Welcome

Guideline
SIMOTION D4x5-2 Training Case with SIMOTION V4.4
SIMOTION

Guideline
SIMOTION D4x5-2 Training Case
with SIMOTION V4.4

Release 07/2014
The procedure described here is meant to be used with the SIMOTION D4x5-2 training case. However, it can be easily adapted to other configurations.

There is a SIMOTION example project according to this documentation. It can be found on the Utilities & Application (U&A, part of SIMOTION Scout) at:

Examples → Guideline SIMOTION D4x5-2 Training Case

The Industry Online Support is available at: http://support.automation.siemens.com. If an “Entry-ID“ is mentioned in the following it can be found under this address.

You will find this guideline and the corresponding example project, probably already in a revised version, under the Entry-ID 27774657.

Note: This slide set had been set up partly on the basis of SIMOTION V4.3 but also applies to newer versions. Hence figures may differ in detail.

For questions regarding this guideline please contact us at the following e-mail address: mailto:tech.team.motioncontrol@siemens.com
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SIMOTION firmware

- You will find the SIMOTION firmware for SIMOTION D4x5-2 devices on the SIMOTION Scout installation medium under VOL2\Addon\3_D4x5_2\Firmware.

- You will find the SIMOTION D4x5-2 firmware also in the Industry Online Support under the Entry-ID 31045047.

- Plug the CompactFlash card into a suitable card slot of your PG/PC.

- Extract the firmware and replace the current content of the CompactFlash card.

- **Note**: The firmware has to be replaced only if required.

- **Note**: For other possibilities to replace the firmware please refer to the Commissioning and Hardware Installation Manual SIMOTION D4x5-2.
Introduction

Preparation

- Plug the prepared CompactFlash card into the SIMOTION D4x5-2.
- Switch on the power supply.
- Start SIMOTION Scout V4.4.
Create a new project

**Note:** The example shown here is generated on the basis of SIMOTION D435-2 DP/PN. If your hardware equipment differs you have to choose a different device characteristic.
The SIMOTION D device family combines the functionality of SIMOTION and SINAMICS.

SIMOTION D435-2 can be inserted as a new device in Scout after creating a new project.

- Select device characteristic D435-2 DP/PN
- Select SIMOTION version V4.4
Here, the Scout access to the D435 is selected by the example Ethernet. The connection cable is plugged into the Ethernet interface of the D435 (X127, PNxIE).

The SIMOTION D435 appears on the project list and HW Config dialog will be open.

Depending on your PC/PG another interface might be necessary.


Detailed instructions for this can be found as FAQ in the Utilities & Applications under FAQs → Engineering → Establishing Online Connections or online at the Siemens Service & Support sites searching for the Entry-ID 22016709.
Download HW Config to module.

1. Download to module
2. Select target module
3. Check IP address
4. Stop controller (only in RUN mode)

Close HW Config after successful configuration download to module.

Please wait until SIMOTION D435 reboot has finished and the green ready LED is on.
Establish connection to SIMOTION D435 and SINAMICS_Integrated

- Select target devices

- Connect to selected target devices
Restore factory settings of the SINAMICS_Integrated

- Restore factory settings

Right click
Because the hardware is already wired in the training case, the automatic configuration can be used.

If the SINAMICS_Integrated is not in factory setting, this can also be done in this step.

An alternative procedure to the automatic configuration of drive objects is to use the configuration wizard as described at slide 23.
Select “Servo” as drive object type for both drives.

Select the drive object type.

Click “Identification via LED” to identify the power unit of the drive object by means of LED flashing.

Click “Create” to complete automatic commissioning.

The message window is a reminder to parameterize the drive offline with the drive wizard (SERVO_03 does not have an electronic type label).

If an automatic FW update of a DRIVE-CLiQ component (e.g. the motor module) are carried out after upgrading to SIMOTION V4.4, this process may take several minutes.
Set training case specific DC link voltage

Because the training case is powered by 230V, the setting of the DC link voltages have to be adapted for SERVO_02 and SERVO_03.

- Open the expert list for SERVO_02 and SERVO_03.
- Set for both drives p1244[0] = 715V
- Set for both drives p1248[0] = 279V

For fast parameter access enter the parameter number in the first column.

Set p1244[0] = 715V
Set p1248[0] = 279V
Interconnection of digital I/O – Infeed operation

When using a Smart Line Module (SLM) without DRIVE-CLiQ connection the infeed operation is signaled via IOs.

1. Connect digital input DI 0
2. Only SERVO_02 has to be connected
3. DI 0 is assigned to the parameter p864 “BI: Infeed operation”
Check wiring

Infeed operation state via the control panel. Switch 0 (DI 0) means that infeed is in operation.
Save and compile

1. Select SINAMICS_Integrated
2. Load CPU / drive unit to PG
3. Save and compile
Operate SERVO_02 via drive control panel

1. Assume control priority for SERVO_02:
   - SINAMICS_Integrated
   - Drives
   - SERVO_02
   - Commissioning
   - Control panel

2. Double click on "Assume control priority!"
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Operate SERVO_02 via drive control panel

- Assume control priority

This function may only be used under observance of the relevant safety notes. Failure to observe these safety notes may result in personal injury or material damage.

- Enables (1.)
- Set speed setpoint (2.)
- Turn the Drive ON (3.)

To turn on the Infeed, DI 0 have to be set on the control panel (see slide 18).

SERVO_02 is in Operation
Operate SERVO_02 via drive control panel

- Turn the Drive OFF

- Return control priority

- Acknowledge the alert with “Yes”

- Go offline

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Complete configuration for SERVO_03

The drive SERVO_03 was created by the automatic configuration, but not configured because the motor and encoder don't have an electronic type label. Follow the configuration wizard for SERVO_03 under “Configure DDS…”.
Setup Control structure and Power unit for SERVO_03.
Complete configuration for SERVO_03 – Power unit

- Setup DI 4 for enable Infeed operation SERVO_03.
Check correct connection for double motor module.
Complete configuration for SERVO_03 – Motor configuration

- Select motor type (1FK7022-xAK7x-xxxx) and motor holding brake.

1. Select standard motor list
2. Enter motor data
3. 3rd party motor integration

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Select encoder (Sin/Cos incremental encoder, 2048 S/R, Code 2001).
### Complete configuration for SERVO_03 – Process data / Summary

- **Process data / Summary**

<table>
<thead>
<tr>
<th>Configuration - SIMANICS_Integrated - Process data exchange (drive)</th>
<th>Configuration - SIMANICS_Integrated - Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Configuration - SIMANICS_Integrated - Process data exchange (drive)" /></td>
<td><img src="image2.png" alt="Configuration - SIMANICS_Integrated - Summary" /></td>
</tr>
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</tr>
</tbody>
</table>

The following data of the drive has been entered:

- **Control structure**: [21] Speed control (with encoder)
- **Power unit**
  - Component name: Motor_Module_1
  - Component type: Double motor module
  - Order no.: 6SL3203-2TE13-0Axx
  - Rated power: 1.6kW
  - Rated current: 3.4A/3A
- **Power unit BICO**
  - pN614 (5G) (input/operation): 6D **EU**_L_0023.722.4
- **Power unit connections**
- **Motor**
  - Motor name: Motor_1
  - Drive type: 1SE71 FK7 synchronous motor
  - Order no.: 1FK7025-1KW7
  - Rated speed: 6000 rpm
  - Rated torque: 9.9 Nm
  - Rated current: 1.4 A
- **Motor holding brake**: Not available
- **Encoder**
  - Encoder evaluation name: 1-SPD_1
  - Encoder type: Encoder 1
  - Order no.: 1FK7025-1KW7
  - Order no.: 1FK7025-1KW7
- **Process data exchange (drive)**
  - Automatic PROFIdrive message frame setting
  - Automatic message frame extension
  - Permit automatic address adaptation

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Load settings to target system

- Save project and connect to target system.
  ![Save project and connect](image)
- Select SINAMICS_Integrated and load project to target system.

![Select project](image)

The setup is completed when the connecting symbol is green. The SINAMICS_Integrated is ready to run.

Select if project should be saved to CF card.

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Load settings to target system

- Copy RAM to ROM (1.)
- Load CPU / drive unit to PG (2.)
- Save and compile (3.)
Some D435 training cases (MLFB: 6SL3120-2TE13-0AA0) will show an error (P1244):

<table>
<thead>
<tr>
<th>Level</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: Consistency check of the DO configuration...</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: Determination of the charts to be loaded...</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: Checking the global device data...</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: Consistency check of the DO configuration...</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: CU_1_003: TO SINAMICS_Integrated: CU_1_003 has been downloaded.</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: SERVO_02: TO SINAMICS_Integrated: SERV/0_02 has been downloaded.</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: SERVO_03: TO SINAMICS_Integrated: SERV/0_03 has been downloaded.</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: TB30_05: TO SINAMICS_Integrated: TB30_05 has been downloaded.</td>
</tr>
<tr>
<td>Information</td>
<td>SINAMICS_Integrated: Initialization of the internal data structures of the drive is running...</td>
</tr>
<tr>
<td>Error</td>
<td>SINAMICS_Integrated:SERVO_03: Parameter P1244 [0]: Unterhalb der gültigen Werte</td>
</tr>
<tr>
<td>Error</td>
<td>SINAMICS_Integrated: Download error</td>
</tr>
<tr>
<td>Information</td>
<td>The following devices are not consistent online: SINAMICS_Integrated.</td>
</tr>
<tr>
<td>Error</td>
<td>Download error (ret = 0xbe0b0011)</td>
</tr>
</tbody>
</table>

**In this case:**
- Open expert list for SERVO_03
- Set p1244[0] = 715 V and p1248[0] = 279 V
- Set p210 = 345 V
- Load CPU / drive unit to PG
- Save and compile

**Note:**
- Operation SERVO_03 via drive control panel is similar to operation SERVO_02. (see slide 20)
- In this case DI 4 instead of DI 0 have to be switch on. (see slide 25)
Double click on “Insert axis”

Two axes are to be inserted (“Red_Axis“ and “Blue_Axis”)

Note: Since SIMOTION V4.2 TOs can be insert in online mode too.
Configure **Red_Axis**

- Choose axis name “Red_Axis” (“Achse_Rot”) and select the necessary technologies
- Determine axis type: rotary, electrical
Configure **Red_Axis**

- Drive assignment: **Red_Axis** to SERVO_02

This message appears due to an error in the electronic type label of the motor. That means that an incorrect reference torque is parameterized. See slide 38 to correct this torque-value.
Configure **Red.Axis**

- Encoder assignment: **Red.Axis** to **SERVO_02 → Encoder_1**
- Summary of Axis configuration
Configure **Red_Axis**

- Modulo axis with 360° length: Go offline ➤ D435 ➤ Axes ➤ **Red_Axis** ➤ Mechanics ➤ Modulo axis (0,0° - 360°)
Error message: “Maximum torque value is too high.” (see slide 35)

The set torque limits may exceed 200% of the reference torque, so they need to be adjusted as described below:

**Configure Red_Axis**

Wrong parameter after automatic configuration:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r151[0]</td>
<td>Accelerating torque, Unsmoothed</td>
<td>0.00 Nm</td>
</tr>
<tr>
<td>p152[0]</td>
<td>CO: Torque limit upper/motoring</td>
<td>3.45 Nm</td>
</tr>
<tr>
<td>p152[1]</td>
<td>CO: Torque limit lower/regenerative</td>
<td>-3.45 Nm</td>
</tr>
</tbody>
</table>

Correct parameter:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>r151[0]</td>
<td>Accelerating torque, Unsmoothed</td>
<td>0.00 Nm</td>
</tr>
<tr>
<td>p152[0]</td>
<td>CO: Torque limit upper/motoring</td>
<td>2.70 Nm</td>
</tr>
<tr>
<td>p152[1]</td>
<td>CO: Torque limit lower/regenerative</td>
<td>-2.70 Nm</td>
</tr>
</tbody>
</table>
Configure the second axis: Blue_Axis

- The configuration of the second axis is similar to the first one “Red_Axis”.
  - click “Insert axis“ and give axis name: “Blue_Axis” (“Achse_Blau”) 
  - select technology: “Synchronous operation” 
  - Select axis type: rotary, electrical
Configure **Blue_Axis**

- Drive assignment: **Blue_Axis** to SERVO_03
- Encoder assignment: **Blue_Axis** to SERVO_03 → Encoder_1
Configure Blue_Axis

- Summary of Axis configuration
Configure **Blue_Axis**

- Modulo axis with 360° length: \(D435 \rightarrow \text{Axes} \rightarrow \text{Blue_Axis} \rightarrow \text{Mechanics} \rightarrow \text{Modulo axis (0,0° - 360°)} \rightarrow \text{Save project} \) → Go online
Add output cam to **Red_Axis**

- Insert output cam

---

**Standard settings**

- Name: Nocken_1
- Proc. cycle clock: IPO
- Output cam type: Position-based cam
- Type of output cam values: Setpoints
  - [ ] Activate output
Download SIMOTION D435 project to target device.
(The 1st download (incl. TPCAM) takes longer.)
By double clicking on (1.) the mask „Automatic controller setting“ opens (see following two slides). You can use the pull-down-menu to choose the controller you want to set.

Slide 46 → Speed controller
Slide 47 → Position controller (DSC)
Automatic controller settings - speed controller

2. Pull-down-menu

3. Assume control priority, Drive ON and perform all steps

4. All steps will be done automatically. Make sure that all safety precautions are observed.

5. New values will be calculated

6. To save settings scroll down and press “Accept values”

7. Switch Drive OFF and give up control priority after automatic controller setting has finished.
Switch Drive OFF and give up control priority after automatic controller setting has finished.

- Assume control priority, Drive ON and perform all steps
- All steps will be done automatically. Make sure that all safety precautions are observed.
- New values will be calculated
- To save settings scroll down and press “Accept values”
Save automatic controller settings

- Select D435 (1.)

- Copy RAM to ROM (2.)

- Select Load CPU / drive unit to PG (3.)

- Save and compile (5.)
Operate **Red_Axis** via SIMOTION axis control panel

1. Operate Red_Axis via SIMOTION axis control panel
2. Assume control priority
3. Yes
4. Accept
Start **Red_Axis** with SIMOTION axis control panel

1. Set enables
2. Acknowledge with OK
3. Show Diagnostics
4. Select speed-controlled traversing of the axis
5. Enter desired speed
6. Start motion

**Note:** To start **Red_Axis** DI 0 have to be switched on (see slide 18)

„**Red_Axis**“ is in operation
Stop Red_Axis with SIMOTION axis control panel

1. Stop motion
2. Remove enables
3. Acknowledge with OK → Error occurs (no PLC control) → Acknowledge Alarm
4. Give up control priority

Note: Now you can operate the Blue_Axis in the same way. Remember that the DI 4 has to be turned on.
For the next steps there are three possibilities:

1. **Programming yourself**
   Follow the instructions how to program SIMOTION
   (needs time for writing the programs)

2. **Use your own project but copy programs from demo project**
   Start another SCOUT instance (open SCOUT a second time)
   Open the demo project with the second SCOUT
   Copy the required programs from the demo project to your own project
   (change names, if you are using other names for axes, ....)

3. **Use demo project**
   Open the sample project and just follow the next steps with the demo project.
Create global variables

- Disconnect from target system
- Open global device variables and create the variables “enable_mcc” and “toggle”

Global variables:
- enable_mcc with data type: bool
- toggle with data type: bool
Insert geometry CAM

- Insert cam for MCC program

[Diagram showing steps to insert geometry CAM, enter settings, and close Cam_1 to save settings.]
Create a SIMOTION MCC program

- **Insert MCC unit**

  1. Insert a MCC unit (MCCQuelle_1)
  2. Compiler settings:
     - Permit program status and single step
  3. Insert MCC Chart (Motion)
Create a SIMOTION MCC program

- When opening an MCC-Chart the toolbar for the MCC instruction groups appears.

- The toolbar contains the following commands:
Create a SIMOTION MCC program

- Construct the shown flow chart (program “Motion”)
  - While variable “enable_mcc” = true start MCC
  - Wait 2 seconds
  - Switch Red_Axis enable
  - Start Red_Axis position-controlled, velocity 200°/s
  - Switch output cam on Red Axis (switch between 10° – 20°)
  - Wait 5 seconds
  - Switch Blue_Axis enable
  - "Cam on" with Blue_Axis and 180° synchronization length
  - Wait 10 seconds
  - "Cam off” with Blue_Axis and 180° desynchronization length
  - Disable Blue_Axis
  - Stop Red_Axis
  - Disable Red_Axis
  - Set variable toggle = NOT toggle

- Start Motion Task_2

Use standard settings, change only specified values. Save and compile.
Create a SIMOTION LAD/FBD program

- Create MCC Chart „loop“
  - Start Motion Task_1

- Insert LAD/FBD unit (1.) „KFQuelle_1“, insert LAD/FBD program (6.) „KOPFUP_1“

Create program:

1. Insert LAD/FBD unit
2. Name: KFQuelle_1
3. General settings
4. Selective linking
5. Enable (X)
6. Insert LAD/FBD program
7. Name: KOPFUP_1
8. Comment:
9. OK

Enter variable „tmp“
SIMOTION programs – Task assignment

- Open execution system
- Assign program “Motion” to Motion Task 1 and “Loop” to Motion Task 2
- In task configuration, check “Activation after Startup task” for Motion Task 1
- Assign program “kopfup_1” to BackgroundTask

- Close and save
Fault handling

- Insert ST program “Fehlerhandling” („Fault handling“).

- Compile and save.

Right click, select „Accept and compile“ or press ▼.
Fault handling - Task assignment

- Assignment of the ST programs to SystemInterruptTask → FaultTasks in execution system

![Diagram showing assignment of ST programs to FaultTasks]

- Double click
- Assignment ST program “TechFaultProg” to TechnologicalFaultTask
- Assignment ST program “PerFaultProg” to PeripheralFaultTask

![Confirmation dialog box]

- D435 - EXECUTION SYSTEM has been changed. Would you like to accept the changes to the project?
- Close
Download SIMOTION program to target system

- Save settings and compile
- Connect to target system
- Download SIMOTION D435 project to target device

Copy RAM to ROM
Start SIMOTION MCC program with variable

- Open “GLOBAL DEVICE VARIABLES” and control variable “enable_mcc” = true to start MCC Chart

Set “True” and “Control immediately”
Monitoring SIMOTION MCC chart

- Enable Monitoring on/off

Right click

Yellow status for monitoring

Blue status for single step
Monitoring SIMOTION LAD/FBD unit

- Enable Program status ON/OFF
Trace signals

- Open Trace
- Select D435, select signals

(1.) Open signal selection
(2.) Assign signal to channel
(3.) Isochronous endless trace
(4.) Download parameterization
Trace signals

- Start trace

- Time diagram for position of both axes and output cam state
Symbol browser

- Control system variables at symbol browser
  - e.g. select symbol browser and then the axis

All symbols can be monitored online
An alternative to the symbol browser is a watch table. In this you can observe variables from different objects/programs:
Watch table

- Right click on variable → Add to watch table → Watch_table_1
- Now you can observe all variables which you previously added to the Watch_table_1.
The axis status can be observed by right clicking on project name, selecting Target system.
Enter the IP address of the SIMOTION device in the web browser (e.g. http://169.254.11.22).

**NOTE:** It might be necessary to disable the “automatic configuration script” first.

**NOTE:** There must be an Ethernet connection to use IT DIAG.

**NOTE:** For more information about SIMOTION IT, see SIMOTION documentation or the Utilities & Applications.
Further information of SIMOTION programming can be obtained using the sample application “SIMOTION Example for Beginners”. The corresponding project and a detailed documentation can be found in the Utilities & Applications under: Examples → Example for Beginners.