Selmo

Filling system analysis process

This document describes the implementation of a demo plant using the Selmo method and is divided into five main areas:

1. Structuring the system:
   The plant is called **a "plant"** and is divided into one or more hardware zones **according to its safety requirements.** The control sequences are mapped in separate sequences to ensure clear and structured process modeling.

2. Activity analysis:
   The basic position of the machine defines the initial situation for the automatic sequence, which is activated by a defined start signal. Moving components, such as cylinders or motors, are monitored by sensors in order to precisely control the process steps.

3. Technology analysis:
   The essential technical components are explained, including **actuators, sensors, drives and operating elements** that are necessary for controlling the plant.

4. Functional analysis:
   The control of the movement sequences is described in detail. The interactions between the individual components and their monitoring by sensors and control logic are considered.

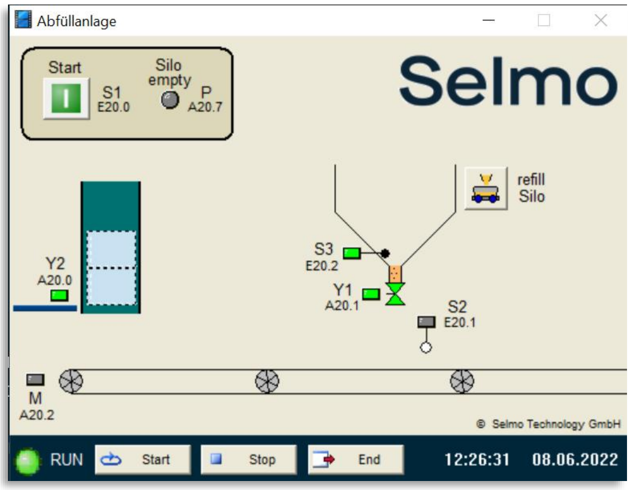
5. Process modeling in Selmo Studio:
   For implementation in Selmo Studio, it is recommended to use the preparatory tutorials in the **Selmo Knowledge Base.** In addition, tips are given on the structured modeling of the demo system in the Selmo Studio as well as on the optimal use of the Selmo functionalities.

For more information on the Selmo analysis process, visit our Knowledge Base.

Selmo

Table of contents

1. Structuring the system



The **structuring of the plant** is carried out according to Selmo's principles, whereby the stations and processes are divided into logical units (hardware zones and sequences).

The structure of the system is divided as follows:

> **Plant:** The entire bottling plant is called a "plant", which includes the complete plant.
>
> **Hardware zone:** The filling line is modeled as a hardware zone only, as the entire plant only covers one protection area. Therefore, there is no need to implement multiple independent automatic flows.
>
> **Sequence:** The process of the filling line is modeled in an independent sequence.

2.Activity analysis

An essential part of the process analysis is the definition of the **home position**, which ensures that all modules are correctly positioned and ready for operation. The basic position of the plant is defined as follows:

> The S3 sensor indicates that the silo is filled. Sensor S2 indicates that the conveyor belt under the silo is free.

The clear definition of the basic position is essential, as it forms the basis for the safe start of the system. Only when the basic position has been clearly defined can the actual **automatic process** be described and implemented.

The automatic sequence of the system can be started by pressing the S1 button. After starting the process, an empty container is transferred from the drop magazine to the conveyor belt via an impulse at the release exit Y2, which is driven by the motor M. The container is transported under the silo. A light barrier S2 detects the container under the silo and the silo valve Y1 opens. The container is filled for 3 seconds. After that, the valve Y3 of the silo closes again and the container is transported on, so that the sensor S2 is free again for the next container. This process is repeated as long as the silo is sufficiently filled.

If the silo is empty, this is indicated by the light of a warning light P. The silo must be refilled via a manual filling button "refill silo". After filling, the start button S1 must be pressed again. After the system has been switched off, the conveyor belt continues to run for three seconds so that all containers are completely removed.

This model contains a large number of components with unmonitored states and thus risky blind spots. Due to the lack of end position monitoring in the flap and in the valve for the silo, timers must be used for time control.

3. Technology analysis

Engine:

The components are each driven by electric motors, which are optimally adapted to their speed and power via gearboxes. Drum drives are often used in which the motor is integrated directly into the drive drum to save space. These are switched on and off via the individual outputs Mxx. The motors have no speed control or operating status monitoring.

Start-Button:

The start button is used to start the process. It is configured as a normally open contact, i.e. in idle mode, the voltage to the controller is interrupted and logic "0" is generated at the corresponding input. When the button is pressed, logic "1" is generated by passing on the voltage.

Sensors:

The sensors are proximity switches that detect objects without touching them. They usually work with magnetic, capacitive, inductive or optical principles to detect the presence of an object in its detection area.

Valve without monitoring:

The valve is a technical component used in conveyor systems and silos to regulate or interrupt material flows. It consists of a closable opening that releases the bulk material or stops it completely. There is no feedback on whether the valve is open or closed.

Flap:

The flap for separating the containers is controlled via a release cylinder. It opens time-controlled for 2 seconds, after which it closes again via a return mechanism. There is no end position monitoring.

Warning light:

The warning lamp is a signal lamp that is controlled by the PLC via an output.

4.Functional analysis

This is followed by the functional analysis, in which the operation of the individual components and stations as well as their control requirements are examined in detail. The aim is to define the necessary functions in order to implement the previously developed process efficiently and precisely.

Transfer

The automatic filling process is started via switch S1. An empty container is fed from the drop magazine onto the conveyor belt via an impulse at the release exit Y2, which is driven by the M motor. If the container is under the silo, the sensor S2 provides a logical on signal and the belt stops.

When the container is full, the belt starts again and a new empty container is placed on the belt. After switching off the system, the belt should continue to run for 3 seconds to remove remaining containers.

Filling

When opening valve Y1, the container should be filled for 3 seconds. Sensor S3 provides an on signal when the silo is no longer sufficiently filled. In this case, the tape should stop and the warning light P should light up. The drop button on the right of the silo can be used to fill it up.

Selmo

Connection:

Ein-/Ausgangsbelegung

Die Ein- und Ausgänge des Modells sind wie folgt belegt (die Bezeichnung Ein- bzw. Ausgang bezieht sich dabei jeweils auf die angeschlossene Steuerung):

Eingang Nr.	Boris	PLC-Variablenname		Beschreibung
1	S1	I_S1	:BOOL;	Ein/Aus Schalter
2	S2	I_S2	:BOOL;	Sensor Behälter unter Silo (Schließer)
3	S3	I_S3	:BOOL;	Sensor Silo leer (Schließer)

Ausgang Nr.	Boris	PLC-Variablenname		Beschreibung
1	Y1	O_Y1	:BOOL;	Siloventil Dossierung
2	Y2	O_Y2	:BOOL;	Freigabe Klappe Behälter
3	M	O_M	:BOOL;	Motor Förderband
4	P	O_P	:BOOL;	Warnlampe Silo leer

5.Process Modeling in Selmo Studio

Relevant tutorials for the model are presented in the next chapter. To get an in-depth insight into the Selmo Studio, you can take the course "Sequence Logic Modelling - The New Way of PLC Programming - Start Now!". These tutorials will support you in practical application and deepen your understanding of working with the Selmo Studio.

To be able to carry out the course, all you have to do is click on the following link and book the course for free.

Link: Sequence Logic Modelling - The new way of PLC programming - Start now!

For a better overview and detailed analysis, the process model should be viewed directly in Selmo Studio, where the logic layer and the system layer are fully visible and comprehensible.

Before you move on to the practical implementation, you should also look at the instructions in the help center. This documentation will provide you with important basics and helpful tips for working in the Selmo Studio.

After reviewing the documentation, you can test the downloaded process model in real time. You can start the simulation of the plant and check the interaction between the process model and the digital twin. Use the created document as an aid to implement what you have learned independently in Selmo Studio.

Good luck with the practical application!