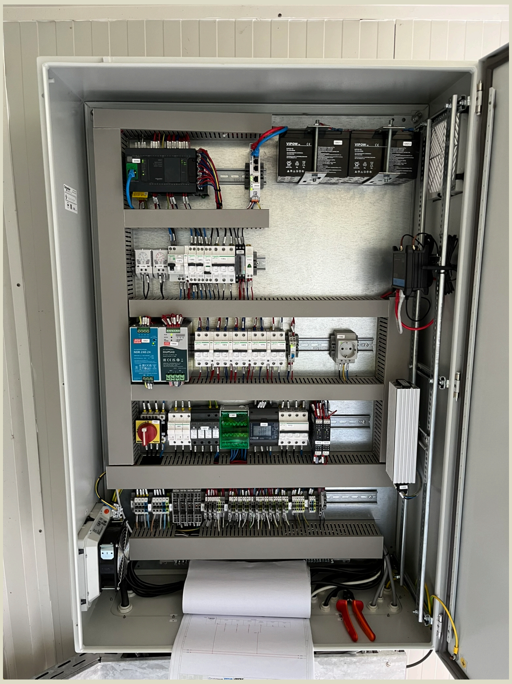


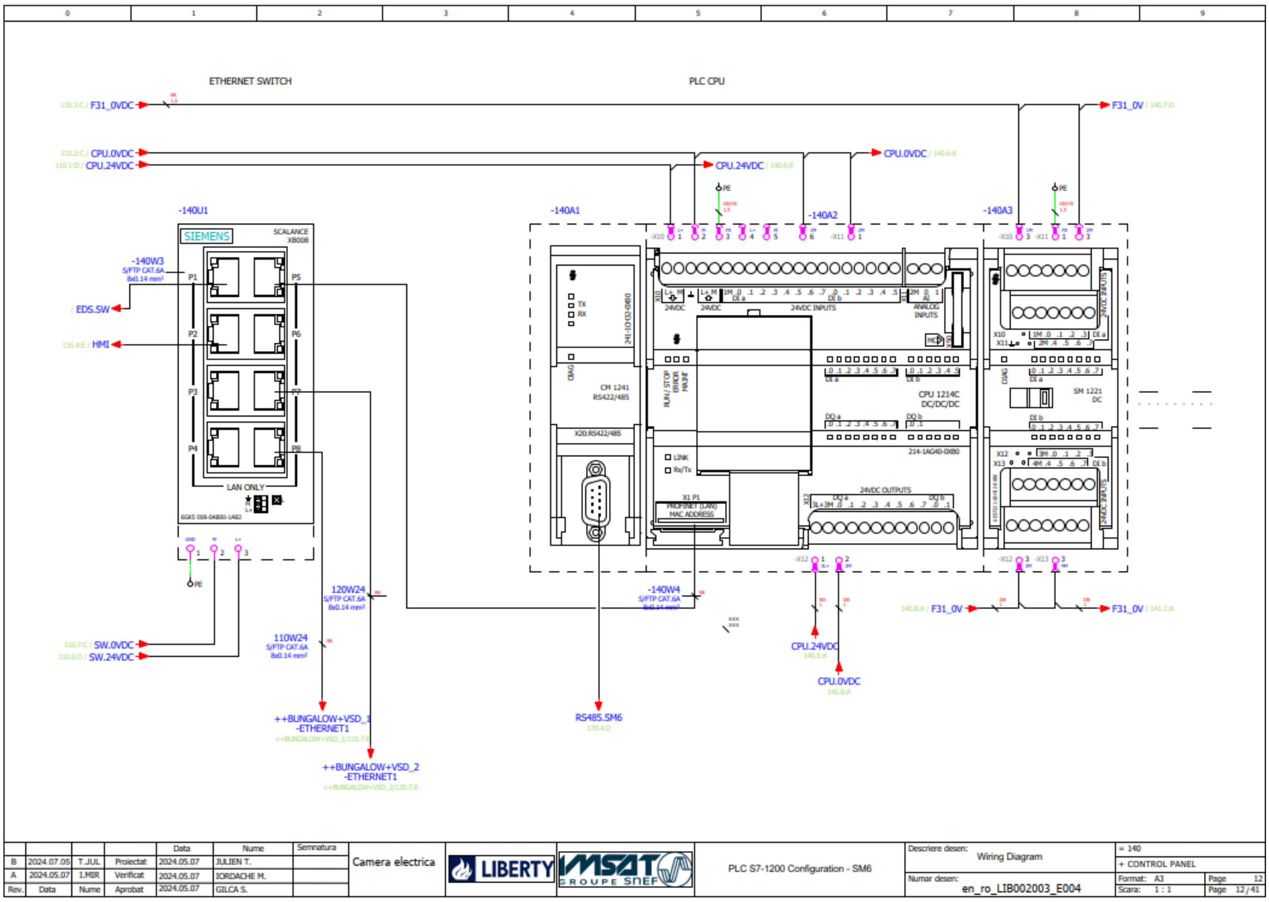
Figure 9 - Control Panel for a station in Alba Iulia

It was very interesting to see this side of the business too, because it makes you aware of certain difficulties that are only visible in the field.

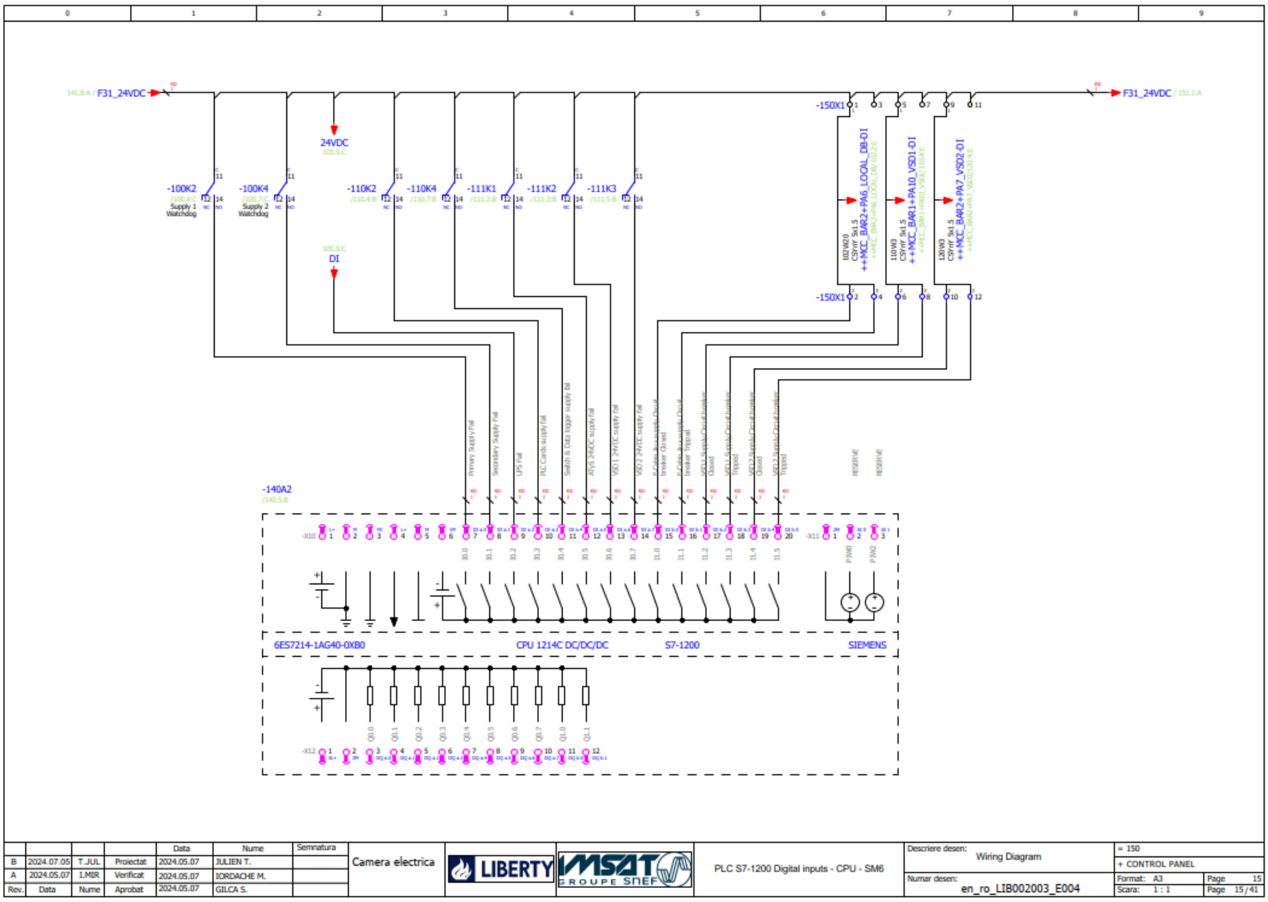
Conclusion

During my 10-week internship at IMSAT in Bucharest, I had the opportunity to significantly enhance my engineering skills by working on various technical aspects of electrical and instrumental studies under the guidance of Mihai IORDACHE in the "Studies & Electrical Design" department. I developed a thorough understanding of electrical distribution systems and created detailed diagrams for the main distribution cabinet using software like Schneider EcoStruxture Power Design. Additionally, I designed a steam production line, selecting appropriate sensors and instruments, and modified the Control Panel diagram to integrate these components. The on-site commissioning of water distribution stations in Alba Iulia provided practical insights and allowed me to collaborate with local teams to ensure the proper operation of installed systems. This internship enriched my technical expertise and problem-solving skills, and working in a multicultural environment improved my adaptability and collaboration abilities. Overall, the experience was invaluable for my professional and personal growth, preparing me for future engineering challenges.

Appendices



Annex 1 - Control Panel Diagram



Annex 2 - Control Panel Diagram