Virtual Commissioning

Demonstrator using TS2 components

Introduction

The goal of the work package is to evaluate the data basis, define a development environment, and implement a proof-of-concept for a standardized virtual commissioning with operational PLC function blocks for Transfer System TS2 with selected material flow scenarios.

After the implementation of the PoC, the concept is generalized to all standardizable material flow scenarios and expanded to the entire TS2 library in Visual Components.

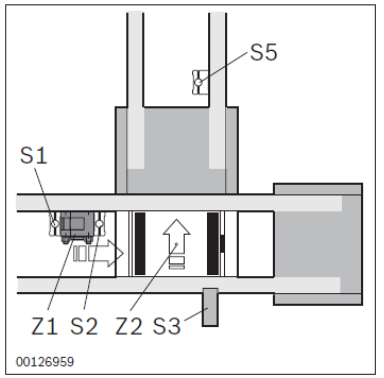
Introduction

TS2 Fundamental Function Plans

The use case scenarios chosen for this are the fundamental function plans for control tasks defined for the TS2 Lift Transfer Unit as per the product catalogue, such as:

1. TFE1 : Implementation in transverse section

- The material flow in this function plan consists 1 entrance from longitudinal section to the 1 transverse exit to the left or right port of the LTU.
- The sensors S1,S2 and S5 determines the opening and closing of the stopper Y1.
- Sensor S3 determines the lifting up and down of the lifting cylinder Y2.



S2	=	WT after VE1 (Z1)
S3	=	WT in position on HQ (Z2) (rocker WI/M)
T3	=	Delaying time 100 ... 200 ms
S5	=	Enable main section 1
Y1	=	Main section VE (Z1)
Y2	=	Lifting cylinder HQ (Z2)

See also explanation on page 10-7

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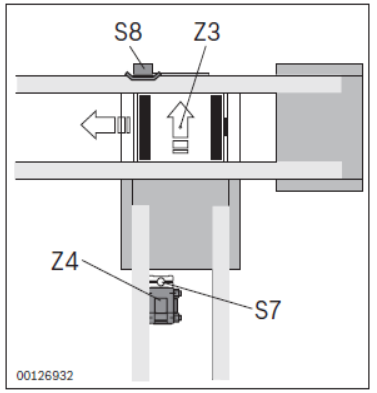
TS2 Fundamental Function Plans

2. TFE2 : Implementation in longitudinal section

- The material flow in this function plan consists 1 entrance from transverse section to the 1 longitudinal exit to the front or back port of the LTU.
- The sensors S7 determines the opening and closing of the stopper Y4.
- Sensor S8 determines the lifting up and down of the lifting cylinder Y4.



S7 = WT after VE4 (Z4)
S8 = WT in position on HQ (rocker WI/M)
T8 = Delaying time 100 ... 200 ms
Y3 = EQ lifting cylinder (Z3)
Y4 = Secondary section VE (Z4)
See also explanation on page 10-7

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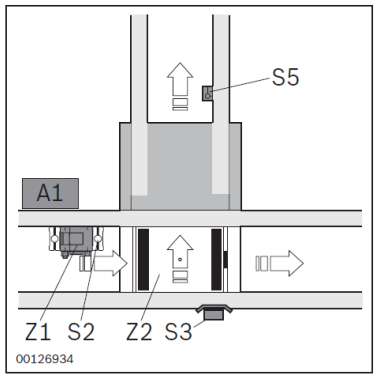
TS2 Fundamental Function Plans

3. TFE3 : Transverse conveyor (separating, outfeeding)

- The material flow in this function plan consists 1 entrance from longitudinal section to the 2 exits to either transverse (Left/Right ports) or longitudinal (Front/Back) port of the LTU.
- The sensors S2,S5 determines the opening and closing of the stopper Y1.
- Sensor S3 determines the lifting up and down of the lifting cylinder Y2.
- Routing to branch or straight is based on identification system with straight signal A1 (0= Branch, 1 = Straight On)



S2	=	WT after VE1 (Z1)
S3	=	WT in position on HQ
T3	=	Delaying time 100 ... 200 ms
S5	=	Enable secondary section
Y1	=	Main section VE (Z1)
Y2	=	Lifting cylinder HQ (Z2)
P10	=	Priority main section
A1	=	Identification system with straight-ahead signal (0 = branch 1 = straight on)

Y2.1 S, Y2.2 R = Lift is UP
Y2.2 S, Y2.1 R = Lift is DOWN
Y2.1 AND Y2.2 Reset = Lift is in MIDDLE position

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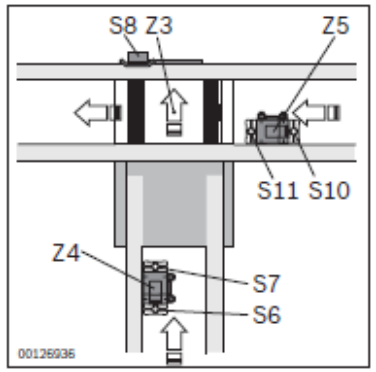
TS2 Fundamental Function Plans

4. TFE4 : Transverse conveyor (separating, infeeding)

- The material flow in this function plan consists 2 entrance from longitudinal and transverse section to the 1 exit to longitudinal section (Front/Back) port of the LTU.
- The sensors S6,S7 & S10,S11 determines the opening and closing of the stoppers Y4 and Y5, respectively.
- Sensor S8 determines the lifting up and down of the lifting cylinder Y3.
- Routing from branch or main section is based on Priority main section variable P10 (0= From branch, 1 = From main section)



T8	=	Delaying time 100 ... 200 ms
S6	=	WT before VE4 (Z4)
S7	=	WT after VE4 (enable secondary section)
S8	=	WT in position on HQ (rocker WI/M)
S10	=	WT before VE5 (Z5)
S11	=	WT after VE5 (Z5)
Y3	=	Lifting cylinder HQ (Z3)
Y4	=	Secondary section VE (Z4)
Y5	=	Main section VE (Z5)
Y6	=	VE in EQ (Z6)
P10	=	Priority main section

See also explanation on page 10-7

Y3.1 S, Y3.2 R = Lift is UP
Y3.2 S, Y3.1 R = Lift is DOWN
Y3.1 AND Y3.2 Reset = Lift is in MIDDLE position

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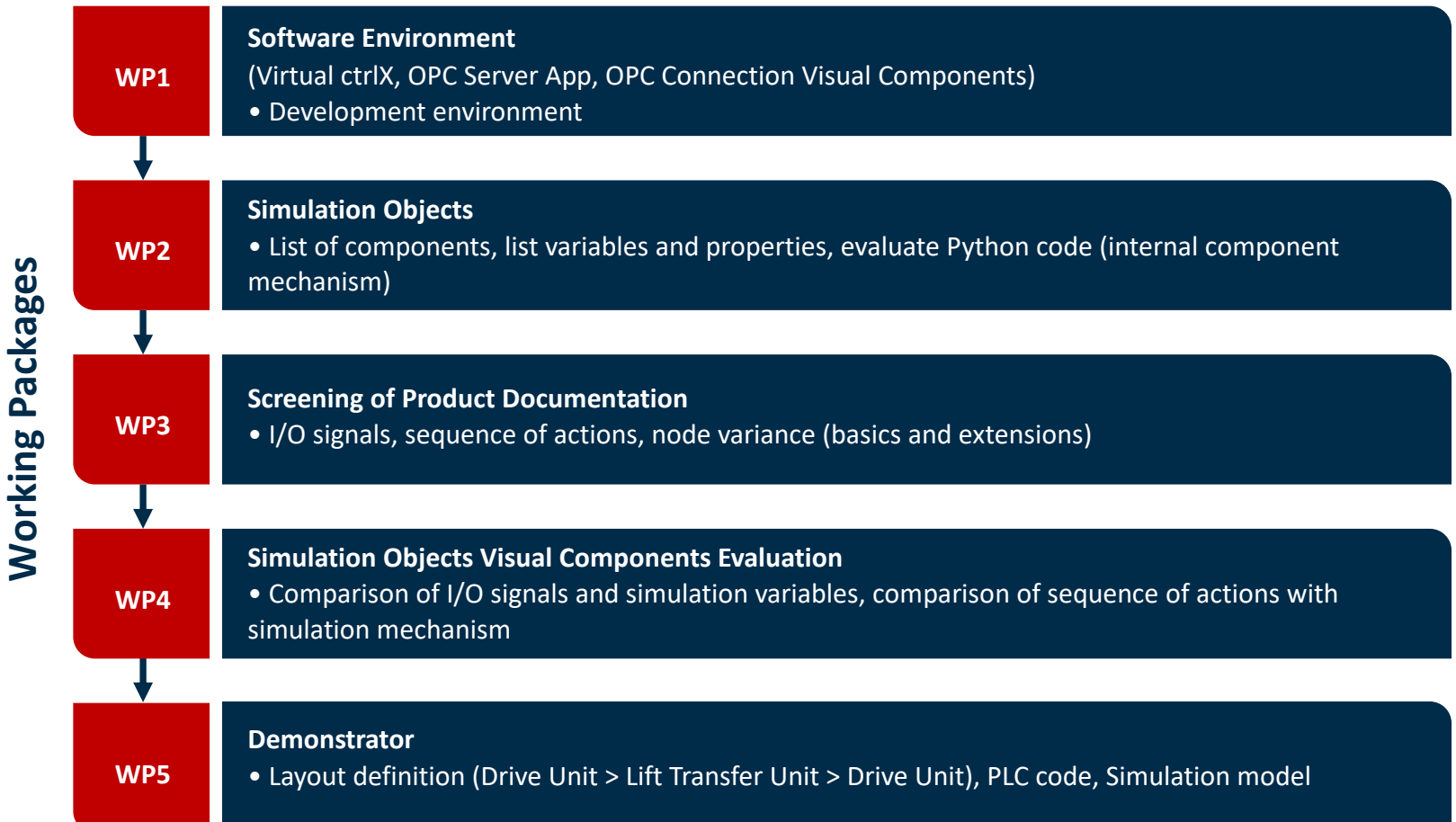
Development Plan for TS2 Library

Overview



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Development Plan for TS2 Library

WP1: Software Environment

- Setting up of virtual environment in ctrlX WORKS, using PLC engineering for process control, OPC UA as the communication protocol and Visual Components for material flow simulation.
- Key steps involve: *Creating virtual environment in ctrlX WORKS* > *Installation of ctrlX Automation apps* > *Configuration of PLC* > *Writing PLC code* > *OPC UA server configuration* > *Variable mapping in Visual Components*.
- Reference: Implementation Simulation Demo ctrlX

Development Plan for TS2 Library

WP1: Software Environment

- For each fundamental function plan corresponding layout is modelled in Visual components using TS2 library components.

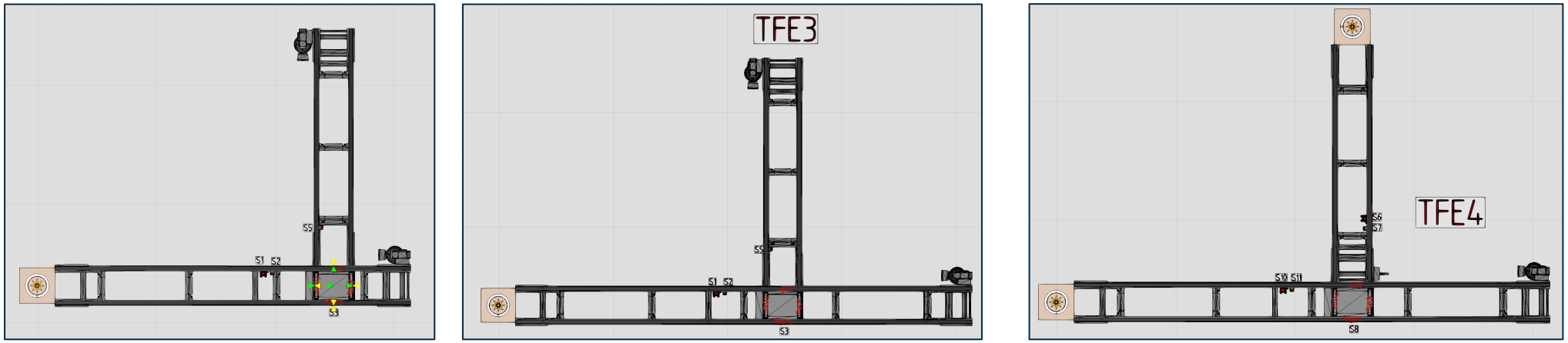

Fig. VC simulation models for function plans TFE1, TFE3 & TFE4 respectively

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WP2: Simulation Objects

- Involves creation of a list of TS2 components specifically used for the creation of the demonstrator models.
- Creation of list of variables and properties concerning the virtual commissioning of the component.
- Evaluation of the python script for each component to evaluate the internal control mechanism of these selected components.

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WP3: Screening of Product Documentation

- Involves definition of I/O signals of the components.
- Evaluation of sequence/flow of actions.
- Evaluation of node variances (basics and extensions)

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WP4: Simulation Objects Visual Components Evaluation

- Comparison of I/O signals of TS2 components and simulation objects.
- Comparison of sequence of actions with internal control mechanisms of simulation objects.

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WP5: Demonstrator

- Definition of layout: drive unit -> lift transfer unit (direction: left) -> drive unit
- Creation of simulation model (Visual Components)
- Implementation of PLC code (ctrlX, function blocks)
- Execution of test run

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