TECHNICAL UNIVERSITY OF NORTH

FACULTY OF ENGINNERING APPLIED SCIENCE

MECHATRONICS ENGINNERING CAREER

TECHNICAL REPORT

SUBJECT:

AUTOMATED MILKING SYSTEM WITH WIRELESS REGISTRATION OF MILK PRODUCTION

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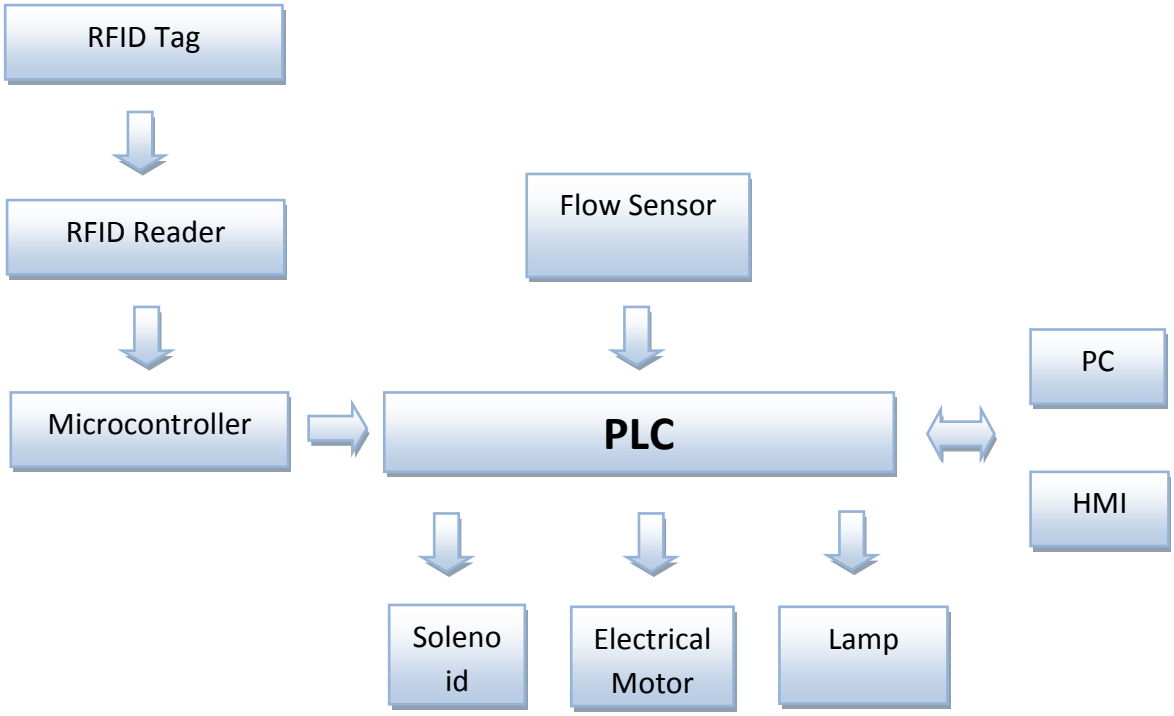
CHAPTER 1: System Introduction

The automated milking system with wireless recording of milk production was specifically designed for implementation at milking stations to optimize production with a more personalized management of cattle.

The system features the following:

- Register wirelessly to each animal with your details (name, date /time of admission and milk production) to enter the milking station.
- At the end stage of milking the system autonomously removes the milking cluster to avoid over-milking of cattle.
- The data will be sent and will be monitored from a PC.

The system hardware is summarized by the following block diagram:



CHAPTER 2: System Parts

The system is mainly divided in three systems:

➢ Wireless Registration System

In this system the animal will enter the milking station with its own RFID tag located on the earring of the same and by the RFID reader will register its entry into the station with your details (name and number of earring), number of liters produced , time and date of entry and then are sent to the PLC LOGO! for registration and monitoring at the PC.

- **RFID Module**

The RFID module to record the model won the Innovations ID - 20 with a range of 16 cm. This device will be located at one end of the season.

- **RFID Tag**

The RFID tags or labels are on the earrings on cattle for their respective identification to enter the milking station.

The RFID tag is a passive tag selected keychain that inside has a CMOS integrated circuit EM4100. Has appropriate physical characteristics to withstand climatic changes, temperature variation, falls, and are waterproof durability, being optimal for the environment in which they are exposed to the cattle ranch.

➢ Automatic Registration System

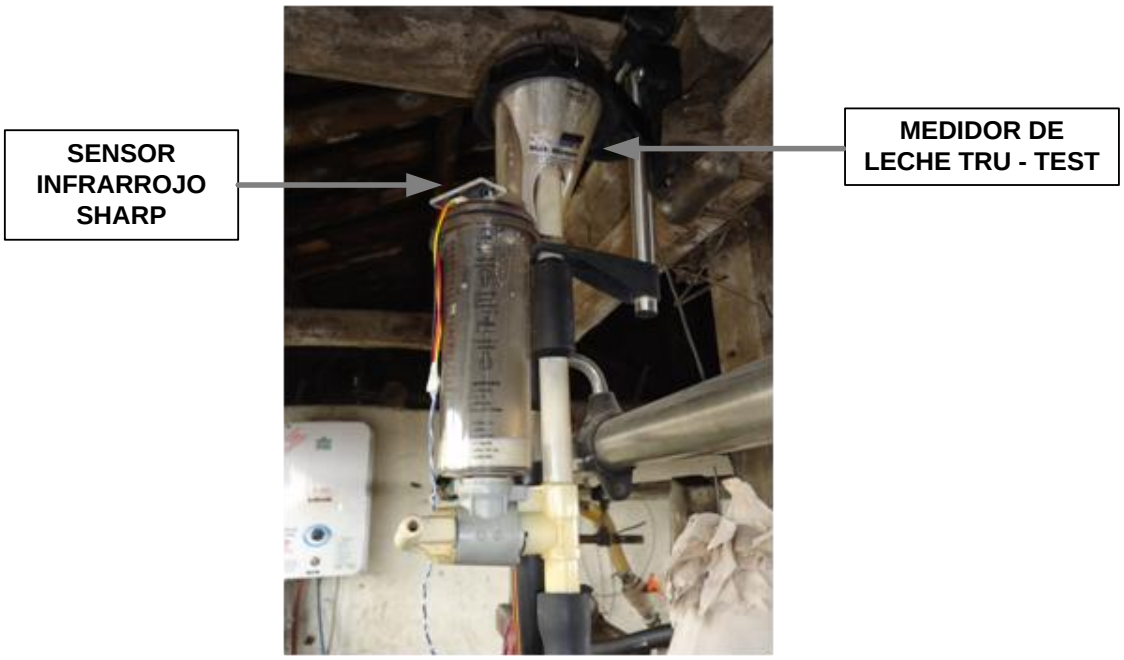
Automatic withdrawal system is to interrupt the milking vacuum when the animal has been milked completely thus reducing the risk of producing milking and mastitis.

The flow sensor monitors the passage of milk during milking, the end of this process when the flow drops below its normal flow, the system sends a signal to the solenoid to cut the gap. Once cut the gap proceeds to remove the liners of the animal by an electric motor.

This process is faster and total milking time is significantly reduced. This system is no longer a factor limiting the number of units that the operator can handle without causing over-milking.

- **Flow Sensor**

The flow sensor shall consist of two parts: the flow meter and the infrared sensor. This flow sensor will be located at the top of the milking station and send the electronic data to the control system and HMI operator to view individual milk production measured in liters.



- **Solenoid**

The solenoid is a valve designed to control the flow of a fluid (milk and compressed air) through a conduit in this case is the hose that is connected to the milking cluster to the stainless steel pipe of the milking station mechanic.

- **Electric Motor**

The electric motor used for the automatic withdrawal is the engine for Toyota Pick Up feathers of 12 V DC. This engine has a speed reducer to safely remove the milking cluster, because this game will be connected by cable to the motor shaft and start collecting at the end stage and computers located in their original position.

- **Warning Lamp**

The visual indicator lamp is used as a siren red, located at the top of the milking station, this is activated by the end of the milking process as a warning to the operator to give way to the next animal for milking.

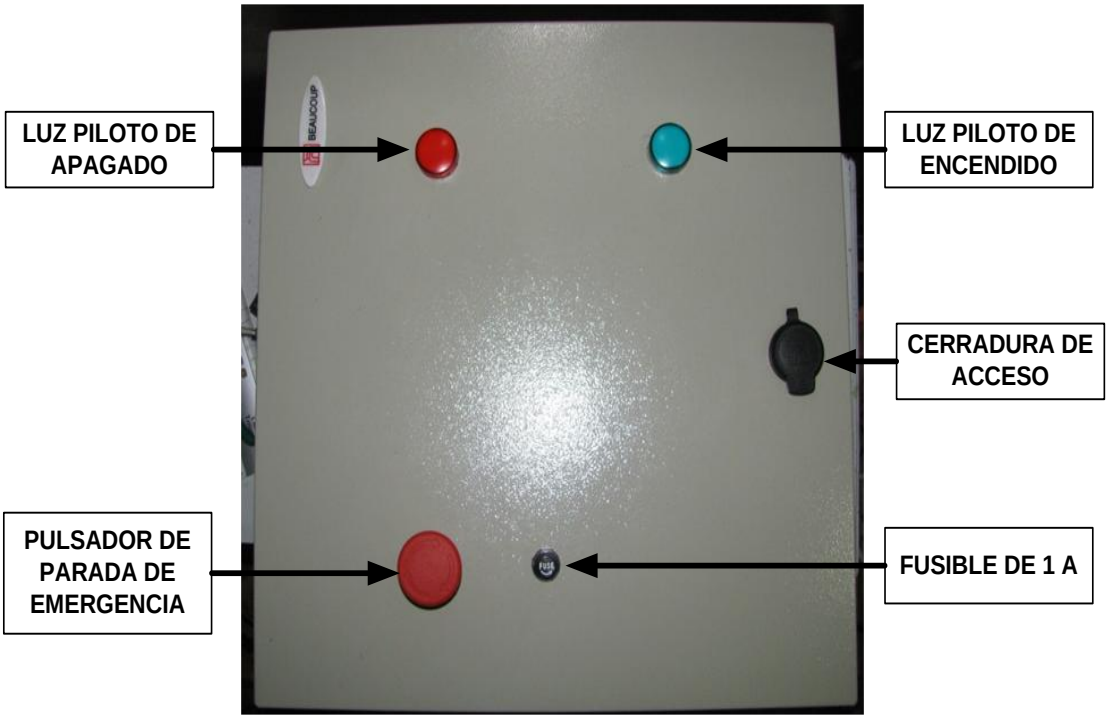
➢ Control System

The control system is responsible for coordinating the wireless registration system and the system of automatic withdrawal. The process begins when the animal is recorded by the RFID reader and once milking the system triggers automatic cancellation of the milking cluster. Then send this data to the HMI operator and the computer where they can be viewed and controlled the data as appropriate.

- **Control Cabinet**

The control system was put in an enclosure of dimensions 40 x 40 x 20 cm for the respective wiring with other systems, power supplies, controllers, actuators, sensors, and terminal blocks.

The outside of the control cabinet is installed lights on (green light) and off (red light) to indicate the status of system operation, fuse protection and emergency stop button.

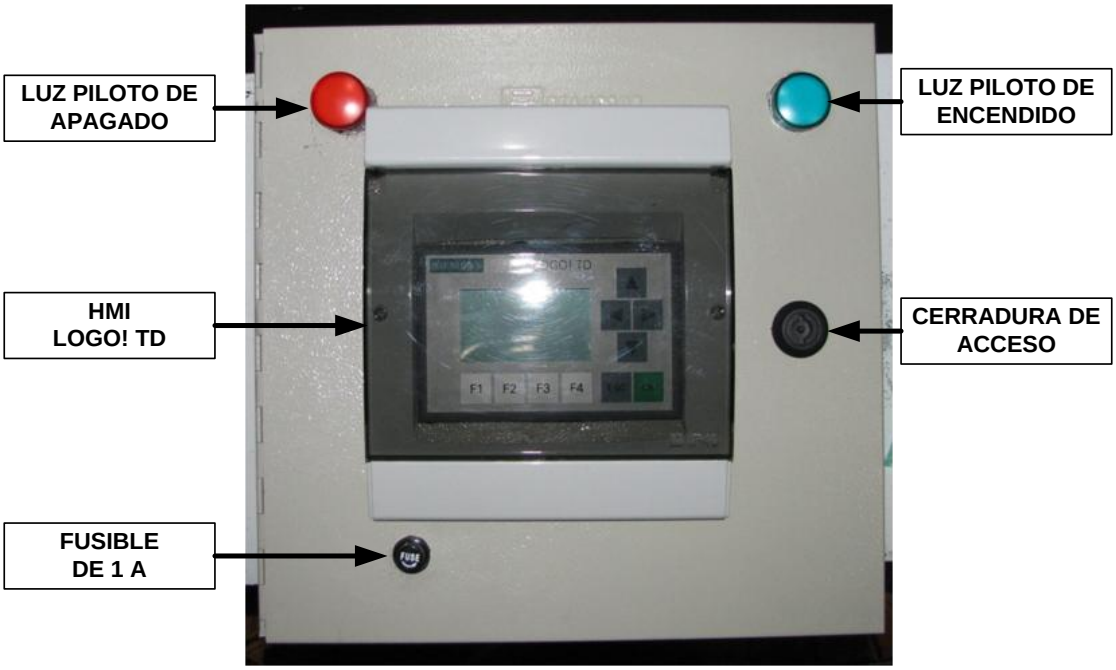


- **HMI**

For the human interface - machine was installed LOGO! TD on the left side of the milking station to have a display and control the milking process from the operator so we can verify all the parameters controlled by the PLC LOGO! are functioning in the normal range of operation.

This screen will have four buttons and a cursor that is used to turn on and shut down, restart the process to the next animal that enters the milking station, verify the gallons produced, animal data, date and time of admission.

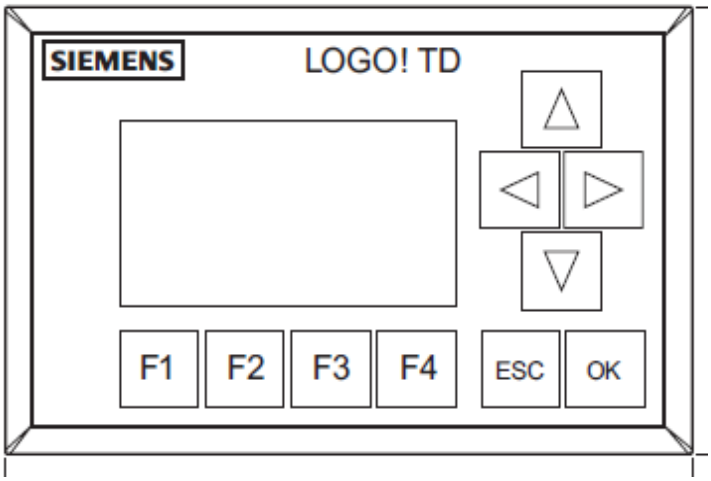
At the top of the HMI is a green light indicates the system is up and a red light indicating that the system is off. And the bottom is the fuse of the HMI.


LUZ PILOTO DE APAGADO
LUZ PILOTO DE ENCENDIDO
HMI LOGO! TD
CERRADURA DE ACCESO
FUSIBLE DE 1 A
F1
F2
F3
F4
FUSE

CHAPTER 3: Operating System

To operate the system using the HMI operator control and display data from the automated milking system.

The graph shows the screen and control buttons.



In the HMI operator uses the following buttons:

[F1] ⟶ Turn the system

[F2] ⟶ Shut down / restart the process

[F3] ⟶ Turn on the electric motor

[F4] ⟶ Off the electric motor

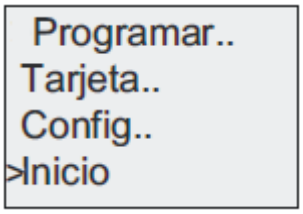
[ESC] ⟶ Out the menu of LOGO!

[OK] ⟶ Select the menu of LOGO!

[◀, ▶, ▼ o ▲] ⟶ Move the cursor on the program menu /LOGO!

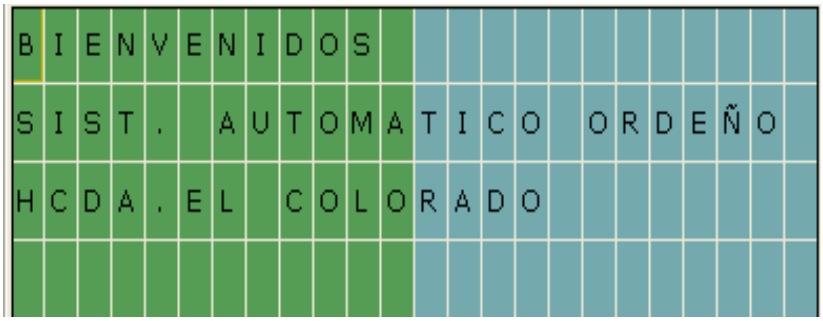
➢ How to Start the Milking Process?

When starting the system in the HMI menu is displayed PLC LOGO! and the cursor keys, position the cursor ▼ o ▲ on the "**Start**" and press "**OK**".



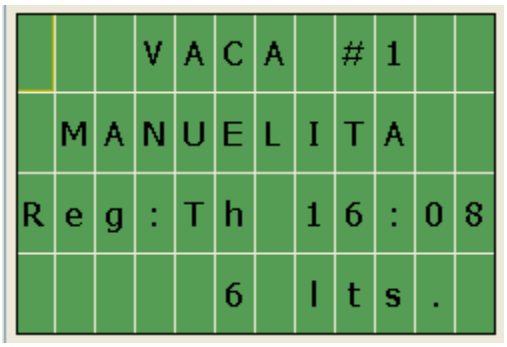
Once the program LOGO! stating the date and time of the system.

To initialize the automated milking system wireless record of milk production in the HMI press "**F1**" once. The HMI display a message of welcome and the pilot light will turn green indicating that the system is ready to go.



- **Reading RFID Tags**

To read the tag of cattle pass the RFID reader by the tag placed on the animal's ear tag and the HMI display screen data registration and animal production.

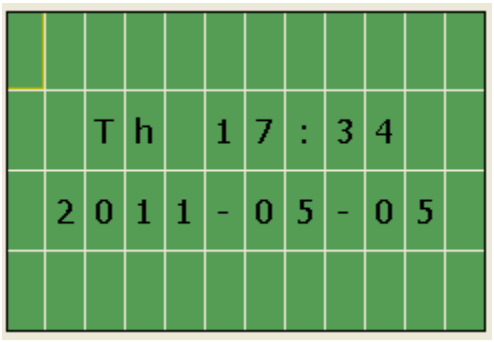


Once registered the animal comes to the stage of milking until the game automatically remove the milking, where the system will be indicated by the warning light that milking is finished to make way for the next animal.

In case the animal's tag is not registered is displayed on the HMI message "Unregistered" and the system does not proceed to machine milking.

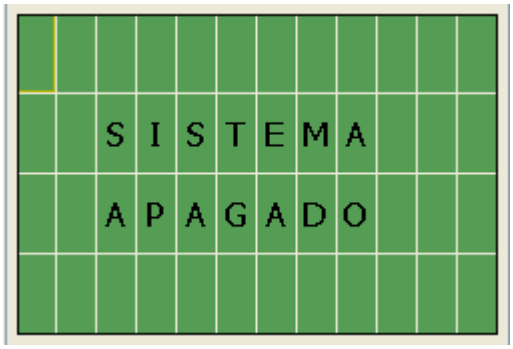
➢ How to Reboot?

Once the order and step to the next animal to press the "**F2**" key once and the system will reboot and display HMI return to its initial state the date and time of the system. So the system is fit for the next milking.



➢ How to Shut Down?

To turn off the system after milking press the "**F2**" for **1 second** and screen HMI display "**System Off"** for **2 seconds**, the green LED light will turn off and the pilot light will turn red indicating the system is off.



CHAPTER 4: Communication PC – System

For verification of data received from the system will use the LOGO! Soft Comfort Siemens.

Within the software you use the "**Test Online**" for receiving data.

➢ How to Start Receiving Data?

To start receiving data in real-time online test mode must meet thefollowing requirements:

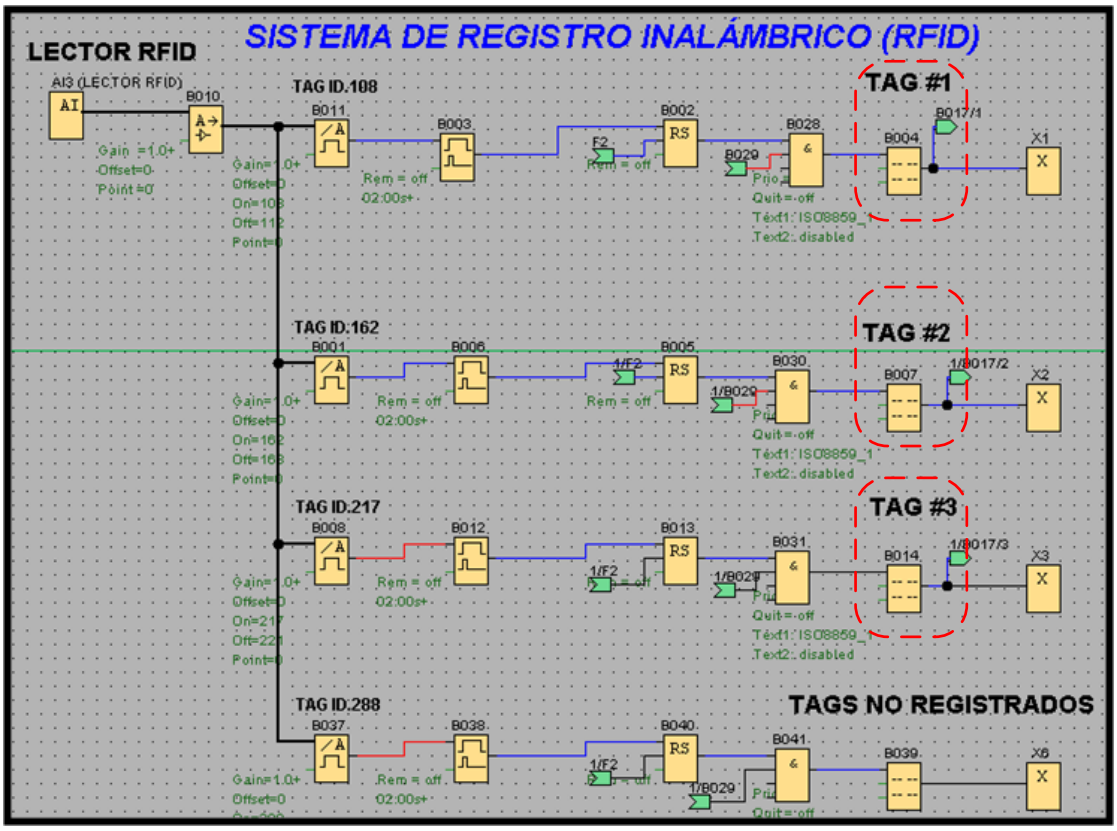
- The PC must be connected to the LOGO!
- The test program should be available in LAD and FBD or have been transferred to LOGO!
- The program in LOGO! Soft Comfort should be the same program in the LOGO!, If not load the program from the LOGO! on the PC or the inverse.
- Online test mode is only available on devices from the series 0BA4

In the programming software LOGO! Soft Comfort load the "**program**" the PLC and the following steps to start the test online mode:

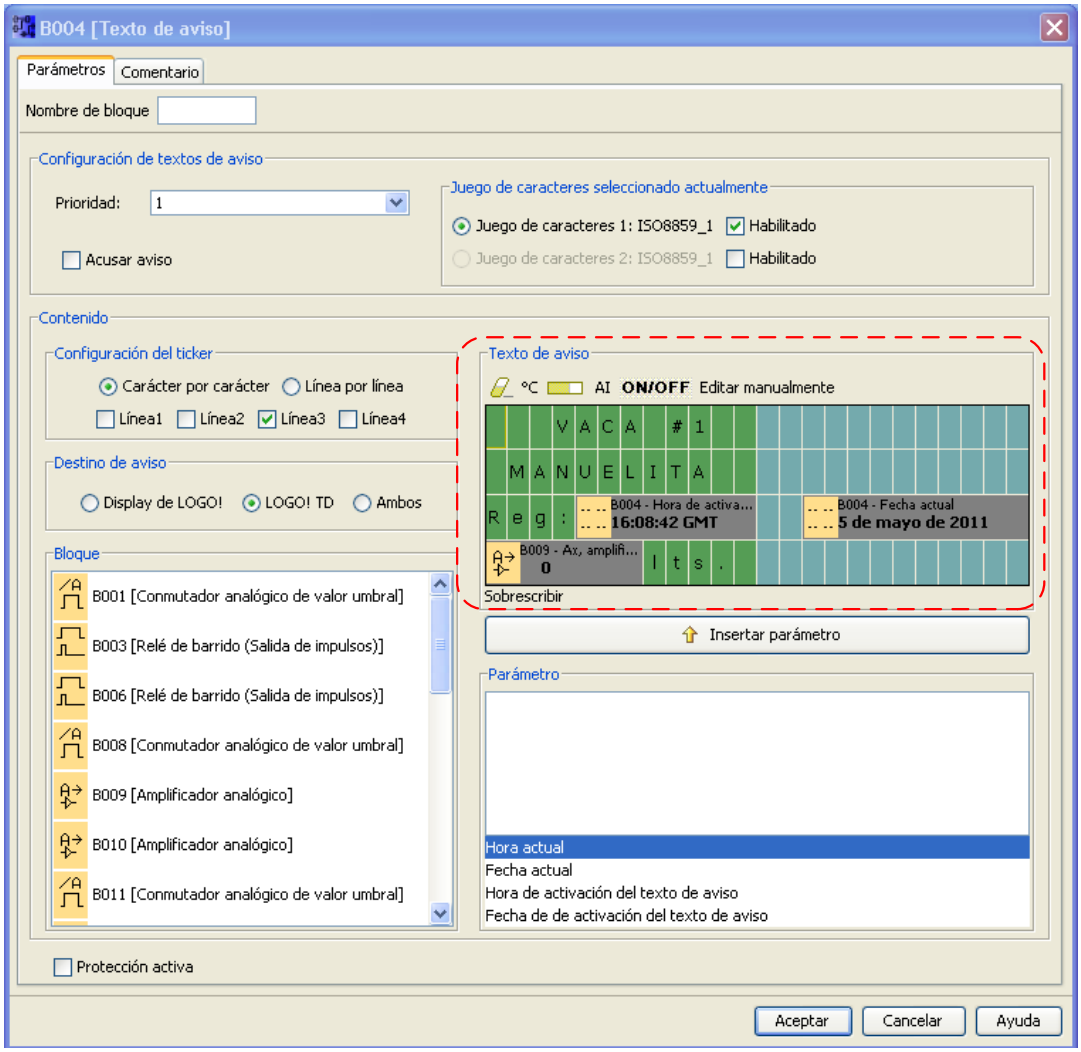
1. Choose the menu command "**Tools**" then "**Test online**".
2. If the LOGO! is in STOP mode, start the LOGO! clicking on the "**Start**" button  . As a result, LOGO! will launch the program.
3. Start mode "**Observation**"  .
4. Select the blocks whose parameters should be monitored so you can view real-time inputs and outputs of LOGO!.
5. To change the LOGO! to STOP you click the button "**Stop**"  .

➢ How to Change the Animal Data?

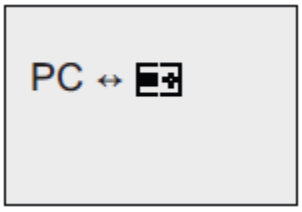
Within the system program in LOGO! Soft Comfort is directed to "**Wireless RFID Tracking System**" and makes double click on the block "**TAG #"** to change.



When you open the selected block will open a sub display data from animal and in the "**Message text**" will change the new animal to register and then clicks "**OK**" to save changes.



After saving changes the system program transfers to the LOGO! by clicking "**Tools**" then "**Transfer**" and finally click on the icon  "**PC -> LOGO!**" and the modified program will begin to transfer to LOGO!.



CHAPTER 5: Troubleshooting

- The LOGO! used does not support the test online **Solution:** Use a LOGO! the most recent series of devices (from the series 0BA4).
- The PC program is different from the program LOGO!. **Solution:** Load the program in LOGO! on the PC or reverse.
- You are trying to simultaneously monitor many parameters /blocks. **Solution:** Reduce the number of parameters / blocks to monitor simultaneously.
- The connection is broken between the PC and LOGO!. **Solution:** Reset the connection. Check the cable if connected.
- If the RFID reader does not start recording. **Solution:** Turn the breaker # 2 control cabinet, wait 5 seconds and then on again.
- If the system gets stuck in any stage or not working properly. **Solution:** Press F2 to restart the process or press the emergency stop for the system to shut down completely.

CHAPTER 6: Maintenance

In the process of mechanical milking machine that works any day, every day of the year, the milking machine needs periodic review. As the half-yearly or annual control to verify proper operation but are also vital to the simple maintenance can be performed by the operator or the farmers themselves and can avoid more serious damage or delay its onset and minimize their severity until it can be checked by a technician of the machine.

The main rules keeping the milking machine are:

- Maintain the vacuum pump in excellent condition with oil levels recommended by the manufacturer.
- Conducting gap must be cleaned at least once a year and whenever milk enters the vacuum system.
- When the regulator operates is constantly sucking air with dust particles to ensure good performance should be cleaned regularly.
- To ensure smooth operation of the buttons need a series of maintenance operations that depends according to the type of the button.
- The collector for the incoming air flow remains constant need to frequently clean the inlet air.
- The frequency of change of liners can vary in relation to working hours and the number of milkings, but a general time of change is every 2500 milkings.
- Clean the milk flow sensor for each day to avoid contamination by waste can be stored in the container of the sensor.