SIEMENS

SIMOCRANE

CeSAR standalone OHBC, Gantry crane

Operating Instructions

valid for:

SIMOCRANE CeSAR standalone OHBC, Gantry crane Version 4.2 SP1

02/2014

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Foreword

The sway control system

The sway control system SIMOCRANE CeSAR standalone OHBC, Gantry crane is part of SIMOCRANE Advanced Technology. It can be operated with or without the SIMOCRANE CenSOR camera measuring system.

This document contains detailed information about the system, its function, engineering, installation and commissioning as well as service and maintenance measures.

Area of application

The sway control system is used to prevent load sway on overhead bridge cranes (OHBC) and gantry cranes, for example, RMGs and RTGs. As a consequence, the crane operator can position his crane precisely and quickly, therefore speedily and safely handling goods without damaging them.

Cranes for harbors and industrial areas with trolley, gantry and either slewing gear or hoist are suitable applications for this system. With the exception of the hoist, up to three drives can be simultaneously moved with sway control.

Additional information

Siemens product support for SIMOCRANE

The following addresses provide support for your SIMOCRANE products:

- Internet:
  - The latest information about SIMOCRANE products, product support, and FAQs can be found on the Internet here (http://support.automation.siemens.com/WW/view/en/10807397/130000).
  - You can find continuously updated information regarding Crane Application Notes on the Internet here (http://support.automation.siemens.com/WW/view/en/48342008/136000).
  - You can find contact persons across the country on the Internet at Contact & Partners / contact persons (http://www.automation.siemens.com/aspa_app/contactmenu.aspx?ci=yes&regid=DEF&lang=de&reduce=prodid518533&comptcID=v).
  - You can find other contact persons that can support you in implementing your requirements on the Internet at Contact & Partners / Solution Partners (https://www.automation.siemens.com/solutionpartner/partnerfinder/Partner-Finder.aspx?lang=en).
- Hotline for Europe:
  - Tel.: +49 (0)911 895 7 222
  - Fax: +49 (0)911 895 7 223
  - Email: Support Europe (mailto:support.automation@siemens.com)
- Hotline for America:
  - Tel.: +1 423 262 5710
  - Fax: +1 423 262 2231
  - Email: Support America (mailto:support.america.automation@siemens.com)
- Hotline for Asia / Pacific
  - Tel.: +86 10 6475 7575
  - Fax: +86 10 6474 7474
  - Email: Support Asia/Pacific (mailto:support.asia.automation@siemens.com)

Siemens product support for SIMOTION and SINAMICS

The latest information about SIMOTION products, product support, and FAQs can be found on the Internet here (http://support.automation.siemens.com/WW/view/en/10805436/130000).

The latest information about SINAMICS products, product support, and FAQs can be found on the Internet here (http://support.automation.siemens.com/WW/view/en/13305690/130000).

Table of contents

Basic safety instructions

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1.1 General safety instructions relating to hardware

⚠ DANGER

Danger to life due to live parts and other energy sources

Touching live parts can result in death or severe injury.

- Only work on electrical equipment if you are appropriately qualified.
- Always observe the country-specific safety rules for all work.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a zero-voltage state, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check that every auxiliary circuit is de-energized.
   - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Take measures to prevent reconnection of the energy sources.
6. Make sure that the machine is completely locked out ... and that you have the right machine.

After you have completed the work, restore the operational readiness by following the above steps in the reverse order.

⚠ WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

In the event of a fault, touching live parts can result in death or severe injury.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

> **⚠ WARNING**
>
> **Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones**
>
> Using mobile radios or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.
>
> - When close to components, switch off all wireless devices and mobile phones.

1.2 General safety instructions relating to software

> **⚠ WARNING**
>
> **Danger to life if the safety instructions and residual risks are not carefully observed**
>
> If the safety instructions and residual risks are not observed in the associated hardware documentation, accidents can occur involving severe injuries or death.
>
> - Observe the safety instructions given in the hardware documentation.
> - When assessing the risk, take into account residual risks.

> **⚠ WARNING**
>
> **Danger to life as a result of incorrect or modified parameterization**
>
> As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.
>
> - Protect the parameterization (parameter assignments) against unauthorized access.
> - Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

> **⚠ WARNING**
>
> **Danger to life posed by uncontrolled changeover between operating states**
>
> Uncontrolled changeover between operating states can cause machines to malfunction, which in turn can lead to injuries or death.
>
> - Include the effects of changeover between operating states in the risk analysis.
> - Implement suitable safety measures, e.g. EMERGENCY OFF.

1.3 IT security

Note

Industrial security

Siemens provides automation and drive products with industrial security functions that support the secure operation of plants or machines. They are an important component in a holistic industrial security concept. With this in mind, our products undergo continuous development. We therefore recommend that you keep yourself informed with the latest information and updates of our products.

Information and newsletters can be found at: http://support.automation.siemens.com.

To ensure the secure operation of a plant or machine, it is also necessary to take suitable preventive action (e.g. cell protection concept) and to integrate the automation and drive components into a state-of-the-art holistic industrial security concept for the entire plant or machine. Any third-party products used must also be taken into account.

For more detailed information, go to: http://www.siemens.com/industrialsecurity.

⚠ **WARNING**

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can lead to death, severe injuries and/or material damage.

- Update your software regularly.

  Information and newsletters can be found at:

  http://support.automation.siemens.com.

- Incorporate the automation and drive components into a state-of-the-art, integrated industrial security concept for the installation or machine.

  For more detailed information, go to:

  http://www.siemens.com/industrialsecurity.

- Make sure that you include all installed products into the integrated industrial security concept.

System description

2

2.1 General

2.1.1 Use of sway control

Every movement of the gantry, trolley or slewing gear causes the load to sway. This makes positioning more difficult, and it takes correspondingly longer. The main task of the sway control system is to remove sway motions. This makes automatic positioning possible. This can relieve the crane operator and increase the handling capacity.
Without an electronic sway control system, implementing crane controls in semi- and fully automatic operation (e.g. coil storage locations in steelworks) is hardly conceivable.

Overview

- The SIMOCRANE CeSAR standalone sway control system is based on the SIMOTION C240 PN platform. It is suitable for new systems and as a solution to modernize old systems. The system can be simply integrated into an existing PROFIBUS network.

- Sway motion is calculated and corrected based on a mathematical oscillation model.

- The system can be operated in one of two versions, i.e. with or without a camera.

2.1.2 Trolley and gantry

Depending on the operation mode selected, either manual operation (a velocity setpoint is entered at the master controller) or positioning operation (a target position is entered) are possible. The operation mode of each drive can be changed over when moving, e.g. from the manual operation mode to positioning operation mode, and vice versa.

2.1.3 Slewing gear or hoist

The third drive can be optionally set as either slewing gear or hoist. This is selected using a configuration parameter (P115).

Depending on the operation mode selected, either manual operation (a velocity setpoint is entered at the master controller) or positioning operation (a target position is entered) are possible.

The slewing gear can be operated with sway control.

2.2 System overview

2.2.1 Preconditions

- Crane control system (PLC) with PROFIBUS connection (operation with optional data transmission rate of 500 kbit/s, 1.5 Mbit/s, 3 Mbit/s, 6 Mbit/s, or 12 Mbit/s.)

- Closed-loop controlled drives

- Position encoder for the hoist to determine the pendulum length

- Position encoder for all drives operated with positioning and sway neutralization operation modes

- Position encoder for the slewing gear if this is:

  – operated in positioning or sway neutralization mode, or

  – can be rotated by more than 5° from the zero position (if the reflector rotates with the slewing gear).

Additional hardware may be required (e.g. camera, reflector, Ethernet switch) depending on the version.

2.2.2 System structure

The following figure shows the communication paths between the individual components.
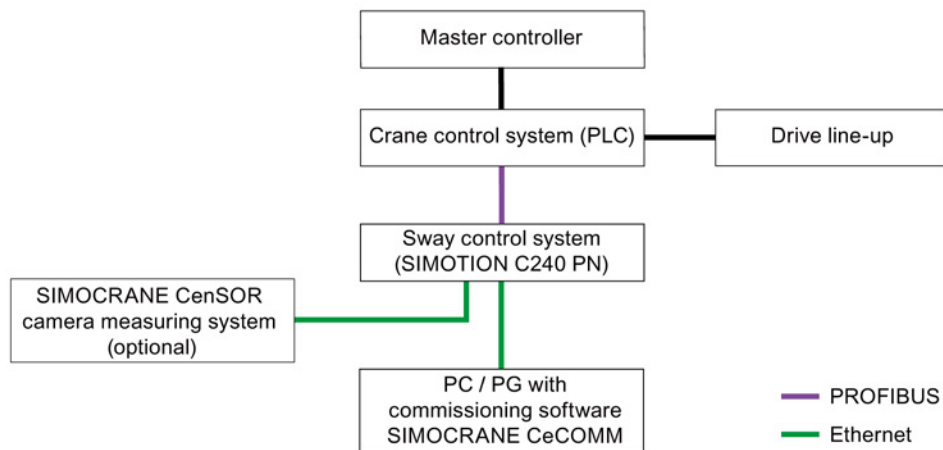
Figure 2-1   Layout diagram of the components

2.2.3   Configurations

2.2.3.1   Overview

The following configurations can be selected in parameter P115:

- Version with / without camera
- Positioning mode activated / deactivated
- Operation with slewing gear or hoist

2.2.3.2   Version without camera

This version is designed for use on cranes that cannot be equipped with a camera for design-related reasons, or which operate in harsh environmental conditions, such as extremely dusty atmospheres or at very high temperatures.

The sway control system ascertains the oscillation states using a mathematical oscillation model. The version without camera is capable of eliminating most oscillations that are caused by crane motion. However, it is not capable of suppressing oscillations caused by external forces such as diagonal pull or wind.

The camera must be deactivated in configuration parameter P115 (option 1 = On) for the version without a camera. All of the functions, parameters and fault messages described in this documentation, which refer to the camera, are then suppressed and deactivated.

2.2.3.3   Version with camera

The camera-based version can also compensate for sway motion caused by external factors (e.g. wind or diagonal pull). A camera measuring system deploys an optical, contactless measurement technique to additionally calculate physical measured variables, i.e. distance between the camera and reflector, pendulum deflection and rotation. The results are incorporated in the calculation model. The calculations are performed on the SIMOTION C240 PN.

The calculations are more accurate than with a system without a camera and sway caused by external forces can also be eliminated.

If the measuring signal of the camera fails, only the mathematical calculation model is used.

Note

For additional information about the camera, please refer to the operating instructions for the SIMOCRANE CenSOR camera measuring system, from edition 08/2012.

2.2.3.4   Operation with slewing gear

Information on installation

On slewing gear that rotates the reflector by more than 5°, the camera and reflector must be mounted so that the slewing motion causes the camera and reflector to rotate simultaneously. A position encoder must also be used.

The oscillation measurements are assigned to the drives (trolley/gantry) by internal computation based on the actual slewing gear position.

Hook slewing gear

For cranes with hook slewing gear, a position encoder is only required when the slewing gear is automatically positioned.

Skew control

Slewing gear can be operated with a skew control system. Hook slewing gear, however, must always be operated with the mathematical oscillation model.

2.3 Scope of delivery

Depending on the application and the environmental conditions, the sway control system can be implemented with or without the SIMOCRANE CenSOR camera measuring system. The hardware and software required for the camera measuring system must be ordered separately and are not listed here.

The "SIMOCRANE CeSAR standalone OHBC, Gantry crane" package includes:

- SIMOTION C240 PN

- Mounting rail

- MMC memory card for SIMOTION C240 PN, configured for sway control

  The MMC memory card supplied with the system already contains all of the required licenses.

  The MMC memory card contains:

  – The SIMOTION Kernel (basic system)

  – Technology packages and user data (programs, configuration data, parameter settings)

  – Runtime licenses

- Product DVD

  The software DVD contains:

  – Installation instructions

  – Readme file

    □ German

    □ English

  – Readme_OSS

    □ German

    □ English

  – Software

    □ Setup program for the SIMOCRANE CeCOMM diagnostic program (setup file)

    □ Card image for the MMC memory card

    □ Application example

  – Documentation Operating Instructions SIMOCRANE CeSAR standalone OHBC, Gantry crane

    □ German

    □ English

  – Documentation SIMOTION C Operating Instructions

    □ German

    □ English

- Certificates for the software licenses

Product	MLFB No	Functionality
SIMOCRANE CeSAR standalone OHBC, Gantry crane: Basic license	6GA7200-1AA00-0AA0	Manual Positioning Sway neutralization
SIMOCRANE CeSAR standalone OHBC, Gantry crane: Manual license	6GA7200-1AA00-2AA0	Manual

Hardware installation

3

3.1 Introduction

The SIMOTION C240 PN forms the main component of the SIMOCRANE CeSAR standalone OHBC, Gantry crane sway control system.

The following section provides an introduction to installing the SIMOTION C240 PN. Please refer to the device documentation also supplied for further information and details.

The control algorithm is saved in the project data on the memory card supplied (MMC).

Note

The SIMOTION C240 PN must only be used for sway control.

SIMOTION C240 PN view

Figure 3-1   SIMOTION C240 PN, from the front, open front

The following image shows the SIMOTION C240 PN module with its interfaces and front panel elements (error and status displays).
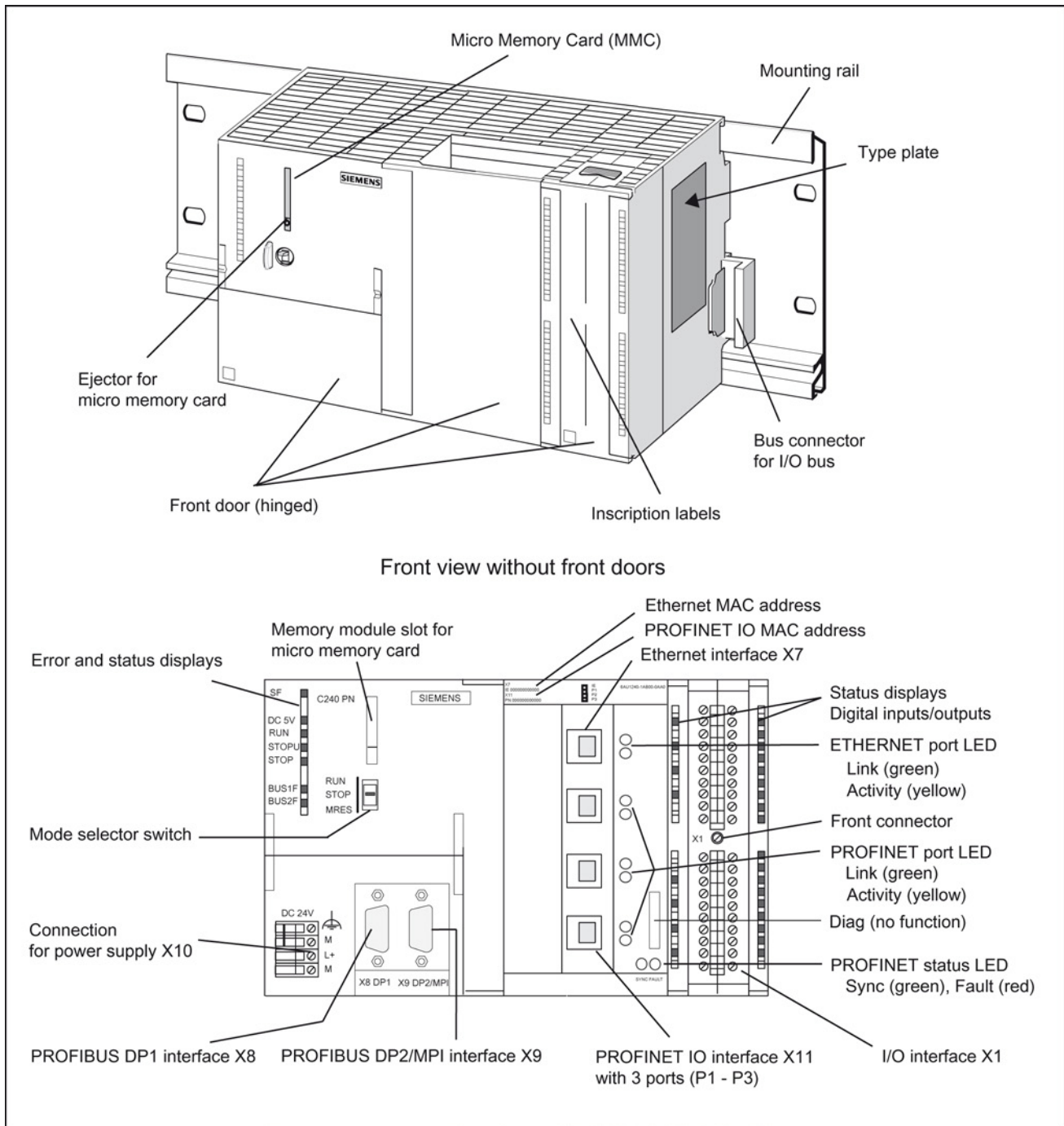
Figure 3-2   Position of the SIMOTION C240 PN interfaces and front panel elements

3.2   Mechanical installation

In this section we will explain how to prepare the SIMOTION C240 PN components for installation and how to install them.

Installation instructions

Installing the mounting rail

1. Fit the mounting rail in a position that will allow enough room for the modules to be installed and for the heat to dissipate (a minimum of 40 mm above and below the mounting rail).

2. Screw the mounting rail onto the surface where it is to be affixed (screw size: M6).
   Is the support a grounded metal plate or a grounded equipment mounting plate?
   If so: ensure that there is a low-resistance connection between the mounting rail and the support. Use suitable electro-lubricant or contact washers with painted and anodized metals, for example.
   If not: no special action required.

3. Connect the mounting rail with the protective conductor. An M6 screw is provided on the rail for this purpose. Minimum cross-section from the cable to the protective conductor: 10 mm^2.

Hang the SIMOTION C240 PN on the mounting rail

1. Hang the SIMOTION C240 PN onto the top of the rail and swing it down.

2. Screw down the module applying a torque of 0.8 to 1.1 Nm.

Insert the micro memory card (MMC)

1. Switch off the power supply module.

2. Insert the micro memory card into the module slot of the SIMOTION C240 PN by applying slight pressure until it snaps into place. Make sure the beveled edge of the micro memory card faces the ejector.

3. Switch the power supply module back on.

Horizontal and vertical installation

You can install the rack either horizontally or vertically. The preferred position is a horizontal one.
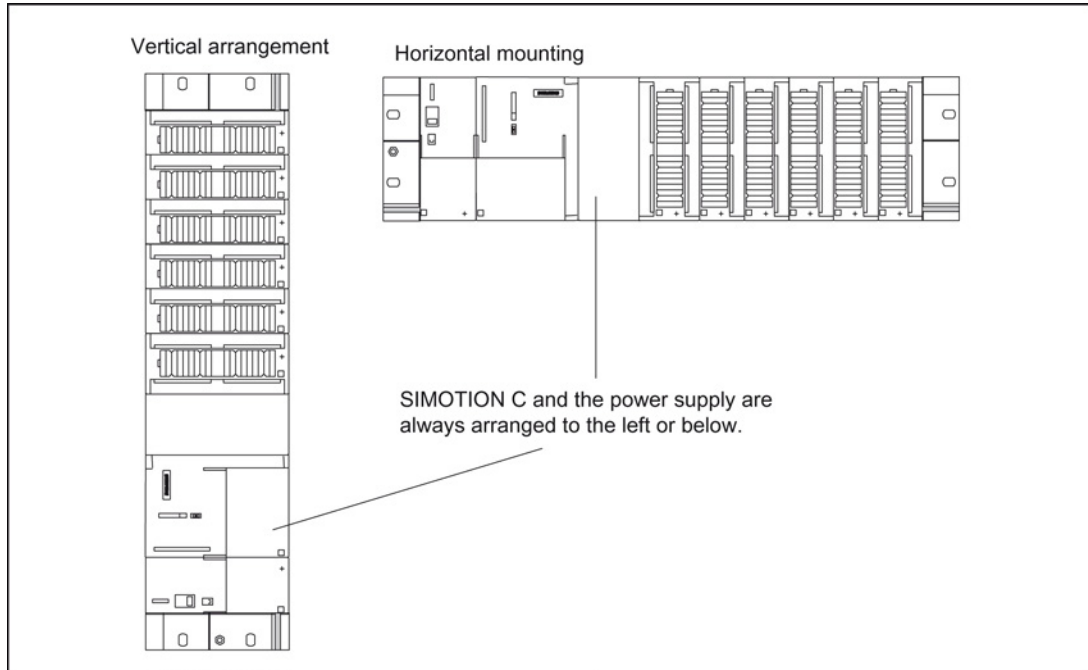
Figure 3-3   Horizontal and vertical installation of the SIMOTION C 240 PN

Permissible ambient temperature

- Horizontal installation: from 0 ... 55 °C
- Vertical installation: from 0 ... 40 °C

Clearances

If you comply with the minimum clearances, you will:

- Ensure that the modules are cooled,
- Have sufficient space to insert and remove the modules,
- Have sufficient space for laying cables,
- Increase the mounting height of the rack to 205 mm.

To guarantee the functionality, clearances of 40 mm must be maintained.

Note

If you use a shield connecting element, the dimensions stated are measured from the lower edge of the shield connecting element.

The following diagram shows the clearances between the individual racks and the clearance to adjacent equipment, cable ducts, cabinet walls, etc.
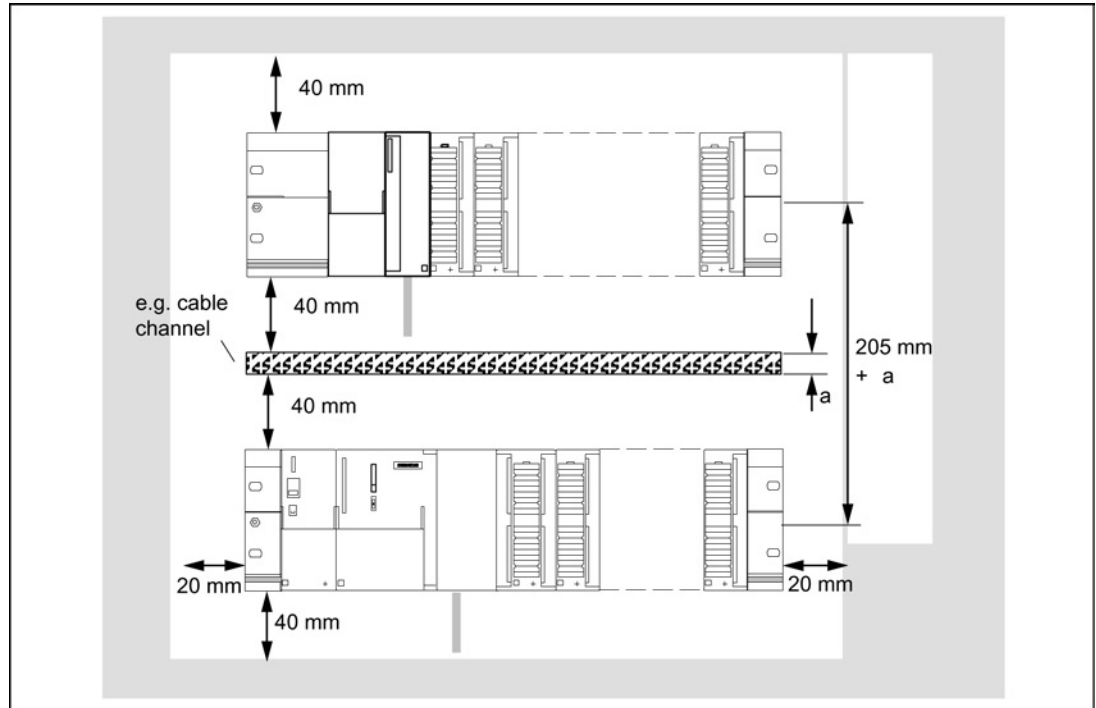
Figure 3-4   Clearances

Installation dimensions of modules

The following table shows the installation dimensions of modules.

Table 3- 1   Installation dimensions of modules

Modules	Module width	Module height	Max. installation depth
PS 307, 2 A power supply	50 mm	125 mm, 185 mm with shield connection element	130 mm or 180 mm with an open SIMOTION C240 PN front panel
PS 307, 5 A power supply	80 mm		
PS 307, 10 A power supply	200 mm		
SIMOTION C240 PN	200 mm		
Signal modules (SMs)	40 mm		
Function modules (FM)	40 mm or 80 mm		
Communication modules (CP)	40 mm		

3.3 Electrical installation

3.3.1 Technical data of the SIMOTION C240 PN

Connection values

Table 3- 2   Connection values

Supply voltage:	24 V DC (permissible range: 20.4 ... 28.8 V)
Power consumption from 24 V	- typically 0.9 A (inputs/outputs open) - typically 1.2 A (with four encoders, 5 V) - typically 1.9 A (with four encoders, 24 V)
Power loss	15 W
Starting current	8 A
Encoder supply 5 V max. output current	1.2 A
Encoder supply 24 V max. output current	1.2 A

Dimensions and weight

Table 3- 3   Dimensions and weight

Dimensions (W x H x D)	200 x 125 x 118
Weight (g)	approx. 1 150

3.3.2 Specifications for insulation tests, safety class, and degree of protection

Test voltages

The insulation resistance is tested in a routine test using the following test voltage to IEC 1131, Part 2:

Table 3- 4   Test voltages

Circuits with rated voltage U_e with respect to other circuits, or with respect to ground	Test voltage
0 V < U_e ≤ 50 V	500 V DC

Protection class

Protection class I in accordance with IEC 536 (VDE 0106, Part 1), i.e. protective conductor connection required at the mounting rail.

Protection against the ingress of foreign bodies and water

- Degree of protection IP 20 according to IEC 529

- In addition: Protection against the ingress of solid foreign bodies with diameters greater than 12.5 mm

- No special protection against the ingress of water

3.3.3 LED displays

The following LED displays are on the front panel of the SIMOTION C240 PN.

Table 3- 5   Status and fault displays

LED	Significance
SF (red)	This LED indicates a fault state of the SIMOTION C240 PN.
5 V DC (green)	This LED indicates that the power supply for the electronics is ready.
RUN (green) – SIMOTION C240 PN in RUN	This LED indicates that the user program is running.
STOPU (yellow) – SIMOTION C240 PN in STOP user program	This LED indicates that the technology packages (for example, synchronous operation and cam) are active. The user program is not active.
STOP (yellow) – SIMOTION C240 PN in STOP	This LED indicates that no user program is running. The technology packages are not active.
BUS1F (red) – group fault	This LED indicates a fault on the PROFIBUS DP1 interface (X8) of the SIMOTION C240 PN.
BUS2F (red) – group fault	This LED indicates a fault on the PROFIBUS DP2/MPI interface (X9) of the SIMOTION C240 PN.
Q0 ... Q7 , I0 ... I11, B1 ... B4, M1, M2 (green) – digital input/digital outputs	These LEDs show the status of the digital inputs/outputs.

3.3.4 Mode switch

Certain operation modes can be selected using the mode switch.

Mode switch positions

The positions of the mode switch are explained in the order in which they appear on the SIMOTION C240 PN.

Operation mode	Explanations
RUN	SIMOTION C240 PN is processing the user program and the associated system functions: • Reading process image inputs • Execution of the user programs assigned to the execution system. • Writing process image outputs The technology packages are active in this state. They can execute commands from the user program.
STOPU	SIMOTION C240 PN is not processing any user program. • The technology packages are active. Test and commissioning functions can be executed. The user program is not active. • The I/O modules (SMs) are in a safe state. Please note: It is only possible to switch to the "STOPU" state via the SIMOTION SCOUT engineering system. You can switch from hardware settings "STOP" and "RUN" to "STOPU" in SIMOTION SCOUT.
STOP	SIMOTION C240 PN is not processing any user program. • It is possible to load a complete user program. • All system services (communications, etc.) are active. • The I/O modules (SMs) are in a safe state. • The technology packages are inactive, i.e. all enables are deleted. No axis movements can be performed.
MRES (memory reset)	Switch setting for memory reset on the SIMOTION C240 PN. A specific sequence of operations is required to perform a memory reset using the mode switch (see SIMOTION C device documentation, Memory Reset chapter).

Interface to the crane control system

<div align="right">

4

</div>

4.1 General

The SIMOTION C240 PN and the crane control system (SIMATIC S7) communicate via PROFIBUS-DP.

All input data must be processed in the crane control system in accordance with the interface description (see Chapter Interface description (Page 45)).

All output data must be processed in the crane control system in accordance with the interface description.

A SIMATIC S7 sample project is provided on the DVD; this simplifies the integration into an existing crane control system.

In principle, the procedure implemented in the SIMATIC S7 sample project can be applied to a crane control system from another manufacturer.

4.2 Structure of the SIMATIC S7 sample blocks

The SIMATIC S7 sample project comprises several functions (FC) and two data blocks (DB). The blocks are not protected and can be freely accessed. Comments make it easier to understand the principle of operation. Input and output data are kept in two data blocks for the send and receive data and updated.

Table 4- 1   Overview of the data and function blocks

Function	Name	Description
FC1000	SC_MAIN_INT	Jump distributor: Calls all of the sample blocks.
FC1001	SC_SEND_INT	Reads input data from the data block DB1012 and places it in the configured PROFIBUS I/O devices to be sent to the SIMOTION C240 PN.
FC2005	SC_RECEIVE	Transmits the output data from the SIMOTION C240 PN out of the PROFIBUS I/O and into data block DB2010.
DB1012	SC_DB_SEND_INT	Contains the input data for the sway control.
DB2010	SC_DB_RECEIVE	Contains the output data from the sway control.
FC1002	SC_AXIS_INT	Universal function block to control the drives via pins. The signals required from the crane control should be connected here. The input data for the sway control is written to DB1012. The output data from the sway control is loaded from DB2010.
FC2006	SC_COMMON	Function block to transfer the "General data" data block via pins. The signals required from the crane control should be connected here. The input data for the sway control is written to DB1012. The output data from the sway control is loaded from DB2010.
FC2007	SC_OBST_0-15	Prepared for detour control (not available in this version); switches the blocked regions 0 ... 15 on or off.
FC2008	SC_OBST_16-31	Prepared for detour control (not available in this version); switches the blocked regions 16 ... 31 on or off.
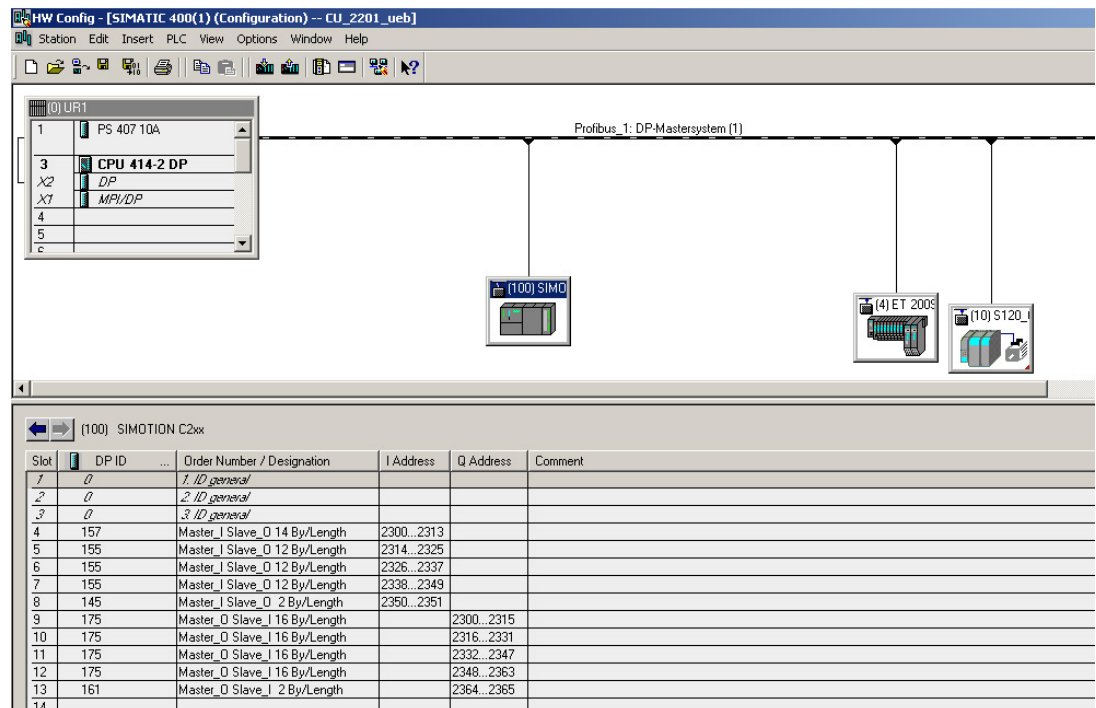
4.3   Hardware configuration in SIMATIC S7, integration into S7 project

The following image shows a SIMATIC S7 hardware configuration with a SIMOTION C240 PN in a configuration required for sway control.

After clicking on the PROFIBUS stream a SIMOTION C240 PN can be inserted as PROFIBUS device via <Insert> <Insert object> … <Additional FIELD DEVICES> <PLC> <SIMOTION> <SIMOTION C2xx>.

The PROFIBUS slave address for the SIMOTION C240PN (default = 100) can be set from the properties window.

The data modules to be transferred can be configured, starting from slot 4, by double clicking. The module addresses must match those at the two FC blocks to be transferred "SC_RECEIVE" or "SC_SEND_INT".

Figure 4-1   Hardware configuration when using the SIMATIC S7 interface

Table 4- 2   Overview, length of the data blocks, PLC → SIMOTION

Data block (PLC →SIMOTION)	Length	Block can be deactivated	Addresses in the SIMATIC S7 example
General data	14 bytes	No	2300 ... 2313
Input data, trolley	12 bytes	Yes	2314 ... 2325
Input data, gantry	12 bytes	Yes	2326 ... 2337
Input data, slewing gear/hoist	12 bytes	Yes	2338 ... 2349
Trailer (telegram counter)	2 bytes	No	2350 ... 2351

Table 4- 3   Overview, length of the data blocks, SIMOTION → PLC

Data block (SIMOTION → PLC)	Length	Block can be deactivated	Addresses in the SIMATIC S7 example
General data	16 bytes	No	2300 ... 2315
Output data, trolley	16 bytes	Yes	2316 ... 2331
Output data, gantry	16 bytes	Yes	2332 ... 2347
Output data, slewing gear/hoist	16 bytes	Yes	2348 ... 2363
Trailer (telegram counter)	2 bytes	No	2364 ... 2365

The properties screen form of the DP slave for inserting the universal modules for the inputs and outputs looks as follows:
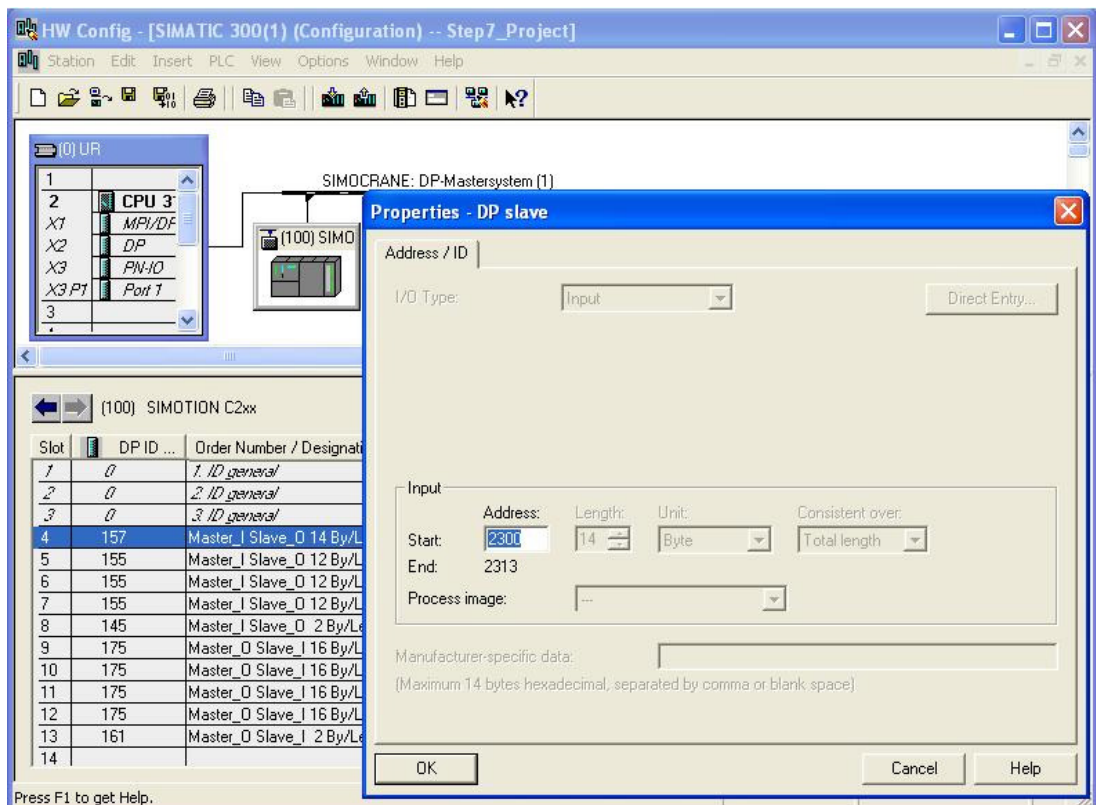
Figure 4-2   Properties screen form of the DP slave for inserting the universal modules

The start addresses, length and unit (see previous tables) must be stated under the DP slave properties. The consistency must be set over the entire length.

The integration in the SIMATIC S7 program always depends on the interface used. The hardware configuration is supplied with the SIMATIC S7 sample project.

Configuring instructions for crane control system 5

5.1 Selecting the operation modes

Different operation modes are available for the different drives (trolley, gantry, slewing gear and hoist).
These operation modes are set up as follows in the SIMATIC S7 sample block FC1002 by entering an integer value at the input OM:

1 = positioning
2 = manual
3 = sway neutralization load position
4 = sway neutralization drive position

Note

Only the positioning and manual operation modes are available for the hoist.

5.2 Switchover between operation with sway control ↔ conventional control

The sway control system must be integrated into a conventional crane control system. Data is exchanged between the crane control and the sway control systems via a bus system. The crane control system remains master and distinguishes between conventional operation and operation with sway control.

Manual switchover between operation with sway control system and conventional operation must be possible at any time. This switchover has to be implemented in the crane control system.

In this way, you can switch over, for example, to conventional operation in case of a fault and continue to operate the crane without the sway control system. The availability of the crane is therefore not reduced by the sway control system.

Note

This switchover must only be possible when all drives are at a standstill (zero speed).

Conventional control

The crane control system reads in the setpoint from the master controller which is then processed in the setpoint channel of the crane control system and transferred to the drive as the output velocity. The "Release" control bit is reset. The output velocities of the SIMOTION C240 PN are then no longer used.

Operation with sway control system

The crane control system reads in the setpoint from the master controller and this is then transferred to the SIMOTION C240 PN. The "Release" control bit is set. The output velocity determined in the SIMOTION C240 PN is transmitted back to the crane control system and is transferred from there to the drive.

The setpoint for the master controller can be modified in the crane control system setpoint channel before it is transferred to the SIMOTION C240 PN (e.g. reducing to pre-limit switch velocity can occur here). In the positioning operation mode, the corresponding output velocities are likewise only generated when the "Release" control bit is set.

If the crane is to be operated with sway control, the output velocity transferred to the crane control system must no longer be influenced by the crane control system or drive (e.g. by limiting or an additional ramp). The enable signals are activated in the SIMOTION C240 PN and the output velocities in the setpoint channel of the crane control system are not used.
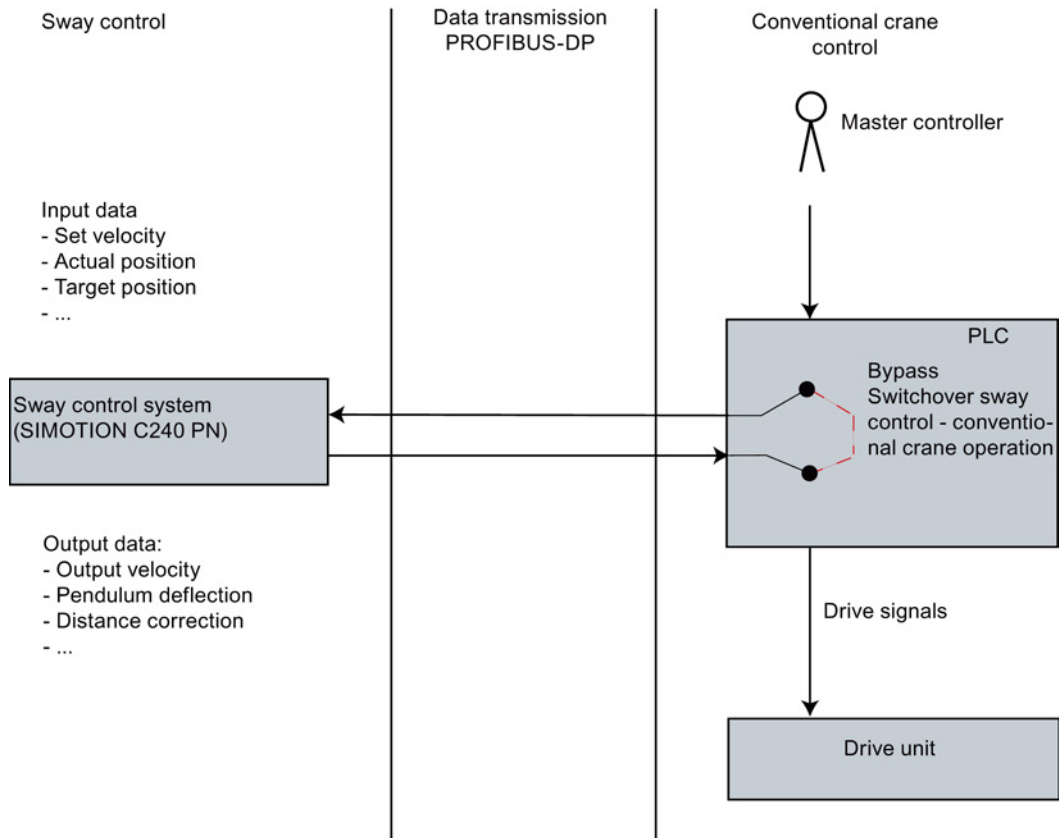
Figure 5-1   Switchover with or without sway control (bypass)

5.3   Pre-assignment of the interfaces

Input data must be pre-assigned depending on the operation modes, functions and the configuration used (P115). It is important that unused functions also be pre-assigned in a defined manner.

Examples:

- If a load measured value is not available at a crane, then this must be assigned zero at the PLC block. The same is true for the "DigitalLiftCorrection" control bit if no information is available about a changed load carrying device.

- The "SC_On" control bit must not be set at the data block when using the third drive as a hoist.

- All control bits that refer to the planned detour control (not available in this version) must also not be set.

Fault value suppression for V_set with manual operation mode

Suppression of any potential fault values in the crane control system must be ensured for V_set = 0 to prevent any unintended motion, for instance, as follows: If V_set is less than a certain value (e.g. 0.5%), the value 0 is transmitted to the sway control.

5.4   Sensing and monitoring the position actual values

5.4.1   Importance of position sensing

Accurate sensing of the actual position values for all drives operated in the positioning operation mode is vitally important. For cases such as these, it is recommended that a redundant position sensing system is provided with self-monitoring function in the PLC.

The measuring system should always provide the best possible reproducibility of the positions with respect to reality (laser, position sensing rails etc.). In practice, basic incremental encoders have turned out to be problematic. Absolute encoders are generally sufficient for the hoist or slewing gear as no significant slip can be expected here.

5.4.2   Checking the correct position sensing

The sway control system is defined in such a way that a positive output velocity results in travel motion with increasing position values (positive count direction). If this criterion is not adhered to then the position value can be converted into an internal actual position value using a gain factor and an offset value. This applies to all drives.

The position determined in the PLC and transmitted to the sway control system should be in "millimeters". Position values with a precision of 1 c° (centigrade) are required for the slewing gear. Actual value steps caused by reference marks should be minimized as far as possible. Manually moving along a track and simultaneously recording the actual position values in the SIMOCRANE CeCOMM diagnostic program (see SIMOCRANE CeCOMM diagnostic program (Page 145)) makes it simpler to locate these types of fault locations.

5.4.3 Synchronization of absolute or incremental encoders, homing

The system is referenced using one or several synchronizing limit switches for each drive. One or several limit switches must be available for each drive to monitor the position. To do this, when the limit switch responds (edge evaluation), its known position is compared with the system position determined at the activation time point. The position difference must lie within an adjustable, maximum permissible range. If this is not the case, an error message is generated. At least one of these monitoring limit switches must be positioned so that its signal state changes once at each unloading or loading operation.

5.5 Formation of the "Travelling" control bit

⚠ WARNING
Danger to life from unexpected machine movement
For as long as the "Travelling" control bit remains set, unexpected movements may occur after the crane has come to a standstill.
The "Travelling" control bit must be reset by the crane control system in the event of an EMERGENCY STOP or cancellation of continued travel.
Cancellation by the sway control may be triggered by the control bits "Release," "Brake_closed," "Controlled stop," and all limit switches.   • The "Travelling" control bit must be activated by a deliberate action.

Travel is initiated in the sway control by setting the "Travelling" control bit (travel signal).

The "Travelling" control bit may then be set in the crane control system if all conditions required to start travel are met, or no status applies that is intended to prevent travel (e.g. EMERGENCY STOP activated).

If this is the case, the "Travelling" control bit can be set as soon as an operating element for this purpose is activated by the crane operator (e.g. deflection of master controller in manual operation mode or start button / momentary-contact foot switch in positioning operation mode).

The "Travelling" control bit must be reset if a state occurs during travel that is intended to prevent continued travel. There is then a stop with quick stop ramp without sway control.

If travel can be terminated without causing a fault, the "Travelling" control bit should be reset with the "Pos_completed" status bit. The travel is then terminated with no remaining sway and the target position is reached in positioning operation mode.

Operation mode manual

When the master controller is deflected, the set velocity (V_set) is transferred to the sway control and the "Travelling" control bit must be set at the same time. When the master controller is released, the set velocity is set to zero, but the "Travelling" control bit must remain set until the sway control returns the "Pos_completed" status bit.

Operation mode positioning

The "Travelling" control bit is formed in a similar way to manual operation mode. However, in this case, a target position is entered. The set velocity V_set is not used in this mode. It is positioned with positioning velocity.

Operation mode sway neutralization

Procedure as in the positioning operation mode. However, the target position is set internally and depends on the selected operation mode – sway neutralization actual position or load position (actual position + actual pendulum deflection).

Note

The "Pos_completed" status bit from the sway control system also includes the status "SC_completed" (AND operation).

5.6 Drive activation and brake control

To activate the drive and control the brakes, we recommend using status bits "Travel_f" and "Travel_b" from the sway control system.

If the "Travelling" control bit is set and the brake is still closed, one of the two direction signals is set to indicate that the crane should start moving. Both direction signals result in a travel command in the crane control system.

This way the drives are activated and the brakes opened in the crane control system. As soon as the brakes are open, the output velocity is enabled with the "Brake_closed" control bit. The output velocity is output and the drive starts.

Vice versa: Sway controlled travel is completed once both direction signals have been reset. The brake can then be closed again in the crane control system.

Note

The brake must be closed when no further direction signals are output; the brake must be opened in the opposite situation. The real mechanical brake opening times (0.5 s ... 1.0 s) mean a time delay occurs between the "brake open" signal and "brake closed" signal. For this reason, the "brake closed" limit switch signal should always be applied to the "Brake_closed" control bit for the particular drive. This can be used to prevent the closed-loop control system from manifesting a dead time behavior.

5.7 Start of travel in manual operation mode

This example shows the sequence of signals in manual operation mode.

Travel is initiated by setting the "Travelling" control bit with the master switch and by resetting the "Brake_Closed" (output value enable) control bit.

The following signal sequence is performed:
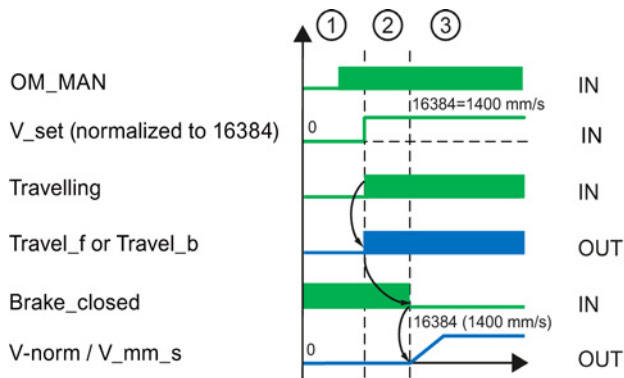
Figure 5-2   Signal sequence when travel starts

Section 1:

Manual operation mode is selected by means of the appropriate control bit "OM_MAN" for all the drives used.

Section 2:

The master controller is deflected. The "Travelling" control bit must be set (see Chapter Formation of the "Travelling" control bit (Page 36)). If this is the case and no fault is present, the direction signals, and thus the signals for opening the brake, are output (see Chapter Drive activation and brake control (Page 37)).

Section 3:

The brake is opened. The output velocity is issued and transferred to the drives.

5.8   End of travel in manual operation mode

This example shows the sequence of signals in manual operation mode.

Travel ends when the output velocity is low and the "Pos_completed" (positioning completed) status bit has been set by the sway control. This is only possible if the set velocity V_set has been set to zero.

The following signal sequence is performed:
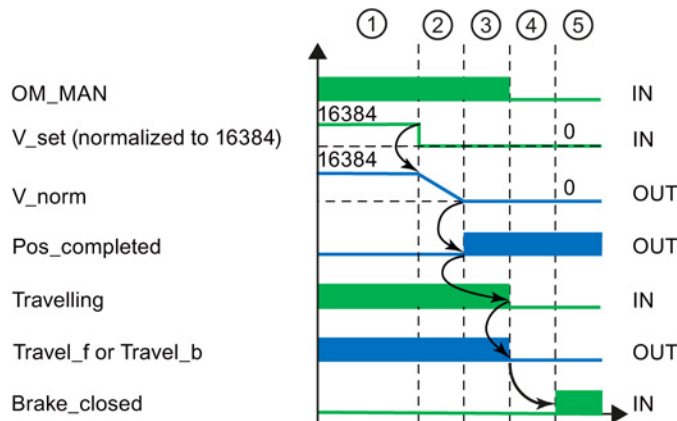
Figure 5-3   Signal sequence when travel ends

Section 1:

Travel with maximum velocity.

Section 2:

Travel terminated by the master controller. Output velocity decreases.

Section 3:

The output velocity is zero, the "Pos_completed" status bit is set.

Section 4:

The "Travelling" control bit must be reset (see Chapter Formation of the "Travelling" control bit (Page 36)). Direction signals are no longer output, which means that the signal to close the brake is initiated (see Chapter Drive activation and brake control (Page 37)). The "OM_MAN" control bit can be reset.

Section 5:

The brake has been applied.

5.9 Start of travel in positioning operation mode

Requirements

- All control bits must be set or reset as described for positioning.

- The target position must not be the same as the actual position. All other signals should have a value within the value range.

- The "Travelling" control bit must remain set for as long as the crane is moving.

  If the control bit is reset, the output velocity "V_norm" of the drive is reduced along the quick stop ramp.

The following signal sequence is performed:
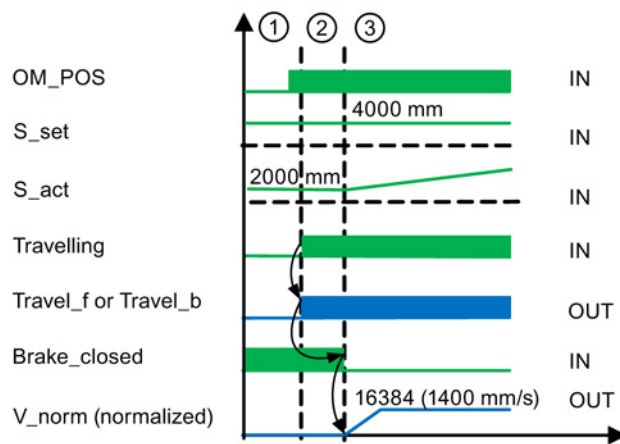
Figure 5-4   Signal sequence at the start of positioning operation mode

Section 1:

The sway control system is activated and the drive is selected for operation in positioning operation mode. A target position has been specified.

Section 2:

The positioning operation is initiated by setting the "Travelling" control bit. If no error has occurred that is blocking the operation mode, the direction signals, and therefore the signals for opening the brake, are output.

Section 3:

The brake is opened. The output velocity "V_norm" is transferred to the drive. Positioning starts.

5.10   End of travel in positioning operation mode

Travel ends when status bit "Pos_completed" is set by the sway control system:

● The difference between the actual and target positions is less than the set positioning accuracy.

● Status bit "SC_completed" is set.

● The output velocity is less than / equal to the zero speed detection.

The following signal sequence is performed:
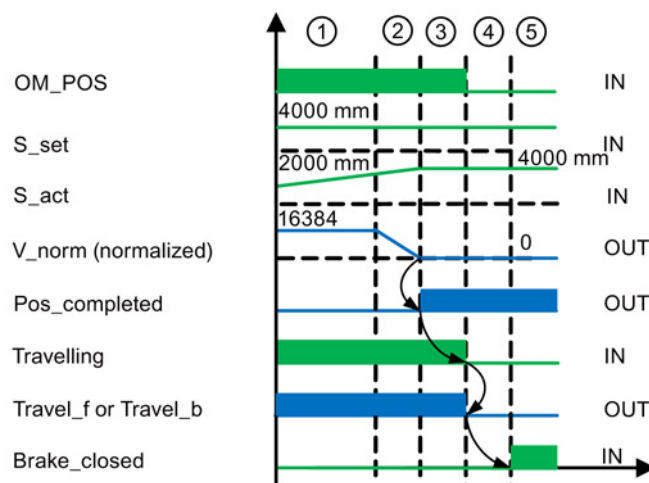
Figure 5-5   Signal sequence at the end of positioning operation mode

Section 1:

Sway-controlled travel of drive towards target position.

Section 2:

Actual position approaches target position.

Output velocity "V_norm" decreases.

Section 3:

Target position reached The output velocity "V_norm" is zero. Signal "Pos_completed" is then set.

Section 4:

The "Travelling" control bit must be reset. This causes no direction signals to be output and so the signal to close the brake initiated. The "OM_POS" control bit can be reset.

Section 5:

The brake has been applied.

> ⚠️ **WARNING**
>
> **Danger to life from unexpected machine movement**
>
> For as long as the "Travelling" control bit remains set, unexpected movements may occur after the crane has come to a standstill.
>
> The "Travelling" control bit must be reset by the crane control system in the event of an EMERGENCY STOP or cancellation of the continued travel.
>
> Cancellation by the sway control may be triggered by the control bits "Release," "Brake_closed," "Controlled stop," and all limit switches.
>
> * The "Travelling" control bit must be activated by a deliberate action.

5.11 Sway controlled stop

The control bit "Stop" (controlled stop) can be activated separately for each drive and causes a sway-controlled stop in all operation modes.

One possible use is to interrupt travel in positioning operation mode in order to wait for a particular event.

Another application is the use of the dead-man switch functionality.

In cases such as these, it is not necessary to change the operation mode. This reduces the amount of programming in the PLC.

Stopping has been completed if the "Pos_Completed" status bit is set for the relevant drive.

While braking, it is possible to withdraw the "Stop" control bit (controlled stop). As soon as the bit has been reset and the "Travelling" control bit is set, the drive starts to move again.

5.12 Positioning in the manual operation mode with S_corr

It is possible to use the sway control in manual operation mode for an external position controller.

The magnitude of the set velocity V_set is calculated by the following formula and must be limited to the desired positioning velocity.

$$V_{\_set} = \sqrt{2a \cdot |\Delta s|}$$

In this case:

* a: desired deceleration
* Δs: position difference

  Δs = target position - actual position - distance correction by sway control (S_corr)

Velocity V_set must have a sign dependent on the direction and must be normalized.

5.13   Normalization

Normalization and denormalization are shown in the following diagram using a trolley as an example.
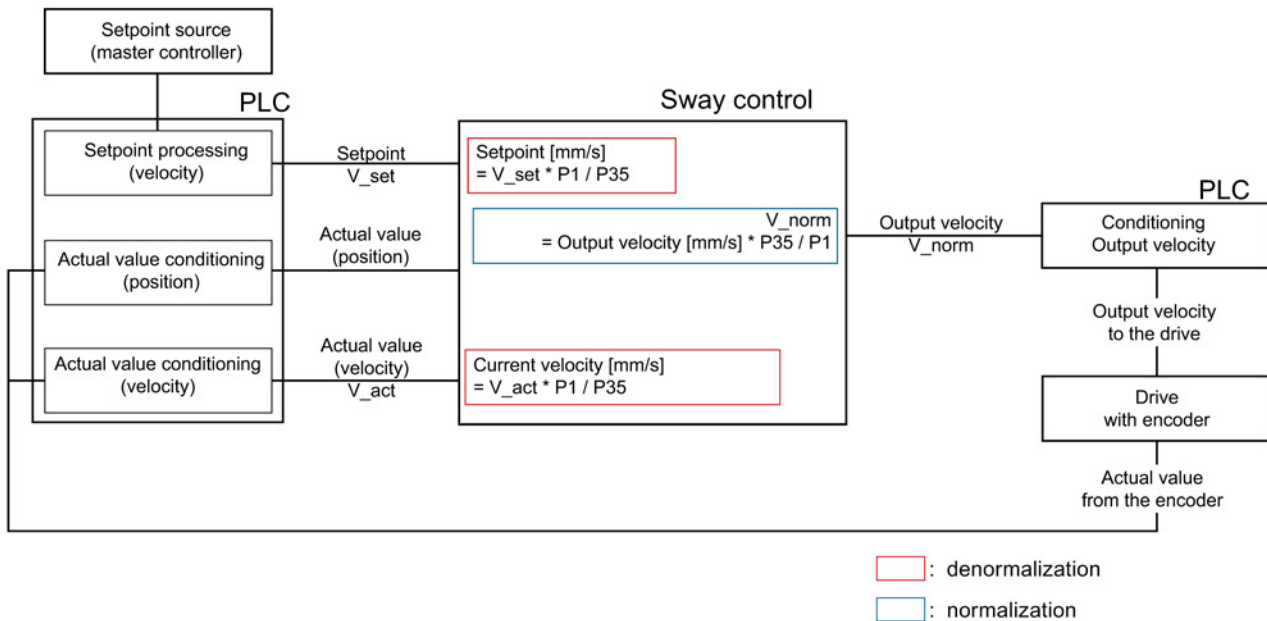
Figure 5-6   Denormalization using a trolley as an example

The setpoint value V_set and actual value V_act are denormalized at the ratio stated (indicated by a red border in the figure).

The output velocity V_norm is denormalized at the ratio stated (indicated by a blue border in the figure).

Example: With P1 = 1000 mm/s and P35 = 16384, a setpoint value of V_set = 16384 corresponds to an internal setpoint value of 1000 mm/s. If an output velocity of 100 mm/s is to be traveled, an output velocity V_norm = 1638 is provided with identical settings.

For sway control to function correctly, it must be ensured in the crane control system that the internal velocity values in mm/s match the actual velocities really measured in mm/s. These are measured, for example, with an external tachometer or by measuring the positions with a tape measure.

Interface description

6

6.1   General

The input data will first be described followed by the output data. Control and/or status bits within the input or output data are again subsequently listed in detail.

The input and output data are described in the tables below as follows:

Table 6- 1   Overview of the data in the interface description

Column	Contents
Name	Short form of the designation that is used in the SIMATIC S7 sample blocks or in other parts of the documentation.
Type	Precise type data: INT, DINT: signed 16, 32-bit number WORD: unsigned 16-bit number REAL: Floating-point number, 32 bit
Address	Consecutive number of the bytes, starting at 0.
Designation	Plain text designation of the value to be transferred.
Unit	Describes the unit and therefore size of the values to be transferred.

The specified addresses are relative addresses and if addresses have already been assigned, an offset must be added.

The PLC telegram (sending) contains, as the first word, an interface ID. The telegram is evaluated appropriately on the sway control side based on this received word.

Note

The SIMOCRANE CeSAR standalone OHBC, Gantry crane sway control system uses the Integer version, ID = 5150.

6.2   Input data

6.2.1   Overview of complete data structure

The data specified here is input data from the perspective of the sway control on the SIMOTION C240 PN. The following table provides a complete overview of the data that is sent from the PLC to the sway control:

Data block DB1012 in the SIMATIC S7 sample project corresponds to this structure.

Table 6- 2   Overall telegram structure / general block

Name	Type	Address	Designation	Unit
IF_IDNo	WORD	0-1	Interface ID	PB_ID_NR=5150
Spare	WORD	2-3	Reserve	
CTRL_BITS	WORD	4-5	General control bits	See Table 6-9 General control bits (Page 50)
Load	WORD	6-7	Load weight	in 10 kg steps
S_Hoist	DINT	8-11	Hoist position for effective pendulum length	± mm
Obst1_off	WORD	12-13	ObstaclesOff 0 … 15	Bits 0 ... 15
Obst2_off	WORD	14-15	ObstaclesOff 16 … 31	Bits 0 ...15

Table 6- 3   Overall telegram structure / trolley block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	16-17	Trolley control bits	See Table 6-11 Trolley control bits (Page 52)
Spare	WORD	18-19	Reserve	
S_act	DINT	20-23	Actual position, trolley	
S_set	DINT	24-27	Target position, trolley	
V_act	INT	28-29	Actual velocity, trolley	Normalized
V_set	INT	30-31	Set velocity, trolley	Normalized

Table 6- 4   Overall telegram structure / gantry block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	32-33	Gantry control bits	See Table 6-13 Gantry control bits (Page 56)
Spare	WORD	34-35	Reserve	
S_act	DINT	36-39	Actual position, gantry	
S_set	DINT	40-43	Target position, gantry	
V_act	INT	44-45	Actual velocity, gantry	Normalized
V_set	INT	46-47	Set velocity, gantry	Normalized

Table 6- 5   Overall telegram structure / slewing gear or hoist block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	48-49	Control bits, slewing gear/hoist	see Table 6-15 Slewing gear control bits (Page 61) and see Table 6-17 Hoist control bits (Page 66)
CTRL_BITS2	WORD	50-51	Not used	
S_act	DINT	52-55	Actual position, slewing gear/hoist	
S_set	DINT	56-59	Target position, slewing gear/hoist	
V_act	INT	60-61	Actual velocity, slewing gear/hoist	Normalized
V_set	INT	62-63	Set velocity, slewing gear/hoist	Normalized

Table 6- 6   Overall telegram structure / trailer

Name	Type	Address	Designation	Unit
Trailer	WORD	64-65	Telegram counter	

The input data interface has the following logical block structure:

Table 6- 7   Block structure

1	General data block	(length = 8 words / 16 bytes)
2	Trolley drive data	(length = 8 words / 16 bytes)
3	Gantry drive data	(length = 8 words / 16 bytes)
4	Slewing gear/hoist drive data	(length = 8 words / 16 bytes)
5	Trailer (telegram counter)	(length = 1 word / 2 bytes)

The blocks are described in more detail in the following chapters.

6.2.2   General block (16 bytes)

6.2.2.1   Input data, general block

Table 6- 8   PROFIBUS DP general block

Name	Type	Address	Designation	Unit
IF_IDNo	WORD	0-1	Interface version ID	PB_ID_NR=5150
Spare	WORD	2-3	Reserve	
CTRL_BITS	WORD	4-5	General control bits	See Table 6-9 General control bits (Page 50)
Load	WORD	6-7	Load weight	in 10 kg steps
S_Hoist	DINT	8-11	Hoist position for effective pendulum length	± mm
Obst1_off*	WORD	12-13	ObstaclesOff 0 … 15	Bits 0 ... 15
Obst2_off*	WORD	14-15	ObstaclesOff 16 … 31	Bits 0 ... 15

Note

The signals designated with * are intended for future expansions, and are deactivated in this version. The assignment in the PLC should be realized with a fixed value of zero.

IF_IDNo - interface ident number, number of the interface version

Using this value, the interface version is selected and defined using the PLC program. The program (ST) saved in SIMOTION interprets the incoming telegram corresponding to this identification number.

5150	Interface Integer, for SIMOCRANE CeSAR standalone
5151	Interface Real, for SIMOCRANE SC integrated application without basic technology
5152	Interface for SIMOCRANE SC integrated application with basic technology

The specified identification numbers are decimal numbers.

Spare - reserve

Reserved for future expansions.

CTRL_BITS - general control bits

Control bits, general block (see Chapter Control bits, general block (Page 50)).

Load - actual load

The load weight is the actually measured load value in 10 kg steps. This value can be used as basis to correct the effective pendulum length. For higher load values, the center of gravity is shifted somewhat downwards. For trolley and gantry, there is a correction factor P25 or P65 for each ("Analog correction of the effective pendulum length"). The transferred load mass results in continuous extension of the pendulum length when using these parameters in mm/kg. The parameters are defined when commissioning the system, by determining the effective pendulum length with attached load. The two correction factors P25 and P65 can be determined based on the difference of the effective pendulum lengths.

The value must be limited to the value range 0 ... 65535 (corresponding to 0 ... 655350 kg) in the crane control system to prevent counter overflows.

Note

Correction based on the load weight is only required for significantly fluctuating load changes, e.g. when transporting casting ladles in a steel plant. Not all cranes are equipped with load measuring equipment. For cases in which the load is relatively constant (e.g. coils or slabs), it is sufficient to apply a fixed offset value (mm).

S_Hoist - Hoist position for effective pendulum length

This value corresponds to the actual position of the hoist which is used as a basis to calculate the effective pendulum lengths of the drives involved. Two parameters (for each drive) are used to convert into the effective pendulum length, for the factor and the offset.

Note

The actual position of the hoist should be in mm for plausibility reasons. Only then are gain factors obtained for the calculation into the effective pendulum length of approx. 1 or approx. -1.

Obst1_off* - blocked regions off, 0 ... 15 / Obst2_off* - blocked regions off, 16 ... 31

These two control words are reserved for future expansions (detour control) and are deactivated in this version. Both words should be pre-assigned to zero in the PLC.

6.2.2.2 Control bits, general block

Table 6- 9   General control bits

Bit no.	Name	Meaning
0	Par_Set_Bit0	Switchover, parameter set bit 0
1	Par_Set_Bit1	Switchover, parameter set bit 1
2	Traj_ON*	Trajectory control ON detour control only; not available in this version)
3	Save_Logger	Save logger file
4	Load_On_Hook*	Load on the hook, take hoist offset into account (detour control only; not available in this version)
5 ... 15	Reserve	Not used

Bits 0 to 1 - Par_Set_Bit0 and Par_Set_Bit1 (switchover parameter sets)

Switchover bits from the PLC to select parameter sets 1 to 4. Also observe parameter 101.

Par_Set_Bit1	Par_Set_Bit0	Parameter set
0	0	Parameter set 1 selected
0	1	Parameter set 2 selected
1	0	Parameter set 3 selected
1	1	Parameter set 4 selected

Bit 2 – Traj_ON * (synchronization of the trolley and gantry for 2D trajectory)

Reserved for detour control (not available in this version)

Bit 3 - Save_Logger (save the actual content of the logger to MMC)

All changes to control, operating and fault bits, as well as changes to target positions, are written in a compressed form into a ring buffer. The content of the logger can be displayed using the SIMOCRANE CeCOMM diagnostic program. By activating the "Save_Logger" bit (edge controlled), the buffer content can be backed up in a file on the MMC. For example, saving the logger file to the MMC can be helpful when analyzing faults, and should only be used in exceptional cases due to the limited MMC memory size.

Note

The "Save Logger" function is for Siemens-internal use only.

Bit 4 – Load_On_Hook * – load connected to the hook

Reserved for detour control with hoist (not available in this version)

6.2.3 Trolley block (16 bytes)

6.2.3.1 Input data, trolley block

Table 6- 10   PROFIBUS DP trolley block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	16-17	Trolley control bits	See Table 6-11 Trolley control bits (Page 52)
Spare	WORD	18-19	Reserve	
S_act	DINT	20-23	Actual position, trolley	
S_set	DINT	24-27	Target position, trolley	
V_act	INT	28-29	Actual velocity, trolley	Normalized
V_set	INT	30-31	Set velocity Trolley	Normalized

CTRL_BITS - trolley control bits

Trolley control bits (see Chapter Control bits, trolley block (Page 52))

S_act - actual position, trolley

Actual position of the trolley
The actual position is only required in positioning and sway neutralization modes.
Actual position [mm] = $S\_act \cdot P5 + P6$

S_set - target position, trolley

Target position of the trolley
The target position is only evaluated in the positioning operation mode.
Target position [mm] = $S\_set \cdot P5 + P6$

V_act - actual velocity, trolley

Actual velocity of the crane control system
V_act must be transmitted from the crane control as a normalized value (see ChapterNormalization (Page 43)).
The sway control ascertains the actual velocity with V [mm/s] = $V\_act \cdot P1 : P35$.

V_set - set velocity, trolley

Specification of the set velocity as a normalized value (see Chapter Normalization (Page 43))

The sway control determines the set velocity with V [mm/s] = V_set · P1 : P35.

The direction is defined by the sign of V_set.

Relationship between the sign of V_set and the position value:

- With V_set > 0, the trolley position value must increase.
- With V_set < 0, the trolley position value must decrease.

6.2.3.2 Control bits, trolley block

Table 6- 11   Trolley control bits

Bit no.	Name	Meaning
0	Release	Enable
1	Travelling	Travel signal
2	OM_POS	Operation mode positioning
3	OM_MAN	Operation mode manual
4	OM_SC_LO	Operation mode sway neutralization load position
5	OM_SC_DR	Operation mode sway neutralization drive position
6	PLS_F	Prelimit switch forward
7	PLS_B	Prelimit switch backward
8	Stop	Controlled stop
9	Brake_closed	Output value enable
10	SC_Only_OnStop	Sway control only when stopping
11	SC_On	Activate sway control
12	DigitalLiftCorrection	Digital effective pendulum length correction
13	--	Not used
14	LS_F	Limit switch forward
15	LS_B	Limit switch backward

Bit 0 – Release (enables the trolley)

0	Drive inhibited, quick stop during travel.
1	Operation modes and the "Travelling" control bit are evaluated.

Bit 1 – Travelling (travel signal of the trolley)

0	Stop with quick stop ramp P12 without sway control.
1	Activation of the specified operation mode. The "Travelling" control bit is set at the start of a travel motion (e.g. deflection of the master controller or start of automatic travel).

Note
Resetting the "Travelling" control bit

If the operation is to be completed with sway control, the "Travelling" control bit may only be reset once the "Pos_completed" status bit has been set.

Bits 2 to 5 - OM (Operation Mode, trolley operation mode)

Note
Only one operation mode is valid.

Only one of the operation mode bits may be set.

Bit 2 - OM_POS (Operation Mode, positioning operation mode, trolley)

Bit 3 - OM_MAN (Operation Mode, manual operation mode, trolley)

Bit 4 - OM_SC_LO (Operation Mode, sway neutralization load position operation mode, trolley)

Bit 5 - OM_SC_ DR (Operation Mode, sway neutralization drive position operation mode, trolley)

0	Inactive
1	Active

Bit 6 – PLS_F (PreLimit Switch, prelimit switch forward, trolley)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 7 – PLS_B (PreLimit Switch, prelimit switch backward, trolley)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 8 – Stop (controlled stop)

0	No stop.
1	Stop with setpoint acceleration trolley P3 and sway control.

Note

Resetting control bits that are relevant to travel

With a controlled stop, all the control bits relevant to travel (Release, Travelling, Brake_closed, OM_POS, OM_MAN, SC_On, etc.) must remain set as for normal travel and must not be reset again until status bit "Pos_completed" has been set.

Bit 9 – Brake_closed (output value enable)

0	Brake is open. Output velocity and direction signals are enabled.
1	Brake is closed. Output velocity is not enabled (braking along the quick stop ramp). Direction signals are enabled.

Bit 10 – SC_Only_OnStop (sway control only when stopping)

0	Sway control always active.
1	Sway control only active when stopping.

Bit 11 – SC_On (activate sway control)

0	Do not activate sway control.
1	Activate sway control.

Bit 12 – DigitalLiftCorrection (digital correction effective pendulum length)

0	The parameter "digital correction effective pendulum length" (P24) is not used.
1	The effective pendulum length is shifted by the parameter value "digital correction effective pendulum length" (P24).

This bit is used to take into account the occasional use of cross beams, chains, cables or other load carrying devices.

Bit 13 – not used

Bit 14 – LS_F (Limit Switch Forward)

0	Actuated, quick stop during travel.
1	Not actuated.

Bit 15 – LS_B (Limit Switch Backward)

0	Actuated, quick stop during travel.
1	Not actuated.

Note

The prelimit and limit switch signals are low active (wire-break proof).

6.2.4 Gantry block (16 bytes)

6.2.4.1 Input data, gantry block

Table 6- 12   PROFIBUS DP gantry block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	32-33	Gantry control bits	See Table 6-13 Gantry control bits (Page 56)
Spare	WORD	34-35	Reserve	
S_act	DINT	36-39	Actual position, gantry	
S_set	DINT	40-43	Target position, gantry	
V_act	INT	44-45	Actual velocity, gantry	Normalized
V_set	INT	46-47	Set velocity, gantry	Normalized

CTRL_BITS - gantry control bits

Gantry control bits (see Chapter Control bits, gantry block (Page 56)).

S_act – actual position, gantry

Actual position of the gantry
The actual position is only required in positioning and sway neutralization modes.
Actual position [mm] = S_act · P45 + P46

S_set – target position, gantry

Target position of the gantry
The target position is only evaluated in the positioning mode.
Target position [mm] = S_set · P45 + P46

V_act – actual velocity, gantry

Actual velocity of the crane control system
V_act must be transmitted from the crane control as a normalized value (see Chapter Normalization (Page 43)).
The sway control ascertains the actual velocity with V [mm/s] = V_act · P41 : P75

V_set – set velocity, gantry

Specification of the set velocity as a normalized value (see Chapter Normalization (Page 43))

The sway control determines the set velocity with V [mm/s] = V_set · P41 : P75.

The direction is defined by the sign of V_set.

Relationship between the sign of V_set and the position value:

- With V_set > 0, the gantry position value must increase.

- With V_set < 0, the gantry position value must decrease.

6.2.4.2 Control bits, gantry block

Table 6- 13 Gantry control bits

Bit no.	Name	Meaning
0	Release	Enable
1	Travelling	Travel signal
2	OM_POS	Operation mode positioning
3	OM_MAN	Operation mode manual
4	OM_SC_LO	Operation mode sway neutralization load position
5	OM_SC_DR	Operation mode sway neutralization drive position
6	PLS_F	Prelimit switch forward
7	PLS_B	Prelimit switch backward
8	Stop	Controlled stop
9	Brake_closed	Output value enable
10	SC_Only_OnStop	Sway control only when stopping
11	SC_On	Activate sway control
12	DigitalLiftCorrection	Digital effective pendulum length correction
13	--	Not used
14	LS_F	Limit switch forward
15	LS_B	Limit switch backward

Bit 0 – Release (enables the gantry)

0	Drive inhibited, quick stop during travel.
1	Operation modes and the "Travelling" control bit are evaluated.

Bit 1 – Travelling (travel signal of the gantry)

0	Stop with quick stop ramp P52 without sway control.
1	Activation of the specified operation mode. The "Travelling" control bit is set at the start of a travel motion (e.g. deflection of the master controller or start of automatic travel).

Note

Resetting the "Travelling" control bit

If the operation is to be completed with sway control, the "Travelling" control bit may only be reset once the "Pos_completed" status bit has been set.

Bits 2 to 5 - OM (Operation Mode, gantry operation mode)

Note

Only one operation mode is valid.

Only one of the operation mode bits may be set.

Bit 2 - OM_POS (Operation Mode, positioning operation mode, gantry)

Bit 3 - OM_MAN (Operation Mode, manual operation mode, gantry)

Bit 4 - OM_SC_LO (Operation Mode, sway neutralization load position operation mode, gantry)

Bit 5 - OM_SC_DR (Operation Mode, sway neutralization drive position operation mode, gantry)

0	Inactive
1	Active

Bit 6 – PLS_F (PreLimit Switch Forward, prelimit switch forward, gantry)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 7 – PLS_B (PreLimit Switch Backward, prelimit switch backward, gantry)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 8 – Stop (controlled stop)

0	No stop.
1	Stop with setpoint acceleration gantry P43 and sway control.

Note

Resetting control bits that are relevant to travel

With a controlled stop, all the control bits relevant to travel (Release, Travelling, Brake_closed, OM_POS, OM_MAN, SC_On, etc.) must remain set as for normal travel and must not be reset again until status bit "Pos_completed" has been set.

Bit 9 – Brake_closed (output value enable)

0	Brake is open. Output velocity and direction signals are enabled.
1	Brake is closed. Output velocity is not enabled (braking along the quick stop ramp). Direction signals are enabled.

Bit 10 – SC_Only_OnStop (sway control only when stopping)

0	Sway control always active.
1	Sway control only active when stopping.

Bit 11 – SC_On (activate sway control)

0	Do not activate sway control.
1	Activate sway control.

Bit 12 – DigitalLiftCorrection (digital correction effective pendulum length)

0	The parameter "digital correction effective pendulum length" (P64) is not used.
1	The effective pendulum length is shifted by the parameter value "digital correction effective pendulum length" (P64).

This bit is used to take into account the occasional use of cross beams, chains, cables or other load carrying devices.

Bit 13 – not used

Bit 14 – LS_F (Limit Switch Forward)

0	Actuated, quick stop during travel.
1	Not actuated.

Bit 15 – LS_B (Limit Switch Backward)

0	Actuated, quick stop during travel.
1	Not actuated.

Note

The prelimit and limit switch signals are low active (wire-break proof).

6.2.5 Slewing gear block (16 bytes)

6.2.5.1 Input data, slewing gear block

Table 6- 14   PROFIBUS DP slewing gear block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	48-49	Slewing gear control bits	See Table 6-15 Slewing gear control bits (Page 61)
CTRL_BITS2	WORD	50-51	Not used	
S_act	DINT	52-55	Actual position, slewing gear	
S_set	DINT	56-59	Target position, slewing gear	
V_act	INT	60-61	Actual velocity, slewing gear	Normalized
V_set	INT	62-63	Set velocity, slewing gear	Normalized

CTRL_BITS – slewing gear control bits

Slewing gear control bits (see Chapter Control bits, slewing gear block (Page 61))

S_act – actual position, slewing gear

Actual position of the slewing gear
Actual position [c°] = S_act · P135 + P136

Note

If the camera and reflector are also rotated by the slewing gear, the actual position of the slewing gear will have to be communicated even if this position is not needed directly for the slewing gear. The measured sway oscillations are assigned to the trolley and gantry based on the position of the slewing gear.

In this case, an incorrect slewing gear position can also result in a malfunction of the sway control for the trolley and gantry.

S_set – target position, slewing gear

Target position of the slewing gear
The target position is only evaluated in the positioning operation mode.
Target position [c°] = S_set · P135 + P136

V_act – actual velocity, slewing gear

Actual velocity of the crane control system

V_act must be transmitted from the crane control as a normalized value (see Chapter Normalization (Page 43)).

The sway control ascertains the actual velocity with V [c°] = V_act · P131 : P165.

V_set – set velocity, slewing gear

Specification of the set velocity as a normalized value (see Chapter Normalization (Page 43))

The sway control determines the set velocity with V [mm/s] = V_set · P131 : P165.

The direction is defined by the sign of V_set.

Relationship between the sign of V_set and the position value:

- With V_set >0, the slewing gear position value must increase.

- With V_set < 0, the slewing gear position value must decrease.

6.2.5.2 Control bits, slewing gear block

Table 6- 15   Slewing gear control bits

Bit no.	Name	Meaning
0	Release	Enable
1	Travelling	Travel signal
2	OM_POS	Operation mode positioning
3	OM_MAN	Operation mode manual
4	OM_SC_LO	Operation mode sway neutralization load position
5	OM_SC_DR	Operation mode sway neutralization drive position
6	PLS_F	Prelimit switch forward
7	PLS_B	Prelimit switch backward
8	Stop	Controlled stop
9	Brake_closed	Output value enable
10	SC_Only_OnStop	Sway control only when stopping
11	SC_On	Activate sway control
12	DigitalLiftCorrection	Digital effective pendulum length correction
13	--	Not used
14	LS_F	Limit switch forward
15	LS_B	Limit switch backward

Bit 0 – Release (enables the slewing gear)

0	Drive inhibited, quick stop during travel.
1	Operation modes and the "Travelling" control bit are evaluated.

Bit 1 – Travelling (travel signal of the slewing gear)

0	Stop with quick stop ramp P142 without sway control.
1	Activation of the specified operation mode. The "Travelling" control bit is set at the start of a travel motion (e.g. deflection of the master controller or start of automatic travel).

Note

Resetting the "Travelling" control bit

If the operation is to be completed with sway control, the "Travelling" control bit may only be reset once the "Pos_completed" status bit has been set.

Bits 2 to 5 - OM (Operation Mode, slewing gear operation mode)

Note

Only one operation mode is valid.

Only one of the operation mode bits may be set.

Bit 2 - OM_POS (Operation Mode, positioning operation mode, slewing gear)

Bit 3 - OM_MAN (Operation Mode, manual operation mode, slewing gear)

Bit 4 - OM_SC_LO (Operation Mode, sway neutralization load position operation mode, slewing gear)

Bit 5 - OM_SC_DR (Operation Mode, sway neutralization drive position operation mode, slewing gear)

0	Inactive
1	Active

Bit 6 – PLS_F (PreLimit Switch Forward, prelimit switch forward, slewing)

0	Actuated, reduction of output velocity.
1	Not actuated

Bit 7 – PLS_B (PreLimit Switch Backward, prelimit switch backward, slewing gear)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 8 – Stop (controlled stop)

0	No stop.
1	Stop with setpoint acceleration slewing gear P133 and sway control.

Note

Resetting control bits that are relevant to travel

With a controlled stop, all the control bits relevant to travel (Release, Travelling, Brake_closed, OM_POS, OM_MAN, SC_On, etc.) must remain set as for normal travel and must not be reset again until status bit "Pos_completed" has been set.

Bit 9 – Brake_closed (output value enable)

0	Brake is open. Output velocity and direction signals are enabled.
1	Brake is closed. Output velocity is not enabled (braking along the quick stop ramp). Direction signals are enabled.

Bit 10 – SC_Only_OnStop (sway control only when stopping)

0	Sway control always active.
1	Sway control only active when stopping.

Bit 11 – SC_On (activate sway control)

0	Do not activate sway control.
1	Activate sway control.

Bit 12 – DigitalLiftCorrection (digital correction effective pendulum length)

0	The effective pendulum length is calculated using parameters P152 (gain) and P153 (offset).
1	The effective pendulum length is calculated using parameters P154 (gain) and P155 (offset).

This bit is used to take into account the occasional use of cross beams, chains, cables or other load carrying devices.

Bit 13 - not used

Bit 14 – LS_F (Limit Switch Forward)

0	Actuated, quick stop during travel.
1	Not actuated.

Bit 15 – LS_B (Limit Switch Backward)

0	Actuated, quick stop during travel.
1	Not actuated.

Note

The prelimit and limit switch signals are low active (wire-break proof).

6.2.6 Hoist block (16 bytes)

6.2.6.1 Input data, hoist block

Table 6- 16   PROFIBUS DP hoist block

Name	Type	Address	Designation	Unit
CTRL_BITS	WORD	48-49	Hoist control bits	See Table 6-17 Hoist control bits (Page 66)
CTRL_BITS2	WORD	50-51	Not used	
S_act	DINT	52-55	Actual position, hoist	
S_set	DINT	56-59	Target position, hoist	
V_act	INT	60-61	Actual velocity, hoist	Normalized
V_set	INT	62-63	Set velocity, hoist	Normalized

CTRL_BITS – hoist control bits

Hoist control bits (see Chapter Control bits, hoist block (Page 66))

S_act – actual position, hoist

Actual position of the hoist
The actual position is only required in positioning operation mode.
Actual position [mm] = S_act · P135 + P136

S_set – target position, hoist

Target position of the hoist
The target position is only evaluated in the positioning operation mode.
Target position [mm] = S_set · P135 + P136

V_act – actual velocity, hoist

Actual velocity of the crane control system
V_act must be transmitted from the crane control as a normalized value (see Chapter Normalization (Page 43)).
The sway control ascertains the actual velocity with V [mm/s] = V_act · P131 : P165.

V_set – set velocity, hoist

Specification of the set velocity as a normalized value (see Chapter Normalization (Page 43))

The sway control determines the set velocity with V [mm/s] = V_set · P131 : P165.

The direction is defined by the sign of V_set.

Relationship between the sign of V_set and the position value:

* With V_set > 0, the hoist position value must increase.
* With V_set < 0, the hoist position value must decrease.

6.2.6.2 Control bits, hoist block

Table 6- 17   Hoist control bits

Bit no.	Name	Meaning
0	Release	Enable
1	Travelling	Travel signal
2	OM_POS	Operation mode positioning
3	OM_MAN	Operation mode manual
4		-
5		-
6	PLS_F	Prelimit switch forward
7	PLS_B	Prelimit switch backward
8	Stop	Controlled stop
9	Brake_closed	Output value enable
10	--	-
11	--	-
12	--	-
13	Take_Over_VHoist*	Take over hoist velocity (detour control only; not available in this version)
14	LS_F	Limit switch forward (lifting)
15	LS_B	Limit switch backward (lowering)

Bit 0 – Release (enables the hoist)

0	Drive inhibited, quick stop during travel.
1	Operation modes and the "Travelling" control bit are evaluated.

Bit 1 – Travelling (travel signal of the hoist)

0	Stop with quick stop ramp P142.
1	Activation of the specified operation mode. The "Travelling" control bit is set at the start of a travel motion (e.g. deflection of the master controller or start of automatic travel).

Note

Resetting the "Travelling" control bit

If the operation is to be completed with sway control, the "Travelling" control bit may only be reset once the "Pos_completed" status bit has been set.

Bits 2 and 3 - OM (Operation Mode, hoist operation mode)

Note

Only one operation mode is valid.

Only one of the operation mode bits may be set.

Bit 2 - OM_POS (Operation Mode, positioning operation mode, hoist)

Bit 3 - OM_MAN (Operation Mode, manual operation mode, hoist)

0	Inactive
1	Active

Bit 4 and bit 5 - not used

Bit 6 – PLS_F (PreLimit Switch Forward, prelimit switch forward, hoist)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 7 – PLS_B (PreLimit Switch Backward, prelimit switch backward, hoist)

0	Actuated, reduction of output velocity.
1	Not actuated.

Bit 8 – Stop (controlled stop)

0	No stop.
1	Stop with acceleration, hoist P132.

Note

Resetting control bits that are relevant to travel

With a controlled stop, all the control bits relevant to travel (Release, Travelling, Brake_closed, OM_POS, OM_MAN, etc.) must remain set as for normal travel and must not be reset again until the status bit "Pos_completed" has been set.

Bit 9 – Brake_closed (output value enable)

0	Brake is open. Output velocity and direction signals are enabled.
1	Brake is closed. Output velocity is not enabled (braking along the quick stop ramp). Direction signals are enabled.

Bit 10 - not used

Bit 11 - not used

Bit 12 - not used

Bit 13 - Take_Over_VHoist* (take over hoist velocity)

Reserved for detour control (not available in this version)

Bit 14 – LS_F (Limit Switch Forward)

0	Actuated, quick stop during travel.
1	Not actuated.

Bit 15 – LS_B (Limit Switch Backward)

0	Actuated, quick stop during travel.
1	Not actuated.

Note

The signals of the prelimit and limit switches are low active (wire-break proof).

6.2.7 Trailer

The last two bytes are intended for a telegram counter (crane control system → SIMOTION C240 PN)

Table 6- 18   PROFIBUS DP Trailer

Name	Type	Address	Designation
Trailer	WORD	64-65	Telegram counter

The last two bytes contain a telegram counter (crane control system → SIMOTION C240 PN).

For more information, see error message E2 (Chapter List of alarm, error, and system messages (Page 159)).

6.2.8 Data from the camera

Table 6- 19   Data from the camera

Type	Name	Significance	Unit
DINT	TEL_COUNT	Telegram counter	
BOOL	CAMERA_OK	Camera supplies valid measured values	
WORD	Error_Cam	Error messages	
DINT	X_POS	Deflection in x direction	mm
DINT	V_X	Velocity in the x direction	mm/s
DINT	Y_POS	Deflection in y direction	mm
DINT	V_Y	Velocity in the y direction	mm/s
DINT	Skew	Rotation	c°
DINT	V_SKEW	Velocity of rotation	c°/s
DINT	Distance	Distance between the camera and reflector	mm

There is no direct data exchange between the camera and the PLC. The measured values of the camera (see the table) are evaluated in the sway control and are used to synchronize the mathematical oscillation model with reality. Error bits such as "camera measuring system impaired" (E10) or "camera measuring system faulted" (E11) are transferred to the PLC (see chapter List of alarm, error, and system messages (Page 159)). The camera data currently received is presented in the SIMOCRANE CeCOMM diagnostic program (screen 4).

Note

Additional information on the data exchange between the camera and the SIMOTION C240 PN can be found in the operating instructions for the SIMOCRANE CenSOR camera measuring system.

6.3 Output data

6.3.1 Overview of complete data structure

The data specified here is output data from the perspective of the sway control on the SIMOTION C240 PN. The following tables provide a complete overview of the data that is sent from the sway control to the PLC:

Data block DB2010 in the SIMATIC S7 sample project corresponds to this structure.

Table 6- 20   General block

Name	Type	Address	Designation	Unit
StateBits	WORD	0-1	Status bits, general	See Table 6-27 Status bits, general (Page 73)
ErrorBits1	WORD	2-3	Error bits 1, general	
ErrorBits2	WORD	4-5	Error bits 2, general	Reserve
CamDist	DINT	6-9	Measured distance between the camera and reflector	± mm
Reserve	DINT	10-13	Not used	

Table 6- 21   Trolley block

Name	Type	Address	Designation	Unit
StateBits	WORD	14-15	Trolley status bits	See Table 6-29 Trolley status bits (Page 75)
V_norm	INT	16-17	Output velocity, trolley	Normalized Default: 16384
V_mm_s	REAL	18-21	Output velocity, trolley	± mm/s
Deflection	INT	22-23	Pendulum deflection, trolley	± mm
S_corr	INT	24-25	Distance correction by sway control, trolley	± mm

Table 6- 22   Gantry block

Name	Type	Address	Designation	Unit
StateBits	WORD	26-27	Gantry status bits	See Table 6-31 Gantry status bits (Page 79)
V_norm	INT	28-29	Output velocity, gantry	Normalized Default: 16384
V_mm_s	REAL	30-33	Output velocity, gantry	± mm/s
Deflection	INT	34-35	Pendulum deflection, gantry	± mm
S_corr	INT	36-37	Distance correction by sway control, gantry	± mm

Table 6- 23   Slewing gear or hoist block

Name	Type	Address	Designation	Unit
StateBits	WORD	38-39	Status bits, slewing gear/hoist	see Table 6-33 Status bits, slewing gear (Page 83) and see Table 6-35 Status bits, hoist (Page 87)
V_norm	INT	40-41	Output velocity, slewing gear/hoist	Normalized Default: 16384
V_mm_s	REAL	42-45	Output velocity, slewing gear/hoist	± c°/s or ± mm/s
Skew	INT	46-47	Rotation	± c° (slewing gear) Hoist = 0 (no significance)
S_corr	INT	48-49	Distance correction through sway control, slewing gear	± c° (slewing gear) Hoist = 0 (no significance)

Table 6- 24   Trailer

Name	Type	Address	Designation	Unit
Trailer	WORD	50-51	Telegram counter	

The output data interface has the following logical block structure:

Table 6- 25   Block structure

1	General data block	(length = 8 words / 14 bytes)
2	Trolley drive data	(length = 8 words / 12 bytes)
3	Gantry drive data	(length = 8 words / 12 bytes)
4	Slewing gear/hoist drive data	(length = 8 words / 12 bytes)
5	Trailer (telegram counter)	(length = 1 word / 2 bytes)

The blocks are explained in more detail in the following sections.

6.3.2   General block (14 bytes)

6.3.2.1   Output data, general block

Table 6- 26   General block

Name	Type	Address	Designation	Unit
StateBits	WORD	0-1	Status bits, general	See Table 6-27 Status bits, general (Page 73)
ErrorBits1	WORD	2-3	Error bits 1, general	
ErrorBits2	WORD	4-5	Error bits 2, general	Reserve
CamDist	DINT	6-9	Distance measured between the camera and reflector	± mm
Reserve	DINT	10-13	Not used	

StateBits – status bits, general

See Chapter Status bits, general block (Page 73).

ErrorBits1 - error bits 1 general

See Chapter Alarm, error, and system messages (Page 157) ; Table 10-1 Error messages with error bit (Page 157)

ErrorBits2 - error bits 2 general

Not currently used. Reserve.

CamDist – distance measured between the camera and reflector

Only relevant to a version including a camera.

See the SIMOCRANE CenSOR operating instructions.

6.3.2.2 Status bits, general block

Table 6- 27   Status bits, general

Bit no.	Names	Meaning
0	PAR SET	Parameter set selection bit 0
1		Parameter set selection bit 1
2	Reserve	
3	Reserve	
4	WATCHDOG	WATCHDOG (flashing signal 200 ms)
5	PosInFixedArea*	Reserved for detour control (not available in this version)
6	WaitForNextTransition*	Next target can be entered
7	Camera_OK	Camera (SIMOCRANE CenSOR) supplies valid values
8-15	-	Not used

Bit 0 to 1 - PAR_SET_Bit0 and PAR_SET_Bit1 (parameter set selection)

PAR_SET_Bit1	PAR_SET_Bit0	Parameter set
0	0	Parameter set 1 active
0	1	Parameter set 2 active
1	0	Parameter set 3 active
1	1	Parameter set 4 active

Bit 4 - WATCHDOG (flashing signal 200 ms)

This bit can be used to monitor communication between the crane control system and the SIMOTION C240 PN in the crane control system.

Bit 5 - PosInFixedArea*

Reserved for future detour control (not available in this version)

Bit 6 - WaitForNextTransition*

Reserved for future detour control (not available in this version)

Bit 7 - Camera_OK

0	Camera error message
	Possible causes:
	• Communication
	• The reflector is not detected.
	• The reflector is located outside the visual range.
	• Pollution/dirt
1	• Camera supplies valid measured values.
	• The reflector is detected.

6.3.3 Trolley block (12 bytes)

6.3.3.1 Output data, trolley block

Table 6- 28 Trolley block

Name	Type	Address	Designation	Unit
StateBits	WORD	14-15	Trolley status bits	See Table 6-29 Trolley status bits (Page 75)
V_norm	INT	16-17	Output velocity, trolley	Normalized Default: 16384
V_mm_s	REAL	18-21	Output velocity, trolley	± mm/s
Deflection	INT	22-23	Pendulum deflection, trolley	± mm
S_corr	INT	24-25	Distance correction by sway control, trolley	± mm

StateBits – status bits, trolley

See Chapter Status bits, trolley block (Page 75).

V_norm – output velocity as normalized value

Trolley output velocity as normalized value. This value must be transferred to the drive.

V_mm_s – output velocity

Output velocity in mm/s.

Deflection – pendulum deflection

Current distance of the reflector from its home position in the direction of the trolley.

When a camera is being used, the real pendulum deflection value is measured and output. The mathematical oscillation model is calibrated with this value. Without a camera, this output returns the pendulum deflection based on the mathematical oscillation model.

S_corr – distance correction through sway control, trolley

With external position control, the S_corr value is required to form the position difference that is the input variable for the external position controller.

Position difference = target position - actual position - distance correction by sway control

Note

S_corr is transmitted from the sway control to the crane control system as an INT value. In the sample block this value is converted to a DINT value and can be further processed as a DINT value.

6.3.3.2 Status bits, trolley block

Table 6- 29 Trolley status bits

Bit no.	Name	Meaning
0	Ready	Ready for operation
1	Active	Active
2	Pos_completed	Positioning and sway neutralization completed
3	SC_completed	Sway neutralization completed
4	Travel_f	Direction of travel forward
5	Travel_b	Direction of travel backward
6	SC_IsOn	Sway control on
7-15	-	Not used

Bit 0 – ready

0	Checkback signal control bit Release (Release=0)
1	Checkback signal control bit Release (Release=1)

Bit 1 – active (trolley active)

0	The output velocity is zero.
1	The drive is active and outputs the output velocity that is currently required.

Bit 2 – Pos_completed (positioning and sway neutralization completed)

0	**Operation mode manual:**
	The set velocity is greater than zero or the output velocity is greater than the zero speed detection P19 or the sway has not been neutralized on the trolley.
	Operation modes positioning and sway neutralization:
	The position deviation is greater than the specified positioning window P9 or the sway has not been neutralized on the trolley or the output velocity is greater than the zero speed detection P19.
1	**Operation mode manual:**
	The set velocity is zero and the output velocity is less than / equal to the zero speed detection P19 and the sway has been neutralized on the trolley.
	Operation modes positioning and sway neutralization:
	The target position has been reached. The position deviation is within the specified positioning window P9 and the sway has been neutralized on the trolley and the output velocity is less than / equal to the zero speed detection P19.

Note

A minimum period of 0.5 s applies to the output velocity condition less than / equal to the zero speed detection P19 in manual operation mode with sway control. A minimum period of 1.0 s applies to output velocity less than / equal to the zero speed detection P19 and the actual position in positioning window P9 in the other operation modes with sway control.

Bit 3 – SC_completed (sway neutralization completed)

0	The pendulum deflection is greater than P33 or the pendulum velocity is greater than P34.
1	The pendulum deflection is less than P33 and the pendulum velocity is less than P34 over a period of at least 250 ms.

Bit 4 - Travel_f (travel direction forward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is greater than or equal to zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is greater than or equal to zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 5 - Travel_b (travel direction backward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is less than zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is less than zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 6 – SC_IsOn (sway control on)

0	The sway control function has been deactivated.
1	The sway control function has been activated.

Under certain circumstances, the sway control function can be deactivated even though control bit "SC_On" is set (see Chapter Operation mode manual with sway control (Page 102)).

6.3.4   Gantry block (12 bytes)

6.3.4.1   Output data, gantry block

Table 6- 30   Gantry block

Name	Type	Address	Designation	Unit
StateBits	WORD	26-27	Gantry status bits	See Table 6-31 Gantry status bits (Page 79)
V_norm	INT	28-29	Output velocity, gantry	Normalized Default: 16384
V_mm_s	REAL	30-33	Output velocity, gantry	± mm/s
Deflection	INT	34-35	Pendulum deflection, gantry	± mm
S_corr	INT	36-37	Distance correction by sway control, gantry	± mm

StateBits – status bits, gantry

See Chapter Status bits, gantry block (Page 79)

V_norm – output velocity as normalized value

Output velocity of the gantry as normalized value.
This value must be transferred to the drive.

V_mm_s – output velocity

Output velocity in mm/s.

Deflection – pendulum deflection

Current distance of the reflector from its home position in the direction of the gantry.

When a camera is being used, the real pendulum deflection value is measured and output. The mathematical oscillation model is calibrated with this value. Without a camera, this output returns the pendulum deflection based on the mathematical oscillation model.

S_corr – distance correction by sway control, gantry

With external position control, the S_corr value is required to form the position difference that is the input variable for the external position controller.

Position difference = target position - actual position - distance correction by sway control

Note

S_corr is transmitted from the sway control to the crane control system as an INT value. In the sample block this value is converted to a DINT value and can be further processed as a DINT value.

6.3.4.2 Status bits, gantry block

Table 6- 31   Gantry status bits

Bit no.	Name	Meaning
0	Ready	Ready for operation
1	Active	Active
2	Pos_completed	Positioning and sway neutralization completed
3	SC_completed	Sway neutralization completed
4	Travel_f	Direction of travel forward
5	Travel_b	Direction of travel backward
6	SC_IsOn	Sway control on
7-15	-	Not used

Bit 0 – ready

0	Checkback signal control bit Release (Release=0)
1	Checkback signal control bit Release (Release=1)

Bit 1 – Active (gantry active)

0	The output velocity is zero.
1	The drive is active and outputs the output velocity that is currently required.

Bit 2 – Pos_completed (positioning and sway neutralization completed)

0	**Operation mode manual:**
	The set velocity is greater than zero or the output velocity is greater than the zero speed detection P59 or the sway has not been neutralized on the gantry.
	Operation modes positioning and sway neutralization:
	The position deviation is greater than the specified positioning window P49 or the sway has not been neutralized on the gantry or the output velocity is greater than the zero speed detection P59.
1	**Operation mode manual:**
	The set velocity is zero and the output velocity is less than / equal to the zero speed detection P59 and the sway has been neutralized on the gantry.
	Operation modes positioning and sway neutralization:
	The target position has been reached. The position deviation is within the specified positioning window P49 and the sway has been neutralized on the gantry and the output velocity is less than / equal to the zero speed detection P59.

Note

A minimum period of 0.5 s applies to the output velocity condition less than / equal to the zero speed detection P59 in manual operation mode with sway control. A minimum period of 1.0 s applies to output velocity less than / equal to the zero speed detection P59 and the actual position in positioning window P49 in the other operation modes with sway control.

Bit 3 – SC_completed (sway neutralization completed)

0	The pendulum deflection is greater than P73 or the pendulum velocity is greater than P74.
1	The pendulum deflection is less than P73 and the pendulum velocity is less than P74 over a period of at least 250 ms.

Bit 4 - Travel_f (travel direction forward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is greater than or equal to zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is greater than or equal to zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 5 - Travel_b (travel direction backward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is less than zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is less than zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 6 – SC_IsOn (sway control on)

0	The sway control function has been deactivated.
1	The sway control function has been activated.

Under certain circumstances, the sway control function can be deactivated even though control bit "SC_On" is set (see Chapter Operation mode manual with sway control (Page 102)).

6.3.5 Slewing gear block (12 bytes)

6.3.5.1 Output data, slew block

Table 6- 32   Slewing gear block

Name	Type	Address	Designation	Unit
StateBits	WORD	38-39	Status bits, slewing gear	See Table 6-33 Status bits, slewing gear (Page 83)
V_norm	INT	40-41	Output velocity, slewing gear	Normalized Default: 16384
V_mm_s	REAL	42-45	Output velocity, slewing gear	± c°/s
Skew	INT	46-47	Rotation	± c°
S_corr	INT	48-49	Distance correction through sway control, slewing gear	± c°

StateBits – status bits, slewing gear

See Chapter Status bits, slewing gear block (Page 83).

V_norm – output velocity as normalized value

Output velocity of the slewing gear as normalized value.
This value must be transferred to the drive.

V_mm_s – output velocity

Output velocity in c°/s

Skew – rotation

Instantaneous rotation of the reflector out of the home position in c°.

When a camera is being used, the real rotation value is measured and output. The mathematical oscillation model is calibrated with this value. Without a camera, this output returns the rotation based on the mathematical oscillation model.

S_corr – distance correction by sway control, slewing gear

With external position control, the S_corr value is required to form the position difference that is the input variable for the external position controller.

Position difference = target position - actual position - distance correction by sway control

Note

S_corr is transmitted from the sway control to the crane control system as an INT value. In the sample block this value is converted to a DINT value and can be further processed as a DINT value.

6.3.5.2 Status bits, slewing gear block

Table 6- 33 Status bits, slewing gear

Bit no.	Name	Meaning
0	Ready	Ready for operation
1	Active	Active
2	Pos_completed	Positioning and sway neutralization completed
3	SC_completed	Sway neutralization completed
4	Travel_f	Direction of travel forward
5	Travel_b	Direction of travel backward
6	SC_IsOn	Sway control on
7-15	-	Not used

Bit 0 – ready

0	Checkback signal control bit Release (Release=0)
1	Checkback signal control bit Release (Release=1)

Bit 1 – active (slewing gear active)

0	The output velocity is zero.
1	The drive is active and outputs the output velocity that is currently required.

Bit 2 – Pos_completed (positioning and sway neutralization completed)

0	**Operation mode manual:**
	The set velocity is greater than zero or the output velocity is greater than the zero speed detection P149 or the sway has not been neutralized on the slewing gear.
	Operation modes positioning and sway neutralization:
	The position deviation is greater than the specified positioning window P139 or the sway has not been neutralized on the slewing gear or the output velocity is greater than the zero speed detection P149.
1	**Operation mode manual:**
	The set velocity is zero and the output velocity is less than / equal to the zero speed detection P149 and the sway has been neutralized on the slewing gear.
	Operation modes positioning and sway neutralization:
	The target position has been reached. The position deviation is within the specified positioning window P139 and the sway has been neutralized on the slewing gear and the output velocity is less than / equal to the zero speed detection P149.

Note

A minimum period of 0.5 s applies to the output velocity condition less than / equal to the zero speed detection P149 in manual operation mode with sway control. A minimum period of 1.0 s applies to output velocity less than / equal to the zero speed detection P149 and the actual position in positioning window P139 in the other operation modes with sway control.

Bit 3 – SC_completed (sway neutralization completed)

0	The rotation is greater than P163 or the pendulum velocity is greater than P164.
1	The rotation of the load is less than P163 and the pendulum velocity is less than P164 over a period of at least 250 ms.

Bit 4 - Travel_f (travel direction forward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is greater than or equal to zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is greater than or equal to zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 5 - Travel_b (travel direction backward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is less than zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is less than zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 6 – SC_IsOn (sway control on)

0	The sway control function has been deactivated.
1	The sway control function has been activated.

Under certain circumstances, the sway control function can be deactivated even though control bit "SC_On" is set (see Chapter Operation mode manual with sway control (Page 102)).

6.3.6   Hoist block (12 bytes)

6.3.6.1   Output data, hoist block

Table 6- 34   Hoist block

Name	Type	Address	Designation	Unit
StateBits	WORD	38-39	Status bits, hoist	See Table 6-35 Status bits, hoist (Page 87)
V_norm	INT	40-41	Output velocity, hoist	Normalized Default: 16384
V_mm_s	REAL	42-45	Output velocity, hoist	± mm/s
Skew	INT	46-47	Not used	
S_corr	INT	48-49	Not used	

StateBits – status bits, hoist

See Chapter Status bits, hoist block (Page 87).

V_norm – output velocity as normalized value

Output velocity of the hoist as normalized value.
This value must be transferred to the drive.

V_mm_s – output velocity

Output velocity in mm/s.

Skew – not used

Is always zero for the hoist.

S_corr – not used

Is always zero for the hoist.

6.3.6.2 Status bits, hoist block

Table 6- 35   Status bits, hoist

Bit no.	Name	Meaning
0	Ready	Ready for operation
1	Active	Active
2	Pos_completed	Positioning completed
3		Not used
4	Travel_f	Direction of travel forward
5	Travel_b	Direction of travel backward
6-15		Not used

Bit 0 – ready

0	Checkback signal control bit Release (Release=0)
1	Checkback signal control bit Release (Release=1)

Bit 1 – active (hoist active)

0	The output velocity is zero.
1	The drive is active and outputs the output velocity that is currently required.

Bit 2 – Pos_completed (positioning completed)

0	**Operation mode manual:** The set velocity is greater than zero or the output velocity is greater than the zero speed detection P149.
	Operation mode positioning: The position deviation is greater than the specified positioning window P139 or the output velocity is greater than the zero speed detection P149.
1	**Operation mode manual:** The set velocity is zero and the output velocity is less than / equal to the zero speed detection P149.
	Operation mode positioning: The target position has been reached. The position deviation is less than the specified positioning window P139 and the output velocity is less than / equal to the zero speed detection P149.

Bit 3 – not used

Bit 4 - Travel_f (travel direction forward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is greater than or equal to zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is greater than or equal to zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

Bit 5 - Travel_b (travel direction backward)

0	All operation modes
	The "Travelling" control bit is zero or an error message is pending that prevents travel.
1	Operation mode manual
	The "Travelling" control bit is set and the set velocity is less than zero.
	Operation mode positioning
	The "Travelling" control bit is set and the difference between the target position and the actual position is less than zero.

Note

Error messages that prevent travel are E3, E6, and E0 if the cause of the error is in the active parameter set.

6.3.7 Trailer (telegram counter)

The last two bytes are intended for a telegram counter.

Table 6- 36   PROFIBUS DP Trailer

Name	Type	Address	Designation
Trailer	WORD	50-51	Telegram counter

The last two bytes contain a telegram counter (SIMOTION C240 PN → crane control system).

For more information, see error message E2 (Chapter List of alarm, error, and system messages (Page 159)).

6.3.8 Data to the camera

Table 6- 37   Data to the camera (PLC → SIMOTION C240 PN → camera measuring system)

Type	Name	Meaning	Unit
DINT	S_Hoist_Cam	Hoist position for effective pendulum length The value is identical with S_Hoist (input date, general block)	mm

S_Hoist_Cam

Transferring the hoist position for effective pendulum length to the SIMOCRANE CenSOR camera measuring system facilitates faster identification of the reflector.
The value S_Hoist (input data, general block) is sent to the value S_Hoist_Cam (data to the camera).
Additional information can be taken from the documentation on the camera measuring system.

Note

The communication configuration to the camera is already completely included in the project data on the MMC provided. The information provided is only intended to provide a better understanding of the correlations.

Function description 7

7.1 General

7.1.1 Operation and characteristics

The sway control receives the pendulum deflection value from the camera measuring system. If the measuring signal fails, calculations are based on the current states of the mathematical oscillation model.

Generally, the sway control system has the following characteristics:

- Load sway is eliminated when the steady state velocity or standstill is reached.

- In positioning operation, the load only overshoots the target position by a very small amount.

You can assign parameters to the sway control system using the SIMOCRANE CeCOMM diagnostic program (see Chapter Parameter sets (Page 93)). The sway control can receive input data (e.g. control bits, setpoints) from the crane control system and transfer output data (e.g. status bits, output values) to the crane control system via the PROFIBUS interface.

Operating principle of the sway control system

The characteristic of pendulum deflection is non-periodic. Acceleration is not constant. It varies depending on the state of the oscillation model and the measured pendulum deflection. The acceleration times are approx 1.1 times the natural oscillation duration of the load oscillation (load sway). The travel operations place very low stress levels on the crane structure.

The following diagram shows the travel response during operation with sway control with a pendulum length of approx. 3.5 m:
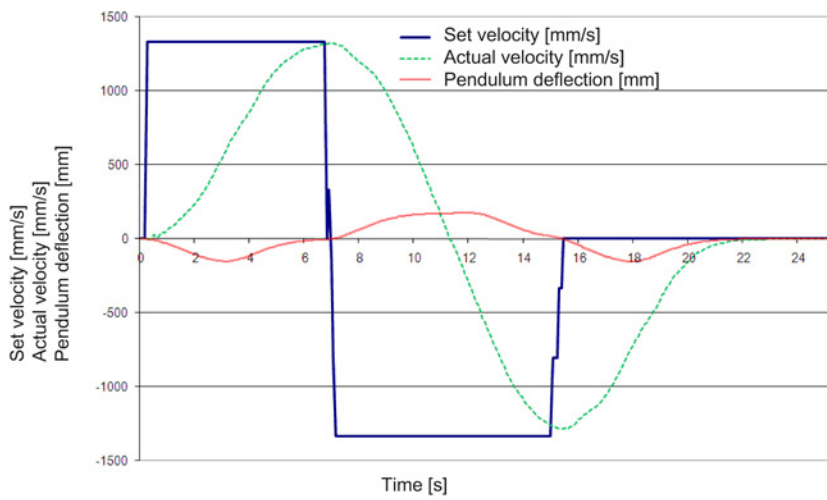
Figure 7-1   Sway control in manual operation mode

7.1.2 Parameter sets

7.1.2.1 Overview

Parameters are assigned to the sway control system using the SIMOCRANE CeCOMM diagnostic program as shown in the following overview:
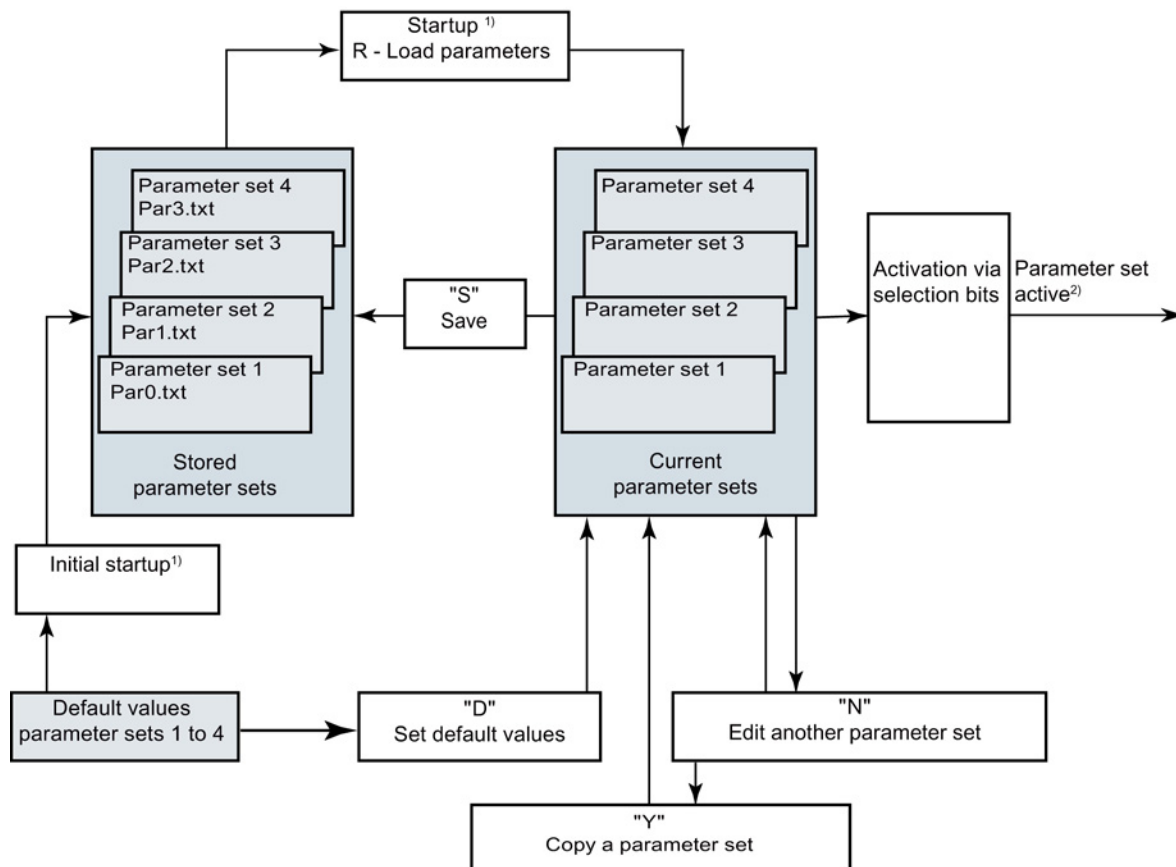
1)   ... or where a fault is detected for the relevant parameter set

2)   This parameter set is effective.

Figure 7-2   Editing parameter sets in SIMOCRANE CeCOMM

All the parameters in the parameter list are available in fours, i.e. in the form of four current parameter sets.

To be able to respond appropriately to the requirements of individual handling tasks (e.g. changes in acceleration), you can adjust the relevant parameter settings in the individual current parameter sets. In other words, you can assign four different parameter values in the four current parameter sets and switch between these sets during operation. This allows you to operate the sway control system flexibly without needing to change parameter settings.

This does not apply to parameters P80, P100, P101, P108, P110, P115, and P159 (see Chapter Changing a parameter (Page 95)). Changes to the settings of these parameters are always effective simultaneously in all four current parameter sets.

In addition to allowing processing of current parameter sets the file manager in SIMOCRANE CeCOMM also enables users to access and edit the four saved text files (parameter files).

These text files are located on the MMC of the SIMOTION C240 PN in the directory /SWAYCONTROL/.

If a parameter exceeds the specified limits when it is loaded, an error message is generated and the value of the relevant parameter is set to the default value. The error is only reset after all parameter sets have been loaded successfully.

7.1.2.2   Calling up the parameter menu

- Parameters are entered and processed via the main menu or via another display screen. The parameter menu is called by pressing "P" (see Chapter Monitoring functions (Page 149)). The parameter menu contains an overview of the parameter groups that can be displayed by page in short form with the keys "1", "2", etc.

- Parameters which are not set to their default settings are identified by a "+". When "?" and the parameter number are entered, a detailed explanation of the parameter is displayed together with the current value and the default, minimum and maximum values.

- The parameter can be changed with "C" and the parameter number. Only values in the range between the fixed minimum and maximum values can be entered for the parameter.

- If values less than 20 are input as settings for the acceleration parameters, they will be interpreted as ramp times, and made available for transfer after conversion to the corresponding acceleration values.

- Note the following:

  – Always use the parameter menu of the SIMOCRANE CeCOMM diagnostic program to edit the parameter sets because only then will a plausibility check be made and incorrectly entered values rejected.
    If you directly edit the stored text files (e.g. Par0.txt), no plausibility check is made and the entire file could be rendered unusable as a result.

  – If the acceleration parameters are set to values less than 20 directly in the text files, these will not be interpreted as ramp times but as acceleration values.

- Detailed information about the parameters is contained in Chapter Parameter list (Page 171) and the online help.

7.1.2.3   Activating a parameter set

A parameter set can be activated with the control bits "Select parameter set" (bits 0 and 1, general control bits). The relevant active parameter set is used by the control.

7.1.2.4 Editing a parameter set

"N" Edit another parameter set

Irrespective of the active parameter set, all current parameter sets can be edited with the "N" key - "Edit another parameter set." The required number must be entered and confirmed with <ENTER>. The selected parameter set is displayed in the SIMOCRANE CeCOMM diagnostic program and can then either be edited by pressing "C - Change parameter" or "Y - Copy parameter." If no parameter set is selected here then the relevant active parameter set can be edited upon exiting the parameter menu.

Note

When the parameter menu is selected only the parameter set which is active at this point can be edited. If the active parameter set changes while the parameter menu is being edited then the parameter set which was active prior to this can still be edited. The parameter set selected with the "N" key can continue to be edited until the parameter menu is exited again. The active parameter set can be edited again when the parameter set is reselected.

7.1.2.5 Changing a parameter

"C" Change parameters

The parameters of the active parameter set or of the parameter set previously selected by pressing "N - Edit another parameter set" can be changed using the "C" function.

Please note:

Changing the following parameters always affects all four parameter sets:

P80	Assignment of camera measurement direction
P100	Access code
P101	Parameter set locked during travel
P108	Pendulum length from the PLC / from the camera
P110	Language
P115	Configuration
P159	Direction of rotation of slewing gear

Once the "C" key is activated the parameter number must be entered (e.g. "1" for parameter P1) and completed with <ENTER>. The new value is then entered and confirmed twice with <ENTER>.

Changed parameters are marked with a "+" and a different font color in the displays ("1" … "12").

Note

Each parameter changed in the active parameter set is effective immediately but is not stored permanently. Changed parameters must also be saved permanently with "S" ("Save all parameter sets"). All parameter sets are saved at all times.

Note

All parameters whose setting is not absolutely necessary during commissioning and which were not therefore described explicitly in the appropriate sections should be left with their default settings and only changed where required.

7.1.2.6 Copying a parameter set

"Y" Copy parameter set

The parameter set that can be edited at this time can be copied to one of the other three current parameter sets with the "Y" - "Copy parameter set" function. The number of the target parameter set must be entered.

7.1.2.7 Loading the saved parameter sets

"R" ReLoad parameters

All saved parameter sets are loaded and the current parameter sets are therefore overwritten with the parameter sets stored in files Par0.txt bis Par3.txt. This is useful when a parameter has been changed but not saved and the previous version needs to be restored. If a parameter set is copied into the directory, the parameters must also be reloaded for updating.

The parameters are reloaded automatically upon power up.

7.1.2.8 Save all parameter sets

"S" Save all parameter sets

All current parameter sets are saved in parameter files Par0.txt to Par3.txt using this function.

Note

Each parameter changed in the active parameter set is effective immediately but is not stored permanently. Changed parameters should also be permanently saved with Save "S." All current parameter sets are saved in all cases.

7.1.2.9 Switching over parameter sets

One of the four current parameter sets can be activated via two selection bits. This enables the sway control to be operated with different parameter settings without having to change the parameter assignment.

The parameter P101 "Parameter set locked during travel" can be used to prevent the switching of parameter sets during travel.

7.1.2.10 Setting default values

"D" Set default values

The parameter settings of all current parameter sets are restored to their defaults with the "D" key.

7.1.2.11 More functions

"L" Show list of parameters

All parameters are listed.

Users can scroll through the entire list with "F2-History."
"F3-Back to Monitor" restores the monitor display.

"F" Search parameters

A search term can be entered. All parameters that contain this search term will be listed.

Note

All set values can best be documented with the functions "L-Show list of parameters," "F2-History," select (e.g. CTRL-A) and "F4-Save as ..." "F3-Back to Monitor" restores the monitor display.

7.1.3 Operation modes

7.1.3.1 Selecting the operation mode

The operation modes are selected using the corresponding control bits and these define whether the corresponding drive is manually operated, a velocity setpoint is entered or automatic travel (positioning) should be realized by entering a target position. Manual operation and positioning are in principle possible with and without sway control. However, we recommend that the positioning operation mode is only used in conjunction with sway control. Operation without sway control only makes sense for manual operation mode. You can find more detailed information on this in Chapter Operation mode manual without sway control (Page 101).

7.1.3.2 Operation mode manual

In this mode, either an individual drive can be operated, or multiple drives together. Trolley, gantry and slewing gear are operated with sway control; however, the hoist is not.

7.1.3.3 Operation mode positioning

In this mode, either an individual drive can be operated, or multiple drives together. Trolley, gantry and slewing gear are operated with sway control; however, the hoist is not.

7.1.3.4 Operation mode sway neutralization

The trolley, gantry and slewing gear drives which can be operated with sway control can also operate in the sway neutralization operation mode. Using two different control bits, it is possible to choose between the operation modes "sway neutralization load position" and "sway neutralization drive position."

We recommend that only one drive at a time be operated in this mode.

This mode can be selected only if the control bit "SC_On" (activate sway control) is set.

7.1.3.5 Fault response

If more than one operation mode per drive is simultaneously selected, then a fault message E01 is output (invalid operation mode). It is recommended that such a bit combination is avoided in the PLC from the beginning, or the fault message mentioned is evaluated with a delay.

7.1.4 Response in the limit switch

7.1.4.1 Response in the manual operation mode

The activation of a limit switch depends on the direction. If a limit switch responds then the brake is decelerating in the corresponding direction with the quick stop ramp (P12, P52, P142) without sway control. It can continue to travel unrestricted in the opposite direction.

7.1.4.2 Response in the positioning operation mode

The activation of a limit switch is independent of the direction. If a limit switch responds, the brake will decelerate with the quick stop ramp (P12, P52, P142) without sway control, irrespective of the direction of motion. The limit switch range can only be exited again if the manual operation mode is selected. The limit switches can also be enabled drive-specifically depending on the direction in positioning operation mode using parameter P97.

7.1.5 Response in the prelimit switch

7.1.5.1 Response in the manual operation mode

Reducing the velocity along a linear ramp

When a prelimit switch is triggered in the manual operation mode, the drive is braked at the deceleration rate set in parameter P14 (trolley), P54 (gantry), and P144 (slewing gear).

Using parameters P13 (trolley), P53 (gantry) and P143 (slewing gear or hoist), this value can be set as a percentage of the maximum velocity.

Braking an axis to this velocity is only possible by using a linear ramp. The sway control is then only effective in the enabled direction, and as a consequence the effect of the sway control system cannot be optimally executed.

Parameters P13, P53, and P143 are only intended for braking at the prelimit switches, and are not limited by the maximum acceleration of the particular drive P4, P44, and P134.

The hoist is braked according to the setting in parameter P132. This deceleration rate is not limited by the maximum acceleration in P134 when a prelimit switch is actuated. However the limit is applied in cases where a prelimit switch has not been actuated.

Reducing the velocity, sway controlled

If softer braking with sway control is required, e.g. if the crane working range is within the prelimit switch range, then the set velocity at the sway control (generally 10%) must be reduced in the crane control system. This may also result in a significantly increased braking distance.

This can be remedied by the provision of additional prelimit switches which are installed at a greater distance from the limit switch than the prelimit switches for operation without sway control.

Note

These prelimit switches must be used to reduce the set velocity in the crane control system. They must not be sent to the corresponding control bits in the sway control system as this would render the linear ramps operative.

If position encoders are installed then the trigger signal can also be generated via software in the crane control system. The software limit switch must be located so that when the limit switch is reached, the prelimit switch velocity has already been reached and the load sway has largely been neutralized.

7.1.5.2 Response in the positioning operation mode

In the positioning operation mode, when the prelimit switch is actuated the output velocity is reduced with sway control activated by limiting the positioning velocity to the prelimit switch velocity. Using parameters P13 (trolley), P53 (gantry) and P143 (slewing gear or hoist), this value can be set as a percentage of the maximum velocity (default 10%).

The deceleration in the prelimit switch range can be set using parameters P14 (trolley), P54 (gantry) and P144 (slewing gear). However, for control-related reasons, these are limited and only effective if the value lies between the setpoint acceleration and maximum acceleration. The setpoint acceleration level takes effect if the value is less than the setpoint acceleration level. The axis is braked with the maximum deceleration level if the value is greater than the maximum acceleration level.

The hoist is braked according to the setting in parameter P132. This deceleration rate is also limited by the maximum acceleration in P134 when a prelimit switch is actuated.

7.2   Operation mode manual

7.2.1   Operation mode manual without sway control

In manual operation mode without sway control the set velocity is specified by the crane operator. Linear acceleration or braking is then applied to this velocity. The load sway is not taken into account.

Operating in the manual operation mode without sway control has the following significance:

- The accuracy of the setpoint channel must be reviewed at the start of commissioning. The most practical approach is to do this without sway control activated; this is because in this particular case, neither the camera signal nor the correct pendulum length is required. For example, for incorrect setpoint polarities, the sway motion can be further increased in a sway-controlled mode. This situation would then only be able to be handled with an EMERGENCY STOP.

- To perform the commissioning steps, test runs are required, which are carried out with the sway control deactivated.

- Internal deactivation of the sway control function (see Chapter Operation mode manual with sway control (Page 102)) means that the travel is completed without the sway control activated.

- If the camera signal fails during regular operation (e.g. because the reflector is dirty etc.), then sway-controlled operation is still maintained. In this case, the mathematical calculation model is used instead of the camera signal.
  If the camera measuring system permanently reports error E10 "camera measuring system impaired", then after 14 s, error message E11 "Camera measuring system faulted" is generated. In this state, the sway control can only be operated based on the mathematical calculation model. The sway control must always be deactivated if the measured distance between the camera and the reflector is used to calculate the pendulum length (P108 = ON).

- If the position sensing functions for the hoist report a fault in the crane control system during regular operation, travel may only continue without the sway control active in case the value S_Hoist (hoist position for effective pendulum length) is used to calculate the pendulum length (P108=OFF).

- If operations are performed with pendulum lengths < P83, then travel only takes place with the mathematical calculation model with sway control. This state can only be maintained for a limited period, after which travel can only take place without sway control (see also Chapter Other settings (Page 138)).

7.2.2 Operation mode manual with sway control

In manual operation mode with sway control the set velocity is specified by the crane operator. The system accelerates or brakes to this velocity in such a way that the load sway is eliminated by the time the acceleration or braking operation is completed.

Activating the operation mode

The manual operation mode is activated by setting the corresponding operation mode bit at the drives (see the tables in Chapters Control bits, trolley block (Page 52), Control bits, gantry block (Page 56), and Control bits, slewing gear block (Page 61)). This operation mode can be started from all other operation modes without having to stop the drives. Hoist movements are possible while the trolley, gantry, or slewing gear are being operated with sway control and have very little effect on the quality of the sway control.

Internal deactivation of the sway control function

The sway control is internally deactivated under the following conditions (although operation is still possible without sway control):

- The "SC_On" control bit is reset.

- The activation velocity (P20, P60, P150) was not achieved.

- The "SC_Only_OnStop" control bit has been set. The sway control system is only active when stopping.

- The hoist is located outside the sway control limits (P84, P85).

- The pendulum length is not within the minimum/maximum length limits (P86, P87).

- The license is corrupt or missing.

Sway control only when stopping

- Sway control is active continuously (control bit "SC_Only_OnStop" = 0):

    The load sway is corrected during travel and is eliminated when either a constant velocity is reached or the crane stops moving.

- Sway control is active only during stopping (control bit "SC_Only_OnStop" = 1):

    The load sway is corrected only during braking and is eliminated altogether after the crane stops moving.

Note

Sway control can be activated only if control bit "SC_On" is set.

Activating/deactivating the sway control function

The sway control function can be activated or deactivated by means of control bit "SC_On." When the sway control function is deactivated, the drives accelerate and decelerate at constant rates according to the parameterized acceleration/deceleration values. The load sway is not taken into account.

The internal activation of the sway control is indicated using status bit "SC_IsOn."

The following figure shows the travel response during operation with sway control.
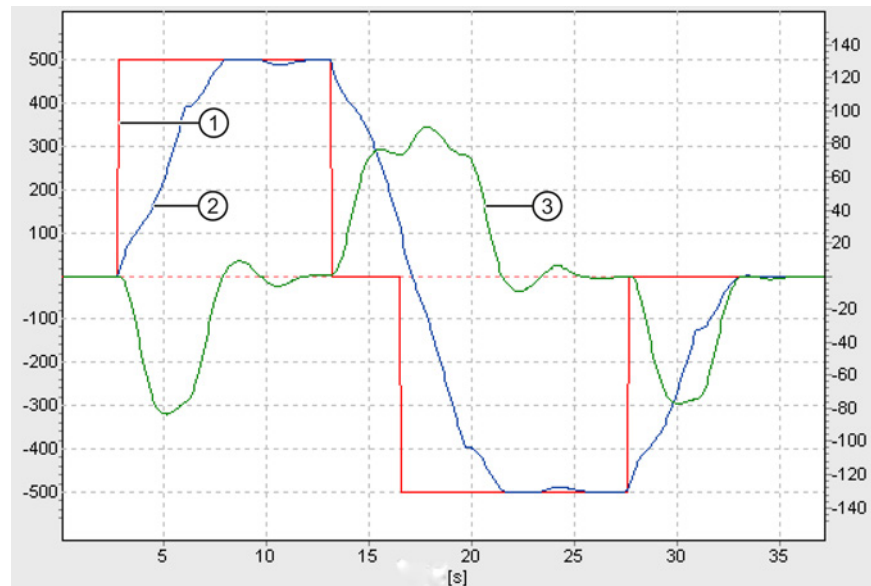
①   Set velocity
②   Output velocity
③   Deflection

Figure 7-3   Sway control in manual operation mode

Once a set velocity ① has been specified the output velocity ② begins to increase in accordance with the set acceleration rates. With this the momentary acceleration does not remain constant as it does with operation without sway control but varies in accordance with the requirements of the sway control. The sway control then works without any faults if the deflection ③ is around zero during movement with constant velocity after the acceleration is completed. The same is valid after the deceleration is completed. The deflection occurring during the acceleration phases is physically unavoidable.

Functions for optimizing travel behavior

The task of this function is to create a crane behavior with electronic sway control so that the crane operator is supported by the sway control function and does not perceive it as disturbing.

The following functions are available in manual operation mode:

- Optimum damping factors (P16, P17, P56, P57, P146, P147):
  The damping factors for the sway control are set so that there is no deceleration in the acceleration phase and no acceleration in the deceleration phase.

- Countering function:
  For opposing set velocity (master controller) and output velocity signs, the deceleration is increased in accordance with the settings in parameters P18 (P58, P148).

- No direction reversal (P89 suppress opposite direction):
  As long as the set velocity is less than the value set in P89 then any travel direction reversal that may be required by the sway control will be suppressed. In practical terms, this means, e.g.: As long as the crane operator only issues travel commands in the forward direction, the drive only moves forward. If sway control is active, the drive will perform a few short forward travel movements after stopping, to reduce oscillation.

- Reduced ramps for fine positioning:
  For small and brief master controller deflections, the acceleration and braking ramps are reduced to the values from P94 and P95. This allows the crane operator to finely position the crane. Sway motion is only excited to a low degree.

- Ramp alignment:
  The ramps for operation without sway control are set so that the acceleration and braking times are similar to those in operation with sway control.

7.3 Operation mode positioning

In the positioning operation mode, a specified target position can be approached automatically with sway control for the trolley, gantry, and slewing gear drives.

In a configuration with hoist, a target position can also be approached automatically (without sway control) for the hoist.

Load sway is eliminated both when positioning velocity is reached and on completion of the positioning operation.

Control bit "OM_POS" is set to activate the positioning operation mode. Positioning starts when the "Travelling" control bit is activated.

The positioning operation can be interrupted at any time by setting the control bit "Stop" (controlled stop). The relevant drive stops with sway control.

The positioning operation can also be interrupted by resetting the "Travelling" control bit. This means that the drive stops along the quick stop ramp without sway control.

The permissible positioning range can be set using the "Minimum position" parameters (P7, P47, P137) and the "Maximum position" parameters (P8, P48, P138). Positioning outside this range is not possible.

7.4 Operation mode sway neutralization load position

The sway neutralization load position operation mode (only for the version with camera) is used to eliminate sway motion of the load from standstill.

The sway neutralization load position operation mode is the same as the positioning operation mode except for the fact that the target position is specified internally and corresponds to the position of the load at the moment the "Travelling" control bit is set when the operation mode is activated.

Calculation of the load position:
Load position = actual position of the drive + pendulum deflection

Sway neutralization results in slight travel movements on both sides of the target position. The signal sequence corresponds to that of positioning.

This operation mode exists for all sway-controlled drives.

Control bit "OM_SC_LO" is set to activate the sway neutralization load position operation mode.

7.5 Operation mode sway neutralization drive position

"Sway neutralization drive position" operation mode (only for the version with a camera) is used to eliminate sway motion of the load from standstill.

The sway neutralization drive position operation mode is the same as positioning operation mode except that the target position is specified internally and corresponds to the actual position of the drive at the moment the "Travelling" control bit is set when the operation mode is activated.

Load sway results in slight travel movements to both sides of the target position. The signal sequence corresponds to that of positioning.

This operation mode exists for all sway-controlled drives.

Control bit "OM_SC_DR" is set to activate the sway neutralization drive position operation mode.

Commissioning 8

8.1 Commissioning prerequisites

8.1.1 General

Commissioning of the drive system and all safety functions of the crane must be performed, especially limit trips, safety interlocks, EMERGENCY STOP functions and centrifugal switch and these must be functional.

8.1.2 Load measurement

If tests are conducted with load, then the load measuring equipment must also function perfectly. In principle, commissioning of the sway control system can be performed completely without load, with the exception of the digital and analog correction of the effective pendulum length; the reason for this is that the load is required as input variable here.

After completing the commissioning test runs, it is recommended that all of the operation modes used in practice are conducted with load.

8.1.3 Position sensing

The position sensing functions for the drives, generally implemented in the crane control system, and the corresponding limit monitoring must function (see Chapter Sensing and monitoring the position actual values (Page 35)).

8.1.4 Sway control components

All components of the system must be installed, connected, functional, and interconnected.

A functioning SIMATIC S7 configuration (crane control without sway control) must be provided.

8.2 Preparing commissioning

8.2.1 Preparing the PLC program

1. Configuring the hardware, integrating the SIMOTION C240 PN as a slave in an existing PLC crane project (see Chapter Hardware configuration in SIMATIC S7, integration into S7 project (Page 31)).

2. Configuring the PROFIBUS I/O (defining inputs and outputs in HW Config);
   see Chapter Hardware configuration in SIMATIC S7, integration into S7 project (Page 31))

3. Copying the SIMATIC S7 sample blocks to the PLC crane project and creating the configured addresses at the receive and send blocks "SC_SEND_INT" and "SC_RECEIVE".

4. Interconnecting the input and output pins at the FC block "SC_COMMON" and "SC_AXIS_INT".
   FC "SC_AXIS_INT" can be called a multiple number of times. The "Axis" input is used to define the drive.
   1 = trolley
   2 = gantry
   3 = slewing gear or hoist (only one of the two drives can be used.)
   Inputs that are not relevant must be assigned a fixed value.

8.2.2 Preparing the converter

8.2.2.1 Converter parameter sets

The setpoints in the converters must be set differently for operation with the sway control system than in conventional operation.

This is achieved using two different parameter sets:

- The first parameter set is used for the conventional crane control. The normal acceleration and deceleration ramps must be set there.

- The second parameter set is used for operation with the sway control system. In this case, the sway control system specifies the ramps. The parameters are set as described in the following sections (see Acceleration and deceleration ramps (Page 109); Initial and final rounding (Page 109)).

8.2.2.2 Acceleration and deceleration ramps

The internal acceleration and deceleration ramps of the converters must be set to the lowest permissible acceptable values (according to the specification of the manufacturer or end customer) for the drives and mechanical components.
These extreme ramps never become effective in normal operation. They work as protective ramp function generators in the event that there are commissioning faults or other functional errors.

Note

Acceleration and deceleration ramps that are excessively long can result in increasing oscillation.

⚠️**CAUTION**

Risk of injury and potential material damage due to unexpected movements of the crane

Unexpected jerking movements may occur during operation with sway control.

These can cause injury to unprotected persons. Damage might also be caused to unprotected objects.

- Protect yourself against unexpected movements (e.g. by wearing a safety harness or standing in a secure position).
- Secure freely movable objects to prevent them from slipping.

8.2.2.3 Initial and final rounding

The velocity characteristic is defined by the sway control system. Deactivate the initial and final rounding functions to prevent falsification of this velocity curve and the consequent reduction in sway control quality.

Note

Excessive rounding in the converter can cause sway!

8.2.2.4 Minimum converter frequency

To be able to eliminate small levels of oscillation after stopping, set the minimum frequency of the converter to 1 Hz or lower.

Note

A minimum frequency that is set too high may result in unwanted residual oscillations.

8.2.2.5 Speed controller of the converter

To achieve the best possible control response, activate the internal speed control of the converter.

Make the following settings:

- Proportional component

- I component

Note

When setting the speed controller, make sure that the ramp response exhibits the lowest possible level of overshoot.

8.2.2.6 Velocity limits

Where velocity needs to be limited then this limit must also be effective in the sway control system.

To implement this limit, proceed as follows, depending on the operation mode:

- Operation mode manual:
  Limitation of the set velocity V_set in the crane control system

- Operation mode positioning:
  Reduction of the positioning velocity (parameter P0) by means of parameter set switchover in the sway control system.

- Valid for all operation modes:
  Use of prelimit switch function (see Chapter Response in the prelimit switch (Page 99))

Note

Limits on the output velocities outside the sway control (e.g. in the drive) can impair the function of the sway control and result in a following error and are therefore not permissible.

8.2.2.7 Check of the control response

The control response is checked based on the actual velocity measured for the drives.

If this value is available in the crane control system (e.g. from the frequency converter), the value must be transmitted to the sway control (input V_act) as a normalized value. It is provided for diagnostic purposes and is not used from a closed-loop control perspective. The value can be used to compare the actual velocity (crane control system) with the set velocity (SIMOTION C240 PN). Both values can be recorded with the SIMOCRANE CeCOMM diagnostic program.

The intention is for the characteristic of the output velocity (return value from the SIMOTION C240 PN) to match the actual drive velocity as closely as possible. The functionality of the sway control cannot be guaranteed in the event of larger deviations.

Note

Internal calculation of the actual velocity

The internal calculation of the actual velocity is used from the moment the SIMOTION C240 PN powers up until the input "V_act" has a value that is not equal to zero. The internal calculation is deactivated after this and "V_act" is used as the actual velocity until the next power-up.

8.2.3 Preparing the SIMOCRANE CenSOR camera measuring system

Commissioning and diagnosis of SIMOCRANE CenSOR is possible with a Web browser. Please refer to the camera measuring system documentation for additional details.

8.3 Configuring the sway control system

8.3.1 Overview

Parameters are assigned to the sway control system using the SIMOCRANE CeCOMM diagnostic program.

The parameters are stored in parameter sets. Detailed information on using the parameter sets can be found in Chapter Parameter sets (Page 93).

You will find information about the parameters in Chapter Parameter list (Page 171).

8.3.2 General requirements

The following preconditions must be fulfilled before the sway control system can be commissioned:

1. All components of the system (camera, reflector) must have been installed, connected, be functional and interconnected.

2. The SIMOCRANE CeCOMM diagnostic program must have been installed and started. The commissioning PC and the SIMOTION C240 PN must be connected (see Chapter SIMOCRANE CeCOMM diagnostic program (Page 145)).

3. All communication addresses must be set (see Chapter Setting addresses (Page 154)).

4. Checking communication between the crane control system and the SIMOTION C240 PN.

5. Commissioning of the SIMOCRANE CenSOR camera measuring system must have taken place and the communication to the SIMOTION C240 PN must have been checked.

8.3.3 Setting the access code

The access code determines which parameters are displayed with keys "1" to "8" in the SIMOCRANE CeCOMM parameter menu and which parameters can be edited with the "C" (Change parameters) command.

The access code can be set with parameter P100.

The following settings are possible:

● Access code 1: Every user (crane operator, maintenance personnel)

● Access code 2: Commissioning engineer

● Access code 3: Service technician

● Access code 4: Development engineer

The relevant access code for each parameter is stated in the parameter list (see Chapter Parameter list (Page 171)).

The meaning of this access code information is as follows:

● Access code 1: This parameter is displayed whenever P100 is set to access code 1, 2, 3 or 4.

● Access code 2: This parameter is displayed when P100 is set to access code 2, 3 or 4.

● Access code 3: This parameter is displayed when P100 is set to access code 3 or 4.

● Access code 4: This parameter is displayed when P100 is set to access code 4.

The message "No authorization!" appears when an attempt is made to change a parameter that does not correspond to the access code.

If you want to be able to edit all parameters, set parameter P100 to 4.

Note

The access code does not influence the display in the parameter files (Par0.txt to Par3.txt), "L" Show list of parameters, "Y" Copy parameter set, "D" Set default values, "F" Search parameters, "S" Save all parameter sets, "R" Reload parameters.

8.3.4 Setting the language

Select a language via the menu "Options / Language" in the CeCOMM diagnostic program. German and English are available.

The appropriate language file is then automatically opened and read. The screen displays are updated.

8.3.5 Check of the crane control ⟷ sway control system interface

Figure 8-1   Monitor function, display screen 2 "Interface"

Check the communication link between the crane control system and the sway control system with the SIMOCRANE CeCOMM diagnostic program. This includes checking whether data is being properly exchanged and whether the correct data formats and content are being used.

The actual input and output data of the sway control system are displayed on the display screen 2 "Interface". Refer to the interface description to check that these data are correct (see Chapter Interface description (Page 45)).
Note that the values of the send and receive counters (sent / received) on display screen 2 must increase. This is a precondition of all subsequent steps because it means that the sway control system is receiving and sending data telegrams.

8.3.6 Checking the communication with the camera measuring system

You will need the measured values of the camera in order to complete the following commissioning steps.

This is conditional upon successful commissioning of the SIMOCRANE CenSOR camera measuring system (see Chapter Preparing the SIMOCRANE CenSOR camera measuring system (Page 111)).

Then check the communication link between the SIMOCRANE CenSOR camera measuring system and the SIMOTION C240 PN as described below:

1. Open display screen 4 in the SIMOCRANE CeCOMM diagnostic program.

2. Note that incrementation of the receive counter reading is an essential requirement because this indicates that the SIMOTION C240 PN is correctly receiving data from the camera.

3. Check the "Status" display:
   "Status OK" indicates that the reflector has been detected.

4. Check that the IP address of the camera is correctly set in the SIMOTION C240 PN in commissioning step 7 (Change communication addresses).

Note

Incorrect setting of the communication address in the SIMOTION C240 PN is not detected immediately, but would have only an indirect effect, i.e. if the wrong hoist height information is transmitted because the communication link is not functional in the send direction.

Note

If the version with camera is used, then the camera must be activated using configuration parameter P115 (default setting).
If the camera has been deactivated using configuration parameter P115, the display screen 4 depicted below will not be displayed.

```
SIMOCRANE CeCOMM
File  View  Options  Calculations  Help
 COM1    192.168.1.158  192.168.1.155

Monitor  Explorer  Diagram  Webbrowser  Telnet  Effective pendulum Length
    F2-History      F3-Return to Monitor
                  * OHBC, Gantry crane - Camera[4] PS1 *
         -----------------------------------------------------------------
         |                                  |   GANTRY
         |                                  |   Deflection camera      4 mm
         |                                  |   Deflection model       0 mm
         |                                  |   PD velocity camera     0 mm/s
         |                                  |   Boosting (P61)         10 %
      G  |                                  |
      A  |                                  |   TROLLEY
      N  |                                  |   Deflection camera      1 mm
      T  |                +                 |   Deflection model       0 mm
      R  |                                  |   PD velocity camera     0 mm/s
      Y  |                                  |   Boosting (P21)         10 %
         |                                  |
         |                                  |   SLEWING GEAR
         |                                  |   Rotation camera       30 c°
         |                                  |   Rotation Modell        0 c°
         |                                  |   PD velocity camera    40 c°/s
         |                                  |   Boosting (P151)        5 %
         -------------------<TROLLEY>--------------------------------------
      State   OK            Distance    2357 mm
      Fault   ----.----     Fault rate     0 %        Received   119575
         -----------------------------------------------------------------
                                                               >> .

      TCP 192.168.1.158      T   V 4.4.2 / 5.15                Diag515_engl.ini
```
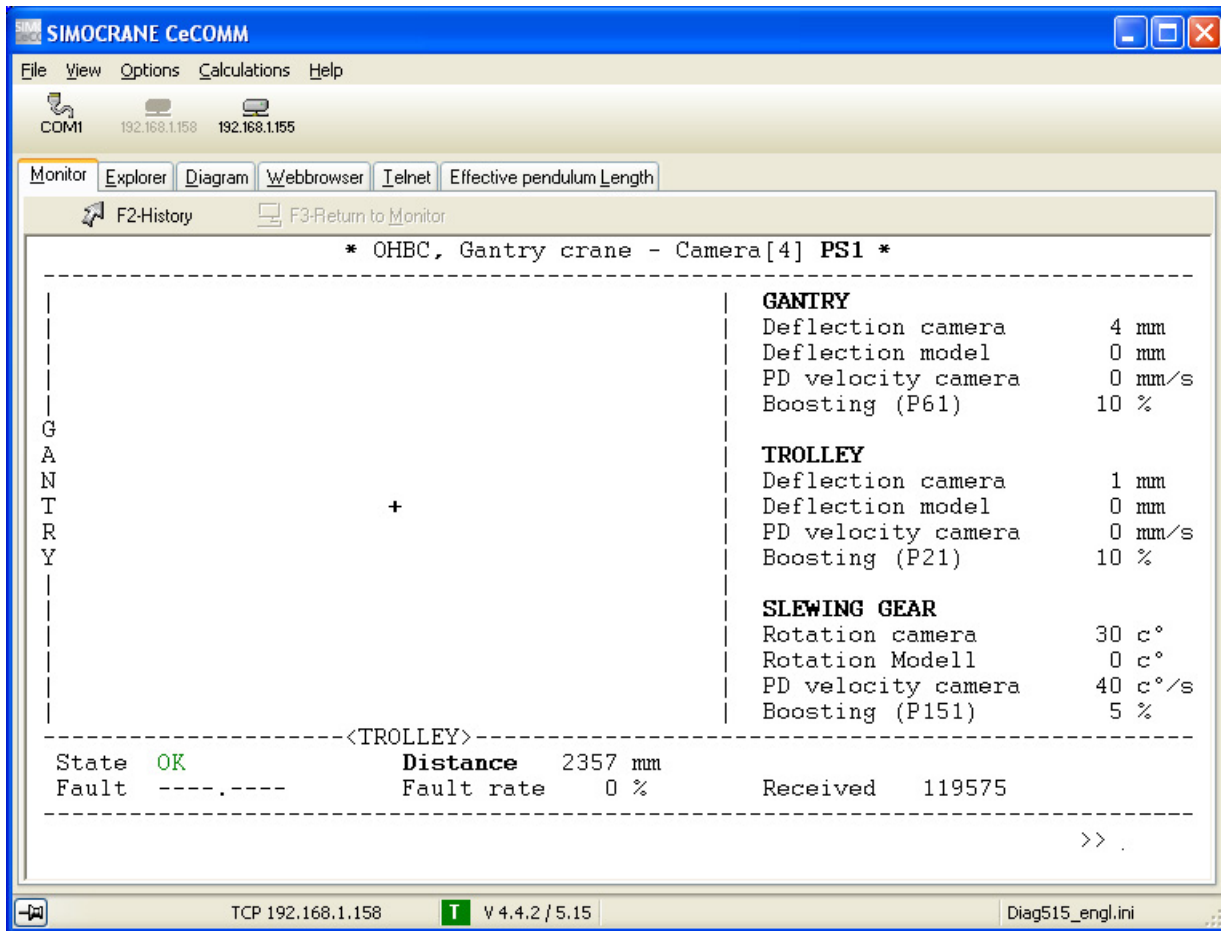
Figure 8-2   Monitor function, display screen 4 "Camera"

8.4 Operation mode manual without sway control

8.4.1 Preparation – first steps

For safety-related reasons, we recommend that the system is initially commissioned with the sway control deactivated. For this purpose, set the drive-specific control bit "SC_On" temporarily to zero in the crane control system.

After you have completed commissioning step 0 (configuration and setting important parameters) or manually setting all required parameters, you can carry out a test run without sway control with the load carrying device in the upper hoist position.

At the same time, activate the trace function in the SIMOCRANE CeCOMM diagnostic program. Using the trace as a reference, you can check whether the signal sequence of the input and output data is correct. Display screen 3 "Status of drives" is helpful at this stage (monitor display in the SIMOCRANE CeCOMM).

Pay attention to the following signal exchange between the sway control system and the crane control system:

- Setting of the operation mode in the crane control system
- Setting – resetting the "Travelling" control bit in the crane control system,
- Transfer of the set velocity V_set,
- Brake control with the "Travel_f" or "Travel_b" status bits (direction signals) in the crane control system
- Output velocity V_norm output,
- Comparison of the actual velocity V_act with the output velocity V_norm
  Linear ramps can be compared at this point. Depending on the manufacturer, it may also make sense to record a trace in the converter.

If the signal exchange is correct, you can continue commissioning.

8.4.2 Commissioning steps in the commissioning menu

8.4.2.1 Procedure

The commissioning steps in the SIMOCRANE CeCOMM diagnostic program are described below.

Start as follows:

1. Launch the SIMOCRANE CeCOMM diagnostic program.

2. Open the commissioning menu by selecting key "I" in the main menu or on the display screens.

3. Carry out the commissioning steps in exactly the sequence specified.
   Start with step "0."
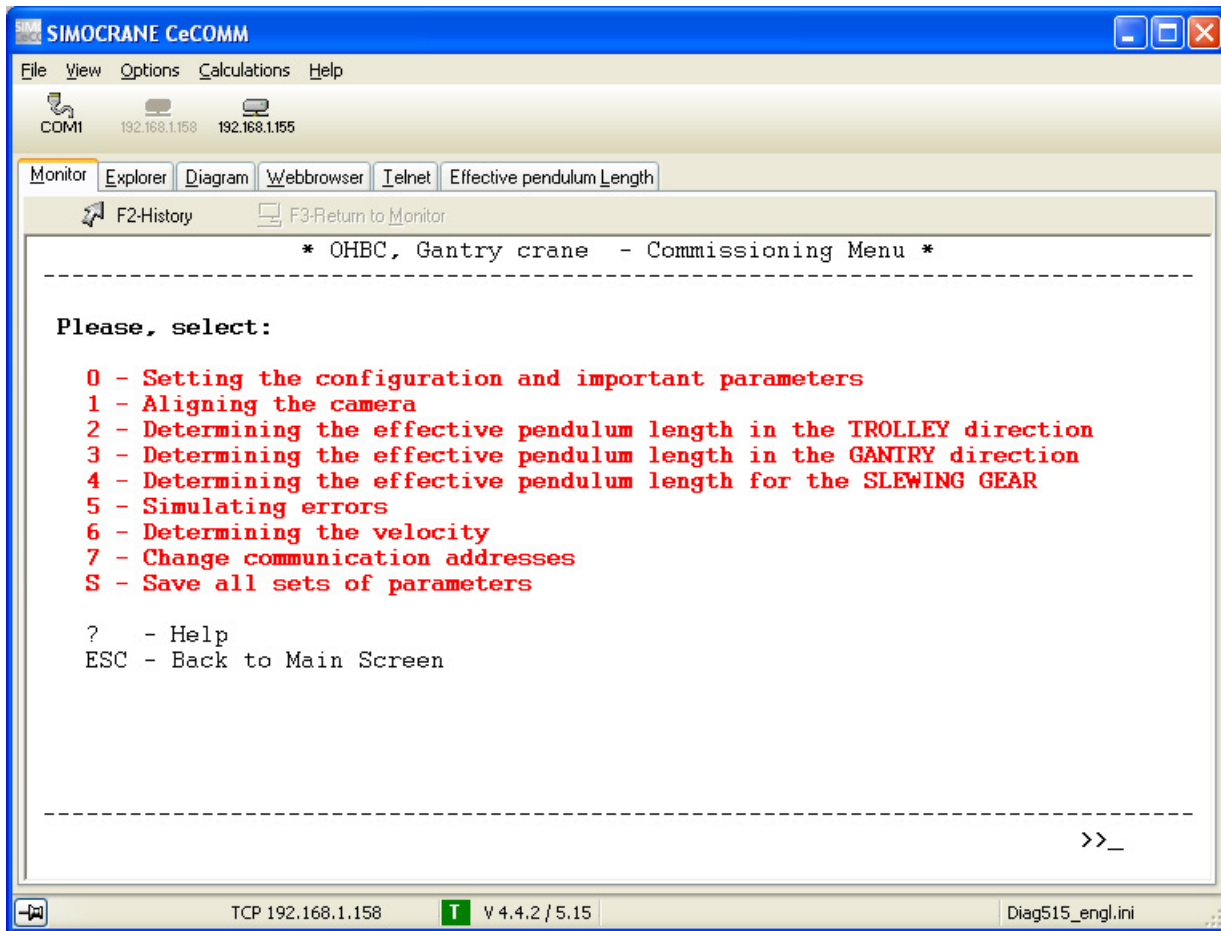
Figure 8-3   Overview of commissioning steps

Note

The parameters ascertained during the commissioning steps are saved in all four parameter sets upon takeover.

The successful completion of a commissioning step is identified by a "+".

After the commissioning steps have been performed successfully, it is no longer necessary to set these parameters manually.

Note

Individual steps can be omitted depending on the configuration.

8.4.2.2 Step 0: Setting the configuration and important parameters

In this commissioning step, the following parameters are successively called automatically and must be set correctly.

The parameters listed in the table below are called only if the camera and positioning mode have been activated with parameter P115 (default). Fewer parameters might be called depending on the setting of this parameter.

Table 8- 1   Parameters called with P115 set to default

No.	Parameter	Designation
1	P115	Configuration
2	P85	Lower limit for sway control
3	P87	Maximum pendulum length
4	P35	Normalization value, trolley
5	P1	Maximum output velocity, trolley
6	P13	Prelimit switch velocity, trolley
7	P14	Deceleration prelimit switch, trolley
8	P2	Acceleration without sway control, trolley
9	P3	Set acceleration, trolley
10	P4	Maximum acceleration, trolley
11	P12	Quick stop ramp, trolley
12	P0	Positioning velocity, trolley
13	P7	Minimum position for positioning, trolley
14	P8	Maximum position for positioning, trolley
15	P75	Normalization value, gantry
16	P41	Maximum output velocity, gantry
17	P53	Prelimit switch velocity, gantry
18	P54	Deceleration prelimit switch, gantry
19	P42	Acceleration without sway control, gantry
20	P43	Set acceleration, gantry
21	P44	Maximum acceleration, gantry
22	P52	Quick stop ramp, gantry
23	P40	Positioning velocity, gantry
24	P47	Minimum position for positioning, gantry
25	P48	Maximum position for positioning, gantry

Table 8- 2   Parameters called when hoist is selected (with P115)

No.	Parameter	Designation
26	P165	Normalization value, hoist
27	P131	Maximum output velocity, hoist
28	P143	Prelimit switch velocity, hoist
29	P132	Acceleration, hoist
30	P134	Maximum acceleration, hoist
31	P142	Quick stop ramp, hoist
32	P130	Positioning velocity, hoist
33	P137	Minimum position for positioning, hoist
34	P138	Maximum position for positioning, hoist
35	P108	Pendulum length from the PLC / from the camera

Table 8- 3   Parameters called when slewing gear is selected (with P115)

No.	Parameter	Designation
26	P165	Normalization value, slewing gear
27	P131	Maximum output velocity, slewing gear
28	P143	Prelimit switch velocity, slewing gear
29	P144	Deceleration prelimit switch, slewing gear
30	P132	Acceleration without sway control, slewing gear
31	P133	Set velocity, slewing gear
32	P134	Maximum acceleration, slewing gear
33	P142	Quick stop ramp, slewing gear
34	P159	Direction of rotation of slewing gear
35	P130	Positioning velocity, slewing gear
36	P137	Minimum position for positioning, slewing gear
37	P138	Maximum position for positioning, slewing gear
38	P88	Relation between the camera and reflector
39	P108	Pendulum length from the PLC / from the camera

8.4.2.3 Step 1: Aligning the camera

Note

You cannot start this commissioning step until the residual sway is close to zero.

If the configuration includes slewing gear, it must be in the zero position.

This commissioning step senses the main direction of oscillation and the sign of the beginning deflection. The assignment of the trolley or gantry direction to the camera x or y measured value and its sign are determined from this information (see description of parameter P80 in Chapter General parameters (Page 212)).

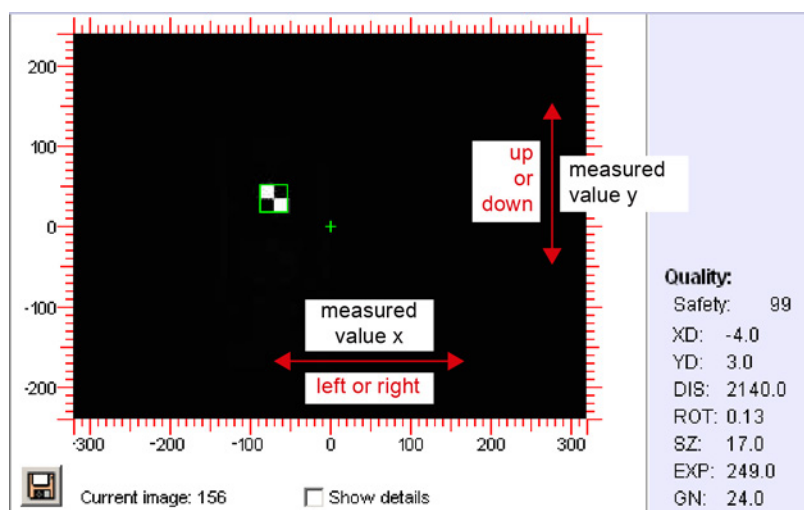Figure 8-4   Camera image when using the SIMOCRANE CenSOR camera measuring system

If there is a gantry with sway control in addition to the trolley then this commissioning step must be carried out twice.

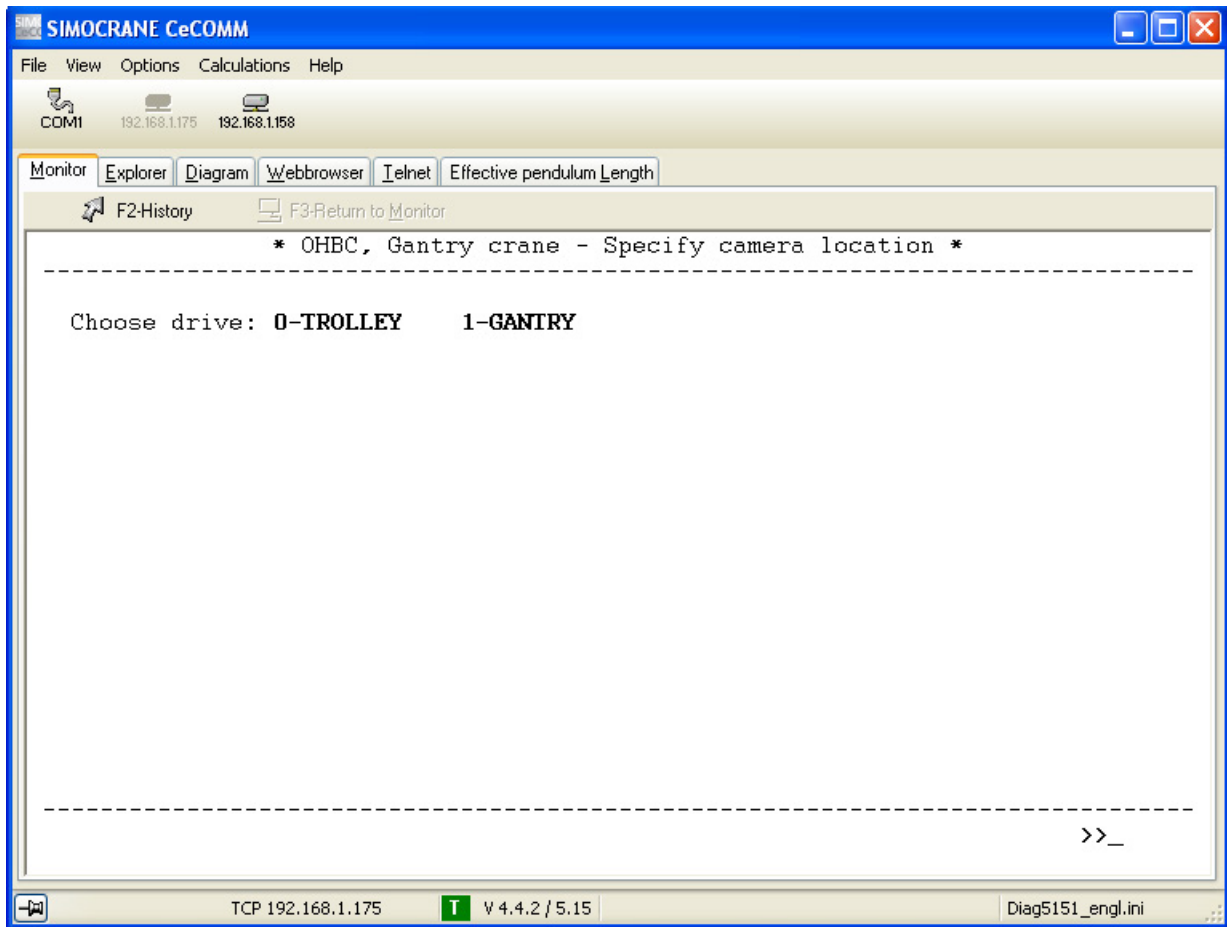A corresponding query is made at the start of the commissioning step:

Figure 8-5   Selecting the drive

Save the result of this assignment of the camera axes to drives in parameter P80.

8.4.2.4 Step 2: Determine parameters of effective pendulum length in the trolley direction

A camera must be used for this commissioning step.

The gain and offset (P22, P23) are determined for the purposes of determining the effective pendulum length.

Depending on P108 either the value "S_Hoist" (Block general) or the value "Distance" (data from the camera) are used for the calculation.

This is determined with two oscillation measurements at different heights.

Without a camera it is not possible to detect any deflection; this means that commissioning steps 2 to 4 (determine parameters of eff. pendulum length...") are hidden. The parameters must be manually determined by counting the number of oscillations during a specific time interval. The SIMOCRANE CeCOMM diagnostic program ("Effective pendulum length" tab) provides good support here.

When determining this parameter, it is recommended that you be online with the SIMOTION C240 PN. Otherwise, the hoist position values must be manually entered and the results documented.

The individual steps in the table are self-explanatory, and are each confirmed with <ENTER> after execution. After all of these steps have been completed, the calculated values can be transferred to the system with "F5 – send values" and saved in the relevant parameters. It must be noted that the oscillations are counted from zero and that the count starts at a turning point (at maximum deflection).

8.4.2.5 Step 3: Determine the parameter effective pendulum length in the gantry direction

A camera must be used for this commissioning step. Otherwise, this commissioning step (counting the oscillations) must be performed using the SIMOCRANE CeCOMM diagnostic program ("Effective pendulum length" tab).

The gain and offset (P62, P63) are ascertained for the purposes of calculating the effective pendulum length.

Depending on P108 either the value "S_Hoist" (Block general) or the value "Distance" (data from the camera) are used for the calculation.

This is determined with two oscillation measurements at different heights.

Note

If the measurement for the gantry direction was not completed (P62=0; P63=0) then the parameters of the trolley direction are used.

If the configuration includes slewing gear, the slewing gear must be in the zero position while commissioning steps "2" and "3" are performed.

8.4.2.6 Step 4: Determine the parameter effective pendulum length, slewing gear

The SIMOCRANE CenSOR camera measuring system is required to complete this commissioning step automatically.

Otherwise, this commissioning step (counting the oscillations) must be performed using the SIMOCRANE CeCOMM diagnostic program ("Effective pendulum length" tab).

The gain and offset (P152, P153) are ascertained in calculating the effective pendulum length.

Depending on P108 either the value "S_Hoist" (Block general) or the value "Distance" (data from the camera) are used for the calculation.

The calculation is made with two skew measurements at different heights.

Depending on the load condition, control bit "DigitalLiftCorrection" can be used to apply other values for gain and offset. To do this, the commissioning step must be carried out once again under the load conditions applicable when the control bit "DigitalLiftCorrection" is set. The results for gain and offset are automatically entered into P152 and P153 once again, so note the original values beforehand. These results must then be entered manually into parameters P154 and P155 and the original values entered into P152 and P153.

8.4.2.7 Step 5: Simulating errors

All error bits of the sway control system can be simulated in this step in order to check the error evaluation in the crane control system.

The relevant bits can be found in the error list (see Table 10-1 Error messages with error bit (Page 157)).

Note

Simulated errors are not entered in the error history.

8.4.2.8 Step 6: Check the velocity

The maximum output velocity can be checked with this step. It requires the crane control system to send current actual distance values which can be converted into millimeters in the sway control where necessary.

This step is performed by moving the drives individually with maximum velocity in manual operation mode.

The maximum actual velocity produced at the maximum output velocity is determined from the output velocity at the converter and the change in the actual distance value each time. The determined velocity can be transferred into the parameter for the maximum output velocity of the drive (P1, P41 and P131).

The set velocity for the positioning operation mode can also be transferred to the parameters for the relevant drive (P0, P40, and P130) and is 90% of the maximum output velocity.

8.4.2.9   Step 7: Change communication addresses

You can change the communication addresses in the screen illustrated below (see also Chapter Setting addresses (Page 154)).
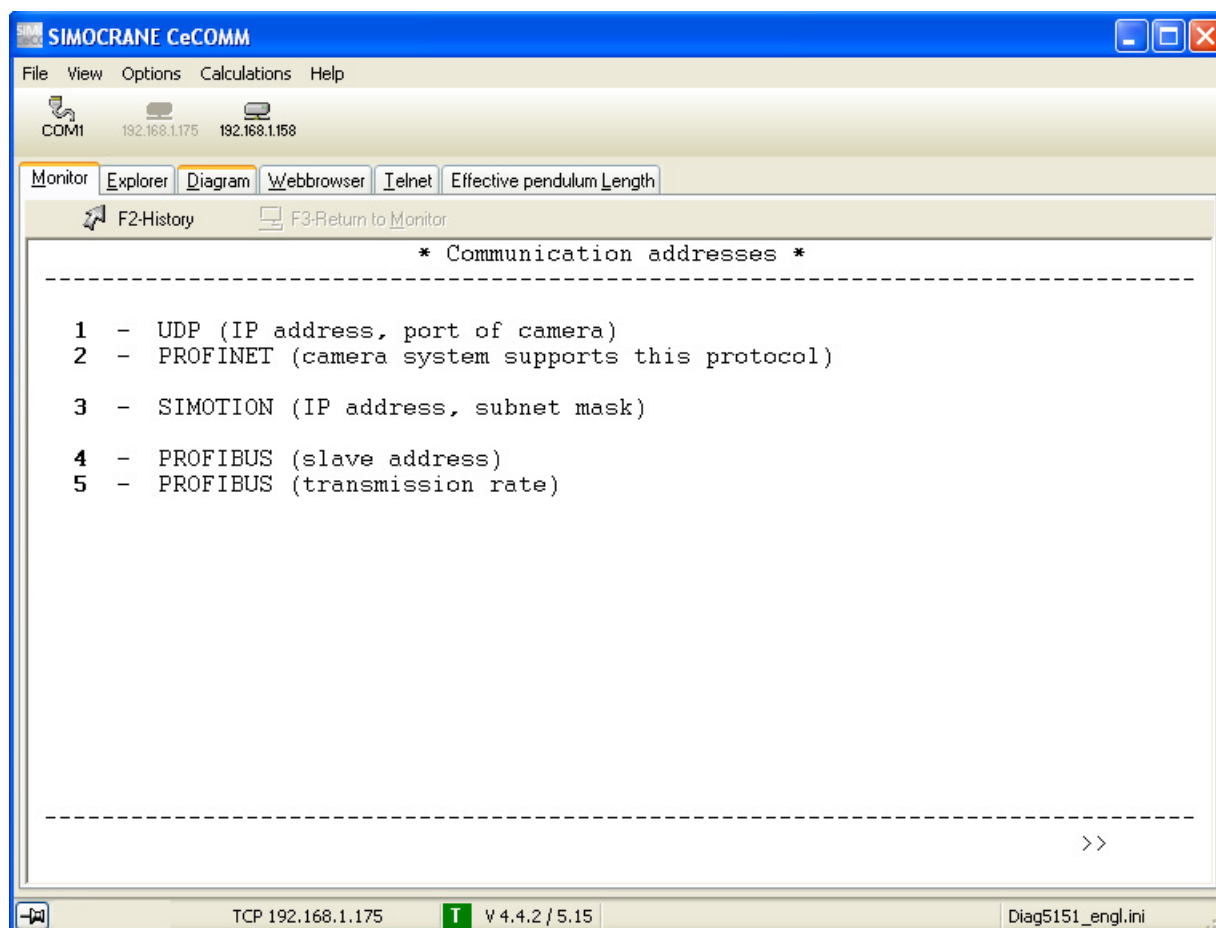

Figure 8-6   Changing the communication address

8.4.2.10   Step S: Save all parameter sets

All parameter sets are saved.

8.5 Operation mode manual with sway control

8.5.1 Preparation

Once you have completed all the commissioning steps, proceed as follows to activate sway control:

● Set the "SC_On" control bit in the crane control system.

We recommend that the first test runs be performed at medium hoist height, and initially without boosted camera measuring signal. The camera measuring signal cannot be boosted again until these initial test runs are successfully concluded.

8.5.2 Test runs without boosting the camera measurement signal

● To carry out test runs without boosted camera measuring signal, set parameters P21 (trolley), P61 (gantry), or P151 (slewing gear) to zero.
This will disable the cameral measuring signal. The advantage of this approach is that you can record a signal trace in SIMOCRANE CeCOMM and use it to compare the pendulum deflection measured by the camera with the pendulum deflection of the mathematical model. You can also test the accuracy of the sway control settings without camera feedback (effective pendulum length, velocities, ramps, etc.).

● Start the first test run with a low set velocity V_set (e.g. with the first stage of the master controller). If this is successful then further test runs may follow with greater set velocity values.

● When evaluating the trace recordings of the pendulum deflection measured by the camera and the pendulum deflection computed by the mathematical model, pay attention to the following points:

– Identical phase relations and amplitudes
The amplitude can be adjusted if necessary using parameters P30 (trolley), P70 (gantry) or P160 (slewing gear). If the phases are in exact opposition, parameter P80 (assignment of camera measuring direction) should be checked.

– Match between frequency of the pendulum deflection measured by the camera ↔ frequency of the pendulum deflection computed by the mathematical model
Check whether the frequency of the pendulum deflection measured by the camera matches the frequency of the pendulum deflection computed by the mathematical model. If they do not match, you must check the accuracy of the effective pendulum length calculation and/or accuracy of the transferred hoist height data, because the mathematical model computes the frequency from the relationship $T = 2 \prod \sqrt{(l : g)}$ (T = period of oscillation; l = effective pendulum length).

- The effectiveness of the sway control system can be easily identified when the master controller is released at constant velocity. Only slight residual sway motion must be present at the end of travel. Note that the initial sway on starting must be close to zero.

> ⚠️ **CAUTION**
>
> **Risk of injury and potential material damage due to unexpected movements of the crane**
>
> Unexpected jerking movements may occur during operation with sway control.
>
> These can cause injury to unprotected persons. Damage might also be caused to unprotected objects.
>
> - Protect yourself against unexpected movements (e.g. by wearing a safety harness or standing in a secure position).
> - Secure freely movable objects to prevent them from slipping.

- If the test runs at medium hoist height have been successful, repeat the runs at different hoist heights to test the accuracy of the effective pendulum length measurement.
  Make sure that tests are carried out at every height in the hoist range.
  If the sway control system does not work correctly at certain hoist heights, you will need to recheck the accuracy of the effective pendulum length calculation and/or the accuracy of the transferred hoist height data. At all hoist heights, the frequency of the pendulum deflection measured by the camera must approximately coincide with the frequency of the pendulum deflection computed by the mathematical model.

- The effective pendulum length is calculated from the hoist height using parameters:
  - Trolley: P22, P23
  - Gantry: P62, P63
  - Slewing gear: P152, P153

- Test runs without boosted camera measuring signal can be regarded as successful if the following conditions are fulfilled:
  - The phase relation, amplitude and frequency of the pendulum deflection measured by the camera are identical to those of the pendulum deflection calculated by the mathematical model.
  - The residual sway at the end of travel is only minor; this applies on condition that the initial sway at the start of travel was also minor.
  - The first two criteria apply to all velocities and all hoist heights.

8.5.3 Test runs with boosted camera measurement signal

- If the test runs without boosted camera measuring signal have been concluded successfully, you can now boost the camera measuring signal again.
  To do this, set P21 (trolley), P61 (gantry) or P151 (slewing gear) to values other than zero again.

- Set the parameters for boosting the camera measuring signal P21 (trolley), P61 (gantry) or P151 (slewing gear) to the lowest possible required setting.
  The higher the settings of these parameters, the greater the influence of the camera measuring signal on the pendulum deflection computed by the mathematical model. However, disturbance variables will also have a greater effect and may impair the overall control quality. The value must be determined experimentally during commissioning, as it largely depends on the controlled system as a whole. Setting values of < 0.1 have proven successful in practice.

- Start the first test run cautiously with a low set velocity V_set (e.g. with the first stage of the master controller).
  If this is successful, you can conduct further test runs at higher set velocities. With this configuration, initial oscillations of the load caused by disturbing effects must be eliminated.

- Test runs with boosted camera measuring signal can be regarded as successful if the following conditions are fulfilled:

  – The residual sway at the end of travel is only minor; this applies even if initial sway occurred at the start of travel.

  – Disturbances during travel (e.g. caused by wind) must be corrected.

  – The first two criteria apply to all velocities and all hoist heights.

8.5.4 Testing in the prelimit switch range

In the prelimit switch range, the velocity must be reduced in good time, so that the axis can safely stop if the limit switch is actuated. The function is described in Chapter Response in the prelimit switch (Page 99).

Test the travel behavior in the prelimit switch range

- Start at the lowest speed level.

- We recommend that you record a signal trace.

- The status of the prelimit switches is displayed in screen 3 "Status of drives" (monitor display in the SIMOCRANE CeCOMM).

- Test the function of the prelimit switches at all hoist heights occurring in normal operation. Testing with long pendulum lengths is especially important.

8.6 Checking and fine-tuning the sway control system

8.6.1 General

This chapter discusses all the settings required for manual operation mode that have not been made during the commissioning phase.

The parameters can be set manually in the Parameters menu of the SIMOCRANE CeCOMM diagnostic program.

8.6.2 Correcting the effective pendulum length

If different load carrying devices and/or variable loads are used, the center of gravity and therefore also the pendulum length may change.

For this reason, digital and analog functions for correcting the effective pendulum length are provided for the trolley and gantry. Only a digital correction of the effective pendulum length is available for the slewing gear.

The effective pendulum length for each drive is displayed in mm on screen 1 (kinematics).

Digital correction of the effective pendulum length for the trolley and the gantry

Requirement

- If a new load carrying device, i.e. which is different to the usual one, is to be used and corrected by the digital correction function, a suitable sensor (e.g. limit switch) must be installed so that the crane control system can detect the new load carrying device. The control bit "DigitalLiftCorrection" cannot be set correctly otherwise.

- The effective pendulum length value under normal conditions (i.e. when the usual load carrying device is used) at medium hoist height must be known.

  If this value is not known, then it needs to be calculated. To do this, carry out the relevant commissioning steps (see Step 2: Determine parameters of effective pendulum length in the trolley direction (Page 123) or Step 3: Determine the parameter effective pendulum length in the gantry direction (Page 123)).

Method of operation

- If the control bit "DigitalLiftCorrection" is set for the trolley, the value of parameter P24 (digital correction effective pendulum length trolley) is added to the existing effective pendulum length for the trolley.

- If the control bit "DigitalLiftCorrection" is set for the gantry, the value of parameter P64 (digital correction of effective pendulum length, gantry) is added to the existing effective pendulum length for the gantry.

Procedure

If you are using a new load carrying device which causes a shift in the center of gravity of the load, you need to recalculate the effective pendulum length as described below:

1. Effective pendulum length at medium hoist height under normal conditions

    – The effective pendulum length value applicable to the usual load carrying device is displayed on screen 1 (kinematics). Make a note of this value.

2. Calculate the oscillation period for the new load carrying device

    – To calculate oscillation period T, perform oscillation measurements with the load carrying device positioned at a medium hoist height.

3. Calculate the correction value for the effective pendulum length

    – Calculate the effective pendulum length for the new load carrying device by the formula: $T = 2 \cdot \prod \sqrt{l{:}g}$

    – Calculate the correction value from the difference between:
    Effective pendulum length (new load carrying device and effective pendulum length (usual load carrying device)

    – Enter the correction value in parameter P24 or P64 in the CeCOMM diagnostic program.

4. Correction of the effective pendulum length in the crane control system

    – When you use the new load carrying device, you must set the bit "DigitalLiftCorrection" in the crane control system to activate the calculated correction values.

Digital correction of the effective pendulum length for the slewing gear

Requirement

- When the load condition which is to be corrected digitally is present on the crane, it must be measured by a suitable sensor (e.g. limit switch) in the crane control system. The control bit "DigitalLiftCorrection" cannot be set correctly otherwise.

Method of operation

Once the bit "DigitalLiftCorrection" is set, the parameters P154 (pendulum length gain under load conditions, slewing gear) und P155 (offset pendulum length under load conditions, slewing gear) are used to calculate the effective pendulum length - otherwise the parameters P152 (pendulum length gain, slewing gear) and P153 (offset pendulum length, slewing gear).

Procedure

See Chapter Commissioning, Step 4: Determine the parameter effective pendulum length, slewing gear (Page 124).

Analog correction of the effective pendulum length

Requirement

- To allow use of the analog correction function for the effective pendulum length, a valid load value must be supplied at the input "Load" (load weight) by the crane control system. The sway control system interprets this value as the total load. The weight of the load carrying device must be entered in parameter P82 (weight of the load carrying device in kg).

- The effective pendulum length value with the unloaded load carrying device at medium hoist height must be known.

  If this value is not known, then it needs to be calculated. To do this, carry out the relevant commissioning steps (see Step 2: Determine parameters of effective pendulum length in the trolley direction (Page 123) or Step 3: Determine the parameter effective pendulum length in the gantry direction (Page 123)).

Method of operation

You can apply continuous correction of the effective pendulum length as a function of load.

The parameters P25 and P65 ("Analog correction of effective pendulum length") are specified in the unit of measurement mm/kg and thus define in mm the increase in the pendulum length per kg of weight. The correction value is calculated according to the following formula:

Trolley: Analog correction = (Load-P82) · P25 if (Load-P82) > 0, otherwise 0

Gantry: Analog correction = (Load-P82) · P65 if (Load-P82) >0, otherwise 0

Procedure

1. Make a note of the effective pendulum length value with the unloaded load carrying device at medium hoist height (see screen 1 - kinematics).

2. Calculate the effective pendulum length with loaded load carrying device at a medium hoist height.

3. Calculate the difference between the effective pendulum lengths, i.e. with and without load:
   Effective pendulum length (with attached load) - effective pendulum length (unloaded)

4. Calculate the correction factor P25 and/or P65.

   Correction factor (mm/kg) = difference between effective pendulum lengths : (total load - weight of load carrying device)

5. Enter the correction value in parameter P25 or P65 in the CeCOMM diagnostic program.

Example:

Total load:	60 t
Weight of load carrying device:	20 t
Effective pendulum length without load:	30 m
Effective pendulum length with load:	32 m

Result:

Parameter P82:	20,000 kg
Difference between effective pendulum lengths:	32 m - 30 m = 2 m (with 40 t weight)
Correction factor P25 or P65:	2000 mm : 40000 kg = 0.05 mm/kg

Additional information

- If the crane control system
  - does not have any information about the load mass,
  - does not have any information about setting the "DigitalLiftCorrection" bit,
  - but, depending on the load and/or the load carrying device in use, is detecting different pendulum lengths with a deterioration of the sway control quality,

    a compromise must be found.

    One option is to vary the offset parameters to calculate the effective pendulum length (P23, P63, P153).

- If both the digital correction and the analog correction of the effective pendulum length are active, both correction values will be added to the original effective pendulum length.

- Where the load is relatively constant (e.g. coils or slabs), it may be more effective to use digital correction rather than analog correction. If you use digital correction, you must set the bit "DigitalLiftCorrection" in the crane control system after the correction value of the effective pendulum length has been calculated.

8.6.3   Setting the permissible residual sway

The parameter for the residual sway can be separately set for each sway-controlled drive.

- Trolley: P33, P34
- Gantry: P73, P74
- Slewing gear: P163, P164

The parameters residual sway and residual pendulum velocity should only be set as low as is required. Excessively low values extend the stopping time ("Pos_completed" and "SC_completed") and may result in sway after stopping due to dead times.

8.6.4 Setting the velocity for zero speed detection

The parameters for zero speed detection can be set separately for each drive.

- Trolley: P19
- Gantry: P59
- Slewing gear: P149
- Hoist: P149

The parameters are a condition for setting the control bit "Pos_completed" (see Chapter Interface description (Page 45)).

Excessively high values result in fast but jerky stopping.

Excessively low values result in very soft stopping, but lengthen the stopping time.

In practice, settings between 1 % and 3 % have proven successful.

8.6.5 Setting the damping factor

A damping factor (P16, P17, P56, P57, P146, P147) can be set separately for the acceleration and deceleration phase for each sway-controlled drive. (This only applies to manual operation mode.)

Values greater than 1.4 result in non-periodic transient responses, values less than 1.4 to overshoot. Damping factors in the range from 1 to 1.2 are a compromise between short rise time and slight overshoot. The difference between the damping factors for acceleration and deceleration should not be too large, as the output velocity can otherwise change abruptly during the transition to the deceleration phase.

Only P16, P56 and P146 are effective for the positioning operation mode.

8.6.6 Setting the switch-on delay of the drives

The output value delay of the controlled system (including frequency converter) can be set for each drive (P27, P67, P157).

Please proceed as follows:

With camera present:

- Set the camera feed to zero (depending on drive P21, P61, P151).
- Start the trace in SIMOCRANE CeCOMM, record the pendulum deflections from the model and from the camera.
- Begin to move in manual operation mode with pendulum deflection close to zero.
- Set the ON delay in such a way that the start of the pendulum deflections from the model and from the camera match as closely as possible.
- Set the camera feed back to the original value.

Without camera:

- Start the trace in SIMOCRANE CeCOMM, record the actual velocity and delayed velocity.

- Begin to move in manual operation mode with pendulum deflection close to zero.

- Set the ON time in such a way that the start of the actual velocity and the delayed velocity correspond as closely as possible.

8.6.7 Defining the activation velocity of the sway control

Using parameters P20, P60 and P150, for each drive, a minimum velocity as a % of the maximum output velocity can be defined to activate the sway control. The minimum velocity refers to setpoint V_set, and is only effective in the manual operation mode.

The sway control is inactive as long as the velocity setpoint is not reached. It is activated if the master controller is deflected to a higher value. The sway control remains active when stopping.

This parameter is intended to allow the drive to be precisely positioned at low velocities, without disturbing neutralizing motion by the sway control. Pendulum deflection is still slight in the lowest travel stage. If the crane operator wants to activate sway control in the first stage, he can briefly deflect the master controller to the next stage and then return to the first one.

8.6.8 Pendulum length from the PLC or camera

If the crane control system does not provide any information about the actual hoist position, the distance between the camera and reflector as measured using the camera measuring system can be used to determine the effective pendulum length. Parameter P108 is used to make the selection.

Note

If the measured distance between the camera and reflector is used, when the camera fails, sway-controlled operation based on the mathematical calculation model can only be used to a limited extent, or not at all.
If the camera fails, the distance measured between the camera and the reflector, and as a consequence, the effective pendulum length determined from this, are no longer updated. This means that using the distance measured between the reflector and camera only represents a compromise solution.

8.6.9 Other settings

Upper limit for sway control (P84)

Outside this limit, sway control is deactivated (see Chapter Parameter list (Page 171); parameter description for P84).

Minimum pendulum length (P86)

For smaller pendulum lengths, sway control is deactivated (see Chapter Parameter list (Page 171); parameter description for P86).

8.7 Commissioning positioning

8.7.1 General

This chapter discusses all the settings required for positioning operation mode that have not been made during the commissioning phase.

The parameters can be set manually in the Parameters menu of the SIMOCRANE CeCOMM diagnostic program.

8.7.2 Conversion of the actual position S_act and target position S_set

The values supplied by the crane control system for the actual position and the target position are converted by the sway control with the parameters "Actual position factor" (P5, P45, P135) and "Actual position offset" (P6, P46, P136)

Proceed as follows to ascertain these parameters:

The following values must be recorded at two different positions:

x1: Position 1 in mm

x2: Position 2 in mm

s1: S_act (actual position) at position 1

s2: S_act (actual position) at position 2

You can calculate the parameters "Actual position factor" (P5, P45, P135) and "Actual position offset" (P6, P46, P136) from these four values. The SIMOCRANE CeCOMM diagnostic program (menu "Calculations / Position parameters") will assist you.

Enter the "Factor" and "Offset" for each drive in the parameters stated above.

Note

Checking the actual position

The sway control system requires the exact correct position values from the crane control system. It is not therefore sufficient to determine the positions purely by calculation. The positions shown must be remeasured directly on site during commissioning. The position sensing and position monitoring functions must be ensured before the positioning operation mode is commissioned.

We recommend using identical reference systems in the crane control and sway control systems. The position values are then the same in both systems and are easier to manage. The factor set is then 1 and the corresponding offset is 0 mm.

Note

If the value S_act received from the crane control system and the conversion parameters are correct, the actual velocity V_act and the output velocity V_norm must be identical - provided that the normalization of the output velocity is correct.

Plotting a diagram with both values using SIMOCRANE CeCOMM is recommended in order to check this.

8.7.3 Position controller setting

1. Set the position controller parameters (P15, P55; P145) to zero.

   The position control will then be deactivated and the actual position ignored. As a result, the position will be determined from the calculated values only.

2. Start the positioning process over a sufficiently large distance.

   – Constant travel should take at least several seconds.

   – Make sure that the distance to the end positions is sufficiently large to allow prompt termination of travel in the event of an error.

   – The setpoint and target positions must be virtually identical at the end. Minor deviations are caused by deactivation of the position controller.
   □ More significant deviations can be caused by incorrect setting of the maximum output velocity or by limiting functions in the drive system.
   □ To identify the error, deactivate the sway control system by resetting the control bit "SC_On" or by setting damping factors P16, P56, P146 (operation without sway control only) to zero.

3. Set the position controllers and damping factors to their default values

   – Set the position controllers in such a way as to obtain a slight overshoot.
   This applies to the actual velocity and the actual position. Short rise times can be achieved in this way.

   – The value of the position controller should not be greater than 0.5.

   – Reduce the value if the velocity curve exhibits oscillations and the actual position overshoots at the target position.

Note

An overshoot at the target position is often the result of an incorrectly set maximum velocity and not from an excessively high position controller (Kp factor). Consequently, before reducing the position controller, in controlled operation (position controller is zero or manual operation), it should again be checked whether for travel at constant velocity, the actual velocity is nearly equal to the output velocity.

8.7.4 Other settings

The following parameters can be set manually:

Positioning accuracy (P9, P49, P139)

The positioning accuracy should not be set lower than the minimum required value.

If the deviation between the current and target positions is smaller than the positioning accuracy setting, the status bit "Pos_completed" (see interface description) will be set in the positioning operation mode. Positioning continues while the mode and the travel signal remain set.

Following error (P28, P68, P158)

The permissible difference between the calculated and actual positions of the relevant drive can be set with the parameters. An error message is triggered if this difference is exceeded (E7, E8, E9).

Note

The difference between the set and actual positions can be traced using the SIMOCRANE CeCOMM diagnostic program. The less difference between the values, the better the settings.

Upper limit for camera measurement (P83)

For pendulum lengths less than this value, only the mathematical oscillation model is applied. The measured pendulum deflection is not taken into account.

Oscillations caused by external forces such as diagonal pull or winds are not acquired and can therefore not be eliminated by closed-loop control. In this situation, sway-controlled operation should only take place for a limited period, as the difference between the calculated value and the actual oscillation becomes greater and greater over increased periods of time.

Note

The camera measurement may therefore need to be deactivated in the case of small pendulum lengths, i.e. if the distance between the camera and the reflector is very small, as for various reasons the pendulum deflection measured may no longer be detected correctly in some cases (e.g. if the reflector fills the camera's entire field of vision).

8.8   Testing the sway neutralization modes

This chapter provides information and instructions relating to the testing of the operation modes "sway neutralization load position" and "sway neutralization drive position."

Requirement

- The SIMOCRANE CenSOR camera measuring system must be used

- The actual position (S_act) for the relevant drive must be available

More detailed information about the function can be found in Chapters Operation mode sway neutralization load position (Page 105) and Operation mode sway neutralization drive position (Page 105).

Testing the "sway neutralization load position" operation mode

1. Set the control bit "OM_SC_LO" (see Interface description (Page 45)) to select sway neutralization load position operation mode.

2. Cause the load to sway. Start the first tests with very small amounts of sway.

3. Start travel by setting the "Travelling" control bit.

   If the operation mode is functioning correctly, neutralizing motions will occur in both directions until the sway is eliminated and the drive stops at its target position. The target position corresponds to the position of the load at the moment the control bit "Travelling" was set. The load position equals the total of S_act + pendulum deflection.

   #### Note

   If the sway motion is not properly corrected, then you must check the previous commissioning steps to identify the error.

   #### Note

   We recommend that you use the CeCOMM diagnostic program to record signal traces so that you can assess the test results more accurately.

4. When the "Pos_completed" status bit is set, reset the "Travelling" control bit.

5. If the results of the first tests are successful, repeat the same tests with larger initial sway motions.

Testing the "sway neutralization drive position" operation mode

1. Set the control bit "OM_SC_DR" (see Interface description (Page 45)) to select sway neutralization drive position operation mode.

2. Cause the load to sway. Start the first tests with very small amounts of sway.

3. Start travel by setting the "Travelling" control bit.

   If the operation mode is functioning correctly, neutralizing motions will occur in both directions until the sway is eliminated and the drive stops at its target position. The target position corresponds to the actual position of the drive S_act at the moment the "Travelling" control bit was set.

   ### Note

   If the sway motion is not properly corrected, then you must check the previous commissioning steps to identify the error.

   ### Note

   We recommend that you use the CeCOMM diagnostic program to record signal traces so that you can assess the test results more accurately.

4. When the "Pos_completed" status bit is set, reset the "Travelling" control bit.

5. If the results of the first tests are successful, repeat the same tests with larger initial sway motions.

Troubleshooting

If the sway motion is not properly eliminated despite correct control settings, you must check the previous commissioning steps to identify the error.

We recommend the following procedure:

1. **Check whether the sway control system works properly in manual operation mode without a camera.**

   – If it does not, the following possible causes should be investigated:
     □ Incorrect calculation of pendulum length,
     □ Errors in basic data such as maximum output velocity or acceleration/deceleration rates.

   – Recommendation: Repeat the entire commissioning process.

2. **Check whether the sway control system works properly in manual operation mode with a camera.**

   – If it does not, the following possible causes should be investigated:
     □ Problem with the camera.

   – Recommendation: Perform a function test on the camera.

3. **Check whether the sway control system works properly in the positioning operation mode.**

   – If it does not, the following possible causes should be investigated:
     □ Actual position is incorrect.

   – Recommendation: Recheck all the settings required for the positioning operation mode

8.9 Stability test and monitoring functions

8.9.1 Stability test

With maximum, medium and minimum pendulum lengths set the load to manual operation mode without sway control and with heavy sway, switch to sway-controlled manual operation and start at the moment of maximum pendulum deflection. The trolley (gantry, slewing gear) must catch the oscillation and steady the load by moving back and forth until it comes to a standstill.

If the sway is already too severe at the start or if the monitoring function (see Chapter Monitoring functions (Page 143)) finds that the sway cannot be eliminated by closed-loop control or even increases, the sway control system will output the error message E13, E14, or E15 (sway control temporarily reduced). No output velocity is then output. The user can reset the error again by resetting control bit "Travelling."

Possible causes for inability to eliminate sway by closed-loop control:

● A maximum acceleration that is set too low

● After the output velocity has been output, it must no longer be influenced by the sway control system (for instance by limiting the maximum value or the acceleration in the converter or by excessive smoothing in the converter).

● Incorrect calculation of the effective pendulum length

Possible causes of increasing sway:

● Incorrect alignment of the camera

● Incorrect setting of P80 (assignment of camera measuring system)

   In this case, commissioning step 1 (Set the alignment of the camera) must be repeated.

Following successful completion these tests should be repeated in positioning operation mode.

⚠ **CAUTION**

Risk of injury and potential material damage due to unexpected movements of the crane

Unexpected jerking movements may occur during operation with sway control.

These can cause injury to unprotected persons. Damage might also be caused to unprotected objects.

● Protect yourself against unexpected movements (e.g. by wearing a safety harness or standing in a secure position).

● Secure freely movable objects to prevent them from slipping.

8.9.2 Monitoring functions

When the drives are traversing with sway control, a monitoring function is run in all operation modes that checks whether the sway control is able to eliminate the sway or if the sway is increasing.

It is assumed that the sway cannot be eliminated if the output velocity has changed direction (passed through zero) nine times since control bit "Travelling" was last set. If this is the case, no output velocity is output and error messages E13, E14, or E15 are set.

It is assumed that the sway is increasing if the amplitudes of the oscillation of the mathematical oscillation model increased in five consecutive oscillation periods. If this is the case, no output velocity is output and error messages E13, E14, or E15 are set.

SIMOCRANE CeCOMM diagnostic program 9

9.1 General

The SIMOCRANE CeCOMM diagnostic program can be used for the following functions:

- Editing the parameter sets (see Chapter Parameter sets (Page 93))
- Monitor functions for monitoring important data
- File manager function for exchanging parameter files, etc.
- Diagram function for recording traces
- Integrated Primary Setup Tool for determining the communication addresses of the connected stations
- Performing the commissioning steps
- Readout of error messages (current messages and history of stored error messages)
- Tool for calculating the effective pendulum length if no camera is used
- Additional functions, such as version information, calculation of position and velocity parameters, web browser

The diagnostic program is available in German and English.

An overview is now provided of the most important functions of the SIMOCRANE CeCOMM diagnostic program.

9.2 Installing

The SIMOCRANE CeCOMM diagnostic program ("Setup_CeCOMM.exe") is provided on the DVD and can be used for commissioning. The program must be installed on the commissioning PC (Windows). The software is installed by running "Setup_CeCOMM.exe". An IP address that is suitable for the SIMOTION C240 PN must be set on the commissioning PC. For default settings this is:

IP address: 192.168.1.X
                (X = freely selectable)
Subnet mask: 255.255.255.0
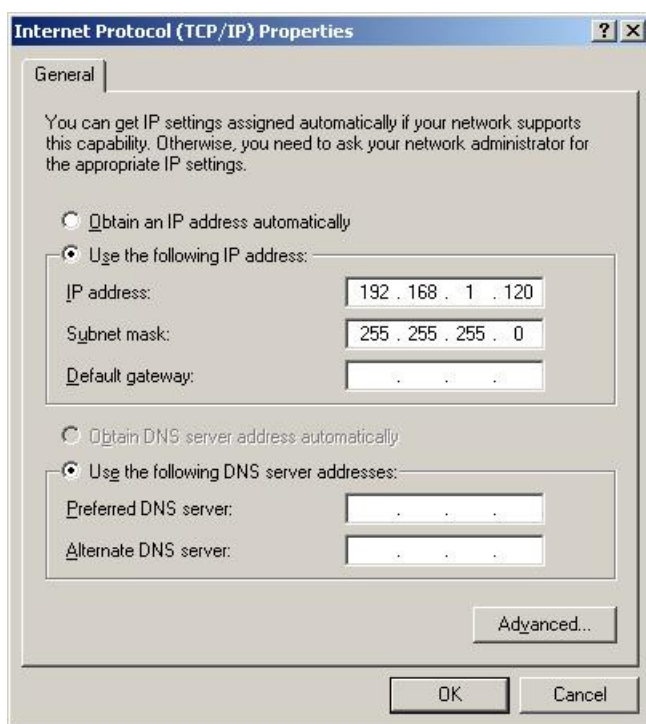
Figure 9-1   Setting a fixed IP address

Note

The program can run under the "WINDOWS 2000," "WINDOWS 7," and "WINDOWS XP" operating system. This requires that the user is logged on to the PC as administrator.

Note

This requires that the user is logged on to the PC as administrator.
Any personal firewalls (e.g. Windows Firewall for Microsoft XP) should be deactivated or specific exceptions permitted.

9.3 Searching the network for SIMOTION C240 PN
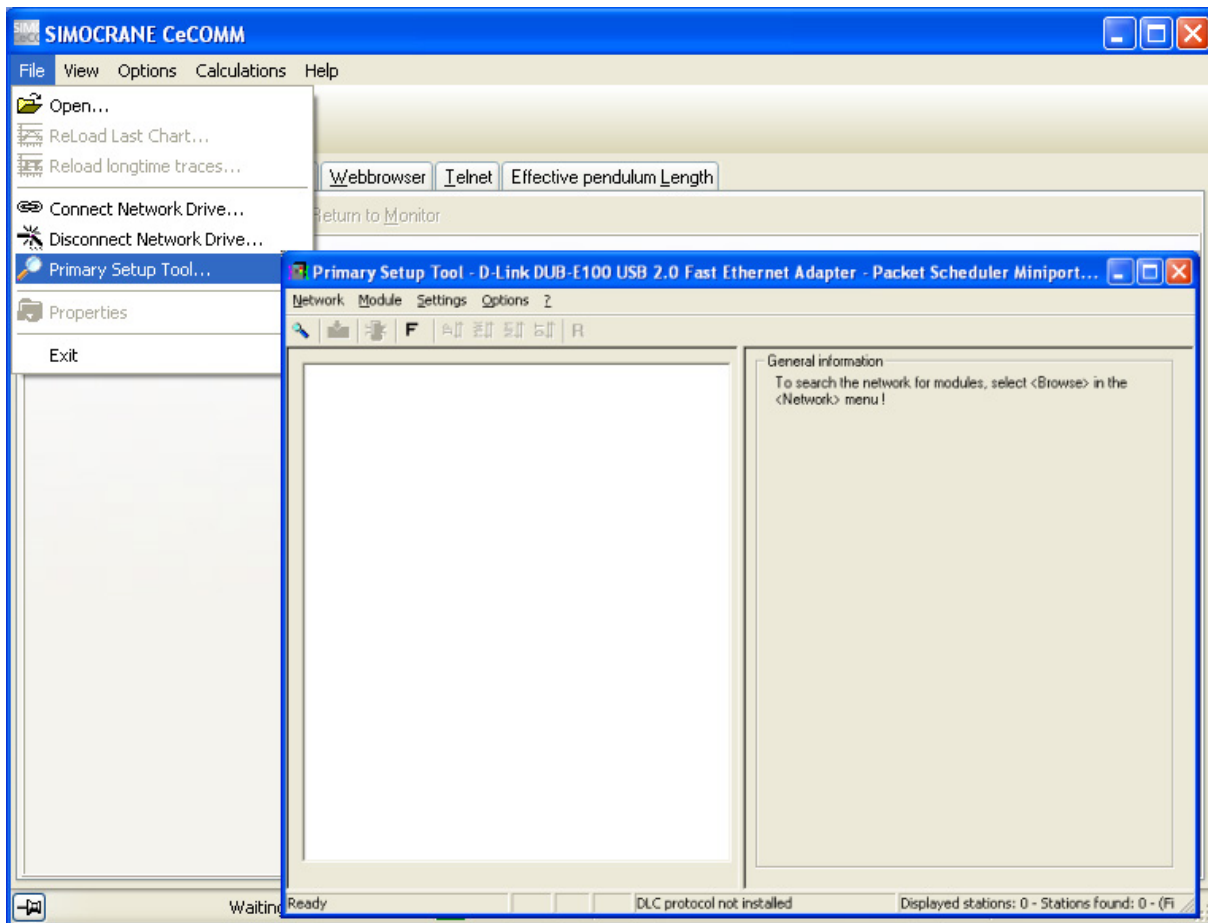
Figure 9-2   Calling the primary setup tool from SIMOCRANE CeCOMM

When SIMOCRANE CeCOMM is installed, the "Primary Setup Tool (abbreviation: PST)" is also installed. This tool can be used to search the network for nodes (devices). For example, the IP addresses of SIMOTION C240 PN and the SIMOCRANE CenSOR camera measuring system can be scanned in this way. The Primary Setup Tool is on the DVD provided, and can be subsequently installed.

The IP address can only be changed temporarily using the PST. The old address is again effective after SIMOTION C240 PN is restarted. In order to permanently change the IP address, this must be set using SIMOCRANE CeCOMM (commissioning menu, step 7 or in the parameter menu "I")

Note

The IP address of the commissioning PC must be set so that it matches the SIMOTION C240 PN address, with the same subnet.

9.4 Establishing the connection

The symbols for establishing a communication link are arranged below the menu bar:
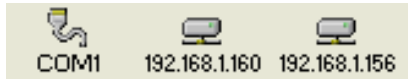
After the program has started, one of these symbols must be used to establish the connection to the SIMOTION C240 PN via the Ethernet interface.

After a connection has been successfully established, the following functions are available under the tabs:

- Monitor: Display all diagnostic information, change parameters, display error messages, etc.
- File manager: User interface for copying, renaming, editing files, etc.
- Diagram: Interface for recording, saving and loading analog and digital signals
- Web browser: Use the web server available on the target system. An Ethernet connection is required
- Telnet: Not used
- Effective pendulum length: Tool for ascertaining the effective pendulum length for systems without a camera

9.5 Monitoring functions

9.5.1 Display and operating information

After the connection has been established, all the available keyboard commands are displayed when the space bar is pressed.

Figure 9-3   Monitor - Main menu

The basic monitor functions can be divided into three groups:

- Screens,
- Parameterization menus,
- Additional functions.
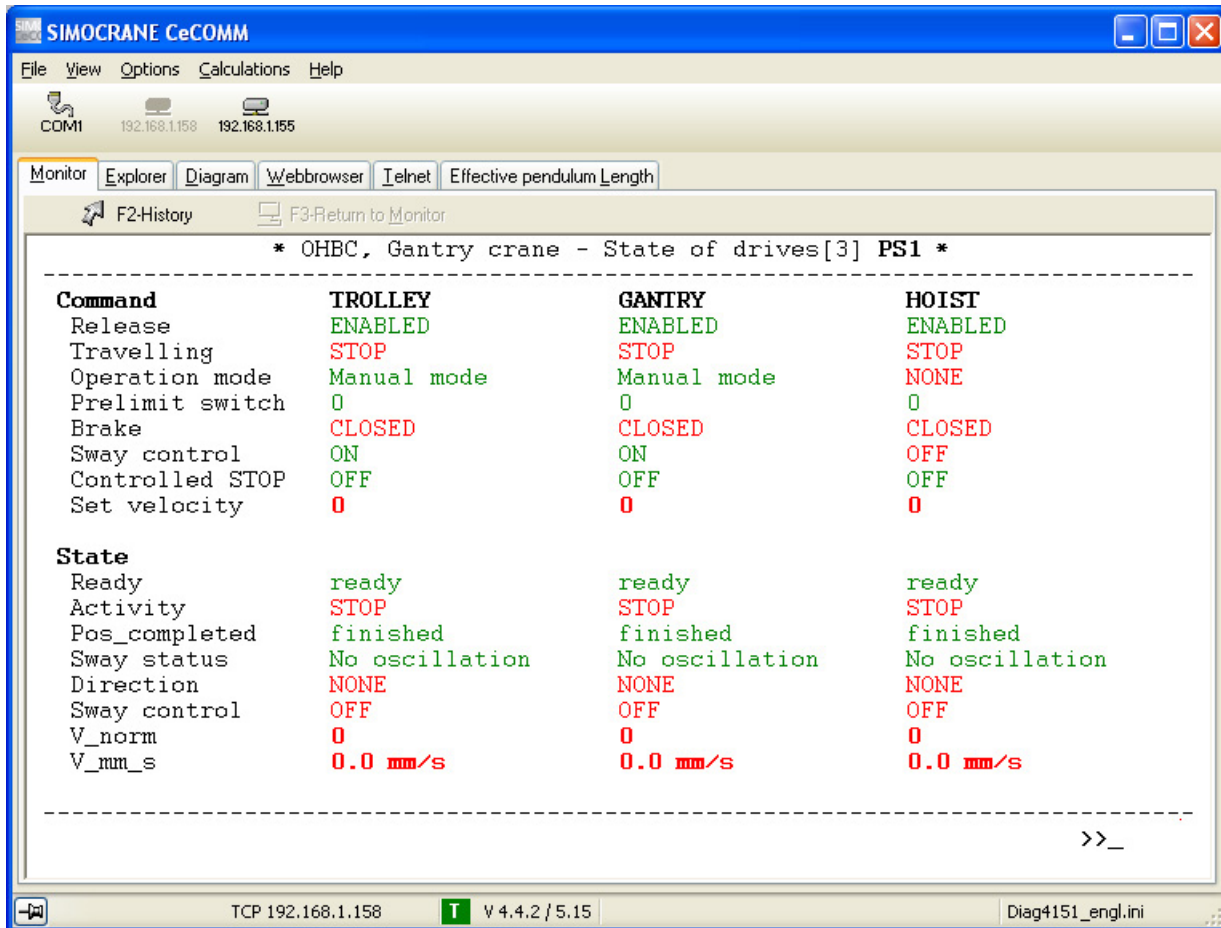
Figure 9-4   Monitor functions

The display for the prelimit switch command in display screen [3] "Status of drives" has the following meaning (selection):

Table 9- 1   Explanation for display screen [3]

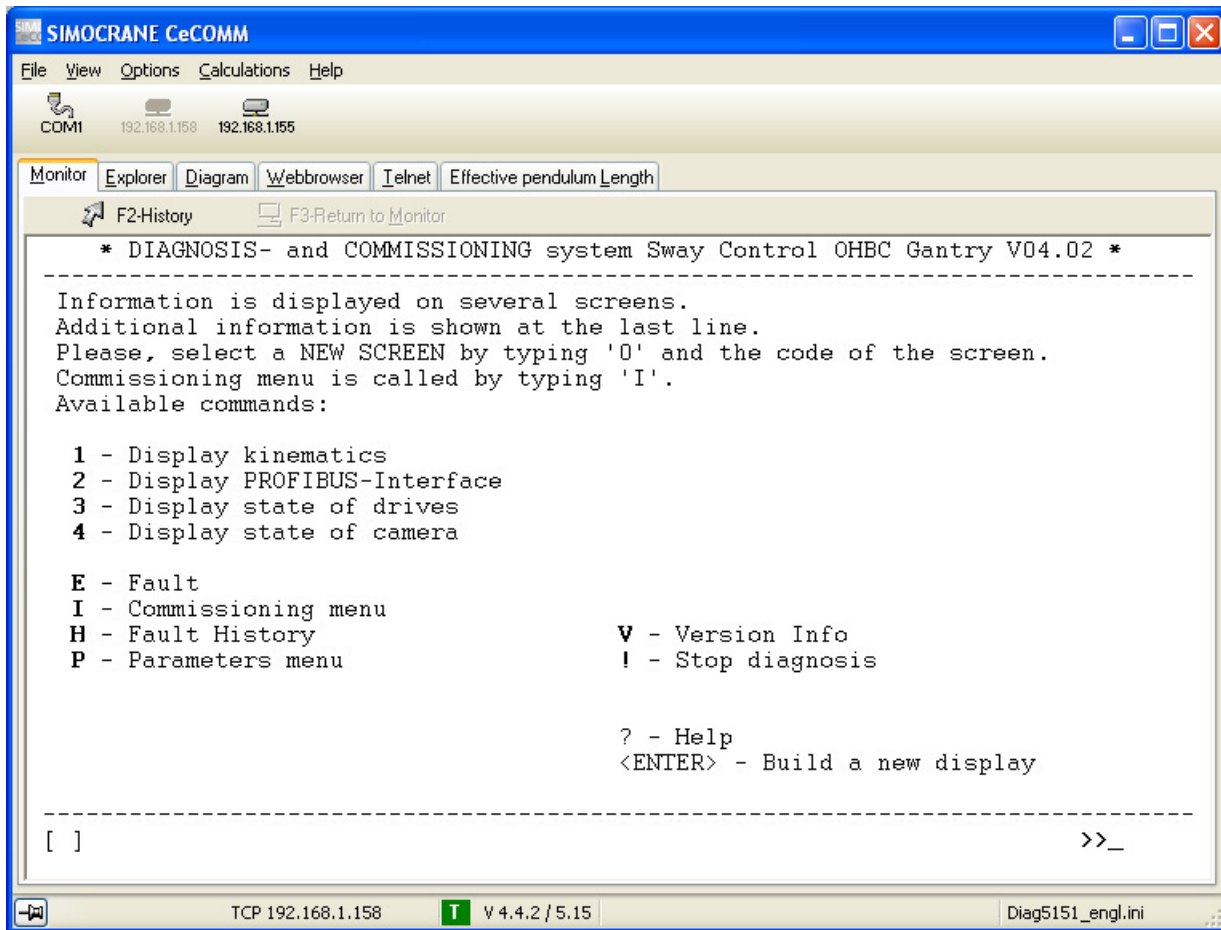| 1+/1+	Prelimit switch forward and limit switch forward responded
1+	Prelimit switch forward responded
0	No limit switch responded
1-	Prelimit switch backward responded
1-/1-	Prelimit switch backward and limit switch backward responded
2	Prelimit switch forward and prelimit switch backward responded
0/2	Limit switch forward and limit switch backward responded
2/2	All limit switches responded

The table below lists the most important operating notes.

Table 9- 2   Operating notes

Display of the available keyboard commands on the main screen	Press the space bar.	
Calling the display screens	Press one of the following keys:	
	"1"	Display kinematics
	"2"	Display PROFIBUS interface
	"3"	Display status of drives
	"4"	Display camera status
	You can toggle between screens "1" to "4".	
	Press the appropriate key.	
Calling menus and additional functions	Press one of the following keys:	
	"P"	Parameter menu; see The parameter menu (Page 152)
	"I"	Commissioning menu
	"ESC"	Exit menu The screen last called is displayed
	"E"	Actual errors
	"H"	Error history
	"V"	Version information
	"ENTER"	Refresh screen
	"L"	only relevant for developers

Example: "Change parameter P0 on the screen":

1. Enter "PC0" (i.e.: Parameter menu - Change Parameter 0)

2. Press the "Enter" key

3. Enter the new value

4. Confirm twice using the "Enter" key

9.5.2   The parameter menu
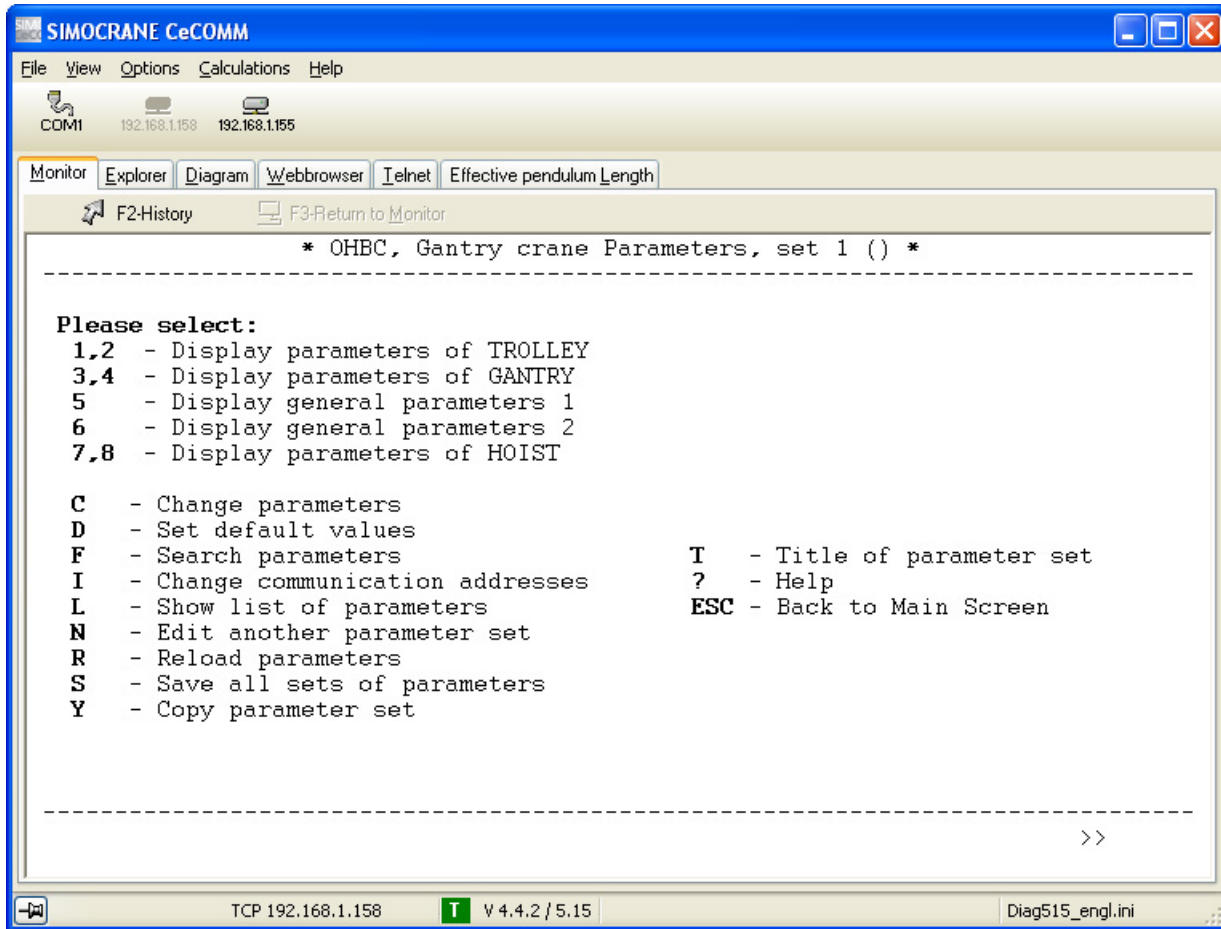
Figure 9-5   Parameter menu

The Parameter menu can be called from the main menu and all display screens with the "P" key. All parameters can be displayed, changed, saved and copied in this menu.

Note

Only those parameters that correspond to the setting of parameter P100 "access code" are displayed; see General parameters (Page 212), description for P100.

The digits "1" to "8" can be used to display the parameters as groups. The "1" to "8" keys can be used to switch arbitrarily between the display screens of the parameters. From these display screens it is also possible to execute the functions from the parameter menu.

Table 9- 3   Key assignment in the parameter menu

Key	Function
"C"	Change parameters
"D"	Set default values
"I"	Change communication addresses
"S"	Save all parameter sets
"N"	Edit another parameter set
"Y"	Copy parameter set
"L"	Show list of parameters
"R"	Reload parameters
"F"	Search parameters
"T"	Title of parameter set A brief description of the parameter set may be entered (max. 20 characters). The brief description is saved in the parameter file.

9.6 Setting addresses

9.6.1 General

Each device must have its own IP address for communication in the Ethernet network.

Note

The IP address of the SIMOTION C240 PN may not be used for another device on the network.

9.6.2 Default settings

IP address for SIMOTION C240 PN:	192.168.1.158
Subnet mask for SIMOTION C240 PN:	255.255.255.0
PROFIBUS DP address:	100
PROFIBUS transmission rate	1.5 Mbit/s

For camera communication via UDP

IP address for camera:	192.168.1.155
Camera port:	8500

For camera communication via PROFINET

IP address of the camera:	0.0.0.0
Camera port:	0

This setting activates PROFINET usage within the SIMOTION C240 PN for communication with the camera.

The following IP addresses saved in the project are then used:

IP address for SIMOTION C240 PN:	192.168.0.2
Subnet mask for SIMOTION C240 PN:	255.255.255.0
IP address for camera:	192.168.0.3
Subnet mask for camera:	255.255.255.0

These addresses cannot be changed by the user.

9.6.3 Setting addresses

You can set the Ethernet and PROFIBUS-DP addresses that the PROFIBUS transmission rate for the SIMOTION C240 PN and the Ethernet address for the camera via the parameter menu in the SIMOCRANE CeCOMM diagnostic program.

Please proceed as follows:

1. Call the parameter menu with the "P" key

2. Call the "I" function: Change communication addresses
   Follow the instructions for SIMOCRANE CeCOMM.

Addresses can also be set via the commissioning menu by pressing the "I" key and calling the function "7 - Change communication addresses".
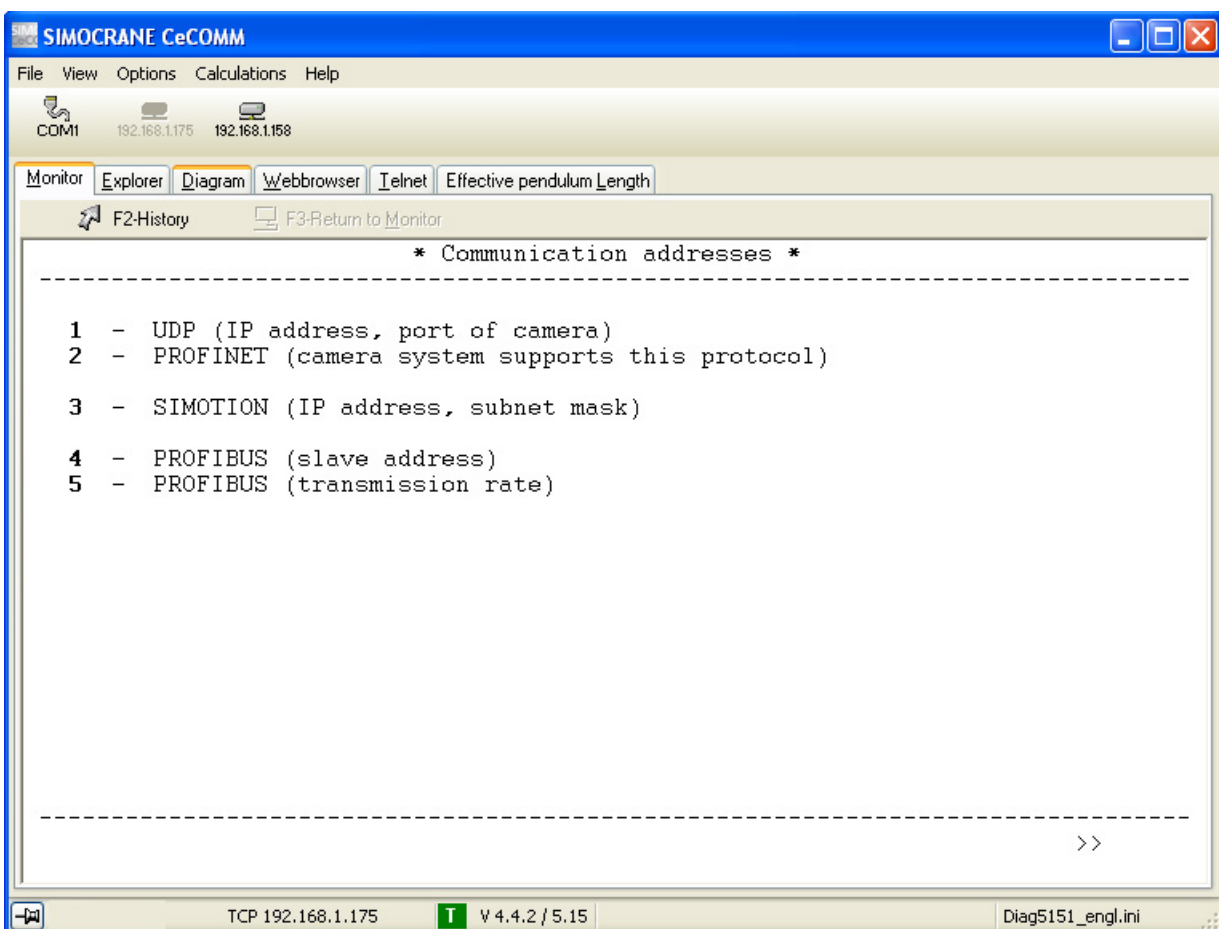
Figure 9-6   Setting addresses

Note:

- IP address of the camera
  Prerequisite: P115 Without Camera = OFF

- IP address of the SIMOTION C240 PN
  If you change the IP address of the SIMOTION C240 PN then the connection between the diagnostic tool and the SIMOTION C240 PN will be lost after confirming and saving. A new connection can be made immediately with the SIMOTION C240 PN via the new IP address.

- Change the PROFIBUS-DP address or the PROFIBUS transmission rate for the SIMOTION C240 PN
  If you change the PROFIBUS-DP address then the SIMOTION C240 PN will restart automatically after confirming and saving. After this boot process, a new connection with the current IP address is required.

Note

The information on the addresses is saved in the text file "IP_Addresses.txt" in the "SwayControl" directory on the MMC and is loaded when the SIMOTION C240 PN is booted. (Exception: The PROFIBUS transmission rate is not stored.)

9.6.4 Determining the changed IP address

If the IP address of the SIMOTION C240 PN has been changed and is no longer recognized, it can be determined using the Primary Setup Tool (see Searching the network for SIMOTION C240 PN (Page 147)).

Alarm, error, and system messages

10

10.1 General

The sway control system issues error messages and warnings to help you diagnose errors. Each error message is transmitted to the crane control system in status word "ErrorBits1" (see Chapter General block (14 bytes) (Page 72)).

A bit number is assigned to each error message as shown in the table below.

Warnings are not assigned a bit number and are not transmitted to the crane control system. They are only displayed in the SIMOCRANE CeCOMM diagnostic program.

The current errors are displayed by pressing the "E" key from the main menu or the display screens. The error history can be called using the "H" key.

Each error has a number, a name, a description and a remedial guide. All errors are self-acknowledging and will be transmitted only while the error condition is present.

Table 10- 1   Error messages with error bit

Error no.	Bit no.	Meaning
E0	0	Invalid parameter file
E1	1	Invalid operation mode
E2	2	Fieldbus error
E3	3	Invalid target position
E4	4	Invalid hoist position (sway control off)
E5	5	Invalid pendulum length (sway control off)
E6	6	Actual position not valid
E7	7	Following error, trolley
E8	8	Following error, gantry
E9	9	Following error, slewing gear
E9	9	Following error, hoist
E10	10	Camera measuring system impaired
E11	11	Camera measuring system faulted
-	12	Reserved
E13	13	Sway control temporarily reduced, trolley
E14	14	Sway control temporarily reduced, gantry
E15	15	Sway control temporarily reduced, slewing gear
E16		Parameter file not found
E17		Parameter file with incorrect version
I18		Parameter file with incorrect number of parameters
E19		Reserved
E20		Invalid parameter value
E21		Incorrect language file

Error no.	Bit no.	Meaning
E22		Language file not loaded
E23		No communication with the camera
E24		Function not included in the license
E25		No valid license available
E26		Cycle time too long
E27		Hoisting height has jumped
E28		
E29		
E30		Sway control only when stopping (trolley)
E31		Sway control only when stopping (gantry)
E32		Sway control only when stopping (slewing gear)
E33		Sway control off (start trolley)
E34		Sway control off (start gantry)
E35		Sway control off (start slewing gear)
E36		Controlled stop active (trolley)
E37		Controlled stop active (gantry)
E38		Controlled stop active (slewing gear)
E38		Controlled stop active (hoist)
E39		Positioning with parameter P115 deactivated
E40		Function with parameter P115 deactivated

10.2 List of alarm, error, and system messages

E0 invalid parameter file

An error has occurred while loading the parameter files. This error is issued only in conjunction with warnings E16, E17, E18 and E20. Refer to these for further information.

Significance: x = parameter set

Error values:

[x1] - parameter file missing
[x2] - incorrect version
[x3] - incorrect number of parameters
[x4] - incorrect parameter value

Error bit:	0
Error type:	Error
Remedy:	Check parameters in the parameter menu and save.

Note

Sway control response with parameter set switchover

Error message E0 has the following results in the sway control:

- If the cause of the problem is not in the active parameter set then there is no effect on the sway control and the drive continues to travel.
- If the cause of the problem is in the active parameter set then the drive is braked with setpoint acceleration and with sway control, and with the settings for the previous error-free parameter set being used. Continued travel is then impossible.

E1 Invalid operation mode

There is no control bit set for the operation mode or there are multiple control bits set for the operation mode or a "sway neutralization" operation mode is selected for the hoist.

Error bit:	1
Error type:	Error
Remedy:	Check PLC program. Set only one operation mode bit per drive.

E2 Fieldbus error

The telegram counter for the receiving telegram is not receiving any data.

Display:

- In SIMOCRANE CeCOMM: Value "received" in display screen 2 (PROFIBUS interface)

- In the PLC: Value "trailer" (telegram counter) in send block SC_DB_SEND_xxx)

Error bit: 2

Error type: Error

Remedy: Investigate the causes listed below.

Possible causes:

- No communication block present in the PLC

- Connection with the PLC faulty (e.g. cable disconnected)

- Incorrect PROFIBUS address

- Faulty hardware configuration, configured addressing ranges do not correspond with those in the FC SC_MAIN_INT.

- Incorrect transmission rate

E3 Invalid target position

The target position of a drive is outside the set limits:

- Trolley P7, P8

- Gantry P47, P48

- Slewing gear P137, P138.

The relevant drive does not start, or stops with the quick stop ramp.

Error value: [Drive number]
[0] – trolley
[1] – gantry
[2] – slewing gear or hoist

Error bit: 3

Error type: Error

Remedy: Check parameters for limits. Check target position.

E4 Invalid hoist position (sway control off)

The current position of the hoist for calculating the pendulum length is outside the set limits (P84, P85). The sway control function is internally deactivated.

Error bit: 4

Error type: Error

Remedy: Check hoist position and parameters.

E5 Invalid pendulum length (sway control off)

The sway control function has been switched off because the determined pendulum length is not within the specified limits (P86, P87).

Error value: [Drive number]
[0] – trolley
[1] – gantry
[2] – slewing gear

Error bit: 5

Error type: Error

Remedy: Check pendulum length and parameters.

E6 Actual position not valid

The actual position of a drive is outside the set limits:

- Trolley P7, P8

- Gantry P47, P48

- Slewing gear P137, P138.

The relevant drive does not start, or stops with the quick stop ramp.

Error value: [Drive number]
[0] - trolley
[1] - gantry
[2] - slewing gear or hoist

Error bit: 6

Error type: Error

Remedy: Check the current position and parameters.

E7 Following error, trolley

The difference between the setpoint and actual position is greater than the value defined using parameter P28.

Error value: [xx]
[xx] – setpoint-actual value deviation in mm

Error bit: 7
Error type: Error
Remedy: Check the drive and position measuring system.

E8 Following error, gantry

The difference between the setpoint and actual position is greater than the value defined using parameter P68.

Error value: [xx]
[xx] – setpoint-actual value deviation in mm

Error bit: 8
Error type: Error
Remedy: Check the drive and position measuring system.

E9 Following error, slewing gear

The difference between the setpoint and actual position is greater than the value defined using parameter P158.

Error value: [xx]
[xx] – setpoint-actual value deviation in c °

Error bit: 9
Error type: Error
Remedy: Check the drive and position measuring system.

E9 Following error, hoist

The difference between the setpoint and actual position is greater than the value defined using parameter P158.

Error value: [xx]
[xx] – setpoint-actual value deviation in mm

Error bit: 9
Error type: Error
Remedy: Check the drive and position measuring system.

E10 Camera measuring system impaired

The camera cannot temporarily detect a reflector.

This may be due to the following causes:

- The reflector is dirty.

- The lighting or visibility conditions are poor.

- The reflector is no longer within the camera's field of vision.

- The reflector is misaligned by 90°.

- The reflector is too small for the set window size, i.e. is too far away.

- The ambient light is too bright or too dark.

- The camera image is not focused.

If this alarm is active for longer than 14 s, it is replaced by error message E11.

Error bit:	10
Error type:	Alarm
Remedy:	Correct the listed error causes.

E11 Camera measuring system faulted

The camera can no longer detect a reflector over a longer period.

This may be due to the following causes:

- The reflector is dirty.

- The lighting and visibility conditions are poor.

- The reflector is no longer within the camera's field of vision.

- The reflector is misaligned by 90°.

- The reflector is too small for the set window size, i.e. is too far away.

- The ambient light is too bright or too dark.

- The camera image is not focused.

This error replaces E10 if the cause of the problem exists for longer than 14 s.

Error bit:	11
Error type:	Error
Remedy:	Correct the listed error causes.

E12 Reserved

E13 Sway control temporarily reduced, trolley

It is not possible to eliminate the sway or the sway is increasing.

Error bit:	13
Error type:	Error
Remedy:	Stop the oscillation manually and check cause of the problem in Chapter Stability test and monitoring functions (Page 142).

E14 Sway control temporarily reduced, gantry

It is not possible to eliminate the sway or the sway is increasing.

Error bit:	14
Error type:	Error
Remedy:	Stop the oscillation manually and check cause of the problem in Chapter Stability test and monitoring functions (Page 142).

E15 Sway control temporarily reduced, slewing gear

It is not possible to eliminate the sway or the sway is increasing.

Error bit:	15
Error type:	Error
Remedy:	Stop the oscillation manually and check cause of the problem in Chapter Stability test and monitoring functions (Page 142).

E16 Parameter file not found

A parameter file cannot be opened when the SIMOTION C240 PN powers up. The relevant parameter set has been set to default values.

Error value: [xxxx] parameter set number (each digit stands for a parameter set involved.)

Error bit:	-
Error type:	Alarm
Remedy:	Check the parameter files involved.

E17 Parameter file with incorrect version

A parameter file contains parameters of an incorrect version. The relevant parameter set has been set to default values.

Error value: [xxxx] parameter set number (each digit stands for a parameter set involved.)

Error bit: -

Error type: Alarm

Remedy: Check the parameter files involved.

E18 Parameter file with incorrect number of parameters

A parameter file contains an incorrect number of parameters. The relevant parameter set has been set to default values.

Error value: [xxxx] parameter set number (each digit stands for a parameter set involved.)

Error bit: -

Error type: Alarm

Remedy: Check the parameter files involved.

E19 Reserved for detour control (not available in this version)

E20 Invalid parameter value

When loading existing parameter files, one or several invalid values were identified. The relevant parameter value is set to the default value. The error is only reset after the parameter files have been loaded successfully. The last incorrect value identified is displayed.

Error value [abbb]: a = parameter set number, bbb = parameter number
The incorrect value is parameter "bbb" in parameter set "a".

Error bit: -

Error type: Alarm

Remedy: Check parameters in the parameter menu and save.

E21 Incorrect language file

Errors have occurred when loading the actual language file.
Excessively long lines, i.e. longer than 77 characters, are cut off. A block (help texts for parameter or error messages) can be a maximum of six lines long. Additional lines are ignored.

Error value: [xxxx] line number with error in the language file

Error bit: -

Error type: Alarm

Remedy: Correct the language file and power up the SIMOTION C240 PN again (stop/run).

E22 Language file not loaded

The actual language file was not able to be loaded.
Language file not on the MMC or corrupted.

Error value: [x] number of the language file

Error bit: -

Error type: Alarm

Remedy: Check that the language file is actually on the MMC.

E23 No communication with the camera

There is no communication connection to the camera, internal telegram counter does not increment.

Error bit: -

Error type: Alarm

Remedy: Check the configuration or hardware.

E24 Function is not included in the license

There is no license available for the selected function.

Error value: [x]

[0] - Manual license missing; only manual operation mode without sway control possible
[1] - Basic license missing; only manual operation mode possible
[2] – Reserved for detour control (not available in this version)

Error bit: -

Error type: Alarm

Remedy: Check license or use enabled function only

E25 No valid license available

The license is corrupt or missing. Only manual operation mode without sway control possible.

Error bit: -
Error type: Alarm
Remedy: Check and/or purchase the license

E26 Cycle time too long

The cycle time is longer than 100 ms.

Error bit: -
Error type: Alarm
Remedy: Allocate DCC plan for a faster motion task in the execution system

E30 Sway control only when stopping (trolley)

The control bit "SC_Only_OnStop" is set.

Error bit: -
Error type: Alarm
Remedy: Reset the control bit.

E31 Sway control only when stopping (gantry)

The control bit "SC_Only_OnStop" is set.

Error bit: -
Error type: Alarm
Remedy: Reset the control bit.

E32 Sway control only when stopping (slewing gear)

The control bit "SC_Only_OnStop" is set. Only applicable for sway-controlled slewing gear.

Error bit: -
Error type: Alarm
Remedy: Reset the control bit.

E33 Sway control off (start trolley)

The set velocity V_set is less than the activation velocity from P20. As a consequence, the sway control is still not activated.

Error bit: -

Error type: Alarm

Remedy: -

E34 Sway control off (start gantry)

The set velocity V_set is less than the activation velocity from P60. As a consequence, the sway control is still not activated.

Error bit: -

Error type: Alarm

Remedy: -

E35 Sway control off (start slewing gear)

The set velocity V_set is less than the activation velocity from P150. As a consequence, the sway control is still not activated.

Error bit: -

Error type: Alarm

Remedy: -

E36 Controlled stop active (trolley)

The control bit "Stop" is set.

Error bit: -

Error type: Alarm

Remedy: Reset control bit "Stop".

E37 Controlled stop active (gantry)

The control bit "Stop" is set.

Error bit: -

Error type: Alarm

Remedy: Reset control bit "Stop".

E38 Controlled stop active (slewing gear)

The control bit "Stop" is set.

Error bit: -
Error type: Alarm
Remedy: Reset control bit "Stop".

E38 Controlled stop active (hoist)

The control bit "Stop" is set.

Error bit: -
Error type: Alarm
Remedy: Reset control bit "Stop".

E39 Positioning with parameter P115 deactivated

The positioning operation mode has been deactivated.

Error bit: -
Error type: Alarm
Remedy: Check parameter P115.

E40 Function with parameter P115 deactivated

The functionality of the third drive has been deactivated.

Error bit: -
Error type: Alarm
Remedy: Check parameter P115.

E41 to E45 Reserved for detour control (not available in this version)

Parameter list 11

11.1 Overview

Table 11- 1   Parameter categories

Trolley parameters	P0 to P35
Gantry parameters	P40 to P75
General parameters	P80 to P119
Slewing gear or hoist parameters	P130 to P165

The parameter menu of the SIMOCRANE CeCOMM diagnostic program displays only those parameters to which access code P100 is assigned.

Access codes:

- Access code 1: Crane operator, maintenance personnel
- Access code 2: Commissioning engineer
- Access code 3: Service technician
- Access code 4: Development engineer

Set the access code to 4 in order to see all of the parameters.

Parameters which are not set to their default are displayed with a "+" symbol in front of the parameter number in the parameter menu of the CeCOMM diagnostic program.

Saving is realized in the parameter menu as well as in the commissioning menu using the key "S". The parameters are then saved in text files (Par0.txt to Par3.txt) on the MMC and are loaded after a new start.

11.2 Trolley parameters

P0 Trolley positioning velocity

This value corresponds to the set velocity in the positioning operation mode. In order to allow a slight overshoot (control margin), a value less than the maximum output velocity P1 should be set (e.g. 90%).

Default: 450 [mm/s]   Min: 10 [mm/s]   Max: 4,000 [mm/s]
Access code: 1

Note

Only relevant for the positioning operation mode.

P1 Maximum trolley output velocity

The parameter is the reference value for normalizing P35. V_norm = output velocity [mm/s] · P35 : P1). If the setting is correct (see Chapter Normalization (Page 43)), this value will be the maximum possible velocity.

Default: 500 [mm/s]   Min: 10 [mm/s]   Max: 4,000 [mm/s]
Access code: 2

P2 Acceleration without sway control, trolley

When the sway control function is deactivated, the drive accelerates and brakes with the set acceleration value.
Values of less than 20 that are entered are interpreted as ramp time.

Default: 100 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]
Access code: 1

P3 Trolley setpoint acceleration

The setpoint acceleration is a guide value in mm/s^2 for accelerating and decelerating with the sway control activated in all operation modes. The acceleration value is not constant. It varies depending on the state of the oscillation model and the measured pendulum deflection. Values of less than 20 that are entered are interpreted as ramp time.

Default: 150 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]
Access code: 1

P4 Maximum trolley acceleration

The maximum acceleration limits the acceleration of the output velocity.

Set manually according to manufacturer's or customer's specifications.

The value P4 should be between 1.5 and 2 times the P3 value. The quick stop ramp P12 is not limited to this value.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 250 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]
Access code: 2

P5 Position conversion factor for trolley

Conversion factor for the actual and target positions of the trolley.

Actual position = P5 · S_act + P6
Target position = P5 · S_set + P6

Default: 1   Min: -100   Max: 100
Access code: 2

P6 Position conversion offset for trolley

Offset for the actual and target positions of the trolley.

Actual position = P5 · S_act + P6
Target position = P5 · S_set + P6

Default: 0 [mm]   Min: -100,000 [mm]   Max: 100,000 [mm]
Access code: 2

P7 Minimum position for trolley positioning

Target position smaller:	Error E03 (error bit 3)
Actual position smaller:	Error E06 (error bit 9)

In both cases, the trolley does not start.
During travel, the trolley stops with quick stop ramp P12.
Target and actual position refer to the values after conversion with P5 and P6.

Default: 0 [mm]   Min: -500,000 [mm]   Max: 500,000 [mm]
Access code: 1

Note

Only relevant for the positioning operation mode.

P8 Maximum position for trolley positioning

Target position larger:	Error E03 (error bit 3)
Actual position larger:	Error E06 (error bit 9)

In both cases, the trolley does not start.
During travel, the trolley stops with quick stop ramp P12.
Target and actual position refer to the values after conversion with P5 and P6.

Default: 200,000 [mm]   Min: -500,000 [mm]   Max: 500,000 [mm]
Access code: 1

Note

Only relevant for the positioning operation mode.

P9 Trolley positioning accuracy

The positioning accuracy should not be set lower than the minimum required value. A difference between the current and target positions that is smaller than the set positioning accuracy is a condition for setting status bit "Pos_completed" (see Chapter Interface description (Page 45)). Positioning will continue while the operation mode remains active and the "Travelling" control bit remains set.

Default: 50 [mm]   Min: 3 [mm]   Max: 200 [mm]

Access code: 1

Note

Only relevant for the positioning operation mode.

P10 Deceleration gain for trolley

Multiplication factor for the deceleration.

Deceleration is obtained

- with active sway control from P3 · P10, for countering from P3 · P10 · P18,

- without sway control from P2 · P10 and for countering from P2 · P10 · P18.

The parameter has no influence on deceleration P14 when a prelimit switch is actuated. The effective deceleration is limited to the maximum acceleration P4.

Default: 1   Min: 0,5   Max: 5

Access code: 1

Note

Only relevant for the manual operation mode.

P11 Not used

P12 Quick stop ramp trolley

Time in ms, to brake from the maximum velocity down to zero.

The drive stops along this ramp without sway control if:

- Control bit "Release" (enable) = 0
- Control bit "Travelling" (travel signal) = 0
- Control bit "Brake_closed" (output value enable) = 1
- Control bit "LS_F" or "LS_B" (limit switch) = 0
- Issue of error messages E1, E3, E6

Default: 1,000 [ms]	Min: 0 [ms]	Max: 10,000 [ms]

Access code: 2

P13 Prelimit switch velocity trolley

The output velocity is limited to this value if a limit switch has responded.
Specified as a % of the maximum output velocity P1.

Default: 10 [%]	Min: 0 [%]	Max: 100 [%]

Access code: 1

P14 Deceleration prelimit switch trolley

Trolley deceleration when the prelimit switch is actuated.

No limit is applied in manual operation mode.

In the other operation modes, the parameter is effective only if the value is between the set acceleration P3 and the maximum acceleration P4.

If P14<P3, then P3 is applied as the deceleration rate.

If P14>P4, then P4 is applied as the deceleration rate.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 250 [mm/s^2]	Min: 1 [mm/s^2]	Max: 4,000 [mm/s^2]

Access code: 1

P15 Position controller trolley

P position controller for positioning and sway neutralization operation modes.

A value lower than zero means that the position controller and the following error monitor are not activated until drive deceleration is about to begin (twice the braking distance before the target position).

Default: 0,5   Min: -1   Max: 10

Access code: 3

Note

Only relevant for the positioning operation mode.

P16 Damping factor trolley (decelerating)

Damping factor for the sway control in all operation modes when decelerating.
High values result in non-periodic, transient responses, low values, in overshoot and shorter rise times.
If the value is zero, no sway control when decelerating.

Default: 1,2   Min: 0   Max: 10

Access code: 3

P17 Damping factor trolley (accelerating)

Damping factor for sway control in the manual operation mode when accelerating.
High values result in the non-periodic transient responses, low values, to overshoot and shorter rise times. In order to achieve fast acceleration levels, the value should be less than when braking.
If the value is zero then there is no sway control when accelerating in manual operation mode.

Default: 1   Min: 0   Max: 5

Access code: 3

Note

Only relevant for the manual operation mode.

P18 Braking gain when countering, trolley

The deceleration is multiplied by this value when the set velocity and the actual velocity have different signs (countering). The resulting deceleration is limited to the relevant maximum acceleration.

Default: 1,2	Min: 0,5	Max: 5
Access code: 1		

Note

Only relevant for the manual operation mode.

P19 Trolley velocity for zero speed detection

Defines the output velocity for the trolley from which "zero" speed is detected. The percentage value refers to the maximum output velocity P1.

Zero speed detection is the condition for setting the control bit "Pos_completed".

Default: 3 [%]	Min: 0 [%]	Max: 75 [%]
Access code: 2		

P20 Activation velocity trolley sway control

The sway control is only activated when the absolute value of the set velocity V_set is greater than this value.

Application: for example, fine positioning in stage 1 without sway control.

Default: 0 [%]	Min: 0 [%]	Max: 100 [%]
Access code: 2		

Note

Only relevant for the manual operation mode.

P21 Boosting of camera measuring signal in trolley dir.

Value to boost the measured deflection to the internal oscillation model.
The camera measuring system has no effect for zero.

Default: 0,1	Min: 0	Max: 1
Access code: 3		

P22 Gain pendulum length for oscillation in trolley dir.

Gain for calculating the effective pendulum length.

Pendulum length = gain · S_Hoist + Offset (P108 is OFF)
Pendulum length = gain · Distance + Offset (P108 is ON)

Default: 1	Min: -20	Max: 20
Access code: 2		

P23 Offset pendulum length for oscillation in trolley dir.

Offset for calculating the effective pendulum length.

Pendulum length = gain · S_Hoist + Offset (P108 is OFF)
Pendulum length = gain · Distance + Offset (P108 is ON)

Default: 0 [mm]	Min: -70,000 [mm]	Max: 70,000 [mm]
Access code: 2		

P24 Digital correction of eff. pendulum length, trolley

Depending on the control bit "DigitalLiftCorrection", the parameter value is added to the actual pendulum length.
The parameter is required to take into account the occasional use of other load carrying devices.

Default: 0 [mm]	Min: -10,000,000 [mm]	Max: 10,000,000 [mm]
Access code: 2		

P25 Analog correction of eff. pendulum length, trolley

Depending on the current load, this parameter is used to calculate a correction value for the pendulum length which is then added to the actual pendulum length.
The parameter is required in order to take into account weight-dependent offset of the center of gravity for significant variations in load.

Default: 0 [mm/kg]	Min: 0 [mm/kg]	Max: 70,000 [mm/kg]
Access code: 2		

P26 Time constant current rise trolley

The current rise and therefore the change in acceleration over time are often limited by the converter. In order to take this delay into account when activating the oscillation model and the position control, a first-order delay element has been provided, whose time constant is set with this parameter. If the value is less than 1, the delay element is deactivated.

Default: 0 [ms]   Min: 0 [ms]   Max: 1,000 [ms]

Access code: 2

P27 Drive switch on delay trolley

Output value delay of the controlled system (including frequency converter)

This delay is taken into account in the calculation of the mathematical model.

If the value is less than 1, the delay element is deactivated.

Default: 0 [ms]   Min: 0 [ms]   Max: 350 [ms]

Access code: 2

P28 Following error trolley

The deviation between the setpoint and actual position must not exceed the value of this parameter during positioning. Otherwise error message E7 is generated. (0 deactivates the monitoring.)

Default: 1,000 [mm]   Min: 0 [mm]   Max: 100,000 [mm]

Access code: 2

Note

Only relevant for the positioning operation mode.

P29 Reserved for detour control (not available in this version)

P30 Camera measuring signal gain in trolley direction

Gain factor for the camera measuring signal before it is boosted to the oscillation model.

Default: 1   Min: 0   Max: 10000

Access code: 2

P31 Not used

P32 Target position offset trolley

Offset of the current position: S_act:=S_act+V[mm/s]·P32·0.001

The dynamic response when braking in the positioning operation mode can be improved using a virtual offset of the current position (compensation for dead times).

Default: 0 [ms]   Min: 0 [ms]   Max: 2000 [ms]

Access code: 2

Note

Only relevant for the positioning operation mode.

P33 Permitted residual sway when stopping, trolley

Maximum permissible pendulum deflection

If the pendulum deflection drops below this value, status bit "SC_completed" is set.

Default: 50 [mm]   Min: 10 [mm]   Max: 300 [mm]

Access code: 1

P34 Permitted residual pendulum velocity, trolley

Maximum permissible pendulum velocity

If the pendulum velocity drops below this value, status bit "SC_completed" is set.

Default: 50 [mm/s]   Min: 10 [mm/s]   Max: 500 [mm/s]

Access code: 1

P35 Normalization value, trolley

With this value, the set velocity V_set specified by the PLC and the actually measured velocity V_act are denormalized, the output velocity V_norm specified by the sway control is normalized.

V_norm = output velocity [mm/s] · P35 : (V_norm: Output velocity output after
P1   normalization)

V_set[mm/s] = V_set · P1 : P35   (V_set: denormalized setpoint in mm/s)

V_act[mm/s] = V_act · P1 : P35   (V_act: denormalized actual value in mm/s)

Default: 16384	Min: 100	Max: 32767
Access code: 2		

11.3   Gantry parameters

P40 Positioning velocity, gantry

This value corresponds to the set velocity in the positioning operation mode. In order to allow a slight overshoot (control margin), a value less than the maximum output velocity P41 should be set (e.g. 90%).

Default: 900 [mm/s]	Min: 10 [mm/s]	Max: 4,000 [mm/s]
Access code: 1		

Note

Only relevant for the positioning operation mode.

P41 Maximum output velocity, gantry

The parameter is the reference value for normalizing P75. V_norm = output velocity [mm/s] · P75 : P41). If the setting is correct (see Chapter Normalization (Page 43)), this value will be the maximum possible velocity.

Default: 1,000 [mm/s]	Min: 10 [mm/s]	Max: 4,000 [mm/s]
Access code: 2		

P42 Acceleration without sway control, gantry

When the sway control function is deactivated, the drive accelerates and decelerates with the set acceleration value. Values of less than 20 that are entered are interpreted as ramp time.

Default: 200 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]

Access code: 1

P43 Setpoint acceleration, gantry

The setpoint acceleration is a guide value in mm/s^2 for accelerating and decelerating with the sway control activated in all operation modes. The acceleration value is not constant. It varies depending on the state of the oscillation model and the measured pendulum deflection. Values of less than 20 that are entered are interpreted as ramp time.

Default: 300 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]

Access code: 1

P44 Maximum acceleration, gantry

The maximum acceleration limits the acceleration of the output velocity.

Set manually according to manufacturer's or customer's specifications.

The value P44 should be between 1.5 and 2 times the P43 value. The quick stop ramp P52 is not limited to this value.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 500 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]

Access code: 2

P45 Position conversion factor, gantry

Conversion factor for the actual and target positions of the gantry.

Actual position = P45 · S_act + P46
Target position = P45 · S_set + P46

Default: 1   Min: -100   Max: 100

Access code: 2

P46 Position conversion offset, gantry

Offset for the actual and target positions of the gantry.

Actual position = P45 · S_act + P46
Target position = P45 · S_set + P46

Default: 0 [mm]	Min: -500,000 [mm]	Max: 500,000 [mm]
Access code: 2		

P47 Minimum position for positioning, gantry

Target position smaller:	Error E03 (error bit 3)
Actual position smaller:	Error E06 (error bit 9)

In both cases, the gantry does not start.
During travel, the gantry stops with quick stop ramp P52.
Target and actual position refer to the values after conversion with P45 and P46.

Default: 0 [mm]	Min: -500,000 [mm]	Max: 500,000 [mm]
Access code: 1		

Note

Only relevant for the positioning operation mode.

P48 Maximum position for positioning, gantry

Target position larger:	Error E03 (error bit 3)
Actual position larger:	Error E06 (error bit 9)

In both cases, the gantry does not start.
During travel, the gantry stops with quick stop ramp P52.
Target and actual position refer to the values after conversion with P45 and P46.

Default: 200,000 [mm]   Min: -2,000,000 [mm]   Max: 2,000,000 [mm]
Access code: 1

Note

Only relevant for the positioning operation mode.

P49 Positioning accuracy, gantry

The positioning accuracy should not be set lower than the minimum required value. A difference between the current and target positions that is smaller than the set positioning accuracy is a condition for setting status bit "Pos_completed" (see Chapter Interface description (Page 45)). Positioning will continue while the operation mode remains active and the "Travelling" control bit remains set.

Note

Only relevant for the positioning operation mode.

Default: 50 [mm]   Min: 3 [mm]   Max: 200 [mm]
Access code: 1

P50 Deceleration gain, gantry

Multiplication factor for the deceleration.

Deceleration is obtained

* with active sway control from P43 · P50, for countering from P43 · P50 · P58,

* without sway control from P42 · P50 and for countering from P42 · P50 · P58.

The parameter has no influence on deceleration P54 when a prelimit switch is actuated. The effective deceleration is limited to the maximum acceleration P44.

Default: 1	Min: 0,5	Max: 5
Access code: 1		

Note

Only relevant for the manual operation mode.

P51 Not used

P52 Quick stop ramp, gantry

Time in ms, to brake from the maximum velocity down to zero.

The drive stops along this ramp without sway control if:

* Control bit "Release" (enable) = 0

* Control bit "Travelling" (travel signal) = 0

* Control bit "Brake_closed" (output value enable) = 1

* Control bit "LS_F" or "LS_B" (limit switch) = 0

* Issue of error messages E1, E3, E6

Default: 1,000 [ms]	Min: 0 [ms]	Max: 10,000 [ms]
Access code: 2		

P53 Prelimit switch velocity, gantry

The output velocity is limited to this value if a limit switch has responded.
(Specified as a % of the maximum output velocity P41)

Default: 10 [%]	Min: 0 [%]	Max: 100 [%]
Access code: 1		

P54 Braking deceleration prelimit switch, gantry

Gantry deceleration when the prelimit switch is actuated.

No limit is applied in manual operation mode.

In the other operation modes, the parameter is effective only if the value is between the set acceleration P43 and the maximum acceleration P44.

If P54<P43, then P43 is applied as the deceleration rate.

If P54>P44, then P44 is applied as the deceleration rate.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 500 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]

Access code: 1

P55 Position controller, gantry

P position controller for positioning and sway neutralization operation modes.

A value lower than zero means that the position controller and the following error monitor are not activated until drive deceleration is about to begin (twice the braking distance before the target position).

Default: 0,5   Min: -1   Max: 10

Access code: 3

Note

Only relevant for the positioning operation mode.

P56 Damping factor, gantry (braking)

Damping factor for the sway control in all operation modes when decelerating.
High values result in non-periodic, transient responses, low values, in overshoot and shorter rise times.
If the value is zero, no sway control when decelerating.

Default: 1,2   Min: 0   Max: 10

Access code: 3

P57 Damping factor, gantry (accelerating)

Damping factor for sway control in the manual operation mode when accelerating.
High values result in the non-periodic transient responses, low values, to overshoot and shorter rise times.
In order to achieve fast acceleration, the value should be less than for braking. If the value is zero, in the manual operation mode there is no sway control when accelerating.

| Default: 1 | Min: 0 | Max: 5 |

Access code: 3

Note

Only relevant for the manual operation mode.

P58 Braking gain when countering, gantry

The deceleration is multiplied by this value when the set velocity and the actual velocity have different signs (countering). The resulting deceleration is limited to the relevant maximum acceleration.

| Default: 1,2 | Min: 0,5 | Max: 5 |

Access code: 1

Note

Only relevant for the manual operation mode.

P59 Velocity for zero speed detection, gantry

Defines the output velocity for the gantry from which "zero" velocity is detected. The percentage value refers to the maximum output velocity P41.

Zero speed detection is the condition for setting the control bit "Pos_completed".

| Default: 3 [%] | Min: 0 [%] | Max: 75 [%] |

Access code: 2

P60 Activation velocity sway control, gantry

The sway control is only activated when the absolute value of the set velocity V_set is greater than this value.

Application: for example, fine positioning in stage 1 without sway control.

Default: 0 [%]   Min: 0 [%]   Max: 100 [%]

Access code: 2

Note

Only relevant for the manual operation mode.

P61 Boosting of camera measuring signal in gantry dir.

Value to boost the measured deflection to the internal oscillation model.
The camera measuring system has no effect for zero.

Default: 0,1   Min: 0   Max: 1

Access code: 3

P62 Gain pendulum length for oscillation in gantry dir.

Gain for calculating the effective pendulum length.

Pendulum length = gain · S_Hoist + Offset (P108 is OFF)
Pendulum length = gain · Distance + Offset (P108 is ON)

Default: 1   Min: -20   Max: 20

Access code: 2

P63 Offset pendulum length for oscillation in gantry dir.

Offset for calculating the effective pendulum length.

Pendulum length = gain · S_Hoist + Offset (P108 is OFF)
Pendulum length = gain · Distance + Offset (P108 is ON)

Default: 0 [mm]   Min: -70,000 [mm]   Max: 70,000 [mm]

Access code: 2

P64 Digital correction of eff. pendulum length, gantry

Depending on the control bit "DigitalLiftCorrection", the parameter value is added to the actual pendulum length.
The parameter is required to take into account the occasional use of other load carrying devices.

Default: 0 [mm]	Min: -10,000,000 [mm]	Max: 10,000,000 [mm]
Access code: 2		

P65 Analog correction, effective pendulum length, gantry

Depending on the current load, this parameter is used to calculate a correction value for the pendulum length which is then added to the actual pendulum length.
The parameter is required in order to take into account weight-dependent offset of the center of gravity for significant variations in load.

Default: 0 [mm/kg]	Min: 0 [mm/kg]	Max: 70,000 [mm/kg]
Access code: 2		

P66 Time constant current rise, gantry

The current rise and therefore the change in acceleration over time are often limited by the converter. In order to take this delay into account when activating the oscillation model and the position control, a first-order delay element has been provided, whose time constant is set with this parameter. If the value is less than 1, the delay element is deactivated.

Default: 0 [ms]	Min: 0 [ms]	Max: 1,000 [ms]
Access code: 2		

P67 Drive switch-on delay, gantry

Output value delay of the controlled system (including frequency converter)

This delay is taken into account in the calculation of the mathematical model.

If the value is less than 1, the delay element is deactivated.

Default: 0 [ms]	Min: 0 [ms]	Max: 350 [ms]
Access code: 2		

P68 Following error, gantry

The deviation between the setpoint and actual position must not exceed the value of this parameter during positioning. Otherwise, error message E8 is generated. (0 deactivates the monitoring.)

Default: 1,000 [mm]   Min: 0 [mm]   Max: 100,000 [mm]

Access code: 2

Note

Only relevant for the positioning operation mode.

P69 Reserved for detour control (not available in this version)

P70 Camera measuring signal gain in gantry direction

Gain factor for the camera measuring signal before it is boosted to the oscillation model.

Default: 1   Min: 0   Max: 10000

Access code: 2

P72 Target position offset, gantry

Offset of the current position: $S\_act := S\_act + V[mm/s] \cdot P72 \cdot 0.001$

The dynamic response when braking in the positioning operation mode can be improved using a virtual offset of the current position (compensation for dead times).

Default: 0 [ms]   Min: 0 [ms]   Max: 2000 [ms]

Access code: 2

Note

Only relevant for the positioning operation mode.

P73 Permitted residual sway when stopping, gantry

Maximum permissible pendulum deflection

If the pendulum deflection drops below this value, status bit "SC_completed" is set.

Default: 50 [mm]   Min: 10 [mm]   Max: 300 [mm]

Access code: 1

P74 Permitted residual pendulum velocity, gantry

Maximum permissible pendulum velocity

If the pendulum velocity drops below this value, status bit "SC_completed" is set.

Default: 50 [mm/s]   Min: 10 [mm/s]   Max: 500 [mm/s]

Access code: 1

P75 Normalization value, gantry

With this value, the set velocity V_set specified by the PLC and the actually measured velocity V_act are denormalized, the output velocity V_norm specified by the sway control is normalized.

V_norm = output velocity [mm/s] · P75 : (V_norm: Output velocity output after normalization)
P41

V_set[mm/s] = V_set · P41 : P75   (V_set: denormalized setpoint in mm/s)

V_act[mm/s] = V_act · P41 : P75   (V_act: denormalized actual value in mm/s)

Default: 16384   Min: 100   Max: 32767

Access code: 2

11.4 Parameters for third drive

11.4.1 Slewing gear parameters

P130 Positioning velocity, slewing gear

This value corresponds to the set velocity in the positioning operation mode. In order to allow a slight overshoot (control margin), a value less than the maximum output velocity P131 should be set (e.g. 90%).

Default: 450 [c°/s]   Min: 10 [c°/s]   Max: 4000 [c°/s]
Access code: 1

Note

Only relevant for the positioning operation mode.

P131 Maximum output velocity, slewing gear

The parameter is the reference value for normalizing P165. V_norm = output velocity [mm/s] · P165 : P131). If the setting is correct (see Chapter Normalization (Page 43)), this value will be the maximum possible velocity.

Default: 500 [c°/s]   Min: 10 [c°/s]   Max: 4000 [c°/s]
Access code: 2

P132 Acceleration without sway control, slewing gear

When the sway control function is deactivated, the drive accelerates and decelerates with the set acceleration value. Values of less than 20 that are entered are interpreted as ramp time.

Default: 100 [c°/s²]   Min: 1 [c°/s²]   Max: 4,000 [c°/s²]
Access code: 1

P133 Setpoint acceleration, slewing gear

The setpoint acceleration is a guide value in $c°/s^2$ for accelerating and decelerating with the sway control activated in all operation modes. The acceleration value is not constant. It varies depending on the state of the oscillation model and the measured pendulum deflection. Values of less than 20 that are entered are interpreted as ramp time.

Default: 150 [$c°/s^2$]   Min: 1 [$c°/s^2$]   Max: 4,000 [$c°/s^2$]

Access code: 1

P134 Maximum acceleration rate, slewing gear

The maximum acceleration limits the acceleration of the output velocity.

Set manually according to manufacturer's or customer's specifications.

The value P134 should be between 1.5 and 2 times the P133 value. The quick stop ramp P142 is not limited to this value.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 250 [$c°/s^2$]   Min: 1 [$c°/s^2$]   Max: 4,000 [$c°/s^2$]

Access code: 2

P135 Position conversion factor, slewing gear

Conversion factor for the actual and target positions of the slewing gear.

Actual position = P135 · S_act + P136
Target position = P135 · S_set + P136

Default: 1   Min: -100   Max: 100

Access code: 2

P136 Position conversion offset, slewing gear

Offset for the actual and target positions of the slewing gear.

Actual position = P135 · S_act + P136
Target position = P135 · S_set + P136

Default: 0 [c°]   Min: -100,000 [c°]   Max: 100,000 [c°]

Access code: 2

P137 Minimum position for slewing gear positioning

Target position smaller:	Error E03 (error bit 3)
Actual position smaller:	Error E06 (error bit 6)

In both cases, the slewing gear does not start.
During travel, the slewing gear stops with quick stop ramp P142.
Target and actual position refer to the values after conversion with P135 and P136.

Default: 0 [c°]	Min: -200,000 [c°]	Max: 200,000 [c°]

Access code: 1

Note

Only relevant for the positioning operation mode.

P138 Maximum position for slewing gear positioning

Target position larger:	Error E03 (error bit 3)
Actual position larger:	Error E06 (error bit 6)

In both cases, the slewing gear does not start.
During travel, the slewing gear stops with quick stop ramp P142.
Target and actual position refer to the values after conversion with P135 and P136.

Default: 36000 [c°]	Min: -200,000 [c°]	Max: 200,000 [c°]

Access code: 1

Note

Only relevant for the positioning operation mode.

P139 Positioning accuracy, slewing gear

The positioning accuracy should not be set lower than the minimum required value. A difference between the current and target positions that is smaller than the set positioning accuracy is a condition for setting status bit "Pos_completed" (see Chapter Interface description (Page 45)). Positioning will continue while the operation mode remains active and the "Travelling" control bit remains set.

Default: 50 [c°]	Min: 3 [c°]	Max: 200 [c°]

Access code: 1

Note

Only relevant for the positioning operation mode.

P140 Deceleration gain, slewing gear

Multiplication factor for the deceleration.

Deceleration is obtained

- for active sway control from P133 · P140, for countering from P133 · P140 · P148,

- without sway control from P132 · P140 and for countering from P132 · P140 · P148.

The parameter has no influence on deceleration P144 when a prelimit switch is actuated. The effective deceleration is limited to the maximum acceleration P134.

Default: 1	Min: 0,5	Max: 5

Access code: 1

Note

Only relevant for the manual operation mode.

P141 Not used

P142 Quick stop ramp, slewing gear

Time in ms, to brake from the maximum velocity down to zero.

The drive stops along this ramp without sway control if:

● Control bit "Release" (enable) = 0

● Control bit "Travelling" (travel signal) = 0

● Control bit "Brake_closed" (output value enable) = 1

● Control bit "LS_F" or "LS_B" (limit switch) = 0

● Issue of error messages E1, E3, E6

Default: 1,000 [ms]   Min: 0 [ms]   Max: 10,000 [ms]

Access code: 2

P143 Prelimit switch velocity, slewing gear

The output velocity is limited to this value if a limit switch has responded.
(Specified as a % of the maximum output velocity P131)

Default: 10 [%]   Min: 0 [%]   Max: 100 [%]

Access code: 1

P144 Braking deceleration of prelimit switch, slewing gear

Slewing gear deceleration when the prelimit switch is actuated.

No limit is applied in manual operation mode.

In the other operation modes, the parameter is effective only if the value is between the set acceleration P133 and the maximum acceleration P134.

If P144<P133, P133 is applied as the deceleration rate.

If P144>P134, P134 is applied as the deceleration rate.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 250 [c°/s^2]   Min: 1 [c°/s^2]   Max: 4,000 [c°/s^2]

Access code: 1

P145 Position controller, slewing gear

P position controller for positioning and sway neutralization operation modes.

A value lower than zero means that the position controller and the following error monitor are not activated until drive deceleration is about to begin (twice the braking distance before the target position).

Default: 0,5   Min: -1   Max: 10

Access code: 3

Note

Only relevant for the positioning operation mode.

P146 Damping factor, slewing gear (decelerating)

Damping factor for the sway control in all operation modes when braking. High values result in non-periodic, transient responses, low values, in overshoot and shorter rise times.
If the value is zero, no sway control when decelerating.

Default: 1,2   Min: 0   Max: 10

Access code: 3

P147 Damping factor, slewing gear (accelerating)

Damping factor for the sway control in the manual operation mode when accelerating. High values result in non-periodic transient responses and low values to overshoot and short rise times. To achieve fast acceleration, the value should be lower than when braking. If the value is zero, in the manual operation mode there is no sway control when accelerating.

Default: 1   Min: 0   Max: 5

Access code: 3

Note

Only relevant for the manual operation mode.

P148 Braking gain when countering, slewing gear

The deceleration is multiplied by this value when the set velocity and the actual velocity have different signs (countering). The resulting deceleration is limited to the relevant maximum acceleration.

Default: 1,2   Min: 0,5   Max: 5

Access code: 1

Note

Only relevant for the manual operation mode.

P149 Slewing gear velocity for zero speed detection

Defines the output velocity for the slewing gear from which "zero" speed is detected. The percentage value refers to the maximum output velocity P131.

Zero speed detection is the condition for setting the control bit "Pos_completed".

Default: 3 [%]   Min: 0 [%]   Max: 75 [%]

Access code: 2

P150 Activation velocity sway control slewing gear

The sway control is only activated when the absolute value of the set velocity V_set is greater than this value.

Application: For example, fine positioning in stage 1 without sway control

Default: 0 [%]   Min: 0 [%]   Max: 100 [%]

Access code: 2

Note

Only relevant for the manual operation mode.

P151 Boosting of camera signal in slewing gear dir.

Value to boost the measured deflection to the internal oscillation model.
The camera measuring system has no effect for zero.

Default: 0,05   Min: 0   Max: 1

Access code: 3

P152 Pendulum length gain, slewing gear

Gain for calculating the effective pendulum length if the control bit "DigitalLiftCorrection" is not set.

Pendulum length = P152 · S_Hoist + P153 (P108 is OFF)
Pendulum length = P152 · Distance + P153 (P108 is ON)

Default: 0,33   Min: -1000   Max: 1000
Access code: 3

P153 Offset pendulum length, slewing gear

Offset for calculating the effective pendulum length if the control bit "DigitalLiftCorrection" is not set.

Pendulum length = P152 · S_Hoist + P153 (P108 is OFF)
Pendulum length = P152 · Distance + P153 (P108 is ON)

Default: 0 [mm]   Min: -200,000 [mm]   Max: 200,000 [mm]
Access code: 3

P154 Pendulum length gain under load conditions, slew. gear

Alternative gain for calculating the effective pendulum length if the control bit "DigitalLiftCorrection" is set.

Pendulum length = P154 · S_Hoist + P155 (P108 is OFF)
Pendulum length = P154 · Distance + P155 (P108 is ON)

Default: 1   Min: -1000   Max: 1000
Access code: 3

P155 Offset pendulum length under load cond., slew. gear

Alternative offset for calculating the effective pendulum length if the control bit "DigitalLiftCorrection" is set.

Pendulum length = P154 · S_Hoist + P155 (P108 is OFF)
Pendulum length = P154 · Distance + P155 (P108 is ON)

Default: 0 [mm]   Min: -200,000 [mm]   Max: 200,000 [mm]
Access code: 3

P156 Time constant current rise, slewing gear

The current rise and therefore the change in acceleration over time are often limited by the converter. In order to take this delay into account when activating the oscillation model and the position control, a first-order delay element has been provided, whose time constant is set with this parameter. If the value is less than 1, the delay element is deactivated.

Default: 0 [ms]	Min: 0 [ms]	Max: 1,000 [ms]
Access code: 2		

P157 Drive switch-on delay, slewing gear

Output value delay of the controlled system (including frequency converter)

This delay is taken into account in the calculation of the mathematical model.

If the value is less than 1, the delay element is deactivated.

Default: 0 [ms]	Min: 0 [ms]	Max: 350 [ms]
Access code: 2		

P158 Following error, slewing gear

The deviation between the setpoint and actual position must not exceed the value of this parameter during positioning. Otherwise, error message E9 is generated. (0 deactivates the monitoring.)

Default: 100 [c°]	Min: 0 [c°]	Max: 10,000 [c°]
Access code: 2		

Note

Only relevant for the positioning operation mode.

P159 Direction of rotation of slewing gear

Selection 1: Direction of rotation of slewing gear

OFF: Counter-clockwise rotation

ON: Clockwise rotation

The direction of rotation is defined from the perspective of the trolley. The angle values for the slewing gear either increase (1) or decrease (0) with a clockwise motion.

Default: 1 (ON)   Min: 0   Max: 1

Access code: 1

Note

Depending on the direction of rotation of the slewing gear, the parameter assigns the appropriate pendulum deflections for the camera in the trolley and gantry directions (if P88=1 is set).
If the parameter value = 0 (OFF: counterclockwise rotation) the current position of the slewing gear is negated with the change in coordinates from the deflections and pendulum velocities measured.

P160 Camera measuring signal gain in dir. of rotation

Gain factor for the camera measuring signal before it is boosted to the oscillation model.

Default: 1   Min: 0   Max: 10000

Access code: 2

P161 Target position offset, slewing gear

Offset of the current position: $S\_act := S\_act + V[c\ °/s] \cdot P161 \cdot 0.001$

The dynamic response when braking in the positioning operation mode can be improved using a virtual offset of the current position (compensation for dead times).

Default: 0 [ms]   Min: 0 [ms]   Max: 2000 [ms]

Access code: 2

Note

Only relevant for the positioning operation mode.

P162 Not used

P163 Permitted residual sway when stopping, slewing gear

Maximum permissible rotation

If the rotation drops below this value, status bit "SC_completed" is set.

Default: 50 [c°]	Min: 10 [c°]	Max: 300 [c°]
Access code: 1		

P164 Permitted residual rotation velocity, slewing gear

Maximum permissible pendulum velocity

If the pendulum velocity drops below this value, status bit "SC_completed" is set.

Default: 50 [c°/s]	Min: 10 [c°/s]	Max: 500 [c°/s]
Access code: 1		

P165 Normalization value, slewing gear

With this value, the set velocity V_set specified by the PLC and the actually measured velocity V_act are denormalized, the output velocity V_norm specified by the sway control is normalized.

V_norm = output velocity [mm/s] · P165 : P131   (V_norm: Output velocity output after normalization)

V_set[mm/s] = V_set · P131 : P165   (V_set: denormalized setpoint in mm/s)

V_act[mm/s] = V_act · P131 : P165   (V_act: denormalized actual value in mm/s)

Default: 16384	Min: 100	Max: 32767
Access code: 2		

11.4.2 Hoist parameters

P130 Positioning velocity, hoist

This value corresponds to the set velocity in the positioning operation mode. In order to allow a slight overshoot (control margin), a value less than the maximum output velocity P131 should be set (e.g. 90%).

Default: 450 [mm/s]   Min: 10 [mm/s]   Max: 4,000 [mm/s]

Access code: 1

Note

Only relevant for the positioning operation mode.

P131 Maximum output velocity, hoist

The parameter is the reference value for normalizing P165. V_norm = output velocity [mm/s] · P165 : P131). If the setting is correct (see Chapter Normalization (Page 43)), this value will be the maximum possible velocity.

Default: 500 [mm/s]   Min: 10 [mm/s]   Max: 4,000 [mm/s]

Access code: 2

P132 Acceleration, hoist

The drive accelerates and brakes with the set acceleration value. Values of less than 20 that are entered are interpreted as ramp time.

Default: 100 [mm/s^2]   Min: 1 [mm/s^2]   Max: 4,000 [mm/s^2]

Access code: 1

P133 Not used

P134 Maximum acceleration, hoist

The maximum acceleration limits the acceleration of the output velocity.

Set manually according to manufacturer's or customer's specifications.

The resulting setpoint acceleration from P132 · P140 · P148 is limited to this value. The quick stop ramp P142 is not limited to this value.

Values of less than 20 that are entered are interpreted as ramp time.

Default: 250 [mm/s²]	Min: 1 [mm/s²]	Max: 4,000 [mm/s²]
Access code: 2		

P135 Position conversion factor, hoist

Conversion factor for the actual and target positions of the hoist.

Actual position = P135 · S_act + P136
Target position = P135 · S_set + P136

Default: 1	Min: -100	Max: 100
Access code: 2		

P136 Position conversion offset, hoist

Offset for the actual and target positions of the hoist.

Actual position = P135 · S_act + P136
Target position = P135 · S_set + P136

Default: 0 [mm]	Min: -100,000 [mm]	Max: 100,000 [mm]
Access code: 2		

P137 Minimum position for hoist positioning

Target position smaller:	Error E03 (error bit 3)
Actual position smaller:	Error E06 (error bit 6)

In both cases, the hoist does not start.
During travel, the hoist stops with quick stop ramp P142.
Target and actual position refer to the values after conversion with P135 and P136.

Default: 0 [mm]   Min: -200,000 [mm]   Max: 200,000 [mm]
Access code: 1

Note

Only relevant for the positioning operation mode.

P138 Maximum position for hoist positioning

Target position larger:	Error E03 (error bit 3)
Actual position larger:	Error E06 (error bit 6)

In both cases, the hoist does not start.
During travel, the hoist stops with quick stop ramp P142.
Target and actual position refer to the values after conversion with P135 and P136.

Default: 20,000 [mm]   Min: -200,000 [mm]   Max: 200,000 [mm]
Access code: 1

Note

Only relevant for the positioning operation mode.

P139 Positioning accuracy, hoist

The positioning accuracy should not be set lower than the minimum required value. A difference between the current and target positions that is smaller than the set positioning accuracy is a condition for setting status bit "Pos_completed" (see Chapter Interface description (Page 45)). Positioning will continue while the operation mode remains active and the "Travelling" control bit remains set.

Default: 50 [mm]   Min: 3 [mm]   Max: 200 [mm]

Access code: 1

Note

Only relevant for the positioning operation mode.

P140 Deceleration gain, hoist

Multiplication factor for the deceleration.

The deceleration results from P132 · P140 and for countering from P132 · P140 · P148.

The effective deceleration is limited to the maximum acceleration P134.

Default: 1   Min: 0,5   Max: 5

Access code: 1

Note

Only relevant for the manual operation mode.

P141 Not used

P142 Quick stop ramp, hoist

Time in ms, to brake from the maximum velocity down to zero.

The drive stops along this ramp if:

- Control bit "Release" (enable) = 0
- Control bit "Travelling" (travel signal) = 0
- Control bit "Brake_closed" (output value enable) = 1
- Control bit "LS_F" or "LS_B" (limit switch) = 0
- Issue of error messages E1, E3, E6

Default: 1,000 [ms]   Min: 0 [ms]   Max: 10,000 [ms]
Access code: 2

P143 Prelimit switch velocity, hoist

The output velocity is limited to this value if a limit switch has responded.
(Specified as a % of the maximum output velocity P131)

Default: 10 [%]   Min: 0 [%]   Max: 100 [%]
Access code: 1

P144 Not used

P145 Position controller, hoist

P position controller for positioning and sway neutralization operation modes.

A value lower than zero means that the position controller and the following error monitor are not activated until drive deceleration is about to begin (twice the braking distance before the target position).

Default: 0,5   Min: -1   Max: 10
Access code: 3

Note

Only relevant for the positioning operation mode.

P146 to P147 Not used

P148 Braking gain when countering, hoist

The deceleration is multiplied by this value when the set velocity and the actual velocity have different signs (countering). The resulting deceleration is limited to the relevant maximum acceleration.

Default: 1,2   Min: 0,5   Max: 5

Access code: 1

Note

Only relevant for the manual operation mode.

P149 Hoist velocity for zero speed detection

Defines the output velocity for the hoist from which "zero" speed is detected. The percentage value refers to the maximum output velocity P131.

Zero speed detection is the condition for setting the control bit "Pos_completed".

Default: 3 [%]   Min: 0 [%]   Max: 75 [%]

Access code: 2

P150 Not used

P151 Not used

P152 Not used

P153 Not used

P154 Not used

P155 Not used

P156 Not used

P157 Not used

P158 Following error, hoist

The deviation between the setpoint and actual position must not exceed the value of this parameter during positioning. Otherwise, error message E9 is generated. (0 deactivates the monitoring.)

Default: 1,000 [mm]   Min: 0 [mm]   Max: 100,000 [mm]
Access code: 2

Note

Only relevant for the positioning operation mode.

P159 Not used

P160 Not used

P161 Target position offset, hoist

Offset of the current position: S_act:=S_act+V[mm/s]·P161·0.001

The dynamic response when braking in the positioning operation mode can be improved using a virtual offset of the current position (compensation for dead times).

Default: 0 [ms]   Min: 0 [ms]   Max: 2000 [ms]
Access code: 2

Note

Only relevant for the positioning operation mode.

P162 Not used

P163 Not used

P164 Not used

P165 Normalization value hoist

With this value, the set velocity V_set specified by the PLC and the actually measured velocity V_act are denormalized, the output velocity V_norm specified by the sway control is normalized.

V_norm = output velocity [mm/s] · P165 : P131

(V_norm: Output velocity output after normalization)

V_set[mm/s] = V_set · P131 : P165

(V_set: denormalized setpoint in mm/s)

V_act[mm/s] = V_act · P131 : P165

(V_act: denormalized actual value in mm/s)

Default:16384   Min: 100   Max: 32767

Access code: 2

11.5 General parameters

P80 Assignment of camera measurement direction

Assignment of the direction of motion from gantry and trolley to the camera measurement direction (x, y direction).

0:	ON:	Motion up or down corresponds to the trolley travel.
	OFF:	Motion up or down corresponds to the gantry travel.

1:	ON:	Motion to the left corresponds to the forward direction.
	OFF:	Motion to the right corresponds to the forward direction.

2:	ON:	Motion up corresponds to the forward direction.
	OFF:	Motion down corresponds to the forward direction.

Default: 0 (all OFF)   Min: 0   Max: 7

Access code: 2

Note

The direction specifications relate to the camera image (see Chapter Step 1: Aligning the camera (Page 121)).

- Selection "1" is only significant for the gantry when selection "0" = ON.
- Selection "2" is only significant for the trolley when selection "0" = ON.
- Where selection "0" = OFF then selection "1" only applies to the trolley and selection "2" only applies to the gantry.

The measuring range of the camera in the y-direction is smaller than the measuring range of the camera in the x-direction. As a result the camera must be mounted in such a way that the x-direction corresponds with the direction of motion of the drive where the larger deflection occurs in operation. This is generally the trolley.

P81 Reserved

P82 Weight of the load carrying device

Weight of the load carrying device to determine the shift in the center of gravity. This value is subtracted from the load weight "Load" in the "General data" interface block. The remaining net load is used to calculate the center of gravity.

Default: 0 [kg]   Min: -50,000 [kg]   Max: 100,000 [kg]

Access code: 2

Note

The total load (load weight "Load") is transmitted in the "General data" interface block in 10 kg steps. Parameter P82, weight of the load carrying device, is subtracted from this value. The weight of the empty load carrying device displayed in SIMOCRANE CeCOMM must be entered into P82 (PROFIBUS interface [2] "Load" value display screen).

P83 Upper limit for camera measurement

For pendulum lengths less than this value, only the mathematical oscillation model is applied. The measured pendulum deflection is not taken into account.

Default: 0 [mm]   Min: 0 [mm]   Max: 100,000 [mm]

Access code: 3

P84 Upper limit for sway control

The sway control system is deactivated at hoist heights (S_Hoist) or at camera-to-reflector distances (Distance) above this limit. The parameter P108 can be set to determine whether "S_Hoist" or "Distance" is applicable.

Default: 100 [mm]   Min: -70,000 [mm]   Max: 70,000 [mm]

Access code: 2

Note

The effectiveness of P84 and P85 does not depend on the direction. The sway control is deactivated if the value for "S_Hoist" or "Distance" is outside the limits of P84 and P85.

P85 Lower limit for sway control

The sway control system is deactivated at hoist heights (S_Hoist) or at camera-to-reflector distances (Distance) above this limit. The parameter P108 can be set to determine whether "S_Hoist" or "Distance" is applicable.

Default: 100,000 [mm]   Min: -100,000 [mm]   Max: 100,000 [mm]

Access code: 2

Note

The effectiveness of P84 and P85 does not depend on the direction. The sway control is deactivated if the value for "S_Hoist" or "Distance" is outside the limits of P84 and P85.

P86 Minimum pendulum length

The pendulum length must have a value at least the size of the set value. Otherwise it will be set to this value and the sway control system deactivated.

Default: 1,000 [mm]   Min: 500 [mm]   Max: 100,000 [mm]

Access code: 3

P87 Maximum pendulum length

The pendulum length must not be larger than the set value. Otherwise it will be set to this value and the sway control system deactivated.

Default: 100,000 [mm]   Min: 1,000 [mm]   Max: 100,000 [mm]

Access code: 3

P88 Relationship between camera and reflector

Mounting of the camera and the reflector with respect to the slewing gear:

1: Slewing gear rotates camera and reflector

2: Slewing gear rotates reflector, but not camera

3: Slewing gear does not rotate camera or reflector

Default: 1	Min: 1	Max: 3
Access code: 3		

Note

If the setting is "1: Slewing gear rotates camera and reflector," the sway angle for the gantry and trolley will be converted as a function of the slewing gear position and the setting of parameter P159. The two other settings result in conversion not being performed.

If the setting is "2: Slewing gear rotates reflector, but not the camera," a zero position of -S_act (current position of the slewing gear) is assumed for the camera deflection.

P89 Suppress opposite direction

As long as the output velocity does not reach this value (as percentage of maximum velocity), the drive will move only in the direction specified by the crane operator.

The parameter is valid for all sway-controlled drives.

Default: 75 [%]	Min: 0 [%]	Max: 100 [%]
Access code: 3		

Note

Only relevant for the manual operation mode.

P90 Reserved for detour control (not available in this version)

P91 Reserved for detour control (not available in this version)

P92 Reserved for detour control with hoist (not available in this version)

P93 Reserved for detour control with hoist (not available in this version)

P94 Acceleration reduction, creeping travel

If the set velocity and the actual velocity equal less than 30 % of the maximum velocity, the set acceleration is multiplied by this factor. The value is valid for all drives.

Default: 0,5	Min: 0.001	Max: 1
Access code: 2		

Note

Only relevant for the manual operation mode with sway control.

P95 Deceleration reduction, creeping travel

If the set velocity and the actual velocity are less than 30 % of the maximum velocity, the set acceleration is multiplied by this factor and used as deceleration setpoint. The value is valid for all drives.

Default: 0,5	Min: 0.001	Max: 1
Access code: 2		

Note

Only relevant for the manual operation mode with sway control.

P96 Rotation of the reflector

This value is added to the measured rotation in order to compensate any rotation in the quiescent position.

Default: 0 [c°]	Min: -2000 [c°]	Max: 2000 [c°]
Access code: 1		

P97 Permit positioning from the limit switch

This parameter can be used to determine whether the limit switches work depending on the direction in positioning operation mode or whether they work independently of the direction of motion.

0:	ON:	Limit switches on trolley work depending on the direction.
	OFF:	Limit switches on trolley work independently of the direction of motion.
1:	ON:	Limit switches on gantry work depending on the direction.
	OFF:	Limit switches on gantry work independently of the direction of motion.
2:	ON:	Limit switches on hoist or slewing gear work depending on the direction.
	OFF:	Limit switches on hoist or slewing gear work independently of the direction of motion.

Default: 0 (all OFF)　　　　Min: 0　　　　　　　　Max: 7

Access code: 1

Note

Only relevant for the positioning operation mode.

P100 Access code

Access code for changing parameters:

1: Every user

2: Commissioning engineer

3: Service technician

4: Development engineer

Default: 3　　　　　　　Min: 1　　　　　　　　Max: 4

Access code: 1

P101 Parameter set locked during travel

Selection: 1: Parameter set locked during travel

OFF: Switching over the parameter set is possible at any time.

ON: It is not possible to switch between parameter sets during travel (if the control bit "Travelling" is set for at least one drive).

Default: 1 (ON)   Min: 0   Max: 1

Access code: 2

P102 Reserved

P103 Not used

P104 Not used

P105 to P107 Reserved

P108 Pendulum length from the PLC / from the camera

Selection 1: Selection of data source to determine pendulum length

OFF: Determination of effective pendulum length with PLC value "S_Hoist" (General block)

ON: Determination of effective pendulum length with distance measured to the reflector, "Distance" value (data from the camera)

Default: 0 (OFF)   Min: 0   Max: 1

Access code: 2

P109 Not used

P110 Language

Select a language:

1: German

2: English

3: German, P115 Hubwerk aktiviert

4: English, P115 Hoist activated

Default: 1   Min: 1   Max: 4

Access code: 1

P111 Not used

P112 Not used

P113 Not used

P114 Not used

P115 Configuration

Selection:

1:	ON:	System without camera (blind)
	OFF:	System with camera
2:	ON:	Positioning deactivated
	OFF:	Positioning activated
3:	ON:	Slewing gear activated
	OFF:	Slewing gear deactivated
4:	ON:	Hoist activated
	OFF:	Hoist deactivated

Default: 0 (all OFF)   Min: 0   Max: 15

Access code: 3

P119 Commissioning status

Information encoded bit-by-bit about which commissioning steps have been completed successfully.

Default: 0	Min: 0	Max: 65535
Access code: 1		

Notes on servicing and maintenance 12

12.1 General information

This chapter provides only selected notes on servicing and maintenance. Please refer to the operating instructions for comprehensive information:

* SIMOTION C
* SIMOCRANE CenSOR.

12.2 Reflector maintenance

The reflector must be cleaned regularly in accordance with the amount of dirt. All dirt and paint residues must be removed. The reflector must be checked to ensure that it is securely mounted as part of the regular crane inspection.

12.3 Camera maintenance

The lens and where applicable the front plate of the protective camera housing must be checked and cleaned in accordance with the amount of dirt and contamination. The camera must also be checked to ensure that it is securely mounted.

Note

Further information is contained in the operating instructions for the SIMOCRANE CenSOR camera measuring system.

12.4 Check of the position sensing functions for the hoist after rope changing

After carrying out maintenance work at the hoist and changing the cable, the position sensing sensor must be checked and should be re-referenced where required.

Appendix

A

A.1 List of abbreviations

The following abbreviations are used in this document:

Abbreviation		Significance
c°	Centigrade	One-hundredth of a degree; unit of measurement used with the slewing gear
LS	Limit switch	Limit switch
MMC	Micro Memory Card	Memory card for non-volatile storage of the drive software and parameters
OM	Operation mode	Operation mode
PD	Pendulum	Pendulum
PS	Parameter Set	Parameter set
PCS	Prelimit switch	Prelimit switch
SC	Sway control	Sway control

Glossary

Crane control system

In this document, the crane control system refers to the higher-level controller (PLC). A SIMATIC S7 is a typical example of a PLC for this application.

All data exchanged between the crane control system and the sway control system is performed via PROFIBUS.

Dead-man's switch

A dead-man's device (or dead man, dead-man's warner, dead-man's switch, dead-man's pedal or dead-man's handle) checks whether a person is present and is able to take action, and triggers a signal or switching action when this is not the case.

Effective pendulum length

The effective pendulum length is the pendulum length that corresponds to that of a physical pendulum.

The oscillation period for this is $T = 2 \cdot \pi \cdot \sqrt{l} : g$.

This effective pendulum length is obtained by means of oscillation tests and differs from the pendulum length obtained by measuring with a tape measure, as the pendulum resulting from the real design of the crane does not meet the conditions of a physical pendulum.

The effective pendulum length is one of the fundamental input variables for the control algorithm for the sway control.

Gantry

Gantry refers to the gantry gear.

Gantry crane

Gantry crane refers to a portal crane.

Hoist

The hoist refers to the crane's hoist mechanism.

OHBC

OHBC is an overhead bridge crane.

RMG

RMG is a rail-mounted gantry crane.

RTG

RTG is a rubber-tired gantry crane.

SIMOCRANE CeCOMM

Diagnostic tool for the sway control system for:

- Commissioning,
- Monitoring and changing parameters,
- Displaying input and output variables,
- Creating trace records.

SIMOCRANE CenSOR

Camera measuring system for capturing

- the pendulum deflection in two directions of motion (gantry and trolley),
- the rotation when slewing gear is used,
- the distance between the camera and reflector.

Technology objects (TO)

The SIMOTION runtime system is implemented in an object-oriented rather than a function-oriented manner, i.e. independent technology objects (TO) are used.

Technology objects have a high degree of functionality integrated into them. For example, a TO axis contains the capability for communication with the drive, as well as measured value processing, position control, and positioning functions.

Technology objects offer the user a technological view of actuators and sensors and provide technological functions for these, for example, the technology object "Axis for drive and encoder."