Selmo

Analysis Process Drilling Device

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.

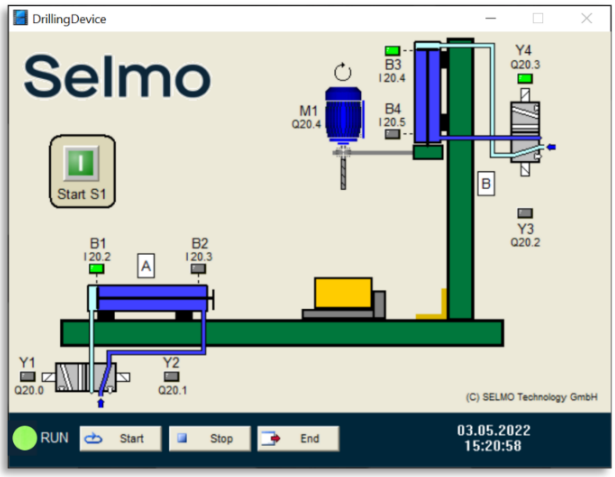
For more information on the Selmo analysis process, visit our Knowledge Base.

Selmo

Table of contents

Selmo

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 drilling rig is called a "plant," which includes the entire rig.
>
> **Hardware zone:** The drilling rig is modeled as a hardware zone only, as the entire rig only includes one protection area. Therefore, there is no need to implement multiple independent automatic flows.
>
> **Sequence:** The sequence of the drilling device is modeled in a separate 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:

> There is an unmachined workpiece in the drilling device. The clamping cylinder and the feed cylinder are in the retracted state. (B1 and B3 actuated) The drill is switched off. (M1 not controlled)

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, the workpiece is clamped via the clamping cylinder (cylinder A) and monitored via the end position B2 during the production process.

Once the drilling process has been started, the clamping cylinder must not come loose again. Then the drill is switched on by means of the motor (M1). To activate the drill, a start-up time of 2 seconds is defined. The drilling process begins with activating the feed rate of the A2 feed cylinder. After reaching the final position B4, the drilling process is started, which is carried out time-controlled via a parameter. The predefined drilling time is 5 seconds. After completion of the hole, the feed cylinder is moved back to the home position and after reaching the end position B3, the drill is switched off. The clamping cylinder loosens the component and after reaching the end position B1, the workpiece can be removed and the process can be started again.

Since there is no component detection in the clamping fixture in this application, it is not possible to ensure that there is really a workpiece in the drilling fixture. The drill's motor has no speed detection or feedback that the drill has been activated. Thus, a timer must be defined for the start-up time.

3.Technology analysis

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 switching the voltage forward.

Pneumatic Cylinder:

To control the pneumatic cylinders, 3/2-way solenoid valves are used, which have three connections and two switching states. These are double-acting cylinders, each with two valves for control for the home and work positions. The end position buttons are operated by retracting and extending the pneumatic cylinders in the respective position. They are configured as normally open contacts and generate logic "1" when the cylinder is in the end position.

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.

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.

The Drilling Device model is a simple drilling device that enables the automatic clamping and drilling of workpieces.

Clamping and drilling

The workpiece is clamped by means of cylinder A. The cylinder is controlled by valve Y1 and is monitored by the end position B2. It must be ensured that the cylinder remains extended and is actively monitored throughout with B2. After clamping the workpiece, the M1 motor of the drill is switched on. As in the clamping process, the drill is also guided into the workpiece by means of cylinder B, by controlling the valve Y3 and monitoring the end position B4 and the workpiece is drilled. Both cylinders must be monitored during the entire drilling process. After completion of the drilling process, cylinder B first retracts by controlling the valve Y4 and monitoring the end position B3 and then, after switching off the M1 engine, cylinder A, by controlling the valve Y2 and monitoring the end position B1.

Connection:

- The limit switches (B1 – B4) are wired as normally open contacts and deliver a 0 signal when not actuated.
- The start button (S1) is also wired as a normally open contact.

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;	Start Taster (Schließer)
2	B1	I_B1	:BOOL;	Endschalter Zylinder 1 eingefahren (Schließer)
3	B2	I_B2	:BOOL;	Endschalter Zylinder 1 ausgefahren (Schließer)
4	B3	I_B3	:BOOL;	Endschalter Zylinder 2 eingefahren (Schließer)
5	B4	I_B4	:BOOL;	Endschalter Zylinder 2 ausgefahren (Schließer)

Ausgang Nr.	Boris	PLC-Variablenname		Beschreibung
1	Y1	O_Y1	:BOOL;	Zylinder 1 ausfahren
2	Y2	O_Y2	:BOOL;	Zylinder 1 einfahren
3	Y3	O_Y3	:BOOL;	Zylinder 2 ausfahren
4	Y4	O_Y4	:BOOL;	Zylinder 2 einfahren
5	M1	O_M1	:BOOL;	Bohrer EIN

Selmo

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!