Application about Drive Technology

"Flying Shears Based on Gearing"
Demonstration
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Foreword

The application described in this document deals with “flying shears”. It shows how an axis can be synchronized to another axis with the aid of the technology CPU so that processing on the fly (cutting, drilling, printing, welding, ...) is enabled.

The core element is the “Flying Shears” technology template which implements the technological functions such as gearing and positioning of an axis.

If you want to obtain further information on the technology template, a separate documentation is available. The reference data for this documentation is listed in the appendix of this document.

Objective of the application

This application shows the use of one of the technological functions or of a technology template in the technology CPU.

In order to provide a compact and practical description, a function frequently used in machines is used in a simple example with HMI connection. This ensures that the application can also be used as a demonstration model.

The application illustrates the following:
- How the used components work together
- Which technological functions are used
- How the application is programmed and parameterized
- How the application can be used as a demonstration system

Main contents of this application

The following main points are described in this application:
- Use of the “Gearing” technology function
- Use of the “Flying Shears” technology template

Delimitation

This application does not include a description of...
- …basic knowledge when using STEP 7
- …basic knowledge in the field of motion control
- …the use of technology functions of the technology CPU
- …the general handling of the technology CPU

Basic knowledge of these topics is required.

Document structure

The documentation of this application is divided into three documents:
- Introduction
- Extension
- Demonstration

In addition, the STEP7 code is available.

The third document, Demonstration, which you are reading right now, is intended for persons who want to install, test and present the application.
## Part Description

<table>
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<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction Application Description and Principles of Operation</td>
<td>This part provides a general overview of the contents. You are informed on the used components (standard hardware and software components and the specially created user software).</td>
</tr>
<tr>
<td>Extension Principles of Operation in Detail and Program Structures</td>
<td>This part describes the detailed functional sequences of the involved hardware and software components, the solution structures and – where useful – the specific implementation of this application. It is required to read this part if you want to familiarize with the interaction of the solution components to use these components, e.g., as a basis for your own developments.</td>
</tr>
<tr>
<td>Demonstration Structure, Configuration and Operation of the Application</td>
<td>This part takes you step by step through structure, important configuration steps, startup and operation of the application.</td>
</tr>
</tbody>
</table>

An additional component available is the S7 program code.

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S7 program code</td>
<td>The S7 program code includes the code and a user interface which is also suitable as a demonstration system.</td>
</tr>
</tbody>
</table>

## Reference to Automation and Drives Service & Support

This entry is from the internet application portal of Automation and Drives Service & Support. The link below takes you directly to the download page of this document.

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</table>
1 Use of the Application Example

1.1 Application example with and without real drives

This application example can be used to demonstrate and to learn the functional correlations in the technology CPU as follows:

- Application example with HMI and virtual axes
- Application example with HMI and real axes

By default, the application example is designed for operation as a demonstration and sample application with virtual axes.

With regard to the application example, the SINAMICS S120 training case is intended for the connection of real axes to the technology CPU.

However, other drive systems can also be used which can be connected to the technology CPU via the equidistant PROFIBUS of DP(Drive). For the respective procedure, please refer to the documentation of the corresponding drive system.

1.2 Structure of this documentation

Since there are different ways to use the application example with and without real drives, the documentation is divided as follows:

- Hardware and Software Installation
- Operation of the Application with virtual Axes
- Connection of real Axes to the Application

Hardware and Software Installation

You are provided with all information required for the installation of the hardware and software components, enabling you to operate the application example with virtual axes.

The information on the installation of the required hardware for operating the application example with real axes is provided in the corresponding section of this documentation.

Operation of the Application with virtual Axes

In this section, you learn how to operate the application example using the HMI included in the delivery.

The description refers to the delivery status of the application example with virtual axes.
Connection of real Axes to the Application

You learn how you can replace the virtual axes of the application example by real axes and which hardware and software components are required. In addition, you are provided with notes on the parameterizations necessary to equip the application example with real axes.

This documentation describes in particular the connection of the SINAMICS S120 training case to the technology CPU to enable the use of the axes of the training case together with the application example.

To connect other drive systems to the application example, the procedures listed in this document can be used as a basis and transferred to the desired drive system.
Configuration and Operation

2 Hardware and Software Installation

2.1 Hardware configuration and installation

Operating the application example as a demonstration and sample application with virtual axes requires a PG/PC and a technology CPU.

Figure 2-1 Overview (without power supply)

Table 2-1 Hardware configuration and installation

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mount the PS307 2A power supply and the CPU on the DIN rail.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Connect the corresponding output terminals of the PS307 power supply to the CPU terminals and connect the mains voltage.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Insert an empty Micro Memory Card (MMC) into the technology CPU. Micro Memory Cards which are not empty have to be cleared in the PG/PC before they can be used in the CPU.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Use a PROFIBUS cable to connect the MPI/DP interface of your PG/PC to the left MPI/DP interface (contact X1) of the technology CPU and set the terminating resistors in the two terminating plugs of the cable to “On”. Do not use the standard MPI cable delivered with the PG/PC for the connection between PG/PC and CPU! Since the connection should be operated at a baud rate of 12Mbps, a PROFIBUS cable with activated terminating resistors should be used between PG/PC and CPU. Otherwise, communication problems may occur between PG/PC and CPU.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Switch on all devices.</td>
<td></td>
</tr>
</tbody>
</table>
2.2 SIEMENS standard software installation

Note

If you intend to use the application only for demonstration and presentation purposes, the installation of WinCC flexible 2005 SP1 HF7 Runtime with 512 PowerTags is sufficient. It is not required to install the engineering system.

2.2.1 Required versions

The application example is designed and developed for use with the software components listed in the following table:

<table>
<thead>
<tr>
<th>Component</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 7</td>
<td>5.3 + SP3</td>
</tr>
<tr>
<td>S7 Technology</td>
<td>3.0 SP2</td>
</tr>
<tr>
<td>WinCC flexible Advanced (incl. Runtime)</td>
<td>2005 SP1 HF7</td>
</tr>
</tbody>
</table>

2.2.2 Performing the installation

Install the SIEMENS standard software in the described order and with the listed options:
- Step7 including service pack
- S7 Technology including service pack
- WinCC flexible Advanced (with the option: Integration in Step7) or WinCC flexible Runtime with 512 PowerTags

Follow the instructions of the corresponding installation program.

2.3 Downloading the user program to the CPU 31xT-2 DP

2.3.1 Preparing the STEP 7 project

Prepare the STEP 7 project as follows:
- Open the SIMATIC Manager.
- Retrieve the STEP 7 archive and then open the retrieved STEP 7 project in the SIMATIC Manager.
2.3.2 Setting the interface on PG/PC and CPU 31xT-2 DP

Since also the large system data blocks of the Runtime software for the technology have to be transferred to the CPU when downloading the STEP 7 program to the technology CPU, the interfaces should be set to a baud rate of 12Mbps.

**Warning**

Before changing the interface speed, you should check which maximum baud rate is supported by your CP or adapter.

If a maximum baud rate of 12Mbps cannot be set and if you load the application to the CPU without prior changes, you can no longer access the CPU after downloading!

In this case, set the baud rate of the MPI/DP bus to the maximum possible transmission rate before downloading.

### Setting the PG/PC interface in the Simatic Manager

**Table 2-3 Setting the PG/PC interface**

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>In the SIMATIC Manager, click “Options / Set PG/PC Interface...” to open the interface configuration.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>In the “Interface Parameter Assignment Used” section, select the “.....(Auto)” interface setting (e.g., “CP5512(Auto)”).</td>
<td>The “...(Auto)” setting should always be selected for the PG/PC interface. With this selection the interface baud rate is automatically determined and set so that the module can be accessed without changing the PG/PC interface configuration also after the configuration of the technology CPU interface.</td>
</tr>
<tr>
<td>3.</td>
<td>Click “Properties” and in the “Automatic Bus Profile Detection” tab, set the address 0.</td>
<td></td>
</tr>
</tbody>
</table>

### Setting the technology CPU interface

The interface of the technology CPU has to be set via the HW Config hardware configuration in the STEP 7 project.

**Table 2-4 Setting the technology CPU interface**

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>In the SIMATIC Manager, double-click “Hardware” to open HW Config.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Double-click “MPI/DP” to open the MPI/DP interface settings of the CPU.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>In the “Interface” section, click the “Properties” button.</td>
<td></td>
</tr>
</tbody>
</table>
4. Select the corresponding subnet and click the “Properties” button.  
   Select subnet MPI(1).

5. Select “Network Settings” to display the setting for the transmission rate.  
   Set the maximum possible baud rate of your CP or adapter.

6. Close all screen forms by clicking OK.

7. Save and compile the hardware configuration and download it to the CPU.

### 2.3.3 Downloading the S7 program to the technology CPU

To download the STEP 7 program of the sample application to the technology CPU, proceed as follows:

**Table 2-5 Downloading the application to the technology CPU**

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>In the SIMATIC Manager, select the SIMATIC 300(1) station.</td>
<td>If prompted with regard to already existing settings and blocks, acknowledge by clicking “Yes”.</td>
</tr>
<tr>
<td>2.</td>
<td>Click the “Download” button to download the entire STEP 7 project to the technology CPU.</td>
<td></td>
</tr>
</tbody>
</table>

---

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21063352_Technology_Shears_Demonstration_DOKU_v32_e.doc
3 Operation of the Application with virtual Axes

The application can be used for presenting the technology CPU and the used technology as well as for familiarizing with and testing the functions of the CPU. The following chapters provide a getting started for demonstrating and presenting the application and an extensive description of all operator displays and operating options.

3.1 Requirements

The following requirements have to be met for operating the application example with virtual axes:

- The STEP7 project is online in the technology CPU.
- At least WinCC flexible 2005 SP1 HF7 Runtime is installed on the PC/PG.
- The PG/PC is connected to the technology CPU and the correct baud rate for the communication is set.
- The technology CPU is in RUN mode.

**Note**

WinCC flexible 2005 SP1 HF7 Runtime requires an authorization.

An authorization for at least 512 PowerTags is necessary for the application example.

Without authorization, a message box indicating the missing authorization is displayed which can be acknowledged.

3.2 Getting started on demonstrating and presenting

This chapter provides a getting started which enables you to start the application example as quickly as possible and to demonstrate and present the essential functions of the application.

3.2.1 Starting the HMI

On the PG/PC, the HMI is started by starting WinCC flexible 2005 SP1 HF7 Runtime via the Windows “Start” button and by downloading the corresponding configuration file.

Proceed as follows:
Table 3-1  Starting the HMI

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
</table>
| 1.  | Start WinCC flexible 2005 SP1 HF7 Runtime and download the configuration file:  
     "C:\...\Fl_Shears\HmiEs\PROJECT_1\PROJECT_1.Fl_Shears.fwx" |                                                                                                             |
| 2.  | If the connection to the CPU could be established, the START button is displayed.  
     Click this button.                                                                                         | If the START button is not displayed, check the following settings:  
     • Baud rate of the MPI/DP connection  
     • Bus connection PG/PC to the technology CPU  
     • CPU mode                                                                                                   |

3.2.2 Operating the HMI

To perform a brief demonstration of the application example, proceed as follows:

Table 3-2

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
<th></th>
</tr>
</thead>
</table>
| 1.  | On the bottom right, please click STOP and then click the manu button on the left.  
     The application is now set to a defined status and the screen shown on the right is displayed. |        |                                                                 |
| 2.  | Click acknowledge to confirm.                                                                                               |        |                                                                 |
3. Home axis 1 to the starting position of the shears by opening the synchronisation operator display, selecting mode 3: direct, set position and entering the 250.000 position. The selected position is set as actual position of the axis by using the start button. After successful homing, done is displayed and the operator display can be closed by clicking synchronisation.

4. The auto button is now available. Click this button to change to automatic mode. Changing to automatic mode is only possible, if:
   - no error is present
   - the axes are enabled
   - no manual function is activated for both axes

5. In automatic mode, the process display is displayed. Click start and end in the material section to switch the motion of the material line on and off. Use the slider in the material velocity section to directly change the velocity of the material line.

6. Click the start and end buttons in the slider section to activate and deactivate the function of the flying shears. The slider in the material velocity section enables to change the velocity of the material line during the entire process.

7. Click technology to show the technology displays. With the aid of these displays, the used functional mechanisms and technologies can be explained. Click technology again to go to the second technology display. Click operation to return to the process display.
3. In the **view status axis / template** section, the status of the axes or of the technology template can be viewed.

4. Click **operation** to return to the process display.

### 3.2.3 Process display

In automatic mode of the application example, the process display is the main display for the operation of the flying shears.

Figure 3-1 Process display (automatic mode)
In the process display, the motion of material line and flying shears can be started, stopped and monitored. In addition, the velocity of the material line can be changed.

**Note**

**Synchronization**

The parameters of the synchronization are set in such a way that the synchronization process can be monitored as clearly as possible.

For use in real applications we recommend settings with higher dynamics, e.g. higher synchronization velocity and shorter synchronization path.

### 3.3 Detailed operating instructions

The following instructions include a detailed and extensive description of the application as required for familiarizing with and testing the CPU functions.

#### 3.3.1 Overview of the structure

The figure below shows the basic operating structure, including all operator displays of the application.

![Diagram of the basic operating structure](image-url)
3.3.2 Start screen of the HMI

To adjust the display of the screen form to the current mode of the application in the controller when starting the HMI, the start screen was inserted. Click the Start button to check whether the application is currently in manual or in automatic mode and subsequently the correct screen form for the currently active mode is displayed on the HMI.

Figure 3-3 Start screen
3.3.3 Operating the HMI

The basic functions of the application are operated using the buttons in the bottom right corner of the screen forms (marked red in the screen shot below) which can be found on almost all screen forms.

Figure 3-4 General displays

The current status is displayed via the button of the respective function; this is explained below using the example of the *auto* button:

Table 3-3 Display

<table>
<thead>
<tr>
<th>Button</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>auto</td>
<td>Function available</td>
</tr>
<tr>
<td>auto</td>
<td>Function activated</td>
</tr>
<tr>
<td>nd</td>
<td>Function currently not available</td>
</tr>
</tbody>
</table>

The individual buttons are used to call the following functions:
### Configuration and Operation

**Operation of the Application with virtual Axes**

**Flying Shears – Demonstration**

**Table 3-4 General buttons**

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="STOP" /></td>
<td>Use the <strong>STOP</strong> button to reset the enable simultaneously for all axes. All axis motions are immediately stopped and the motion can only be continued after selecting the <strong>acknowledge</strong> button.</td>
</tr>
<tr>
<td><img src="image" alt="acknowledge" /></td>
<td>Use the <strong>acknowledge</strong> button to confirm pending error messages. (This button is only available in manual mode)</td>
</tr>
<tr>
<td><img src="image" alt="manu" /></td>
<td>Use the <strong>manu</strong> button to call setup mode (manual mode).</td>
</tr>
<tr>
<td><img src="image" alt="auto" /></td>
<td>Use the <strong>auto</strong> button to call automatic mode.</td>
</tr>
<tr>
<td><img src="image" alt="operation" /></td>
<td>Use the <strong>operation</strong> button to call the process display in automatic mode.</td>
</tr>
<tr>
<td><img src="image" alt="technology" /></td>
<td>Use the <strong>technology</strong> button to call the technology display in automatic mode. With repeated clicks on this button you can change between the two available technology screen forms.</td>
</tr>
</tbody>
</table>

#### 3.3.4 Operator functions in manual mode

In manual mode, the material axis and the flying shears axis can be moved manually. Three different operator functions are available in this mode.

- **Synchronisation**
  Homing the axis or setting a specified position.

- **Jog**
  Manual moving of the axis in jog mode at a preset velocity.

- **Positioning**
  Positioning the axis to a defined position at a preset velocity.

**Note**

Only one of the three manual operator functions can be activated for each axis at a time. The button is then displayed in green (e.g. Jog).

Before another operator function can be activated, it is required to terminate the currently activated operator function. This is done by again clicking the button of the active operator function (e.g. Jog).
The handling of the different operator functions will now be explained in detail:

Enabling axis and monitoring axis status

In manual mode, you can acknowledge errors on the axes or directly change to the status display of the respective axis.

Table 3-5 Enabling axis

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Click the <strong>axis reset</strong> button to acknowledge an error on this axis after its correction.</td>
<td><img src="image" alt="axis reset" /></td>
</tr>
<tr>
<td>2.</td>
<td>Click the <strong>enabled/disabled</strong> button to enable or disable the axis. The desired status is displayed as text, the current status is indicated by the color. Green indicates that the axis is enabled, red shows that it is disabled.</td>
<td><img src="image" alt="enabled/disabled" /></td>
</tr>
</tbody>
</table>
3. A click in the sensitive section shown in the figure enables you to directly change to the status display of the axis.

---

### Synchronizing or homing axis

**Table 3-6  Synchronizing or homing axis**

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Click the <strong>synchronisation</strong> button to activate the synchronization.</td>
<td>Only one of the three operator functions can be activated for each axis at a time.</td>
</tr>
<tr>
<td>2.</td>
<td>In the <strong>select mode</strong> drop-down list, select the synchronization type. In the <strong>position to set</strong> input box, enter the desired home position. The meaning of the individual modes is explained in detail in the user manual of the technology CPU. To directly apply the entered value, we recommend mode 3. <strong>Note:</strong> Please do not forget to press ENTER to confirm the input of the position value.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Click the <strong>start</strong> button to start the synchronization / homing of the axis.</td>
<td>When the synchronization of the axis has been successfully completed, the <strong>done</strong> message is displayed.</td>
</tr>
<tr>
<td>4.</td>
<td>Click the <strong>synchronisation</strong> button to deactivate the synchronization.</td>
<td></td>
</tr>
</tbody>
</table>

---

### Manual moving with a preset velocity (JOG)

**Table 3-7  Manual moving with a preset velocity (JOG)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Click the <strong>jog</strong> button to activate the mode for manual axis motion.</td>
<td>Only one of the three operator functions can be activated for each axis at a time.</td>
</tr>
</tbody>
</table>
2. Use the slider to set the desired velocity. The selected velocity is shown on the top right in the display.

3. Use the **jog**- or **jog+** button to move the axis in the corresponding direction. The axis is moved as long as the button remains clicked.

4. Click the **jog** button to deactivate the mode for manual axis motion.

**Note**
As soon as the shears axis *axis 1* has been operated in automatic mode, the software limit switches of this axis are activated. The manual travel range of the axis is then limited by the software limit switches.

When a software limit switch is reached, the axis can be reset by clicking the **axis reset** button.

---

**Absolute positioning**

Table 3-8 Absolute positioning

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Click the <strong>positioning</strong> button to activate the positioning.</td>
<td>Only one of the three operator functions can be activated for each axis at a time.</td>
</tr>
<tr>
<td>2</td>
<td>Enter the desired position and the velocity at which the position is to be approached in the corresponding input boxes. If negative values are entered for velocity, the default velocity defined in the STEP7 project is used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Please do not forget to press ENTER to confirm your entries.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Click the <strong>start</strong> button to start the positioning of the axis. The axis automatically moves at the set velocity until the defined target position is reached.</td>
<td>Use the <strong>cancel</strong> button to cancel the positioning. The axis is then stopped immediately.</td>
</tr>
<tr>
<td>4</td>
<td>Click the <strong>positioning</strong> button to deactivate the positioning.</td>
<td></td>
</tr>
</tbody>
</table>
**Note**

As soon as the shears axis axis 1 has been operated in automatic mode, the software limit switches of this axis are activated. The manual travel range of the axis is then limited by the software limit switches.

When a software limit switch is reached, the axis can be reset by clicking the axis reset button.

**Access to technology parameters**

With the technology parameter button you can open the display for technology parameter access.

Figure 3-6 Technology parameters

<table>
<thead>
<tr>
<th>parameter</th>
<th>Bocl</th>
<th>Int / Dint</th>
<th>Real</th>
</tr>
</thead>
<tbody>
<tr>
<td>tech DB 1</td>
<td>write</td>
<td>false</td>
<td>0</td>
</tr>
<tr>
<td>tech DB 2</td>
<td>read</td>
<td>done</td>
<td>false</td>
</tr>
</tbody>
</table>

Enter the parameter number and the number of the desired technology data block, thus of the corresponding technology object, to check and change the technological settings of the controller.

**Example:** Check of the setpoint position of axis 2 via parameter 1 of technology data block DB 2

Table 3-9 Changing technology parameters

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
</table>
| 1.  | Enter the number of the desired parameter in the input box.  
*Note:* Please do not forget to press ENTER to confirm your entries! | parameter 1 |
| 2.  | Enter the number of the desired technology data block in the input box. | tech DB 2 |
| 3.  | Click the read button to read the settings of the selected parameter in the indicated technology block.  
The value of the parameter is output in the display sections according to the data format. | If reading the parameter has been successfully completed, the done message is displayed, otherwise, an error message is output. |
| 4.  | If you want to write a parameter, enter the value of the parameter to be written in the box of the corresponding data format.  
Click the write button to transmit the write job. | If writing the parameter has been successfully completed, the done message is displayed, otherwise, an error message is output. |

**Note** Parameter changes are only stored in the RAM and lost when the supply voltage is switched off.
A list of the available technology parameters is available in the appendix of the technology CPU manual.

**Status display of the axes**

The status display includes some information from the technology data block of the axis, e.g. the current velocity and position as well as the status and error word of the axis.

An exact specification of warning and error messages on the axis is possible via the ErrorID of the axis. In this display, warning messages are displayed in yellow and error messages are indicated in red.

An individual status display via which the corresponding axis can be monitored is available for each axis of the application example.

Figure 3-7  Axis status

Use the **operation** button to return to the basic display of the currently active mode.

**Technology template status**

The status display for the technology template displays some information from the instance data block of the technology template such as status of the input and output parameters of the function block and the current status of the technology template.

In addition, the global settings of the technology template from the instance data block are directly displayed, e.g. starting position of the shears, software limit switches, synchronization position and synchronization length.

Click the **restart template** button to restart the state machine of the technology template and thus the technology template.
3.3.5 Operator functions in automatic mode

In automatic mode, the flying shears can be operated in process mode, i.e. automatically. In addition, different screen forms are available for monitoring process mode.

- **Process display**
  Monitoring process mode of the flying shears.

- **Expert settings**
  Option of changing different parameters for process mode.

- **Technology displays**
  Monitoring the technological correlations of the technology objects during process mode.
  The technology displays will be explained in detail in the next chapter.

**Note**
Automatic mode is available only if there is no failure and if no manual operator functions are active on the axes.
Process display

Figure 3-9 Process display

Table 3-10 Operation in the process display

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Click the <strong>start</strong> button in the <strong>slider</strong> section to start the flying shears.</td>
<td><img src="image" alt="Slider" /></td>
</tr>
<tr>
<td>2.</td>
<td>Click the <strong>start</strong> button in the <strong>material</strong> section to start the material line.</td>
<td><img src="image" alt="Material" /></td>
</tr>
<tr>
<td>3.</td>
<td>Use the <strong>material velocity</strong> slider to set the velocity of the material line.</td>
<td><img src="image" alt="Material Velocity" /></td>
</tr>
</tbody>
</table>
4. Monitor the cutting process in the displayed side view.

**Note:**
It is also possible to change to other operator displays to monitor selected processes in greater detail while the cutting process is active.

5. Click the **end** button in the **slider** section to stop the flying shears.

**Note:**
An active cutting process is interrupted immediately. The shears are opened and returned to the starting position.

6. Click the **end** button in the **material** section to stop the material line.

**Expert settings**

Via the expert settings, the cutting length, i.e. the distance of the cutting positions **cut length** and the length of the synchronization range **sync length** can be changed.

**Note**

In expert mode, the set software limit switches **SW Limit Switch**, the starting position of the shears **Start Position**, the synchronization position **Sync Position** and the specified synchronization range **Sync Length** are displayed below the material line.
Figure 3-10  Process display with expert setting

Table 3-11  Operating the expert settings

1. Click the on button in the expert mode section to start expert mode.

   ![Expert Mode On/Off]

2. Set the desired piece length in the cut length section.

   ![Cut Length Slider]

   **Note:**
   The slider’s range of values depends on the set material velocity of the material line and on the selected length of the synchronization range sync length of the shears!
3. In the **sync length** section, set the desired length of the synchronization range of the shears.

4. Click the **off** button in the **export mode** section to exit expert mode.
3.3.6 Monitoring the technological correlations

In the picture section, click the technology button to change to the technology view of the application.

With repeated clicks on the technology button you can change between the individual technology displays.

**Technology display 1: Trace display**

Figure 3-11 Technology display 1

Technology display 1 shows the time characteristic of the actual positions of material line and shears slide and of the “synchronized axis” binary signal. The display clearly shows the synchronization motion of the shears axis before the synchronous operation of material line and shears.

For repositioning to the next cut mark the zero position of the material line is set to the position of the next cut mark.
Technology display 2: Program execution display

Figure 3-12 Technology display 2

Technology display 2 shows the current status of the STEP7 program. The overview of functions of the program is dynamically adapted to the current operation phase of the flying shears or of the technology template. Active program parts are highlighted, program parts which are not active are hidden. The table below lists the possible operation phases and their individual functions.

<table>
<thead>
<tr>
<th>Status</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>synchronizing</td>
<td>The shears slide is synchronized to the velocity of the material line so that the shears are moved exactly above the cutting position.</td>
</tr>
<tr>
<td>cutting</td>
<td>The cutting process is performed at the cutting position while the shears move synchronously to the material line. The actual cut is simulated via the lapse of the cutting time.</td>
</tr>
<tr>
<td>repositioning / next cut</td>
<td>At the end of the cutting process, the shears slide is returned to starting position. For the next cut the zero position of the material line is set to the next cutting position.</td>
</tr>
</tbody>
</table>
Figure 3-13  Displayed operation phases

1. Synchronizing
2. Cutting
3. Repositioning / next cut
4 Connection of real Axes to the Application

To enable an operation of the application example with real axes, a drive whose axes are to perform the desired motions can be connected to the technology CPU. This requires additional parameterizations in the application example which will be explained in the following.

4.1 Connecting the SINAMICS S120 training case

For the presentation and operation of the application example with real axes, the connection of the SINAMICS S120 training case to the technology CPU will be described in the following sections.

The SINAMICS S120 training case has to be connected and commissioned by you. For the operation of the application example with the drive, a STEP 7 archive is not available for download.

4.1.1 Requirements – SINAMICS S120 on technology CPU

To be able to operate the application example with the drives of the SINAMICS S120 training case, it is required to include the SINAMICS S120 in the configuration of the application example.

For the connection of the SINAMICS S120 training case to the technology CPU, an FAQ document can be downloaded from the internet with which installation and startup of the SINAMICS S120 can be performed on the technology CPU.

Use the following link to download the FAQ document from the internet:

The basic procedure for connecting the SINAMICS S120 training case to the technology CPU is explained in the table below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Extract the STEP 7 archive of the application example with virtual axes.</td>
<td></td>
</tr>
</tbody>
</table>
2. Open the STEP 7 project for the application example in the SIMATIC Manager.

3. Now follow the instructions of the FAQ document for the connection of the SINAMICS S120 to the technology CPU and use the STEP 7 project of the application example as a source project.

   Note: If you want to back up data on the drive before connecting the SINAMICS S120, follow the instructions of the FAQ before integrating the SINAMICS S120 drive system into the application example.

   Sequence of the activities to be performed:
   - Creating SINAMICS S120 in HW Config with corresponding firmware and connecting to PROFIBUS DP(Drive).
   - Activating the routing in NetPro for the connection establishment to the SINAMICS S120.
   - Restoring the factory settings on the SINAMICS S120 as an initial situation.
   - Automatic commissioning of the Drive-CLiQ components.
   - Manual commissioning of the non Drive-CLiQ components.

4. Back up the performed configuration in the STEP 7 project and in the SINAMICS S120.

   Uploading the drive data to the PG and backing up the data in the actual drive by copying from RAM to ROM.

The SINAMICS S120 training case is now prepared for operation with the technology CPU.
4.1.2 Connecting the “Axis” technology objects to the drives

In the second step, the “Axis” technology objects of the application example have to be connected to the real drives of the SINAMICS S120 training case instead of virtual drives.

Data to be set when configuring the technology objects

When configuring the technology objects, the following data has to be entered in the screen forms in S7T Config.

The second part of this chapter describes how to access these screen forms.

Table 4-2 Data to be set when configuring the technology objects

<table>
<thead>
<tr>
<th>Parameter to be set</th>
<th>Shears axis technology object</th>
<th>Material line technology object</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Axis_1</td>
<td>Axis_2</td>
</tr>
<tr>
<td>Technology</td>
<td>Synchronized axis</td>
<td>Positioning axis</td>
</tr>
<tr>
<td><strong>Drive assignment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drive unit</td>
<td>SINAMICS_S120</td>
<td>SINAMICS_S120</td>
</tr>
<tr>
<td>Drive</td>
<td>SERVO_02</td>
<td>SERVO_03</td>
</tr>
<tr>
<td>Message frame</td>
<td>105</td>
<td>105</td>
</tr>
<tr>
<td>DSC</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>6000</td>
<td>6000</td>
</tr>
<tr>
<td><strong>Encoder assignment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection position encoder</td>
<td>Directly to SERVO_02</td>
<td>Directly to SERVO_03</td>
</tr>
<tr>
<td>Message frame</td>
<td>105</td>
<td>105</td>
</tr>
<tr>
<td>Encoder type</td>
<td>Absolute value encoder</td>
<td>Incremental encoder</td>
</tr>
<tr>
<td>Encoder mode</td>
<td>Endat</td>
<td>Sine</td>
</tr>
<tr>
<td>Measuring system</td>
<td>Encoder system rotary</td>
<td>Encoder system rotary</td>
</tr>
<tr>
<td><strong>Encoder data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encoder pulses per revolution</td>
<td>512</td>
<td>2048</td>
</tr>
<tr>
<td>Number of data bits</td>
<td>21</td>
<td>---</td>
</tr>
<tr>
<td>Multiplication factor Gn_XIST2</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>Multiplication factor Gn_XIST1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Encoder monitoring active</td>
<td>Yes</td>
<td>---</td>
</tr>
</tbody>
</table>

Connecting the technology objects

The connection of a technology object to a drive of the SINAMICS S120 training case is now shown in place of an axis:
### Table 4-3 Additional inputs for connecting the axis to a drive

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>In S7T Config, open the configuration of the corresponding axis and run the Wizzard until the Drive assignment screen form is displayed.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>If a drive unit is not yet offered for selection in the screen form, click the Align Sinamics devices… button to perform an alignment with the configured drives.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Select the desired drive for the alignment from the displayed list.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>You can now select the drive unit you want to connect to the Axis technology object from the drop-down list.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Select the corresponding drive of the device, define the message frame for the PROFIBUS communication and set the maximum speed of the connected motor. For optimum dynamics also activate Dynamic Servo Control (DSC).</td>
<td></td>
</tr>
</tbody>
</table>
6. Set Encoder type, Encoder mode and Measuring system type at the selected drive.

7. Set the Encoder pulses per revolution and the Multiplication factor of the cyclic actual value of the encoder.

8. Click the Finish button to complete the configuration of the material axis.

Note

If Dynamic Servo Control (DSC) is activated on the drive, at least PROFIBUS message frame 105 has to be set for the communication between technology CPU and drive.
4.1.3 Special parameter settings for the application example

For the application example, the following additional parameter changes have to be made on the SINAMICS S120 to ensure the operating capability of the application example together with the drive.

Table 4-4 Special parameter settings on the SINAMICS S120

<table>
<thead>
<tr>
<th>Parameter to be set</th>
<th>SERVO_02 drive</th>
<th>SERVO_03 drive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drives / … / open-loop control/closed-loop control / speed controllers</strong></td>
<td>21 speed control (with encoder)</td>
<td>21 speed control (with encoder)</td>
</tr>
<tr>
<td>Control mode</td>
<td>p1300[0]</td>
<td>0.150</td>
</tr>
<tr>
<td>P gain</td>
<td>p1460[0]</td>
<td>10.00</td>
</tr>
</tbody>
</table>
Appendix and Bibliographic References

5 Bibliographic References

5.1 Bibliographic references

This list is by no means complete and only provides a selection of appropriate sources.

Table 5-1

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
</tr>
</thead>
</table>
| /1/           | STEP7 Automating with STEP7 in STL and SCL  
                Hans Berger  
                Publicis MCD Verlag - 2004  
                ISBN 3-89578-242-4 |
| /2/           | Technology CPU SIMATIC – S7-300 CPU Data: CPU 315T-2DP  
                Siemens Manual  
                MLFB: A5E00427932-03 |
| /3/           | Technology CPU SIMATIC – S7-300 CPU Data: CPU 317T-2DP  
                Siemens Manual  
                MLFB: A5E00251769-05 |
| /4/           | Technology CPU SIMATIC – S7 Technology  
                Siemens Manual  
                MLFB: A5E00251797-05 |
| /5/           | Technology CPU CPU 317T-2DP: Controlling a SINAMICS S120  
                Getting Started  
                MLFB: A5E00480390-02 |
| /6/           | Technology CPU CPU 317T-2DP: Controlling a virtual axis  
                Getting Started  
                MLFB: A5E00266283-04 |
| /7/           | Technology CPU CPU 317T-2DP: Controlling a physical axis  
                Getting Started  
                MLFB: A5E00251785-04 |
| /8/           | SINAMICS S120 SINAMICS S120 – Installation and Start-Up Manual (IH1)  
                Manufacturer / Service Documentation  
                Edition 04/2006  
                MLFB: 6SL3 097-2AF00-0AP5 |
### Bibliographic References

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
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</table>

### 5.2 Internet links

This list is by no means complete and only provides a selection of appropriate sources.

Table 5-2

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>/2\</td>
<td>Siemens A&amp;D Customer Support</td>
</tr>
</tbody>
</table>
## Bibliographic References

### Flying Shears – Demonstration

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>\5\</td>
<td>Technology CPU manual</td>
</tr>
<tr>
<td></td>
<td>Select “Product Support”</td>
</tr>
<tr>
<td></td>
<td>Open the following directories in the Product Information tree:</td>
</tr>
<tr>
<td></td>
<td>• Automation systems</td>
</tr>
<tr>
<td></td>
<td>• SIMATIC Industrial Automation Systems</td>
</tr>
<tr>
<td></td>
<td>• PLC</td>
</tr>
<tr>
<td></td>
<td>• SIMATIC S7</td>
</tr>
<tr>
<td></td>
<td>• 300/300F</td>
</tr>
<tr>
<td></td>
<td>• CPUs</td>
</tr>
<tr>
<td></td>
<td>Click the Manual tab to open a list with related documents or click the following links:</td>
</tr>
<tr>
<td>\6\</td>
<td>SINAMICS S120 instruction manual</td>
</tr>
<tr>
<td></td>
<td>Select “Product Support”</td>
</tr>
<tr>
<td></td>
<td>Open the following directories in the Product Information tree:</td>
</tr>
<tr>
<td></td>
<td>• Drive technology</td>
</tr>
<tr>
<td></td>
<td>• AC Converter</td>
</tr>
<tr>
<td></td>
<td>• Low voltage converters</td>
</tr>
<tr>
<td></td>
<td>• Built-in and cabinet system SINAMICS S120</td>
</tr>
<tr>
<td></td>
<td>Click the Manual tab in the right window to open a list with related documents or select the following link:</td>
</tr>
<tr>
<td>\8\</td>
<td>FAQ technology CPU version overview</td>
</tr>
</tbody>
</table>
5.3 Related documentation

This list includes a summary of related documentations which you can obtain from Siemens Customer Support or your Siemens contact person.

Table 5-3

<table>
<thead>
<tr>
<th>Topic</th>
<th>Title</th>
</tr>
</thead>
</table>

6 History

Table 6-1 History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>V3.2</td>
<td>06/05/07</td>
<td>Adaptation of the documentation to the S7 Technology V3.0 SP2 technology package. Adding of the Microbox 420-T. Adding of Runtime.</td>
</tr>
<tr>
<td>V3.21</td>
<td>08/2010</td>
<td>Removed Microbox 420-T</td>
</tr>
</tbody>
</table>