Intelligent Belt for S7-1500 – simulation with SIMATIC Machine Simulator & NX MCD

SIMATIC S7-1500 / PLCSIM Advanced V2.0 SP1 / SIMIT V10 Upd1 / NX MCD V12.0.2

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1 Introduction

1.1 Overview

The Intelligent Belt application (multi belt control) can be used to pick up sequentially arriving products and to provide them grouped at an unloading position. The most important feature is that loading and unloading are independently performed.

The Intelligent Belt application is intended for use in production machines, mainly in the packaging industry. More information about Intelligent Belt application can be found in Intelligent Belt manual /3/.

This application example allows you to simulate Intelligent Belt application using PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD).

Limitations

This application example contains no descriptions of the following topics:

- Fundamentals of TIA Portal and STEP 7 (for details see SIMATIC STEP 7 Basic/Professional V15.1 and SIMATIC WinCC V15.1 /5/)
- Fundamentals of the SIMIT coupling types (for details, see SIMATIC SIMIT Simulation Platform /6/)
- Fundamentals of the NX CAD and MCD (for details, see NX12 documentation /7/ and SIMATIC Machine Simulator – Getting Started /8/)

In order to understand this application example, it is assumed that readers have adequate knowledge of these topics.
1.2 Components used

This application example has been created with the following software components:

Table 1-1 Software components

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Article number</th>
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<td>STEP 7 Professional V15.1</td>
<td>1</td>
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<td>NX MCD 12.0.2</td>
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<td>SIMIT S V10 Upd1</td>
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<td>6DL8913-0AK00-0AB5</td>
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</table>

This application example consists of the following components:

Table 1-2 Components

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<tr>
<th>Component</th>
<th>File name</th>
<th>Note</th>
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<tr>
<td>Documentation</td>
<td>LIBelt_SIMATIC_SimulationWithMCD_V1.0_en.pdf</td>
<td></td>
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<tr>
<td>STEP 7 project</td>
<td>LIBelt_Example_V1.1_4.zip</td>
<td>In a subfolder</td>
</tr>
<tr>
<td>SIMIT project</td>
<td>LIBelt_MCD_SIMIT_V1.0_0.zip</td>
<td>In a subfolder; with collision table Customer.xls</td>
</tr>
<tr>
<td>MCD project</td>
<td>LIBelt_MCD_SIMIT_V1.0_0.zip</td>
<td>In a subfolder; with collision table Customer.xls</td>
</tr>
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</table>
2 Engineering

2.1 Software setup

2.1.1 TIA Portal

Please set the variable mcdSimulation in IBelt_Control DB to activate support of SIMIT and NX MCD in the LI-Belt example project. No further configuration is required.

The application specific parameters are stored in IBelt_Parameter DB and are set in FB IBelt_CallExample in first call.

Figure 2-1 Parameterization of the Intelligent Belt application

The Intelligent Belt application is called in FB IBelt_CallExample, which is called from IBelt_Call_Time_delay_interrupt (OB23). The IBelt_Call_Time_delay_interrupt (OB23) is called in MC-PostServo (OB95) with the instruction SRT_DINT.

Figure 2-2 Call of the Intelligent Belt application in the example project
2.1.2 SIMIT

Please configure the MCD coupling to external file first. The MCD coupling always refers to the absolute path of the NX MCD model. If the model has been moved to another path, the MCD coupling must be updated manually.

In this case please select the part file "Main_IBelt_Demo_Complete.prt" as "Link to external file" from the unzipped download. Make sure that the checkbox "Bus synchronous" is set for time slice 2.

Figure 2-3 MCD coupling in SIMIT

2.1.3 NX MCD

For this example to function correctly, the collision table found in the unzipped download folder (Customer_Defaults_Collision_Category.xls) must be copied to the NX installation directory (\NX 12.0\MECHATRONICS). Other NX MCD projects may be affected.

2.1.4 Starting the simulation

Open the SIMIT project and start the simulation by clicking on “Start/Play” button. An orange background indicates that the simulation is active. The PLCSIM Advanced instance\(^1\) (in the background) and NX MCD\(^2\) are start automatically.

\(^1\) If you want to see the instance of your virtual PLC please additionally start PLCSIM Advanced
\(^2\) The simulation in NX MCD is already activated
If required, download the STEP 7 project into the virtual PLC. Switch the PLCSIM Advanced instance to RUN.

2.2 Operation

As soon as the simulation is running (orange background in SIMIT) and the STEP 7 project is loaded and the virtual PLC is running, the application example can be operated via the so-called Control Panel in SIMIT.

Figure 2-5 Control Panel chart in SIMIT
• The “Enable Belts” button enables all belts.
• The “Auto Prepare” button starts the auto prepare process with the “Complete” mode—all belts are homing and then move to their initial positions. The preconditions are that all belts are enabled, automatic mode is active, no errors are present and no processing is already active.
• The “Auto Start” button starts the auto processing. The preconditions are that all belts are enabled, all belts are homed, automatic mode is active, no errors are present and no auto prepare process is active.
• The “Stop Belts” button stops all belts.
• The “Reset” button acknowledges the PLC errors. If an error could not be acknowledged, the “PLC Error” LED signals the error again.
• The “PLC Error” LED indicates an Intelligent Belt application error.
• The “Forward” and “Backward” buttons are only active in manual mode. They perform the jogging of all belts (synchronized) in positive or negative direction. The preconditions are that all belts are enabled, manual mode is active and no errors are present.
• The “Manual/Automatic” switch can be used to switch between manual and automatic mode.
• The “Emergency Stop” switch performs the stop of the Intelligent Belt application with fast stop dynamics.
The supply and outfeed conveyors are controlled by SIMIT. They are moving with constant velocity when auto processing is active and no errors are present. The products are created by a timer when auto processing is active and no errors are present.

For test purposes, the velocities of the conveyors and the time of product generation can be changed. These signals can be found in the SensorSignals chart in SIMIT (SIMIT project -> Charts -> Connections -> SensorSignals).

Figure 2-8 Velocities of the conveyors in SIMIT chart

Figure 2-9 Generation of products in SIMIT chart via timer
### 2.3 Error handling

Error and status messages of the Intelligent Belt application can be viewed in “Call of IBelt Manager” network at output `status` of the called block `LIBelt_Manager`.

Figure 2-10 Output `status` of block `LIBelt_Manager`

- Network 4: Call of IBelt manager
  - For emergency stop handling: if fast stop mode is activated then "eStop" signal is also reset after a…

If you have the error “Encoder adaptation error” for one or both belt technology objects, please restart the PLCSIM Advanced instance (Power off/Power on of the instance). To do this, make sure that PLCSIM Advanced is running with the virtual PLC instance.
2 Engineering

Figure 2-11 Power off/ Power on of the virtual PLC instance

If you have error 16#8401 (LIBELT_ERR_BELTS_NOT_HOMED), execute the auto prepare process again.

If you have error 16#8403 (LIBELT_ERR_HOMING_PROCESS) during auto prepare process then please check if Customer_Defaults_Collision_Category.xls in the Customer Defaults settings can be used in NX MCD (see NX MCD).

Further error codes of Intelligent Belt application can be found in the Intelligent Belt documentation /3/.

If the error “The configuration file for the MCD coupling is damaged” is reported by SIMIT, please configure the MCD coupling (see SIMIT).

In certain cases it is necessary to delete the “Virtual SIMATIC Memory Card”. It can be performed in SIMIT.

Figure 2-12 Deleting the “Virtual SIMATIC Memory Card” in SIMIT
3 Appendix

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3 Appendix

3.2 Application support

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mailto: tech.team.motioncontrol@siemens.com

3.3 Links and literature

Table 3-1 Links and literature

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<td>5</td>
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3.4 Change documentation

Table 3-2 Change documentation

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