BACHELOR'S THESIS:

"SYSTEM TO CONTROL THE LEVEL OF THE WATER IN A TANK USED TO CONTROL THE HUMIDITY LEVEL OF A CHAMBER."

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ESCOLA TÈCNICA SUPERIOR D'ENGINYERS INDUSTRIALS

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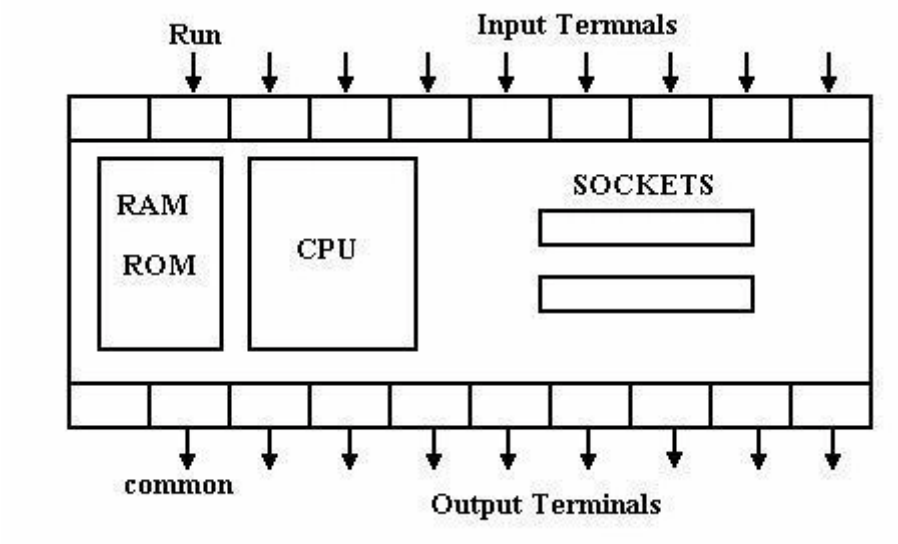
1.INTRODUCTION

The goal of this thesis is developing a program to control the filling and emptying of a tank that is used to control the humidity of a chamber. First of all, I will explain a bit about Programmable Logic Controllers.

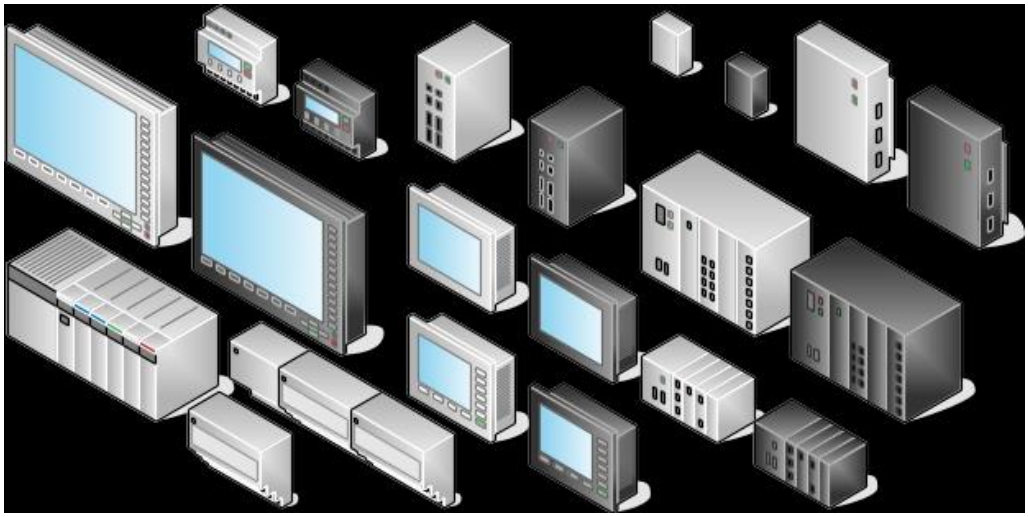
A **P**rogrammable **L**ogic **C**ontroller, is an industrial automaton designed to control sequential processes. A PLC is an electronic device programmable by the user. It is created to control machines, logical processes and secondaries. This device uses a logical program and It's able to do many functions, for example, It can collect data through the inputs (analog or digital), It can also do mathematical calculations, take decisions from preprogrammed criteria and act on the outputs.



Basically It is a computer, but It is designed to control machines and manufacturing processes. This is the reason It has specialized peripherals

like the input modules to control the different signals (push-button, proximity sensor, pressure sensors, motors, heaters, control panels…).

The Programmable Logic Controller is physically designed to endure the difficult conditions of the industrial environment, like the vibrations and the electromagnetic interferences, providing it with anchors and shields.

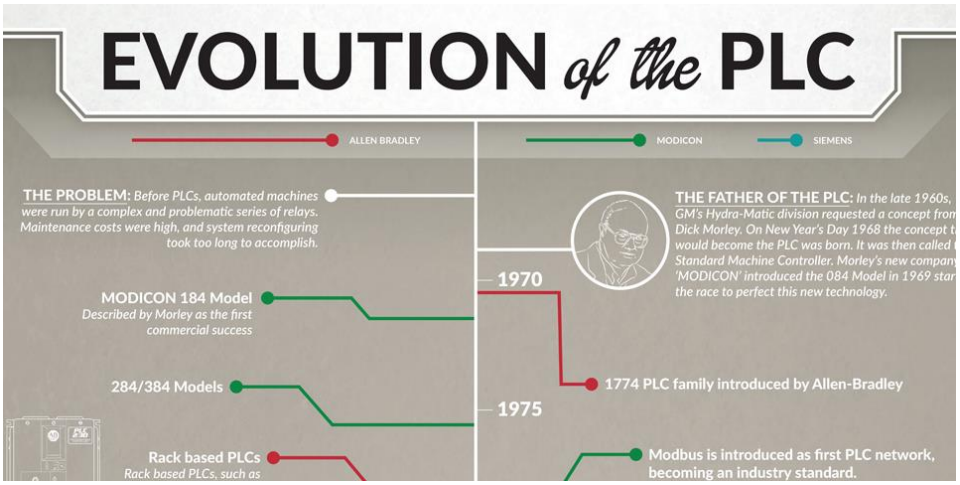


In relation to the operative system, It should be a RTOS (Real Time Operative System). It is able to give an answer in real time. So that, the PLC is able to calculate in a really short time the machine's answer to a determined change in the inputs.

To introduce, see and modify the control program, We use different programs : Ladder Diagram, GRAFCET, inSTructions List…

2.HISTORY OF THE PLC

The PLC or Programmable Logic Controller has revolutionized the automation industry. Today PLCs can be found in everything from factory equipment to vending machines, but prior to New Year's Day 1968 the programmable controller didn't even exist. Instead what existed was a unique set of challenges that needed a solution. In order to understand the history of the PLC we must first take some time to understand the problems that existed before programmable controllers.



Originally developed for the American automotive industry, the programmable logic controller has transformed modern-day industrial manufacturing.

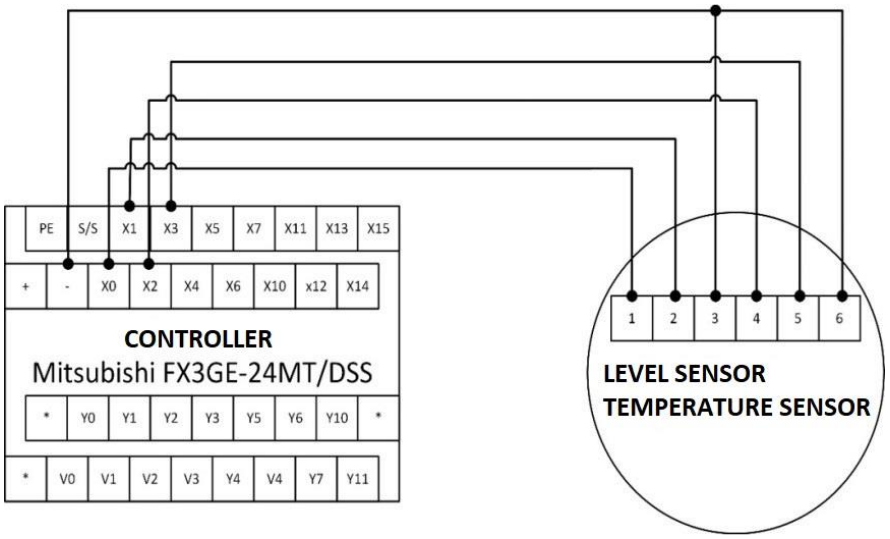
In the automotive industry, when the production model changed, the control system had to change. This involved hours of tedious work that only highly trained engineers could accomplish. Programmable logic controllers (PLCs) made the constant rewiring of control panels — which could include thousands of hard-wired relays, motor-driven timers and rotary sequencers — for every new production model obsolete. Today, manufacturers from every industry have turned to this technology to automate a variety of industrial processes.

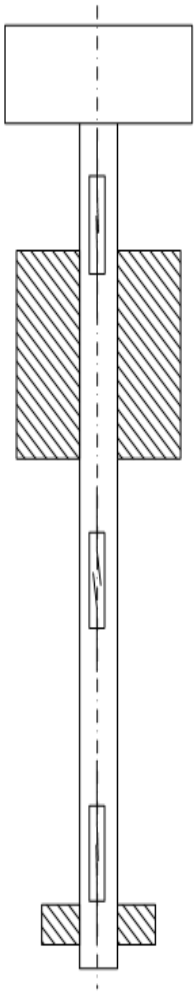
The PLC is a generic digital computer that, with programming, can be used to automate almost any electromechanical process. PLCs can be used to control amusement rides, HVAC systems or assembly lines, and are manufactured to be reliable and withstand harsh environments — making them perfect for industrial manufacturing.

While PLCs are not new technology, their functionality has evolved to include networking, relay control and advanced data-handling capabilities. The first programmable controllers were small, with a limited ability to send and receive signals at a reasonable response speed, which today has been cut down to mere milliseconds. The first PLCs also lacked standardized communication protocols, which made PLC-to-PLC control difficult. Eventually, PLCs became programmable with personal computer software, and PLC communication became more and more standardized — and widely incorporated into a variety of industrial processes.

The PLC’s were developed to answer the need of the nord-american auto industry to be automatized by the engineering Dick Morley.

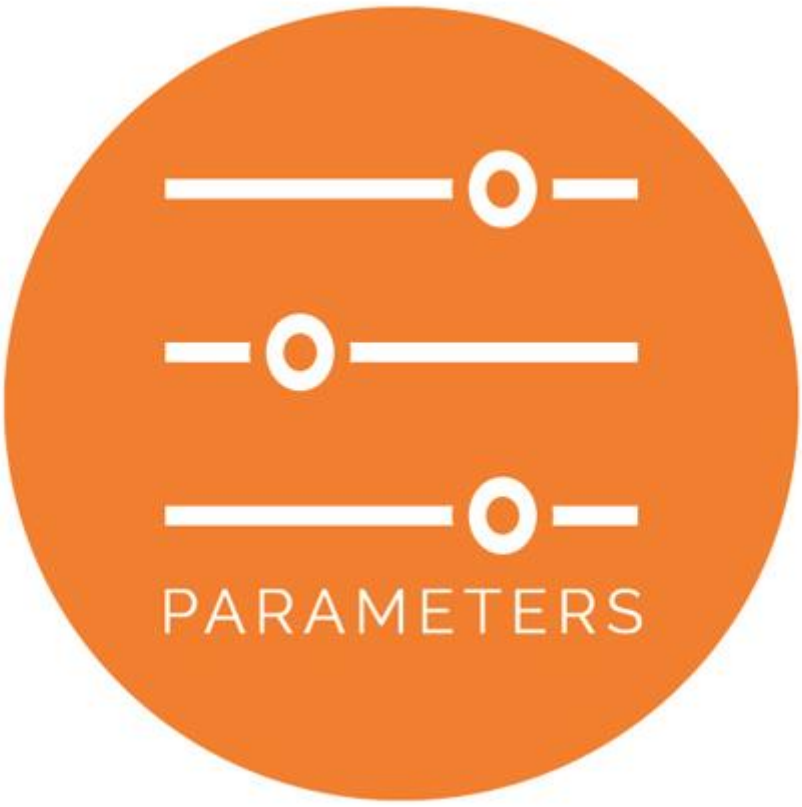
3.ELECTRONIC VERSION





PARAMETERS

Medium	top water
Maximum pressure	16MPa
Maximum temperature of water	50ºC
Range of work from min to max level of water	
How range of mist nozzles	2dm^3/h
Max pressure of mist nozzles	8Mpa



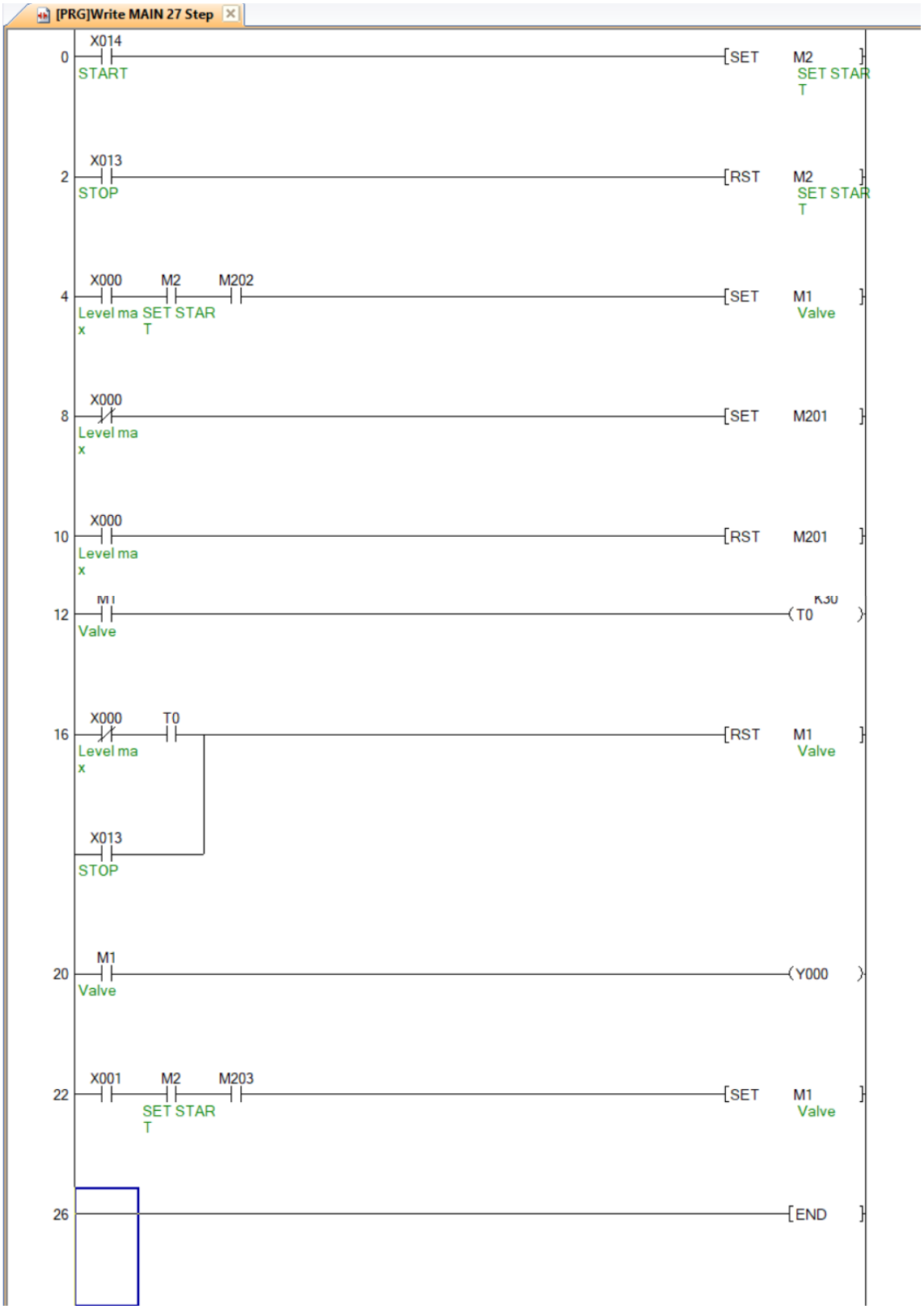
4.PROGRAM

In this thesis I developed a program to control the filling and emptying of a tank that is used to control the humidity of a chamber.

With this program the system will be able to control itself when to fill the tank because the water has been used to increase the humidity level of the chamber. Then We don’t have to be worried about fill the tank when the water would be used because the system will work automatically.

In the next page I present the mentioned program.

4.1 MAIN PROGRAM



I used the program GX works. GX Works consists of various different components that help to simplify project creation and maintenance tasks. A system design console that enables projects to be created at the system overview stage has been added. Additionally, the main programming languages are supported and their labels (variables) are shared, further simplifying programming. Various debug and maintenance features are also included.

During the thesis I also used the GT Designer**.** GT Designer is a screen design software program used to create HMI screens for the entire line of Mitsubishi Electric GOTs. A user-friendly Windows environment provides a simple and recognizable interface, facilitating a fast learning curve for new users.

4.2 SCREEN

The system can work in two different configurations. First of all and the most important one is when the system is working when the water is near to the maximum level. Secondly, It could work when the water is near to the minimum level.

Now, I'm gonna describe the different screens of the system.

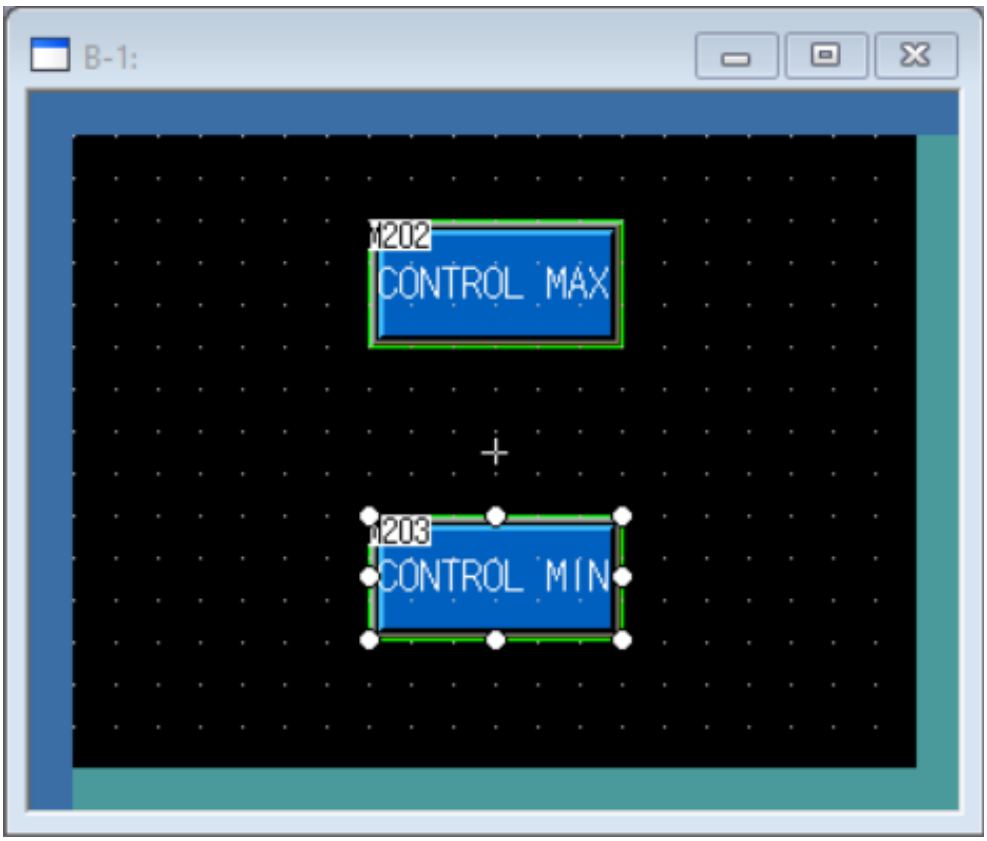
Here there is the screen number 1 (B-1).

This screen is the first that appears when the system starts. There are two buttons which switch the screen.

The first button M202 (CONTROL MAX) switches the screen to the screen number 2 (B-2).

In the same way, the second button M203 (CONTROL MIN) switches the screen to the screen number 3 (B-3).

Both screens are also equipped with a button M202 (BACK) & M203 (BACK) which switches the screen back to the screen number 1 (B-1).



Here there is the screen number 2 (B-2).

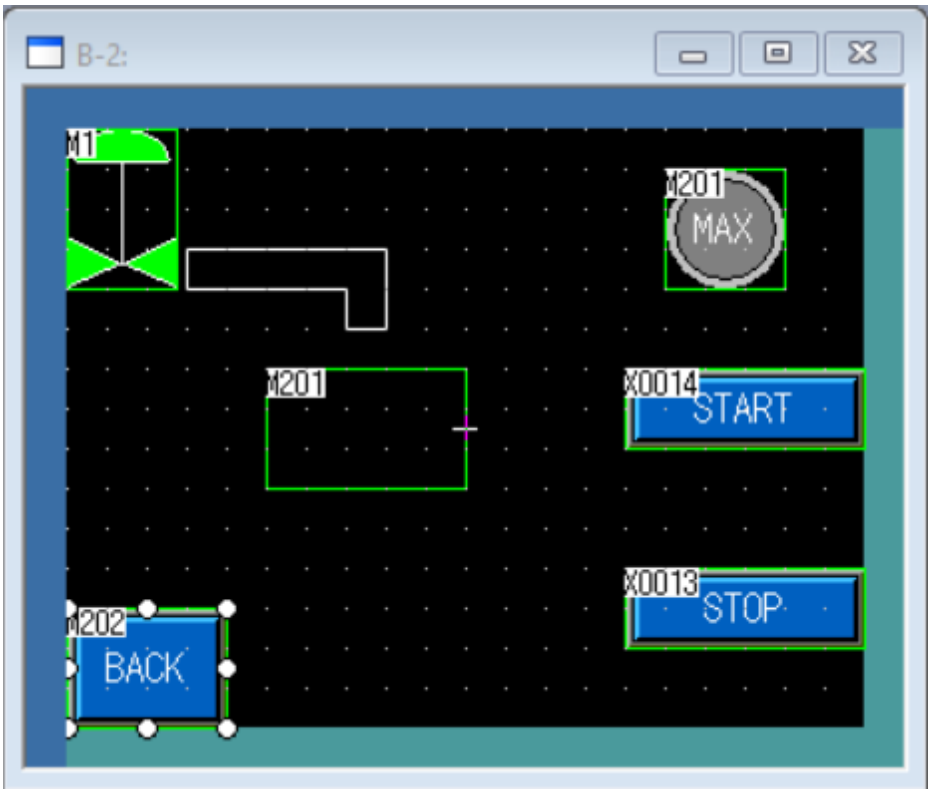
In this screen there are different things with different functions.

We already talked about the button M202 (BACK) which switches the screen to the screen number 1 (B-1).

This screen controls the system when the water in the tank is near to the maximum level. So that We have the bulb M201 (MAX) which turns green when the water reaches the maximum level.

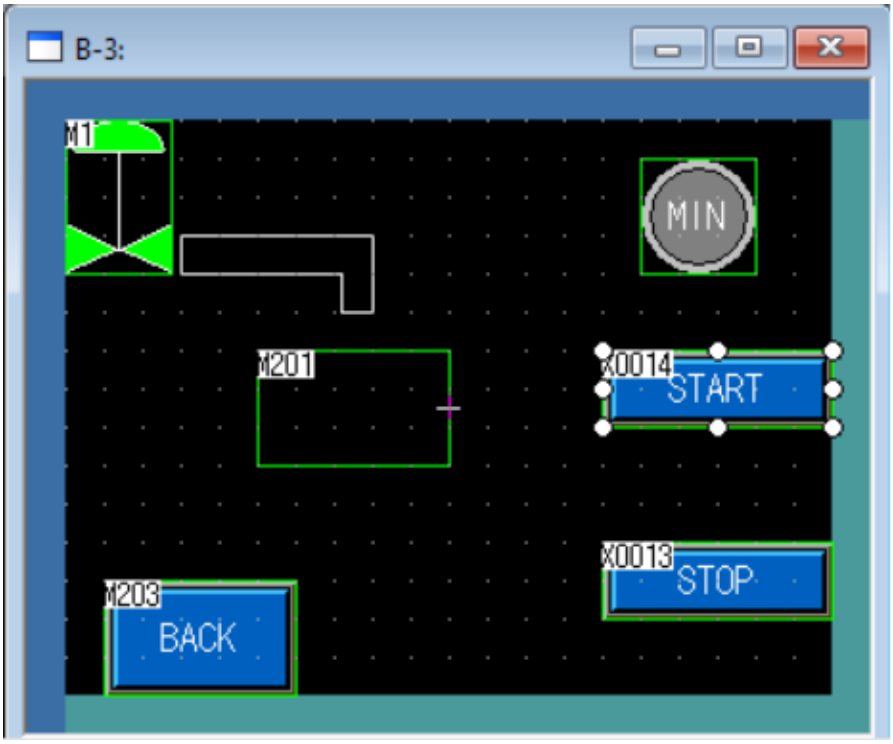
We also have the buttons X0014 and X0013 (START and STOP) which as their names already indicates are used to start or stop the system.

Finally there are different devices which show an animation when the tank is been filling. (Valve, tube and tank). They also change the colour when there are been used or when the tank is totally filled.



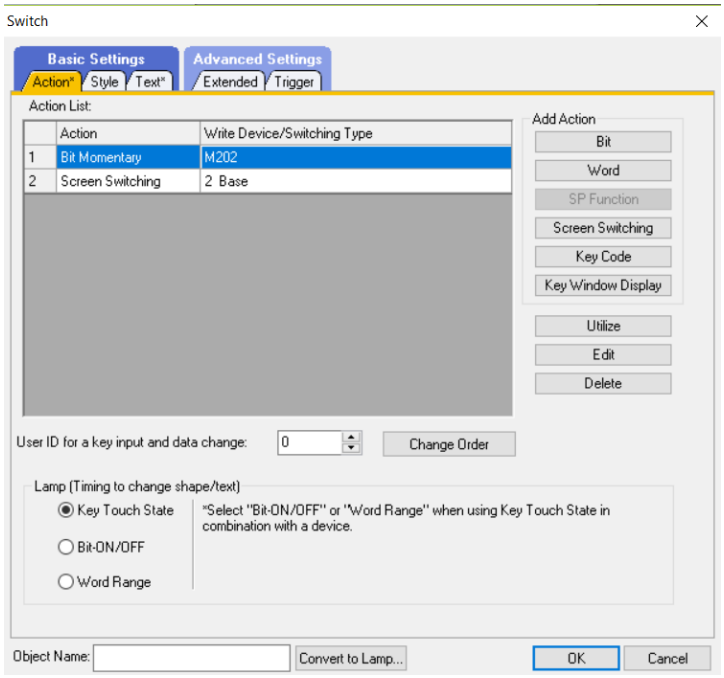
Finally, here there is the screen number 3 (B-3).

It works exactly the same as the screen number 2 but when the water level is near to the minimum level.

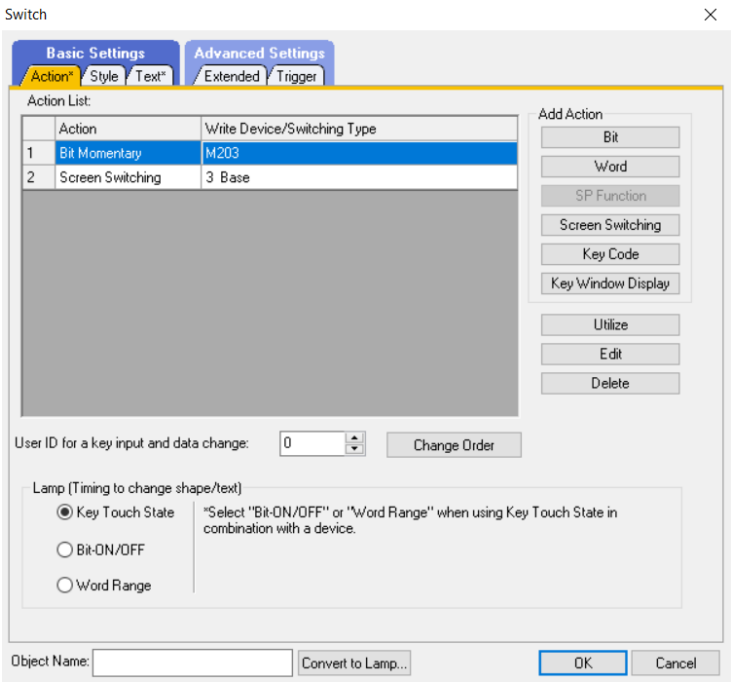


Then I will show the programming of the different buttons in the GT Designer.

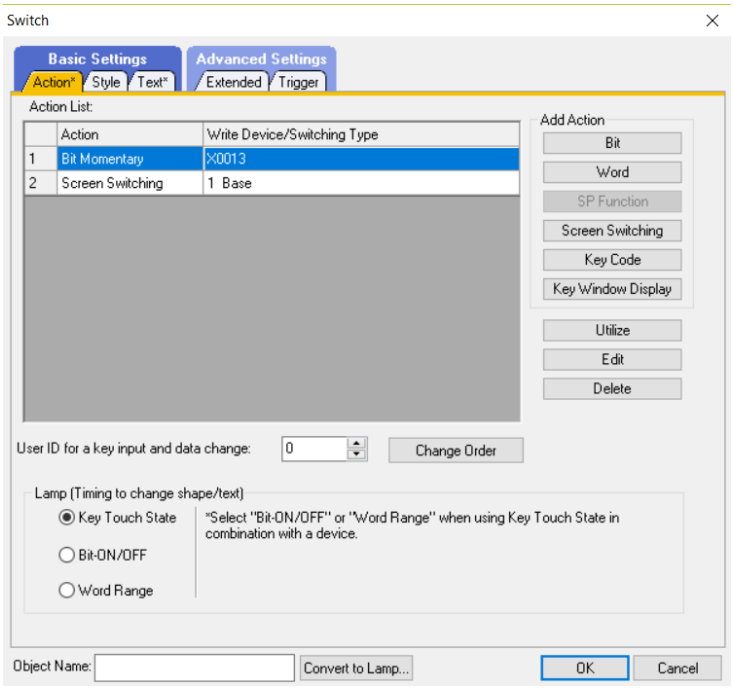
CONTROL MAX, B-1:



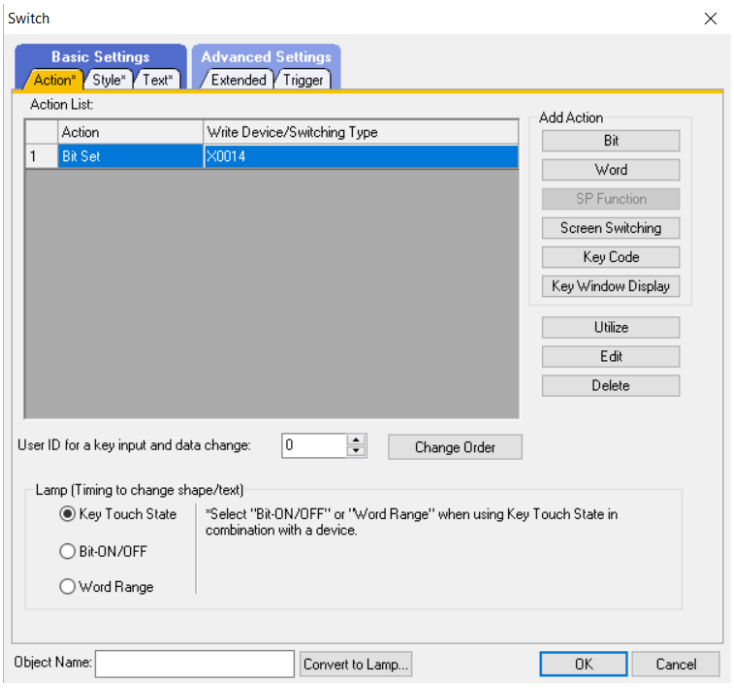
CONTROL MIN, B-1:



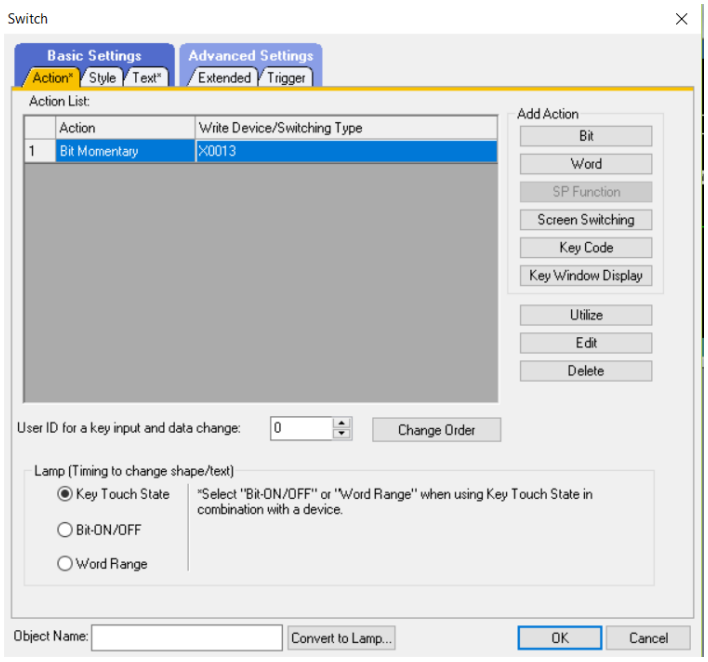
BACK, B-2:



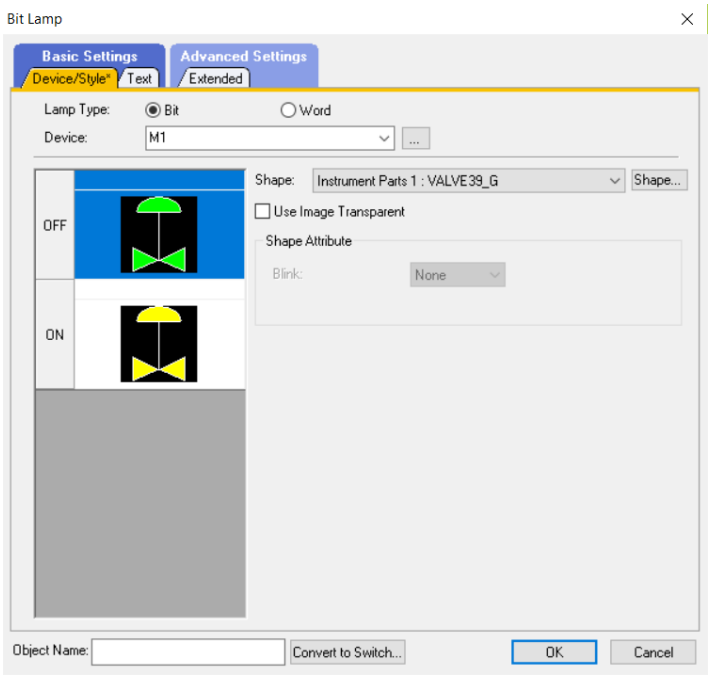
START, B-2 & B-3 :



STOP, B-2 & B-3:

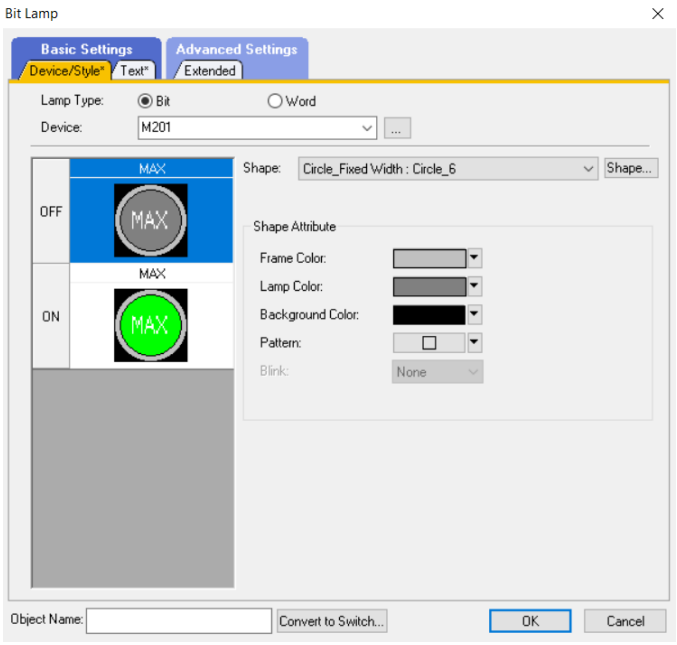


VALVE:



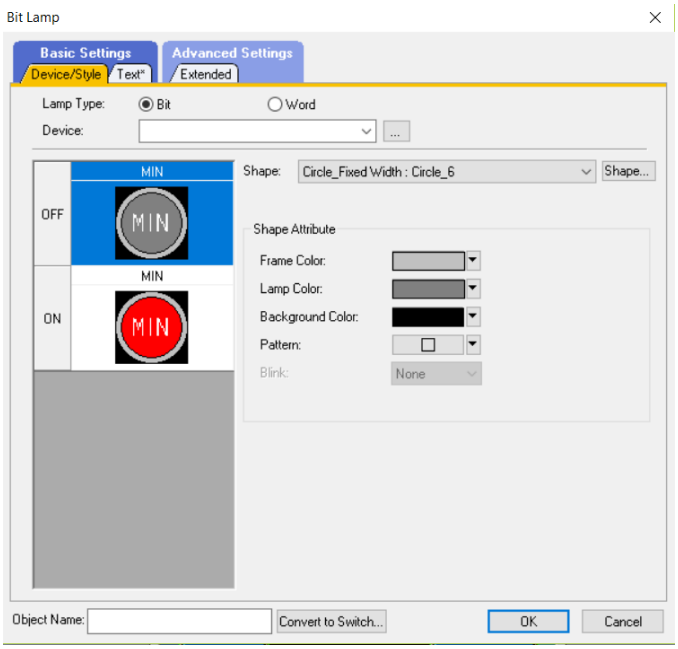

T0003
M201
MAX

MAX, B-2 :


Bit Lamp
Basic Settings
Advanced Settings
Device/Style*
Text*
Extended
Lamp Type:
Bit
Word
Device:
M201
MAX
OFF
MAX
ON
Shape:
Circle_Fixed Width : Circle_6
Shape...
Shape Attribute
Frame Color:
Lamp Color:
Background Color:
Pattern:
Blink:
None
Object Name:
Convert to Switch...
OK
Cancel

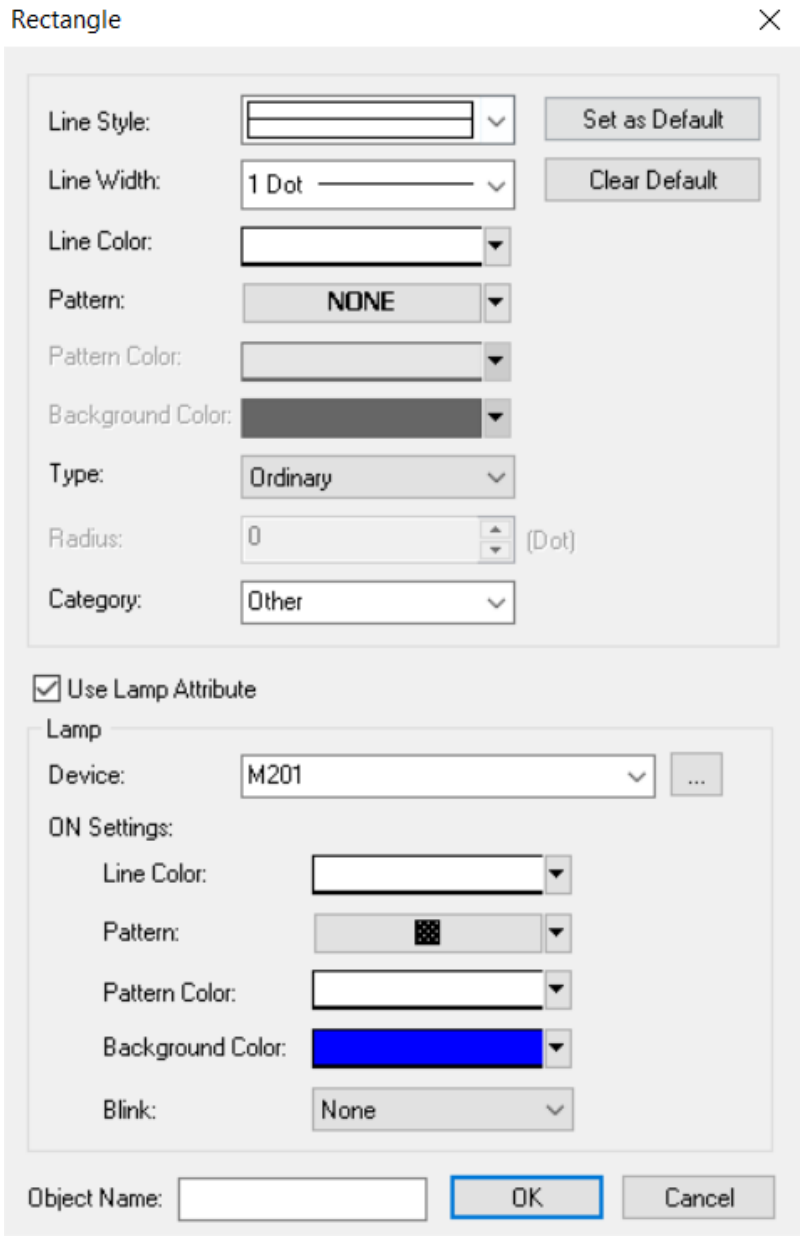

T0003
MIN

MIN, B-3:


Bit Lamp
Basic Settings
Advanced Settings
Device/Style
Text*
Extended
Lamp Type:
Bit
Word
Device:
MIN
OFF
MIN
ON
Shape:
Circle_Fixed Width : Circle_6
Shape...
Shape Attribute
Frame Color:
Lamp Color:
Background Color:
Pattern:
Blink:
None
Object Name:
Convert to Switch...
OK
Cancel


M201

TANK, B-2 & B-3:


Rectangle
Line Style:
Set as Default
Line Width:
1 Dot
Clear Default
Line Color:
Pattern:
NONE
Pattern Color:
Background Color:
Type:
Ordinary
Radius:
0
(Dot)
Category:
Other
Use Lamp Attribute
Lamp
Device:
M201
...
ON Settings:
Line Color:
Pattern:
Pattern Color:
Background Color:
Blink:
None
Object Name:
OK
Cancel

5.CONCLUSION & GRATEFULLNESS

Thanks to this project, I have learned a lot about PLC's. Not only how They operate, but also about their history.

During this project I have made a system that controls the level of the water in a tank used to control the humidity level of a chamber.

The system is able to control the tank when the level is near to the maximum level or when the tank is near to the low level.

First of all, I would like to thank Artur Gawlik . His support was essential for doing my project.

I would like also to thank the Universitat Politècnica de València. During my bachelor they taught me all I know.

Ultimately I would like to thank Marro López, her support was essential during my final thesis.

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