SIMOCRANE Product Portfolio

- **Crane Technology**
  - Crane Management System
  - Advanced Technology
  - Basic Technology

- **Motion Controller**
  - SIMOTION D435-2
  - Advanced CUD

- **Drive Controller**
  - Drive-Based Technology
  - Drive-Based Sway Control
  - Drive-Based Sway Control

- **Drives**
  - DCM
  - Crane Cabinet Modules
  - Chassis

- **Motors**
  - DC-Motor
  - 1LP1
  - 1LQ1
  - 1LM1
  - 1PH8
  - 1PC1
  - 1LE1

**High Performance**
- (Remote) CMS
- Sway Control
- Skew Control
- 2D-Trajectory
- Truck Position System
- ECO Technology
- Basic Technology

**Mid Performance**
- CMS Lean
- Drive-Based Sway Control
- Drive-Based Technology

**Platform**
- Crane Technology
- Motion Controller
- Drive Controller
- Drives
- Motors

**SIMOCRANE**
- V1.0 SP2
- V1.0 SP2 HF1

**Book-size Chassis**
- CU320-2
- CU310-2

**1PH8**
- 1LP1
- 1LQ1
- 1LM1

**1PC1**
- 1PH8
- 1PC1
- 1LE1

**PM340/PM240-2 (FSA-FSG)**
- PM250

**PM Chassis**
- PM340/PM240-2 (FSA-FSG)

**Advanced Technology**
- Basic Technology

**Around 2420 pieces sold till 06/2018**
SIMOCRANE Drive-Based Technology V1.0 SP2 HF1 on base of SINAMICS FW V5.1 standard

Single-axis Solution
Package: 6GA7270-1AA20-0AA0

- Control Units
  - CU310-2
- AC/AC drives
  - PM340/PM Chassis
  - PM250
  - PM240-2 (FSA-FSG)

Multi-axis Solution
Package: 6GA7270-1AA20-0AA0

- Control Units
  - CU320-2
- DC/AC drives
  - Crane Cabinet Modules
  - Chassis
  - Book-size
SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 on base of SINAMICS FW V4.7 HF11 Cranes

Single-axis Solution
Package: 6GA7270-1AA11-0AA0

Control Units
- CU310-2

AC/AC drives
- PM340/PM Chassis
- PM250
- PM240-2 (FSA-FSC)
Product Introduction
Functional Scope DBT V1.0 SP2 HF1 (part 1)

- **Crane midrange solution is**
  - A drive-based solution in SINAMICS S120 environment
  - For both Single-axis (CU310-2) and Multi-axis (CU320-2) solution,
  - Standard SINAMICS Firmware V5.1
  - Crane specialized technologies in DCC-blocks

- **SINAMICS FW V5.1 can operate**
  - With PM340 and PM Chassis
  - With PM240-2 (Frame size A – Frame size G)
  - With Motor Module and cabinet modules
  - But not with PM250

- **Crane technology in DCC-Blocks**
  - Load-dependent field weakening
  - Pre-limit switch (selectable limiting)
  - Start pulse
  - Master switch
  - Over-speed monitoring (not a fail-safe function)
  - Current distribution monitoring (for double Axes)
Standard application for Single-axis via I/O-onboard or via Profibus
- Selectable via I/O-onboard or via Profibus
- Selectable with analogue or digital master-switch
- Selectable for Hoist/Trolley/Gantry
- Combination of Startpulse with brake control
- Configuration via scripting

Standard application for multi-axis via Profinet
- for Hoist, Trolley and Gantry
- Communication via Profinet
- application for Master-Slave torque control
- Configuration via scripting

The Crane DCC-chart is know-how protected, therefore, it can not be opened. The customized DCC application can be made in another DCC-chart under other Drive-Object (e.g. CU).

The grab function and synchronous operation are not parts of this product.
Scope of Delivery

Package for DBT V1.0 SP2 HF1
Order number: 6GA7270-1AA20-0AA0

- Memory card (CF card)
  - SINAMICS FW V5.1 (Standard)
- CD with
  - Cranes DCC blocks
  - Standard applications
  - Documentation
SIMOCRANE Drive-Based Technology
Training Possibilities

- Video Download

- Training Course in SiTrain-NL
  - Basics crane course
    - Crane Physics and Drive sizing
      - 5 days
    - Simocranes Commissioning
      - Drive Based Technology
        - Basic Motions and Sway Control
          - 3 days
    - SINAMICS Safety Integrated for Cranes
      - 2 days

- Training slides – Description and Tutorial
SIMOCRANE Drive-Based Technology Demo-kit

- For training of commissioning
  - with BOP 20
  - with Starter
  - with Sinamics web server

- For test of customized adaptation

- For customer presentation

- Components
  - PM340 * 1AC 230V
  - Asynchronmotor 1LA7060 -4.. with/without encoder
  - CU310-2 DP with BOP 20 → CU310-2 PN
  - Emergency Stop Pushbutton (Safety integrated function)
  - Switches hard-wired to CU310-2 DP → CU310-2 PN
Application examples
Use Case 1
Simple OHBC with hanging key button
SIMOCRANE Drive-Based Technology
Ready to Apply Solution on CU310-2 DP

- Standard application for Single-axis
  - Controlled via onboard-I/O
  - Digital Master-switch up to 4 speed-levels
  - Combination of Startpulse with brake control
  - With encoder

- Start commissioning after few steps in engineering and crane installation
- Simple commissioning via onboard Basic Operator Panel BOP20
- Optional commissioning via SINAMICS web server on PC or Tablet
Configuration Example for Use Case 1 (single-axis)  
OHBC with Onboard I/O- Signals
Use Case 2
OHBC crane with remote control

Waste incineration plant crane
Configuration Example of OHBC for Use Case 2 with PLC via Profibus (Single-axis)
SIMOCRANE Drive-Based Technology
Ready to Apply Solution for Multi-axis

Pre-configuring via script

Application note for multi-axis
Configuration Example for Use Case 2
OHBC with PLC via Profinet RT (Multi-axis)
Product Support for SIMOCRANE Drive-Based Technology

- Product News about Delivery release (including slides)
  It will be soon published

- Operation instruction
  https://support.industry.siemens.com/cs/de/en/view/109747425

- Flyer
  http://w3app.siemens.com/mcms/infocenter/content/en/Pages/order_form.aspx?nodeKey=key_9180778&infotype=brochures

- Catalogue CR 1
SIMOCRANE Product Support

- SIMOCRANE Product-Support (news, FAQs, Manuals, application note..) in Internet
  [https://support.industry.siemens.com/cs/ww/de/ps/20087](https://support.industry.siemens.com/cs/ww/de/ps/20087)

- SIMOCRANE Training

- Support request via Internet (Product → Simocrene)
  [http://support.automation.siemens.com](http://support.automation.siemens.com)

- Hotline EUROPA
  - Telefon: +49 (0) 911 895 7 222
  - Fax: +49 (0) 911 895 7 223
  - Email: support.automation@siemens.com

- Hotline AMERICA
  - Telefon: +1 423 262 5710
  - Fax: +1 423 262 2231
  - Email: support.america.automation@siemens.com

- Hotline ASIA / PACIFIC
  - Telefon: +86 10 6475 7575
  - Fax: +86 10 6474 7474
  - Email: support.asia.automation@siemens.com
Commissioning Guideline
SIMOCRANE Drive-Based Technology
Overview of Commissioning Guideline

Start

Step 1
Import Standard project

Step 2
Configure DO

Step 3
Run Script file

Step 4
Compile and download

Step 5
Commissioning Drive

Step 6
Parametrizing DBT
Step 1 - Import Standard project
Import project with the IMPORT function

1. Start the engineering tool STARTER
2. Actual project must be closed, then import the project
Step 2 - Configure DO
Configuration of the Drive Object (DO)
Step 2 - Configure DO
Select control method
Step 2 - Configure DO
Configuring of the power unit and drive properties
Step 2 - Configure DO
Configuring of motor
Step 2 - Configure DO
Configuring of holding brake and encoder
Step 2 - Configure DO
Select drive functions, communication frame type..
Step 2 - Configure DO

Summary

The following data of the drive has been entered:

Control structure:
- Control type: [21] Speed control (with encoder)
- Power unit component
- Component name: Power unit
- Component type: AC-Drive Module
- Order no.: 6SL3210-1SE11-7FA1
- Rated power: 0.95 kW
- Rated current: 1.7 A
- Power unit supplementary data:
  - No filter/choke
- Adaptor module: CU310 DP

Drive setting:
- Standard: IEC motor (50 Hz, 51 units)
- Connection voltage: 400 V
- Power unit application: [0] Load duty cycle with high overload for vector drives

Motor:
- Motor type: Motor
- Motor type: 11/11LA7 standard induction motor

Motor data:
- p304[0]: Rated motor voltage: 400 V rms
- p305[0]: Rated motor current: 1.25 A rms
- p307[0]: Rated motor power: 0.4 kW
- p308[0]: Rated motor power factor: 0.840
- p310[0]: Rated motor frequency: 50 Hz
- p311[0]: Rated motor speed: 1380 rpm
- p322[0]: Motor cooling type: [0] Non-ventilated

Calculation of the Motor/Controller Data:
- Complete calculation with equiv. circuit diagram data
- Motor holding brake
- Motor holding brake: Not available
Step 2 - Configure DO
Check Topology
Step 3 - Run Script file
Execute Script file
Step 3 - Run Script file
Script file window

SIMOCRANE Drive-Based Technology

The script file is a help for the application to connect the BICO - parameters by using Profinet or I/O - communication automatically. Besides the Crane DCC-blocks will also be connected depending on the selected axis. The Script file can be extended by the user. Since variance cannot be precluded entirely, we cannot guarantee full consistency.

Path and Name for Logfile
D:\logfile.txt

Select the drives in your project
- HOIST
- GANTRY / TROLLEY

Select the communication in your project
- PROFIBUS DP
- ONBOARD I/O

Select the master switch setpoint in your project
Attention only for ONBOARD I/O communication
- Analog master-switch
- Digital master-switch

OK CANCEL
Step 3 - Run Script file

Running script

In the script window all parameter settings will be shown.
A log-file can be saved for documentation
Step 3 - Run Script file
Setpoint channel in CU310-2 after running script (via Profibus control)
Step 3 - Run Script file
Setpoint channel in CU310-2 after running script (with digital master-switch, Brake control and StartPulse)
Step 4 - Compile and download
Download into CF-card

Save and compile the project and then the project can be downloaded in two ways:

1. With STARTER go online via Profibus to SINAMICS CU310-2 and download the project into the device.

2. Put the Compact Flash card into a card reader and download the project direct to the CF card and then put the CF card into the device.
Step 4 - Compile and download
Communication Interface via Profibus

For online download the profibus address must be configured as follows:
Step 4 - Compile and download Communication Interface via Profibus

- The profibus address is entered here. (This must correspond to the profibus address found on the CU310-2)

- The profibus address can be set on the CU310-2 by setting the switches found underneath the BOP.
Step 4 - Compile and download
Communication interface via Ethernet (1)

For using an Ethernet connection to connect to the control unit select the accessible nodes button to find device.
Step 4 - Compile and download
Communication interface via Ethernet (2)

- If the device is not found immediately:
  1. Set access point to device in the accessible nodes tab.
2. Set the PG/PC interface in the accessible nodes tab. (Tip: Select component which has <Active> written after it).
Step 4 - Compile and download
Communication interface via Ethernet (4)

3. Select search for accessible nodes again.
4. When the device is found note the IP address.
Step 4 - Compile and download
Communication interface via Ethernet (5)

5. Adjust the PG/PC IP address so that it will have the same first 3 numbers as the address of the device but with a different fourth number. (E.g. If the device address is 169.254.11.22 then the PC/PG address should be changed accordingly to an address with the same first 3 numbers but a different fourth e.g. 169.254.11.1)

6. Highlight device in accessible nodes tab and accept device into project.
Step 5 - Commissioning Drive
Overview of drive navigator
Step 5 - Commissioning Drive
Overview of I/O-Signals

Analogue

Digital
### Step 5 - Commissioning Drive

#### Overview of parameter list

![Parameter List Screenshot](image)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1350</td>
<td>p1(210000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1341</td>
<td>p2(20001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1342</td>
<td>p2(20002)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1343</td>
<td>p2(20003)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1344</td>
<td>p2(20004)</td>
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<td></td>
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<td>1345</td>
<td>p2(20005)</td>
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<td>1346</td>
<td>p2(20006)</td>
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<td>p2(20011)</td>
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<td>p2(20019)</td>
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</tr>
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<td>p2(20026)</td>
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<td>p2(20027)</td>
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<td>1372</td>
<td>p2(20032)</td>
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<td>p2(20033)</td>
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<td></td>
</tr>
<tr>
<td>1374</td>
<td>p2(20034)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Step 5 - Commissioning Drive
Mainstream of speed setpoint and closed-loop control

Speed setpoint
Ramp function generator
Setpoint filter+precontrol

Speed controller
Torque setpoints
Torque limiting

Current setpoint filter
Current controller
Power unit

DRIVE-CLiQ
M

Sinamics
Step 5 - Commissioning Drive

Speed setpoint
Step 5 - Commissioning Drive
Ramp-function generator
Step 5 - Commissioning Drive
Ramp-function generator

Simple ramp-function generator
Extended ramp-function generator

Internal Enables

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Step 5 - Commissioning Drive

Speed controller

![Diagram of Speed controller with encoder and control parameters: P gain, Reset time, Reference model, Static speed setpoint, RPM, ms, and other control components.](image)
Step 5 - Commissioning Drive
Upper and Lower Torque Limit

**Upper Torque Limit**
- Torque limit upper
- Scaling
- Torque link extension

**Lower Torque Limit**
- Torque limit lower
- Scaling
- Torque link extension

A negative value on the output of the torque limit calculation results in an unwanted behavior of the drive, e.g., runaway of the drive.

A positive value on the output of the torque limit calculation results in an unwanted behavior of the drive, e.g., runaway of the drive.
Step 5 - Commissioning Drive
Introduction stationary measurement
Step 5 - Commissioning Drive
Purpose of stationary measurement (refer to Chapter 6.3)

- SINAMICS Drive Object
  - Stationary measurement
    - Equivalent circuit diagram data
    - Total resistance for:
      - power cable resistance and
      - stator resistance
    - IGBT on-state voltage or compensation for the IGBT lockout times
  - Control Panel (speed direction check, if necessary directional change, p1821)
Step 5 - Commissioning Drive
Start stationary measurement

1. Select stationary measurement from the drop down menu.
2. Activate measurement.
### Step 5 - Commissioning Drive

Results of the stationary measurement

#### Stationary/Moving measurement

The following parameters have to be configured before the measurement:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter text</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>p350[0]</td>
<td>Cable resistance</td>
<td>0.0000</td>
<td>Ohm</td>
</tr>
<tr>
<td>p351[0]</td>
<td>Motor series inductance</td>
<td>0.00</td>
<td>mH</td>
</tr>
<tr>
<td>p522[0]</td>
<td>Motor ambient temperature</td>
<td>29</td>
<td>°C</td>
</tr>
<tr>
<td>p535[0]</td>
<td>Motor data identification control word</td>
<td>0000</td>
<td></td>
</tr>
</tbody>
</table>

The following parameters are determined or changed with the motor data identification:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter text</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>p350[0]</td>
<td>Motor stator resistance, coil</td>
<td>0.0000</td>
<td>Ohm</td>
</tr>
<tr>
<td>p351[0]</td>
<td>Motor stator resistance and damping resistance diode</td>
<td>0.0000</td>
<td>Ohm</td>
</tr>
<tr>
<td>p352[0]</td>
<td>Motor stator leakage inductance</td>
<td>0.0000</td>
<td>mH</td>
</tr>
<tr>
<td>p353[0]</td>
<td>Motor stator leakage inductance / damping inductance, d axis</td>
<td>0.0000</td>
<td>mH</td>
</tr>
<tr>
<td>p500[0]</td>
<td>Motor magnetizing inductance/damping inductance, d axis saturated</td>
<td>0.0000</td>
<td>mH</td>
</tr>
<tr>
<td>p1826</td>
<td>Compensation valve lockout time phase U</td>
<td>0.00</td>
<td>µs</td>
</tr>
<tr>
<td>p1827</td>
<td>Compensation valve lockout time phase V</td>
<td>0.00</td>
<td>µs</td>
</tr>
<tr>
<td>p1828</td>
<td>Compensation valve lockout time phase W</td>
<td>0.00</td>
<td>µs</td>
</tr>
</tbody>
</table>
Step 5 - Commissioning Drive
Start stationary measurement

1. Select control panel.
2. Select assume control priority.
3. Tick the enables box.
4. Select the green I button and the test begins.
Step 5 - Commissioning Drive
Purpose of rotating measurement (refer to Chapter 6.3)

- SINAMICS Drive Object
  - Rotating Measurement and Speed Controller Optimization
    - Measurement of magnetization characteristic
    - Measurement of magnetization current
    - Speed controller optimization
    - Acceleration pre-control setting
    - Setting for ratio between the total moment of inertia and that for the motor
Step 5 - Commissioning Drive
Start turning measurement

1. After stationery measurement select deactivate measurement.
2. Then select next measurement.
   - Repeat steps taken for stationery except select turning measurement with encoder from the drop down menu,
Step 5 - Commissioning Drive

Errors in rotating measurement

- If errors occur in rotating measurement test make sure that all steps have been followed correctly.
- Check drive diagnostics in control panel.

<table>
<thead>
<tr>
<th>Control/status words</th>
<th>Status parameter</th>
<th>Missing enables</th>
</tr>
</thead>
</table>

If the setpoint is only specified via p1070 (main setpoint), the drive can only be traversed when all enables are available. If an additional setpoint input is used, the drive can already be traversed even when certain enables are missing.

The following enables are missing:

- Bit 0: OFF1 enable missing
- Bit 8: EP terminals enable missing
Step 5 - Commissioning Drive
Errors in rotating measurement

- Use alarm screen and click on error message for help to troubleshoot fault.
- To attempt rotating test again make sure to acknowledge errors in alarms screen.
Step 5 - Commissioning Drive
Results of the rotating measurement

![Image of a computer screen showing a Siemens Cranes software interface with a focus on parameter values.

Parameter Values:
- Parameter: Value
- Parameter: Value
- Parameter: Value
- Parameter: Value

Note: The image shows a screenshot of a computer interface with parameter settings and values highlighted for a Siemens Cranes software.

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If the rotating measurement cannot be performed, it is possible to correct manually the missed rotating measurement settings:

- To correct manually the magnetizing current and magnetizing inductance

- Speed control optimization by re-calculating the control parameters (p0340) or by optimizing manually the controller

Refer to the manual “SIMOCRANE Drive-Based Technology”, Chapter 6.3
Step 6 - Parametrizing DBT
Open the Expert list

Select DriveAxis with the right mouse, a new window will be opened.

Select Expert and Expert list
Step 6 - Parametrizing DBT
DCC Parameters in the Expert list

![Image of Simocrane software interface showing parameters list and settings]
In order that for low deflection angles lower speed setpoints are obtained than those that correspond linearly to the deflection angle, the master switch setpoint is modeled through a non-linear function. This allows the drive to be precisely positioned in the manual mode.
Step 6 - Parametrizing DBT
DCC_DigitalMasterSwitch (refer to Chapter 7.1.1)
For hoists, when starting (i.e. opening the hoisting gear brake) with freely suspended load, often the load undesirably sags. The reason for this is that the torque is not available when starting. When starting with a suspended load, the torque must be quickly established.
Step 6 - Parametrizing DBT
DCC_Startpulse in combination of Brake control
This function prevents that the drive moves with full speed to the limit switch or to the safety buffer. A total of 4 different speed limits can be configured. Interconnect the maximum speed with speed limit 1. This limits speed to the maximum value.
Step 6 - Parametrizing DBT
DCC_Overspeed (refer Chapter 4.5)

Function 1
to monitor the actual velocity for an overspeed condition. Compared value can be either in range of the rated speed or in field weakening area.

Function 2
to monitor continuously setpoint-actual value deviation
Step 6 - Parametrizing DBT
DCC_CurrentDistributionMon (refer to Chapter 4.6)

This function can be used for master-slave operation or synchronous operation. The block monitors that the total current of both drives is distributed evenly.

In synchronous operation, the current setpoint value is monitored for the two drives. In master-slave operation, the current actual values of two drives are monitored.

If the difference of the setpoint or actual currents of both drives exceeds the configured values for deviation and time, then output r22037 "boFaultCurrentMonitoring" is set.
Step 6 - Parametrizing DBT
DCC_LoadDependingFieldWeak (refer to Chapter 4.7 and 6.5)

When selecting field weakening, e.g. using the master switch, a supplementary speed setpoint for field weakening, which is permissible for the actual load, is generated.

Theoretical basics and equations

The steady-state load torque is calculated as follows:

\[ MM = M_{Load} + M_{Friction} \]

- **MM**: Motor torque
- **M_{Load}**: Load torque
- **M_{Friction}**: Frictional torque

Commissioning instructions

1. To generate the measured variables (refer to chapter 6.5.2.2)
2. Compensating the frictional torque (refer to chapter 6.5.2.2)
3. Correcting the efficiency (refer to chapter 6.5.2.3)
4. Calculating the physical size of the load (refer to chapter 6.5.2.4)
After commissioning save the project

After the Commissioning is finished, following steps must be done:

- Copy RAM to ROM (all settings will be saved on CF card)

- If the parameter settings in the CU310 are changed online, then upload the project to PG and save the project in the STARTER.

- Do a copy of the complete CF flash card to the hard-disc as a backup.
Thank you for your attention!

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