

SIEMENS



**Catalog
CR 1**

**Edition
2024**

CRANES

Drive, Control and Automation Components and Solutions for Cranes

[siemens.com/cr1](https://www.siemens.com/cr1)

Related catalogs

Motion Control System

SIMOTION

Equipment for Production Machines

PM 21

E86060-K4921-A101-A4-7600



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Chassis-2 Format Converter Units
Cabinet Modules, Cabinet Modules-2

D 21.3

SINAMICS S150

Converter Cabinet Units
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Motion Control Drives

SINAMICS S120, SINAMICS S220 and
SIMOTICS

D 21.4

E86060-K5521-A141-A2-7600



Motion Control Drives

SINAMICS Converters for Single-Axis Drives
Built-In Units

D 31.1

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Motion Control Drives

SINAMICS Converters for Single-Axis Drives
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ST 70

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SIMATIC HMI / PC-based Automation

Human Machine Interface Systems
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ST 80/ST PC

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SITRAIN

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Additional documentation

You will find all information material, such as brochures, catalogs, manuals and operating instructions up-to-date on the internet

www.siemens.com/cranes
www.siemens.com/motioncontrol/docu

You can order the listed documentation or download it in the common file format (PDF, ZIP).

Drive, Control and Automation Components and Solutions for Cranes

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Cranes



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Supersedes:
Catalog CR 1 · 2015

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The products and systems described in this catalog are manufactured/distributed under application of a certified quality management system in accordance with EN ISO 9001. The certificate is recognized by all IQNet countries.

Digitalization in drive technology

From the digital world to the real world

siemens.com/digital-drives

Increase your transparency and productivity by digitalizing your drive technology

Many drives are used in the manufacturing and process industries. They produce lots of data anyway – why not use them to increase the availability and productivity of machines and plants?

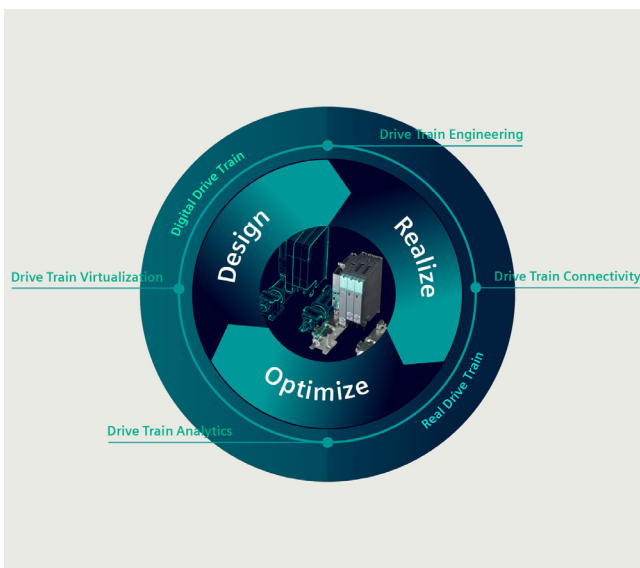
Drive technology offers the ideal entry point into the world of digitalization – for plant and machine builders as well as for users.

The digitalization portfolio for the drive train spans over the complete life cycle – from the design phase to realization and optimization – in the digital and the real world.

Our portfolio contains drive simulation solutions and efficient engineering tools, comprehensive connectivity that allows drives to be easily linked to the relevant platforms as well as smart analytics (e.g. cloud and edge apps) and drive system services.

These solutions enable you to gain a better understanding of processes, states and utilization. The health status of the drive train can be monitored and analyzing drive data enables an early detection of anomalies and reduces downtimes. This way, availability and productivity of machines and plants can be increased and the actual maintenance demand can be identified. Furthermore, data-based business models and service offerings are facilitated.

Our digitalization portfolio covers all phases of the life cycle: from the design phase to realization and optimization. It covers the digital and the real drive train.



Design: By creating a digital twin of the drives, machine builders can shorten their time-to-market since they can design, simulate and optimize their machine before ordering any material or products. Together with other tools from the engineering box, simulation can also speed up the engineering phase of drives and entire machines, for example by virtual commissioning of the PLC.

Realize: Once the machine is in operation, the drives can be connected to other platforms, for example to the cloud and Industrial Edge. This creates transparency in terms of what is going on inside the drive train, e.g. with regard to the actual current, torque and speed.

Optimize: To understand the collected data, our drive train analytics portfolio provides algorithms and analysis tools to unlock the potential of the data and turn the gained transparency into insights and valuable knowledge. These insights can then again be used in the design phase of the next life cycle, thus closing the loop.

Benefits of drive train digitalization

Machine builders



Availability



Increase the availability of your machines

Speed



Shorten time-to-market

Business models



Develop new service and business models

Machine operators



Productivity



Increase the productivity of your production

Flexibility



Increase the flexibility of your production

Efficiency



Identify potential for optimization

Benefits for machine and plant builders

- Increased availability of machines and plants – thanks to digital options for checking and implementing design improvements and comprehensive monitoring of drive systems
- Shorter time-to-market and faster development times – thanks to practical software tools and a continuous database for concurrent development processes as well as virtual simulations, tests, and commissioning of machines and plants
- New options for future service and business models – ranging from customized application solutions and digital services to contractually guaranteed availabilities of machines and plants

Benefits for machine and plant operators

- Increased availability and productivity of production, fewer unscheduled downtimes – through the early detection of deviations and emerging risks thanks to digital drive monitoring
- More flexible production down to batch size 1 – through more effective use of knowledge from existing production lines thanks to transparent utilization, states, locations, and capacities down to the drive level
- Identification of potential for optimization to make production faster, better, and more efficient thanks to data-based transparency – for example, for faster modifications, simpler quality control, and the early prediction of maintenance demand as well as demand-oriented maintenance



TIA Selection Tool – quick, easy, smart configuration

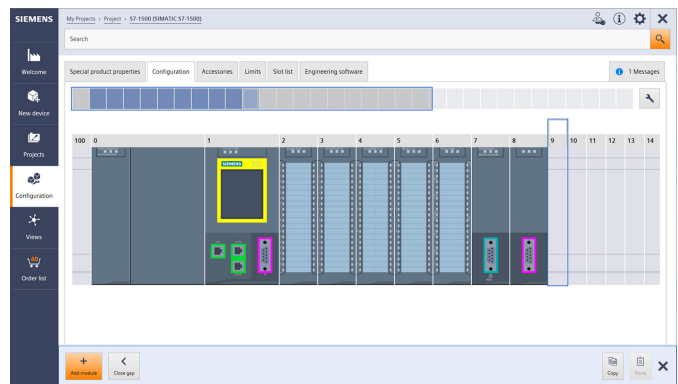
For you to get the most out of our portfolio quickly and easily.

Do you always need the optimum configuration for planning your project?

For your application we offer the TIA Selection Tool to support all project planners, beginners and experts alike.

No detailed portfolio knowledge is necessary.

TIA Selection Tool is available for download as a free desktop version or a cloud variant.



Your Advantages

Quick

- Configure a complete project with just a few entries – without a manual, without special knowledge
- Import and export of hardware configuration to TIA Portal or other systems
- Ideal visualization of the projects to be configured

Easy

- Tool download either as desktop version or web-based cloud version
- Technically always up-to-date about product portfolio and innovative approaches
- Highly flexible, secure, cross-team work in the cloud
- Direct ordering in SiePortal

Smart

- Smart selection wizard for error-free configuration and ordering
- Configuration options can be tested and simulated in advance
- Library for archiving sample configurations

The TIA Selection Tool is a completely paperless solution.

Download it now:

www.siemens.com/tst

For more
information,
scan the
QR code

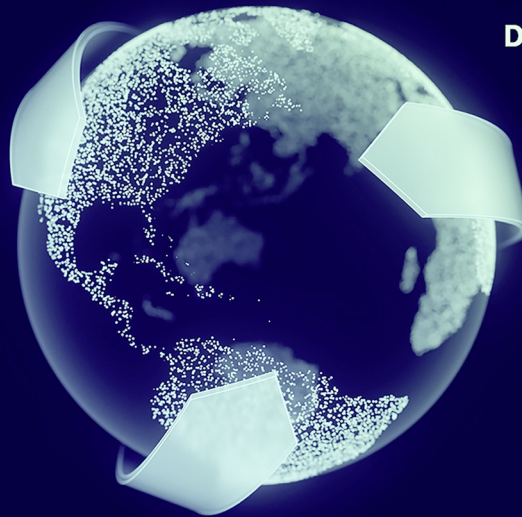




Sustainability @Siemens

Transforming the everyday to
create a better tomorrow.

For more
information, see
[www.siemens.com/
sustainability-
figures](http://www.siemens.com/sustainability-figures)



Decarbonization

Ethics

Governance

Resource Efficiency

Equity

Employability

As a company, Siemens considers environmental, social and governance (ESG) criteria from all angles with its DEGREE framework (decarbonization, ethics, governance, resource efficiency, equity and employability). We are not only committed to reducing the carbon footprint in our own operations to net zero by 2030, but also helping our customers achieve their decarbonization and sustainability goals.

Mission & strategy

As a focused technology company, Siemens is committed to addressing the world's most profound challenges by leveraging the synergies between digitalization and sustainability.

Technology with aim and purpose

We develop technologies that connect the real and digital worlds and enable our customers to positively transform the industries that form the backbone of our economy: industry, infrastructure, transportation and healthcare.

Our contribution

Siemens makes an impact every day by providing innovative solutions in response to challenges relating to environmental protection, decarbonization, health and safety. Innovative solutions that have a clear goal: to make the world more sustainable, more integrative and a better place to live.

Sustainability facts

For almost 175 years, Siemens has been driven by the desire to improve the lives of people around the world with our technologies.

SIMOCRANE crane technology platform



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SIMOCRANE crane technology platform

Siemens vision on crane control

1

Overview

Competent and innovative

Siemens has a vast experience in crane technology. In 1891 Siemens commissioned the worlds first electrical port cranes, already even featuring energy regeneration on the hoist. More than 130 years have passed where we saw the evolution of various drive, control and automation systems where Siemens was one of the dominant innovators.

Trends in crane operation

Reliability, availability, safety and performance were always dominating the KPIs in crane operation. Lowest lifecycle cost as well. It all starts with utilizing high quality products, components and systems, all type & system tested to ensure we start on a good foundation. Lowest lifecycle cost need to be supported via long-term availability of spare parts and worldwide servicing capabilities.

Not all cranes need all aspects in crane control, some cranes need a simple control systems where others need more functions, therefore crane control should be modular. Each module performs specific tasks and is open, scalable and can be customized to the specific crane application or task.

Cranes are evolving further into process integrated hoisting systems, increasingly automated, digitalized and data driven. Extracting data from cranes and crane operation is a given and mainstream. Important here is the clear, standardized and open interfaces for communication and a good architecture.

Remote controlled or even fully autonomous while guaranteeing safety of operation. With an increasingly amount of cranes operating automated, crane operators supervise the handling processes. New remote-control concepts tailored for the task. Robust open modular automation systems with clear and open communication interfaces future-proof investments in automated crane control systems and have the highest capabilities to withstand cyber threats.

By specifying to comply to openness and clear and open communication interfaces the crane operators ensure upgrading and prevent lock-in situations to vendors proprietary automation systems. We do see architectural KPIs soon to find its way into the tender specifications.

Digital twinning is standard at Siemens. Engineering and pre-commissioning can be done on a virtual – a 100% virtual copy-crane. Various operational scenarios can be tested in this virtual environment. Gained experiences flow into the final designs of the cranes. Remote commissioning in case of travel restrictions or the assistance of specialists who are not on site is easily embedded via a remote commissioning setup and tooling. When the cranes finally do arrive on site a fast productivity ramp up can be achieved since most of the operational testing is already done on the virtual cranes. One last aspect is the training of operators. Operator training can start on the digital twin, long before the real cranes arrive on site. Also training on dangerous situations is easier done in this virtual environment than in real life.

Sustainable operation is achieved in more than one way. We do see diesel driven cranes being converted to electrical, for new cranes electrical is mainstream. In situation with weak power grids we do see the need for optimized energy management systems on power grid, plant or even on crane level to ensure flawless operation against minimum power demand where no energy goes to waste.

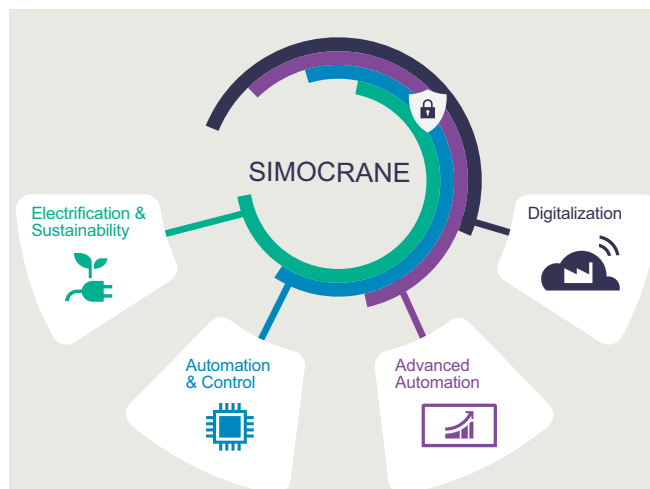
SIMOCRANE platform and technology suite

SIMOCRANE Technology Suite

The SIMOCRANE Technology Suite encompasses a range of modular solutions for digitalizing crane operation. This suite combines a modular open architecture with open and standardized interfaces, allowing for data-driven remotely controlled and sustainable crane operation. By addressing potential cyber threats and leveraging digital twinning capabilities, this technology suite offers a resilient and highly efficient crane operation.

Architecture

The foundation of the SIMOCRANE Technology Suite lies in its modular open architecture. This approach allows for the seamless integration of various hardware and software components, enabling flexibility and scalability. By adopting an open architecture, crane operators can choose from a wide range of compatible devices and systems, simplifying the integration and ensuring adaptability for future upgrades. A future-proof investment.



Remote control and data-driven crane operation

The Remote Control Operating System relies on safe sensor and camera streams enabling operator support, performance and safety. In some crane applications the cranes are integrated in the process and run fully autonomously where the operator supervises multiple cranes working autonomously. The Crane Management System collects, visualizes and analyses data from various sensors and systems, operators gain valuable insights into crane performance, potential risks, and operational efficiencies. This data-driven approach enables optimized operation, preventive maintenance, and comparability with a fleet of cranes.

Sustainable crane operation

Within the SIMOCRANE Technology Suite an advanced Energy Management System, accompanied by energy-efficient components, and intelligent control algorithms ensure minimized energy consumption and a reduced carbon footprints. This sustainability-driven approach not only benefits the environment but also yields cost savings and enhances overall operational efficiency. Siemens ensures availability of spare parts at least 10 years after the official phase out announcement of components. Together with worldwide servicing capabilities end users experience their investments are robust and future-proof by utilizing Siemens components.

Overview

Resilience against cyber threats

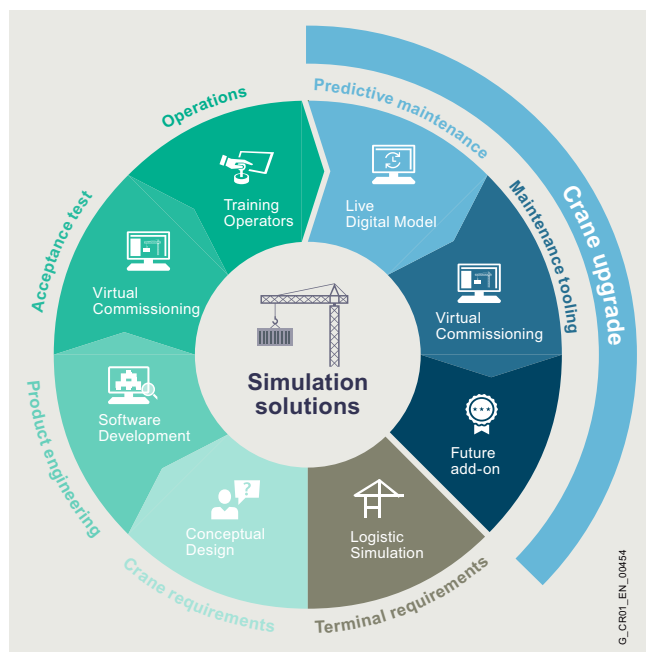
Cyber threats cannot be underestimated, especially in autonomously operating fully automated cranes the consequences could be severe. Cybersecurity is integrated to ensure resilience against cyberattacks. Robust security measures, such as encrypted communication protocols and authentication mechanisms, safeguard crane operations from unauthorized access and malicious activities. Continuous monitoring, threat analysis, and timely security updates provide an additional layer of protection, making the SIMOCRANE system highly resilient to cyber threats.

Digital twinning and simulation

Digital twinning is at the core of the SIMOCRANE Technology Suite, enabling fine-tuning of designs, testing various operational scenarios, and operator training. By creating a virtual replica of the crane, operators can simulate real-world conditions and assess the impact of design modifications or operational changes before implementation. This digital copy also facilitates operator training, allowing them to gain practical experience and enhance their skills on the digital twin before the real cranes arrive on site. Besides the simulation of individual cranes, also the complete fleet of cranes and associated equipment can be simulated in an Equipment Logistics System. This system ensures the complete logistical process can be analyzed and updated via simulations before and after commissioning. It ensures a balanced layout and alignment of the combination of equipment beforehand and delivers continuous insights for optimization of cranes and equipment in running operations.

More information

A glossary of terms for SIMOCRANE can be found in Chapter 11 Appendix.



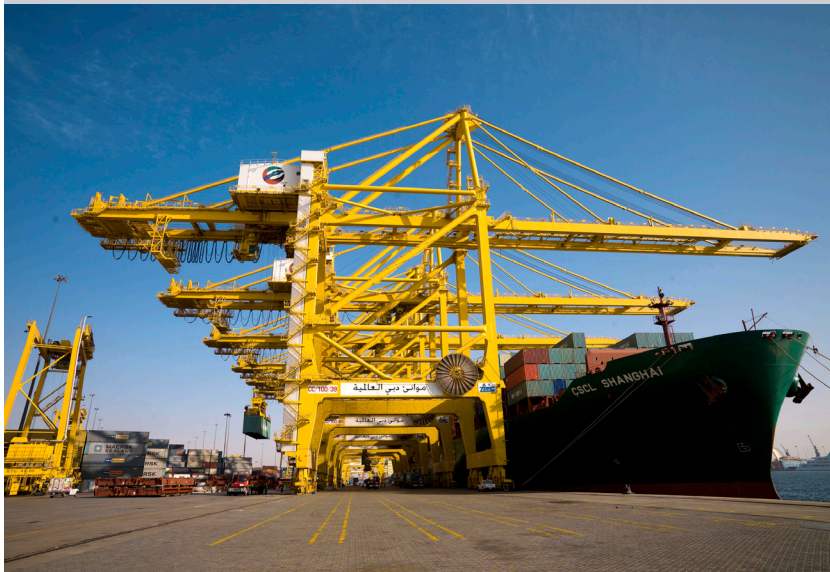
SIMOCRANE crane technology platform

Crane solutions – Components in the application

Harbor cranes

Overview

Application examples



Example: STS crane, lifting capacity up to 120 t, trolley speed up to 250 m/min

Quay cranes

- STS (ship-to-shore) cranes

Grab cranes

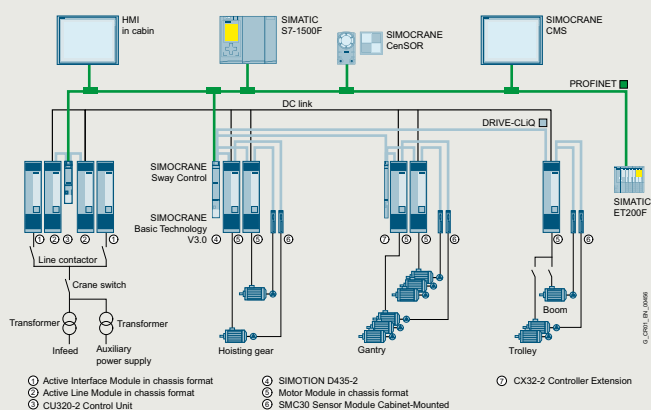
- GSU (grab ship unloader) cranes

Stacking cranes

- ASC (automated stacking cranes)
- RTG (rubber tired gantry) cranes
- RMG (rail mounted gantry) cranes

Crane topologies

Topology with SIMOCRANE Basic Technology V3.0



Drive system:
SINAMICS S120

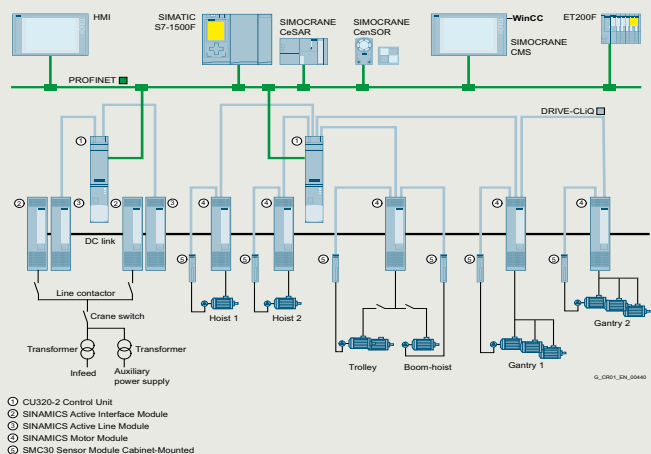
Controller:
SIMOTION D

SIMATIC S7 I/O:
PROFIBUS/PROFINET

HMI/diagnostics:
SIMATIC Panel with WinCC

SIMOCRANE product:
SIMOCRANE Basic Technology V3.0
SIMOCRANE CMS/RCMS
SIMOCRANE SC integrated
SIMOCRANE CenSOR

Topology with SIMOCRANE Basic Technology V5.0



Drive system:
SINAMICS S120

Controller:
SINAMICS CU320-2 PN
SIMATIC S7-1500

SIMATIC S7 I/O:
PROFINET

HMI/diagnostics:
SIMATIC Panel with WinCC

SIMOCRANE product:
SIMOCRANE Basic Technology V5.0
SIMOCRANE CMS/RCMS
SIMOCRANE CeSAR
SIMOCRANE CenSOR

Overview

Drive systems

SINAMICS S120 high-performance multi-axis drive system



Built-in units

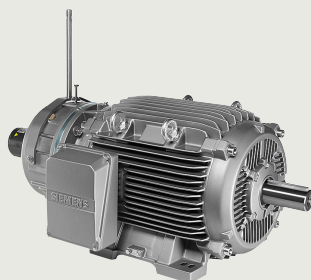
- Infeed/regenerative feedback modules from 16 to 900 kW (up to 3420 kW through parallel connection)
- Motor Modules for the operation of three-phase induction motors from 1.6 to 800 kW

Cabinet units

- Line Connection Modules for connecting line-side components to the supply system
- Active Line Modules for the infeed/regenerative feedback of 300 to 900 kW (up to 3420 kW through parallel connection)
- Motor Modules for the operation of three-phase induction motors from 110 to 800 kW
- Switch-Over Modules for connecting Motor Modules to motors for optimal utilization and/or redundancy of the drive components
- Motor Multi Connection Modules for connecting several motors to a common Motor Module in multiple-motor applications for gantries
- Motor Double Choke Modules for interconnecting motor reactors in applications with long motor cables, e.g. gantries

Motors for cranes

Three-phase induction motors for use with SINAMICS S120



Hoist motors

- Innomotics 1PH8
IP23/IP55,
230 to 1340 kW, 3661 to 12415 Nm
- Innomotics 1LE15, 1LE16, 1LE5
IP55,
1.75 to 1000 kW, 15 to 8100 Nm
- Innomotics 1PC1341
IP55,
5.5 to 214 kW, 41 to 2923 Nm

Gantry/trolley motors

- Innomotics 1PC1361
IP55,
1.1 to 47 kW, 24 to 694 Nm

SIMOCRANE crane technology platform

Crane solutions – Components in the application

Industrial cranes

Overview

Application examples



Example: Ladle crane, lifting capacity 200 - 500 t, gantry speed approx. 60 m/min

Ladle cranes

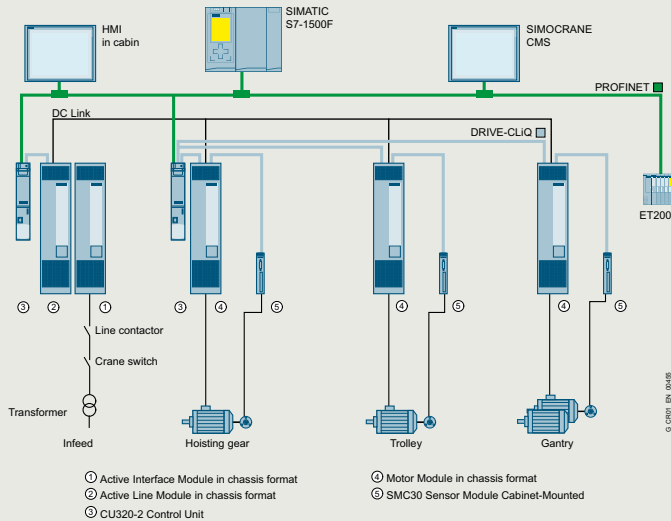
Bridge cranes

- OHBC (overhead bridge cranes)

Goliath cranes

Crane topologies

Topology with SIMOCRANE Drive-Based Technology V1.0 SP2



Drive system:
SINAMICS S120

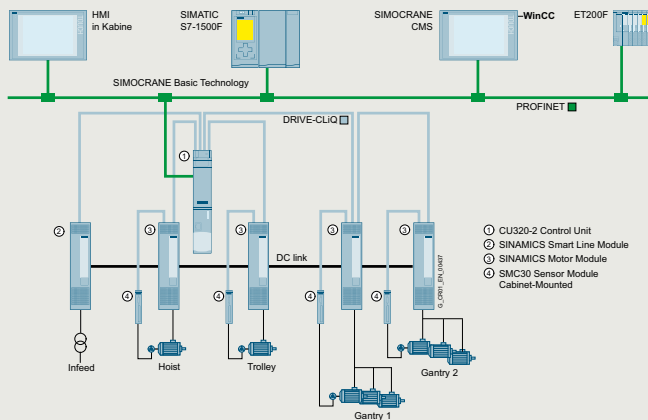
Controller:
SIMOTION D
SIMATIC S7

I/O:
PROFIBUS/PROFINET

HMI/diagnostics:
SIMATIC Panel with WinCC

SIMOCRANE product:
SIMOCRANE Drive-Based Technology V1.0 SP2
SIMOCRANE CMS

Topology with SIMOCRANE Basic Technology V5.0



Drive system:
SINAMICS S120

Controller:
SINAMICS S120
SIMATIC S7

I/O:
PROFINET

HMI/diagnostics:
SIMATIC Panel with WinCC

SIMOCRANE product:
SIMOCRANE Basic Technology V5.0
SIMOCRANE CMS

Overview

Drive systems

SINAMICS S120 high-performance multi-axis drive system



Built-in units

- Infeed/regenerative feedback modules from 16 to 900 kW (up to 3420 kW through parallel connection)
- Motor Modules for the operation of three-phase induction motors from 1.6 to 800 kW

Cabinet units

- Line Connection Modules for connecting line-side components to the supply system
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- Motor Double Choke Modules for interconnecting motor reactors in applications with long motor cables, e.g. gantries

Power Modules

- AC/AC built-in units from 0.37 to 200 kW

Motors for cranes

Three-phase induction motors for use with SINAMICS S120



Hoist motors

- Innomotics 1PH8
IP23/IP55,
230 to 1340 kW, 3661 to 12451 Nm
- Innomotics 1LE15, 1LE16, 1LE5
IP55,
1.75 to 1000 kW, 15 to 8100 Nm

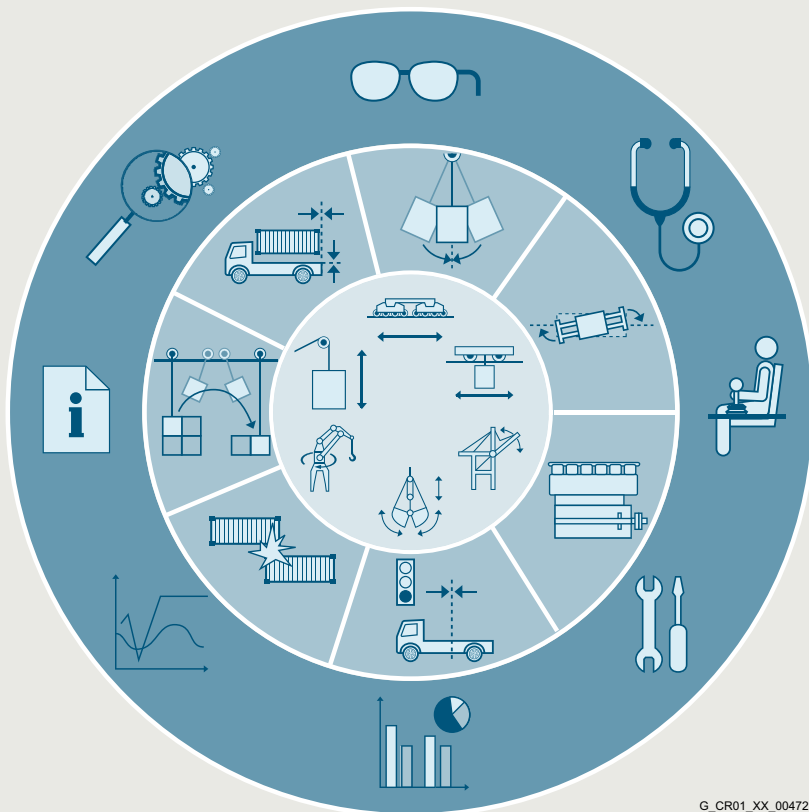
SIMOCRANE Standard Technology

SIMOCRANE Standard Technology

SIMOCRANE Standard Technology

Siemens offers the drive-based mid-performance solution with a compact functional scope SIMOCRANE Drive-Based Technology and the high-performance solution SIMOCRANE Basic

Technology, which you can expand using SIMOCRANE Advanced Technology. SIMOCRANE Basic Technology V5.0 is the successor product that has been migrated and expanded in TIA Portal for both the current SIMOCRANE Basic Technology V3.0 and SIMOCRANE Drive-Based Technology V1.0 SP2 HF1.

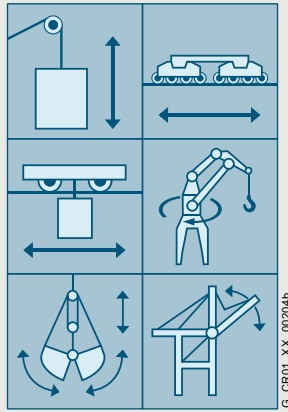


Overview

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

- SIMOTION D435-2 and CX32-2 hardware
- Engineering software
- SIMOTION SCOUT



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SIMOCRANE offers scalable technology modules for crane automation to increase productivity. The technology module basis is SIMOCRANE Basic Technology which is expanded with the SIMOCRANE Advanced Technology modules such as Sway Control, Skew Control and Truck Positioning.

The different modules enable the applications required in the crane environment for automation of manual, semi or fully automatic cranes to be represented.

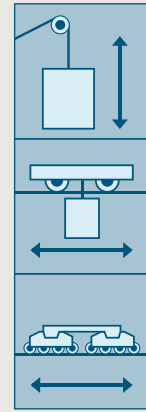
SIMOCRANE Basic Technology enables and optimizes the motion control of the different axes of a crane, also interactively. The software concept is modular, which makes it easier to implement different crane types. The hardware platform for SIMOCRANE Basic Technology is the drive-based SIMOTION D Motion Controller. Together with the SINAMICS S120 drives family, SIMOCRANE offers a high-performance drive system for total control of the motion and therefore provides the platform for automation of the crane.

The software modules for the drives are a component part of SIMOCRANE Basic Technology:

- Hoist
- Gantry
- Trolley
- Slewing gear
- Grab
- Jib (boom hoist) or luffing gear

SIMOCRANE Drive-Based Technology V1.0 SP2

- SINAMICS CU310-2 hardware and Power Modules
- Engineering software
- SINAMICS STARTER



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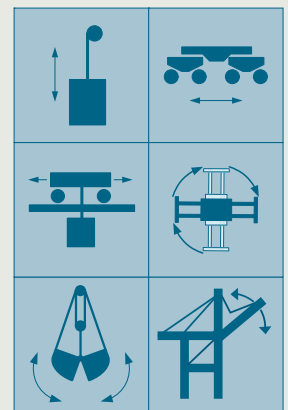
SIMOCRANE Drive-Based Technology is drive-based and offers a compact functional scope within the SINAMICS environment, which can also be extended with the SIMOCRANE Drive-Based Sway Control. Highlights of Drive-Based Technology are fast commissioning by using standard applications and a high degree of flexibility through the appropriate adaptation options.

SIMOCRANE Drive-Based Technology encompasses the following features:

- All of the functions that have been proven in practice and required for mid-performance applications are available on the SINAMICS platform for parameterization
- Pre-configured standard applications for hoist and trolley/gantry with control via PROFIBUS DP or via I/O signals ("ready-to-run", only have to be parameterized using script)
- Can be adapted for customer-specific requirements "ready-to-apply" (for adaptation by the user).

SIMOCRANE Basic Technology V5.0

- SINAMICS CU320-2/CU310-2 hardware and Power Module
- SIMATIC S7-1500
- Engineering software
- SINAMICS Startdrive/STARTER
- SINAMICS Drive Control Chart



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The new SIMOCRANE Basic Technology V5.0 is an innovative Siemens standard solution for crane-specific motion control applications. SIMOCRANE Basic Technology V5.0 is the successor product for SIMOCRANE Basic Technology V3.0 and SIMOCRANE Drive-Based Technology V1.0 SP2 HF1.

Most important changes in the new version:

- New hardware and software platform: TIA Portal, S7-1500 CPU – SINAMICS S120 (CU320-2/CU310-2)
- New software architecture, designed for the TIA Portal
- Scalable function scope thanks to licensing concept
- Basic Technology Configurator for "ready-to-apply" (Startdrive)
- Smart functions for industry crane applications
- Further development and optimization of existing algorithms
- Enhanced usability

SIMOCRANE crane technology platform

SIMOCRANE Advanced Technology

1

Overview

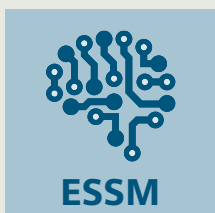
SIMOCRANE Advanced Technology

Apart from the drive technology, technological supplementary functions and sensor-based automation components are gaining in importance in the fulfillment of current market requirements. An important trend with cranes is the increasing degree of automation and simultaneous reduction in CO₂ values.

SIMOCRANE Advanced Technology comprises optional additional components for increasing productivity and enhancing safety for personnel and machines.

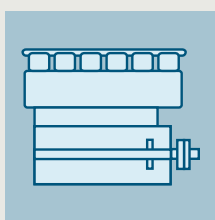
Perfectly tuned SIMOCRANE modules allow different depths of automation to be achieved as well as CO₂ emissions to be reduced.

SIMOCRANE Energy Storage System Management



Compared to a diesel generator supply, a supply with an energy storage system based on the SINAMICS DCP DC converter and battery is more energy efficient and reduces CO₂ emissions through the possibility of storing the braking energy from the drive system. The SIMOCRANE Energy Storage System Management (ESSM) software solution provides the functionalities for integrating such an energy storage system into the crane application.

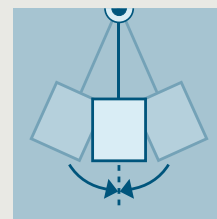
SIMOCRANE ECO Technology



In mobile cranes, diesel generators are used conventionally in constant speed mode for generating electrical power. With SIMOCRANE ECO Technology, diesel generators are operated at speeds dependent on the load. This results in reduced fuel consumption and, therefore, savings in operating costs and reduced emissions.

SIMOCRANE Sway Control Systems

- Integrated solution with SIMOTION D
- Standalone solution with SIMOTION C
- Drive-Based solution with SINAMICS S120



Each movement of a crane with cable guides results in the load swaying and therefore represents a risk to humans and property. Transport processes also take longer to complete. A sway control system can be used to make the transport processes more effective and safer.

SIMOCRANE offers a high-performance sway control system with different operating modes that ensures a high degree of safety for persons, transport goods and equipment. Automatic sway control relieves the crane driver and also ensures faster and more accurate positioning of the load.

The high-performance solution can be applied for different types of cranes, like STS, GSU in harbor and OHBC cranes in industry.

To meet the requirements in STS automation, a semi-automatic mode of the sway control system is essential to avoid the risk of collisions and accidents and to move the load to the target position along the time-optimized trajectory. To increase the degree of safety the sway control system can even consider the obstacles during manual operation and response correspondingly to avoid collision.

In the case of grab cranes the productivity can be increased by completely controlled sway for on-the-fly unloading.

Furthermore, SIMOCRANE even meets the challenge of mid-performance market applications with its drive-based solution SIMOCRANE Drive-Based Sway Control. This software solution is embedded in the SINAMICS drive to decrease costs. Its main function is to damp sway in manual operation and in positioning, so that the crane driver can be relieved, the load can be exactly positioned, and the productivity can be increased.

SIMOCRANE crane technology platform

SIMOCRANE CMS Crane Management System

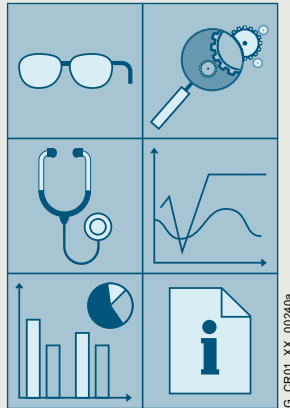
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Overview

SIMOCRANE CMS Crane Management System

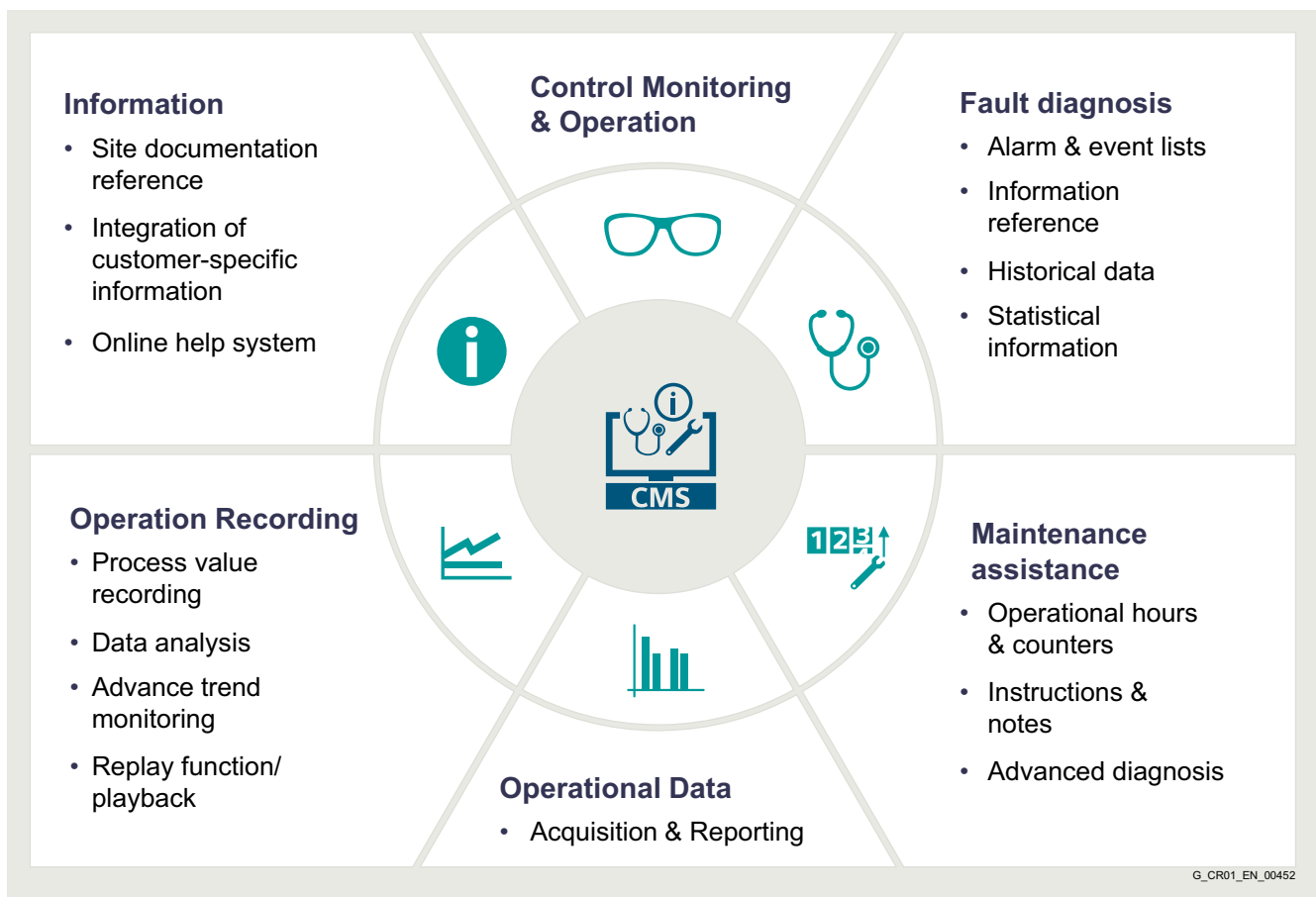
SIMOCRANE CMS Crane Management System

- Hardware
SIMATIC IPC
(Rack PC, Microbox, Touch PC)
- Software
SIMOCRANE CMS +
SIMATIC WinCC + options/AddOns



The SIMOCRANE CMS Crane Management System is a PC-based visualization software (SCADA) providing operational data and diagnostic information for crane operators, maintenance personnel, and plant operators.

It also supports maintenance personnel evaluating operational hours and load cycle counters for the entire terminal using the Remote Crane Management System. Crane-specific market applications are delivered with SIMOCRANE CMS, e.g. Replay function for playing back the crane operator actions, container operating data statistics and reporting, own designed objects for crane applications, remote crane diagnosis, etc.



With SIMOCRANE CMS Siemens relies on well-established standard of SIMATIC products from the industrial sector. The crane management system is based on SIMATIC WinCC, the SCADA software from Siemens, offering all functions of an advanced visualization software.

Typical fields of application are harbor and industrial crane systems.

The crane management system SIMOCRANE CMS includes various components:

- Crane controller
 - CMS standard package for local installation on the crane (e.g. fault diagnosis, Replay)
 - CMS options (e.g. multi-terminal operation, advanced reporting)
- Management level
 - RCMS server and client stations for centralized crane diagnosis, data analysis and remote operations

SIMOCRANE crane technology platform

SIMOCRANE Solutions – SIMOCRANE application examples – Drive systems – Motors for cranes

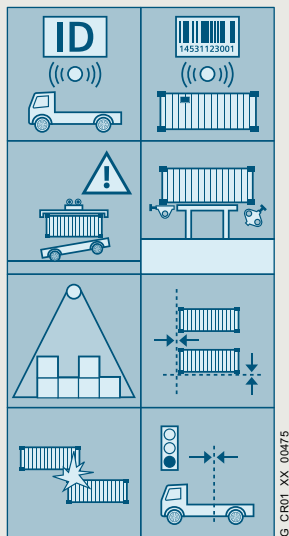
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Overview

SIMOCRANE Solutions

SIMOCRANE Solutions

- Remote Control Operation
- Laser-based Sensor Modules
- Camera-based Sensor Modules



SIMOCRANE laser- and camera-based Sensor Modules empower modular enhancement of the crane automation level. The modules are performing multiple crane sensing tasks and are designed as reliable assistant systems.

SIMOCRANE application examples

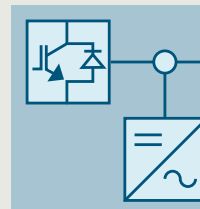
SIMOCRANE offers a range of perfectly interacting products that can be combined to fulfill a wide range of different requirements. The high degree of scalability is a decisive advantage for implementing crane applications ranging from simple, manual applications to semi-automatic or fully-automatic crane applications. The diversity and combination possibilities of SIMOCRANE products for implementing the different requirements will be illustrated here.

Through the use of Basic Technology and different Advanced Technology functions, different applications can be implemented and various degrees of automation can be achieved.

Besides the high-performance solution SIMOCRANE provides also a mid-performance solution as well.

Drive systems

SINAMICS S120 Cabinet Modules for crane applications



SINAMICS is the drive platform from Siemens designed for mechanical and plant engineering.

Crane applications place demanding requirements on the dynamic response and integration capability of additional technology functions.

SINAMICS S120 provides the solution for these demanding tasks in combination with the technologies of SIMOCRANE.

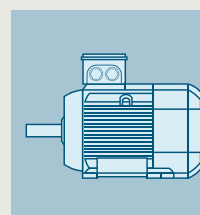
SINAMICS S120 is characterized by the following properties:

- Modularity
- Combination capability
- High performance in terms of output and closed-loop control

Multi-axis drives with higher-level motion control solutions for cranes can be implemented with the SINAMICS S120 modular system as easily as single-drive solutions.

Motors for cranes

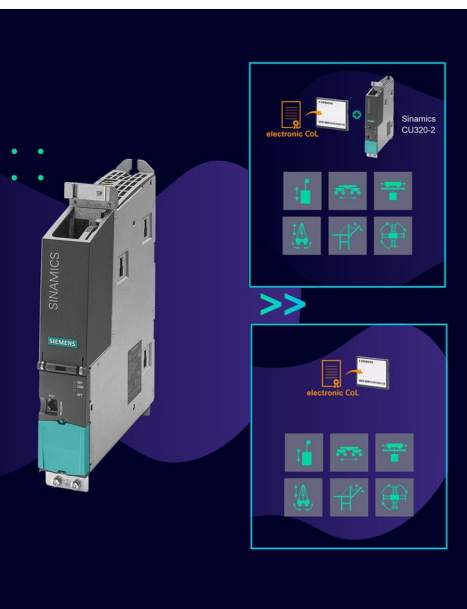
Three-phase induction motors



The challenge in the field of crane drives is the demand on highly compact and dynamic motors in a wide power range and variants. The broad spectrum of crane motors from Innomatics for crane applications satisfies these demands. A suitable motor of induction design is available for every Motion Control task – with ratings ranging from 1.1 to 1340 kW.

For the selection of an optimally designed motor for crane applications please contact your local Siemens Cranes sales representative.

SIMOCRANE Standard Technology

**2/2 SIMOCRANE Basic Technology V5.0**

- 2/2 Motion control
- 2/2 Overview
- 2/2 Benefits
- 2/2 Application
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Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

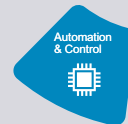
For additional information on industrial cybersecurity measures that may be implemented, please visit

www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

www.siemens.com/cert.



SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V5.0 (TIA Portal)

Motion Control

2

Overview

The new SIMOCRANE Basic Technology V5.0 is an innovated standard solution for crane-specific motion control and merges the existing SIMOCRANE Basic Technology V3.0 and SIMOCRANE Drive-Based Technology V1.0 SP2 HF1 with latest technology in TIA Portal.

The SIMOCRANE Basic Technology V5.0 provides proven and innovative crane-specific functions for all main drives on a crane:

- Hoist
- Holding gear and closing gear
- Boom-Hoist
- Gantry
- Trolley
- Slewing gear

The essential changes in this new version are:

- New hardware and engineering platform: SIMATIC S7-1500 CPU, SINAMICS S120 (CU320-2/CU310-2), TIA Portal and Startdrive
- New software architecture with high usability in TIA Portal
- Fusion of the existing SIMOCRANE Basic Technology with SIMOCRANE Drive-Based Technology
- Extension of crane-specific technology
- Innovation and optimization of the existing algorithms
- Smart functions for industry crane applications
- Scalable range of functions by selecting different licenses

Benefits

The SIMOCRANE Basic Technology V5.0 provides the following benefits:

- Scalable for high-performance and mid-performance applications
- "Ready-to-run" by using standard applications
- Project-Configurator significantly reduces the engineering time for "ready-to-apply"
- Easy adaptation and expansion for customized requirements by master-copy template
- Standard interface between PLC and SINAMICS for use-friendly integration and upgrading
- Prepared software architecture for adding Sway Control

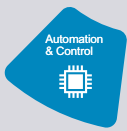
Consequently:

- Engineering and commissioning costs are greatly reduced
- Customer-oriented standardization

Application

The SIMOCRANE Basic Technology V5.0 provides crane-specific motion control for each main drive of a crane. It's scalable for high-performance and mid-performance applications. Its software has a modular structure according to the main drives, so that it can be easily and flexibly applied for all types of cranes, e.g. for

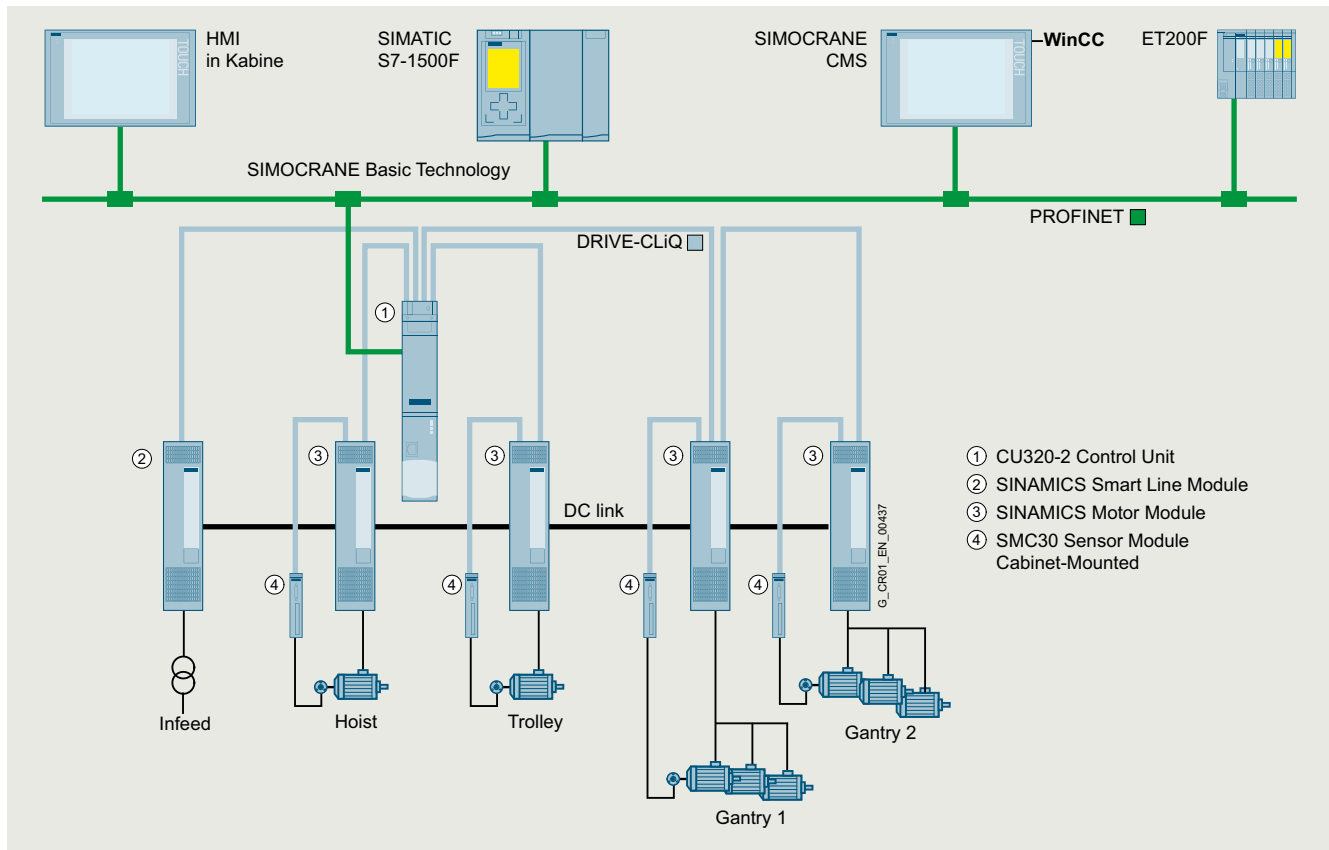
- Harbor cranes
 - STS (ship to shore cranes, also for double spreader in tandem operation)
 - RMG (rail-mounted gantry cranes)
 - RTG (rubber-tired gantry cranes)
 - Intermodal cranes
 - GSU (grab ship unloader) etc.
- High-performance and mid-performance industrial cranes
 - OHBC (overhead bridge cranes, such as coil cranes, waste incineration cranes, ladle cranes, etc.)
 - Gantry cranes
- Modernization with three-phase AC drives
 - STS (ship to shore cranes)
 - GSU (grab ship unloader)
 - OHBC (overhead bridge cranes), etc.



Design

Hardware configuration

The figure below shows the hardware configuration based on the example of an industry overhead bridge crane (OHBC).



Example configuration for industry cranes by using SIMOCRANE Basic Technology V5.0 (Basic License)

SIMOCRANE Standard Technology

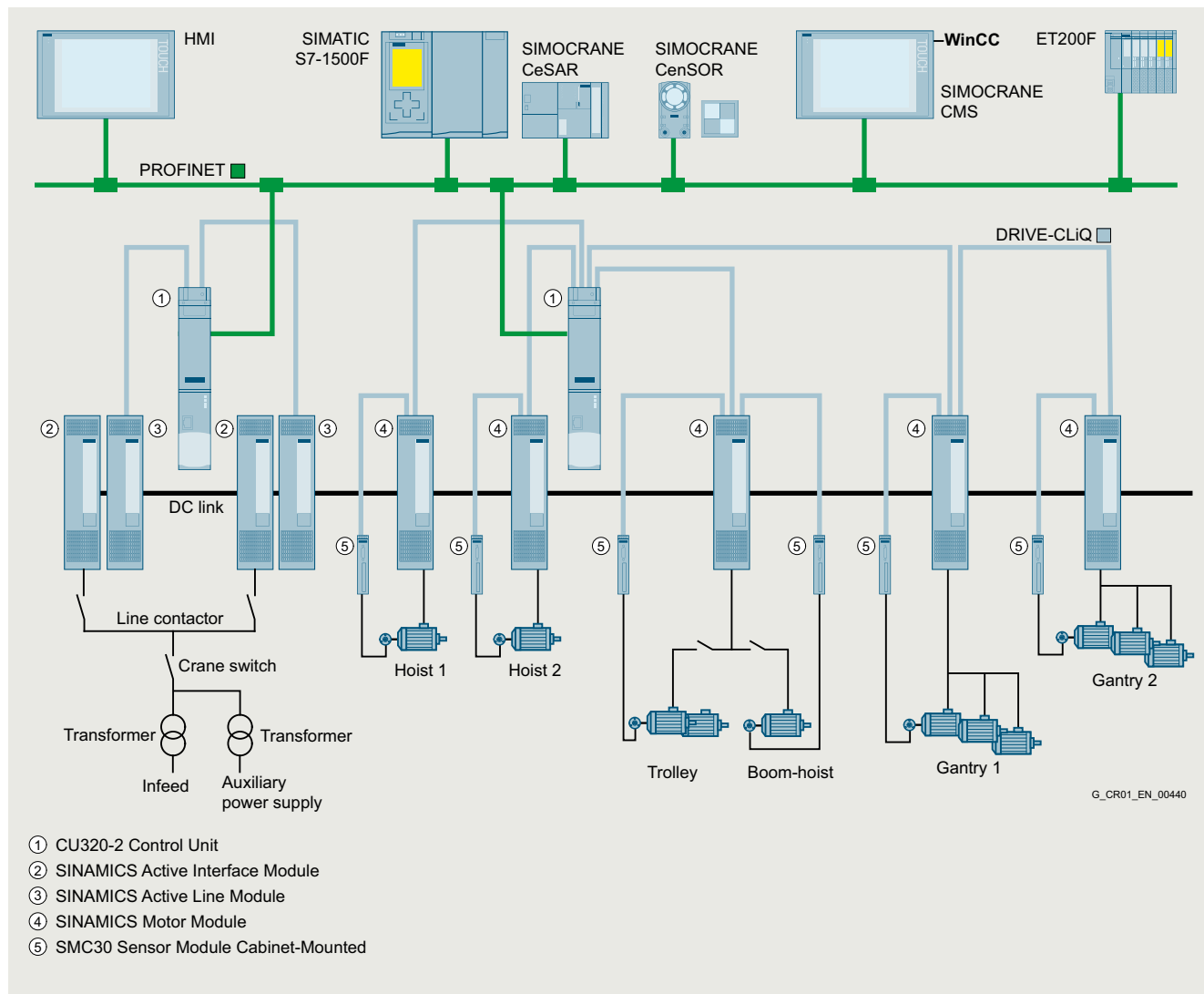
SIMOCRANE Basic Technology V5.0 (TIA Portal)

Motion Control

Design

The figure below shows the hardware configuration based on the example of a container quay crane. The prepared software architecture allows the easy integration of SIMOCRANE Sway

Control, which is described in the SIMOCRANE Advanced Technology section.



Example configuration for a container quay crane by using SIMOCRANE Basic Technology V5.0 (Advanced License)



Design

SIMOCRANE Basic Technology V5.0 software

The SIMOCRANE Basic Technology V5.0 package provides not only the core functionalities in form of a product library, but also 2 application libraries which can be adapted by the users. The former is optimized for crane-specific motion control. The latter are mainly applied for sequential control inside the SIMATIC S7-1500, the communication between PLC and drive, the monitoring as well as the switchover inside the SINAMICS S120. The package also contains standard applications for STS crane, GSU crane and OHBC crane separately.

The modular software concept based on each main drive of the crane construction (e.g. hoist) makes it easier to build up different applications according to the crane type. The figures below show the exemplary software structure for a coil crane and a container quay crane in the following examples. The motion control of each main drive is preconfigured by using the corresponding core function blocks from the product library in SINAMICS. Coordinating and monitoring the main drives are realized in the application by using 2 application libraries in both SIMATIC and SINAMICS.

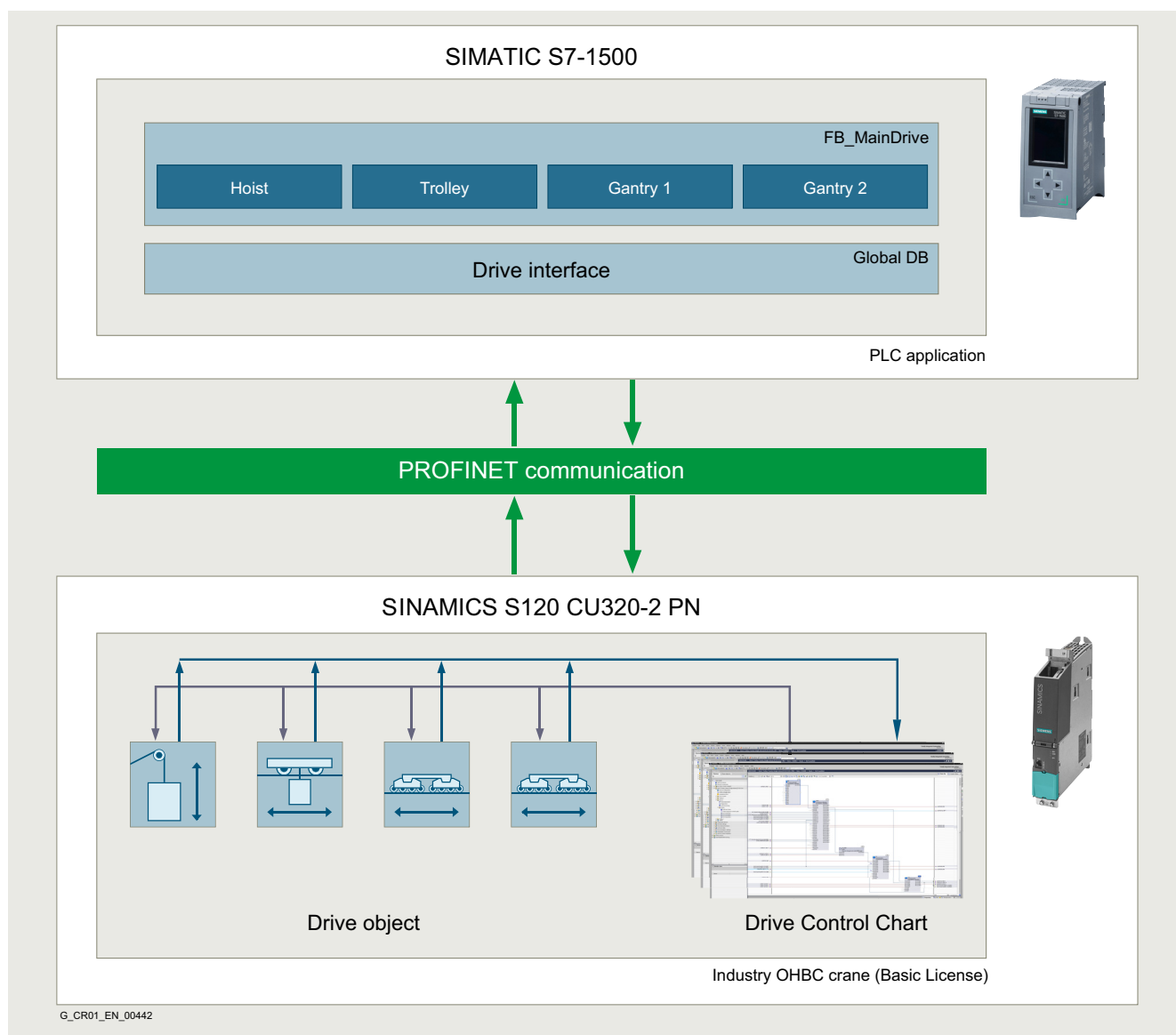
Each function module (e.g. hoist) has 3 DCC charts separately in fast/middle/slow cycle time in SINAMICS for processing the setpoint in consideration of the related crane technology.

Furthermore, it has one function block instance in the SIMATIC PLC for executing logic control, mode management and communication. The communication between the SIMATIC S7-1500 and SINAMICS S120 can be carried out by the standardized interface via PROFINET or PROFIBUS for each main drive. All function modules have been designed in the same structure.

The standard application is created for the most commonly used crane types. These are "container quay crane", "grab ship unloader" and "overhead bridge crane". These are fit for "ready-to-run" users to set parameters only. SIMOCRANE Basic Technology V5.0 additionally provides a configurator and copy-templates for "ready-to-apply" users to build up their individual projects with expansions and adaptations in specific crane applications by just a few mouse clicks.

SIMOCRANE Basic Technology V5.0 is designed for the TIA world. It could replace not only the SIMOCRANE Basic Technology V3.0 but also the SIMOCRANE Drive-Based Technology V1.0 SP2 HF1 in near future. Customers can select the optimal range of functions depending on the application requirements by ordering different licenses.

2



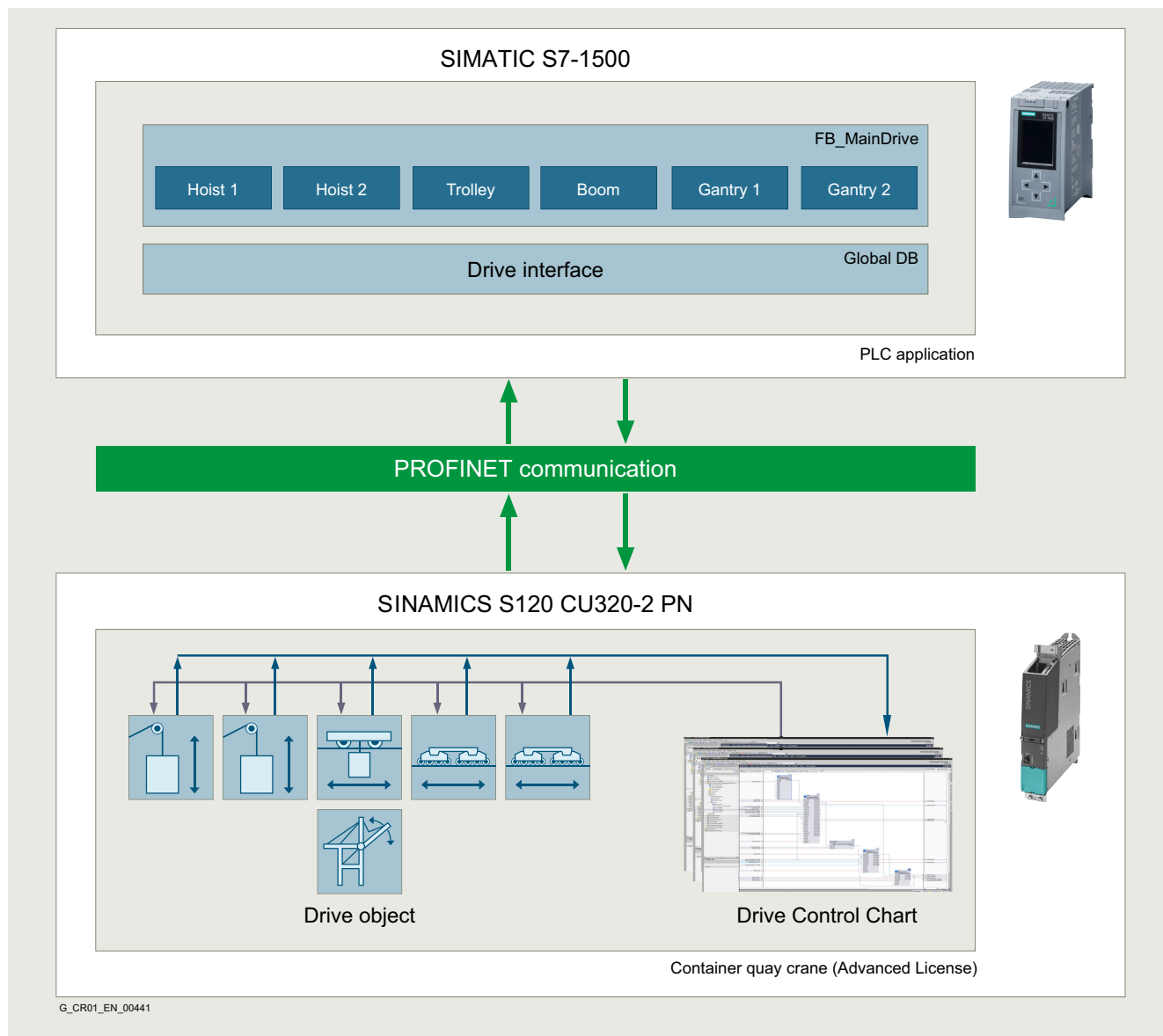
SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V5.0 (TIA Portal)

Motion Control

Design

2



Software structure for a container quay crane



Design

Technical functions

No.	Function	Brief description	Advanced License	Basic License
1	Load-dependent field weakening	Using the DCC block, a supplementary speed setpoint is calculated during the acceleration phase dependent on the load. The hoist gear continuously accelerates to its maximum field weakening speed. This additional speed above the rated speed allows to always operate partial loads at its peak performance, which increases the crane's throughput significantly. This DCC block provides the auto-tuning function for commissioning to optimize parameters automatically.	✓	
2	Simplified load-dependent field weakening	A supplementary speed setpoint is calculated during constant movement. The hoist accelerates after the measurement. This function allows to always operate partial loads at peak performance, which increases the crane's productivity.	✓	✓
3	Prelimit switch (selectable limiting)	The velocity of the drive can be limited using the DCC block when a pre-defined prelimit switch is reached.	✓	✓
4	Start pulse	Using the DCC block, "load sag" is prevented at starting the hoist gear with a suspended load.	✓	✓
5	Actual position and velocity	Using the DCC block, the actual motor speed is converted to actual velocity and integrated to actual position. These values are saved permanently in case of power off. The actual position can be referenced again at standstill and on the fly.	✓	✓
6	Target control	This DCC block forces all main drives on cranes to position exactly in kind of smart slowdown, especially suitable for systems that tend to be subject to mechanical vibration, such as trolleys on STS cranes. If required, a creep speed can be selected to move further after reaching the target position.	✓	✓
7	Slack rope control	This DCC block prevents a slack rope during a grab is closing in the goods being handled. It ensures a controlled digging of the grab into the bulk material to achieve maximum filling.	✓	
8	Current equalization control	When hoisting and lowering a closed grab, the tension levels in the holding and the closing gear should be approximately the same. Using this DCC block the required total hoisting power can be optimally distributed across the two drives. The load distribution between the leading drive and the following drive can be set on demand.	✓	
9	Synchronization control	This DCC block enables both speed or position synchronization between a leading drive and several following drives by correcting any offset. If a specified offset is required, it can be created and kept.	✓	
10	Master controller	Using the DCC block, the scaling of the master controller can be set depending on the speed setpoint, especially at lower speed. This makes it easier for a crane operator to have a fine sensitivity in manual positioning.	✓	✓
11	Continuous load measurement	This DCC block is required for grab cranes like dredgers, whose grab is under water and not visible. A continuous load measurement is carried out to show the crane driver the grab filling level and to give the message "Grab is touchdown". This DCC block provides the auto-tuning function for commissioning to optimize parameters automatically.	✓	
12	Grab Control	This DCC block is responsible for the closing gear to close and open the grab by exact positioning. Furthermore, the synchronous operation between the holding gear and the closing gear is possible when hoisting and lowering the grab. For a polyp grab, it can be used to detect bulky load material.	✓	
13	Push button controller	Using this DCC block it is possible for a push button controller to generate a fixed or changeable setpoint.	✓	✓
14	Leading-following closed-loop torque control	Leading-following operation is used if 2 motors are connected to a common shaft. The leading drive operates either closed-loop position controlled or closed-loop speed controlled depending on the operating mode. The following drive only operates closed-loop torque controlled. The leading drive sends the torque as setpoint to the following drive.	✓	✓
15	Customized monitoring	This function can be applied for any customized monitoring function inside SINAMICS.	✓	✓
16	Brake test	The mechanical brake function (e.g. hoist) should be regularly checked using this function. To do this, the axis moves against the closed brake with a certain torque setpoint in order to check the braking capability of the brake.	✓	✓
17	Ramp function generator with conter and zero-crossing function	This function is adapted for crane-specific requirements, e.g. without begin or end rounding at conter or zero-crossing movement.	✓	✓
18	Torque proving	If required, the torque can be double checked with both a saved value from "Start Pulse" and a preset minimum value before opening the brake.	✓	✓
19	Inching	This smart function enables the drive axis to move a predefined distance by activating the inching operating mode each time.	✓	✓
20	Tandem operation	Tandem operation is an extension of the synchronization control. Synchronous operation takes place between 2 groups. In each group, 2 drives can be coupled in leading following closed-loop torque control or also in synchronous operation. The function is suitable to address applications for both harbor cranes, such as a double spreader STS container crane or large ship unloaders with 4 drum grabs, as well as industrial cranes with several hoists and trolleys.	✓	

✓ = scope of delivery

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V5.0 (TIA Portal)

Motion Control

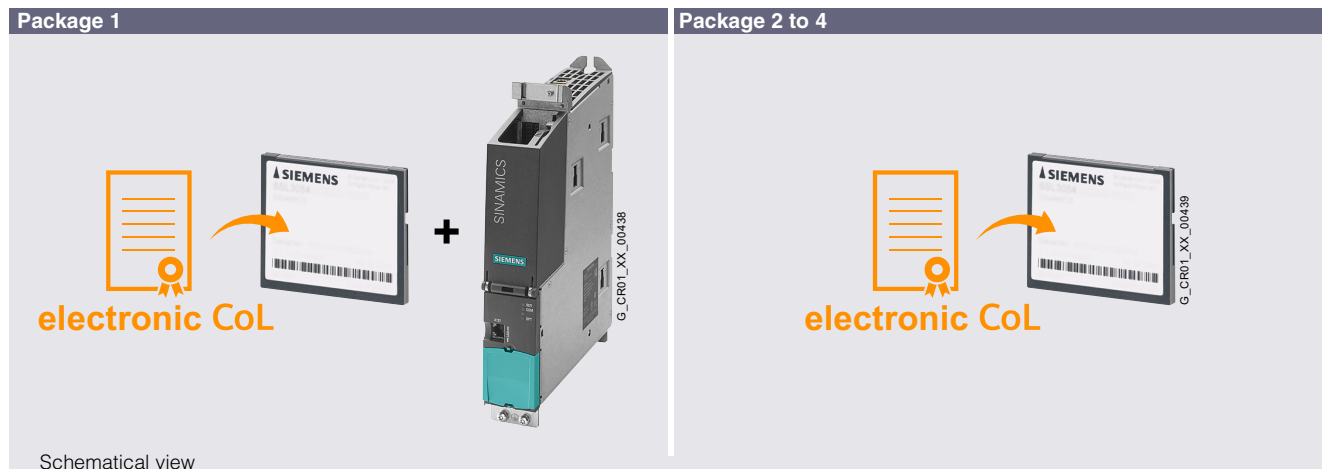
Selection and ordering data

Scope of delivery

Four different packages can be selected, which allow maximum flexibility and functional scalability:

Two functional scopes are divided separately for the replacement of the SIMOCRANE Basic Technology V3.0 and the

SIMOCRANE Drive-Based Technology V1.0 SP2 HF1. With or without hardware or SINAMICS performance expansion license, depending on application demand.



		Package 1	Package 2	Package 3	Package 4
		Advanced License	Advanced License	Basic License	Basic License
Hardware	SINAMICS S120 CU320-2 PN Control Unit	✓			
	CompactFlash card • SIMOCRANE Basic Technology V5.0 with Advanced License • SINAMICS S120 Performance License (required from the 4th axis) • SINAMICS firmware V5.2 SP3	✓	✓		
	CompactFlash card • SIMOCRANE Basic Technology V5.0 with Basic License • SINAMICS S120 Performance License (required when using more than 3 axes) • SINAMICS firmware V5.2 SP3			✓	
	CompactFlash card • SIMOCRANE Basic Technology V5.0 with Basic License • SINAMICS firmware V5.2 SP3				✓
Software/ Documentation	Available for download at SiePortal • Global library with - Product DCC-Library - Application DCC-Library - Application FB-Library - Online help - Copy templates with different drive configurations • Standard applications • Product manuals • Application note • Basic Technology Configurator (Startdrive) • Basic Technology Script (STARTER)	✓	✓	✓	✓
License certificate in electronic form		✓	✓	✓	✓
Instruction leaflet		✓	✓	✓	✓

✓ = scope of delivery



SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V5.0 (TIA Portal)

Motion Control

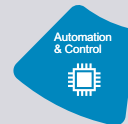
Selection and ordering data

Description	Article No.
SIMOCRANE Basic Technology V5.0 (Package 1) Including CU320-2 PN and CompactFlash card with Advanced and Performance Licenses	6GA7260-5AA30-1AA0
SIMOCRANE Basic Technology V5.0 (Package 2) Including CompactFlash card with Advanced and Performance Licenses	6GA7260-6AA30-1AA0
SIMOCRANE Basic Technology V5.0 (Package 3) Including CompactFlash card with Basic and Performance Licenses	6GA7260-6AA30-1BA0
SIMOCRANE Basic Technology V5.0 (Package 4) Including CompactFlash card with Basic License	6GA7260-6AA30-0BA0

Supplementary components

Depending on the application, the following components can be ordered:

Description	Article No.
SINAMICS CU320-2 PN Control Unit	6SL3040-1MA01-0AA0
SINAMICS CU320-2 DP Control Unit	6SL3040-1MA00-0AA0
SINAMICS S120 memory card Without performance expansion With firmware version V5.2 SP3	6SL3054-0FC30-1BA0



SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

Motion Control

Overview

Crane applications

SIMOCRANE Basic Technology V3.0 is a system of hardware and software packages for automating cranes that supports customers in achieving maximum performance with crane applications. The solution has the following features:

- The SIMOCRANE Basic Technology V3.0 comprises the following standard functions and covers the motion control of all of the main drives of a crane:
 - Hoist
 - Holding gear and closing gear
 - Boom-hoist
 - Gantry
 - Trolley
 - Slewing gear
- All of the functions proven in practice are implemented on the SIMOTION platform.
- Closed-loop control concept for synchronous operation and positioning with position controller
- Can be adapted to customer-specific requirements, a package supports both:
 - "Ready-to-run" (parameters have only to be assigned) as well as
 - "Ready-to-apply" (adapted by the user)
- The technological basis is the SIMOTION D Motion Control System.

The SIMOCRANE Basic Technology V3.0 package comprises the following components:

Hardware

- Control Unit SIMOTION D435-2 with SINAMICS firmware version as of V4.5

CompactFlash card

- Current firmware version
- Licenses
 - SIMOTION MultiAxes (for Motion Control)
 - SIMOTION Crane Basic Technology (for functions in the Crane DCC Library)

CD-ROM with

- Setup with Crane DCC Library and online help
- Crane FB Library
- Standard applications, e.g. for container quay crane (STS – ship to shore) or ship unloading crane (GSU – grab ship unloader), etc.
- SIMOTION D4x5-2 V4.3.1 and SINAMICS V4.5 firmware
- Documentation

Features of SIMOCRANE Basic Technology V3.0:

- Supports configurations with mixed three-phase AC drives (DC/AC) and DC drives (DC/DC)
- Can be operated with SINAMICS DC Master (DCM) via PROFINET
- Improved usability, e.g. auto-setting function for commissioning
- Virtual internal SIMATIC S7 interface to reduce the external control hardware
- Web-based tool for commissioning and diagnostics
- Expanded and optimized functionality, e.g. adjustable jerk for SIMATIC S7

Benefits

SIMOCRANE Basic Technology V3.0 provides the following benefits:

- Standard applications significantly reduce the time for engineering ("ready-to-run")
- Easy adaptation and expansion for customized requirements ("ready-to-apply")
- One platform for all crane technologies (different crane technologies such as sway control (SIMOCRANE Sway Control) are systematically based on the SIMOCRANE Basic Technology)

Consequently:

- The number of interfaces is reduced by using SIMOTION D
- Engineering and commissioning efforts are reduced
- Standardization is made easier

Application

The SIMOCRANE Basic Technology V3.0 software has a modular structure. The application solution can be flexibly implemented for different types of cranes, e. g. for

- Harbor cranes
 - STS (ship to shore crane, also for double spreader in tandem operation)
 - RMG (rail mounted gantry crane)
 - Intermodal cranes
 - GSU (grab ship unloader) etc.
- High-performance and mid-performance industrial cranes
 - OHBC (overhead bridge cranes, such as coil cranes, waste incineration cranes, ladle cranes, etc.)
 - Gantry cranes, etc.
- Modernization with DC drives or a combination of three-phase AC and DC drives
 - STS (ship to shore crane)
 - GSU (grab ship unloader)
 - LSC (lifting and slewing crane)



Design

Structure of an axis grouping with the SIMOTION D435-2 Motion Control System in the crane application

The following components comprise a SIMOTION D crane application:

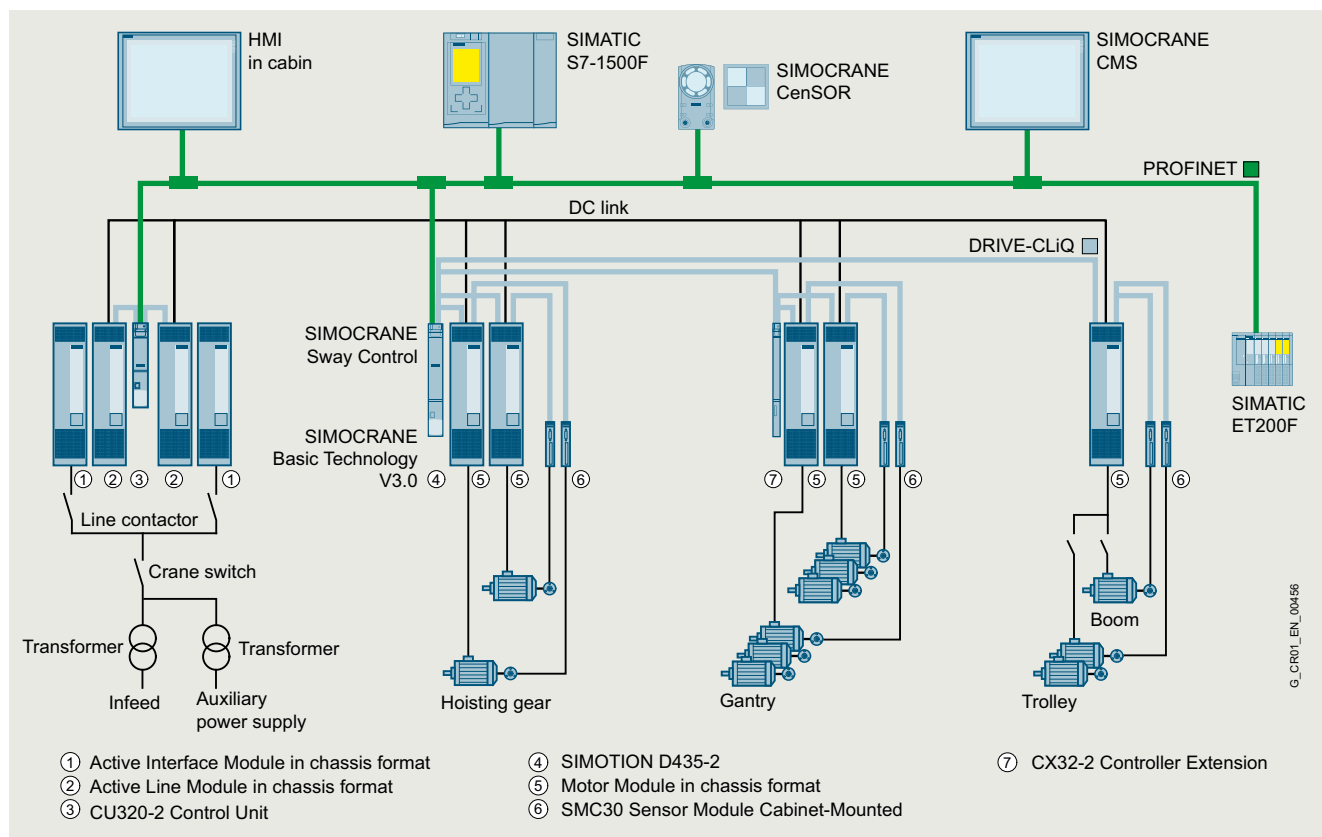
- A SIMOTION D435-2 Control Unit, designed for open and closed-loop control of a multi-axis drive line-up
- One or several SIMOTION CX32-2 Controller Extensions for more than 6 axes (see the application example "Topology of container quay crane" → "Hardware configuration")
- Several SINAMICS S120 Motor Modules (power units)
- Several SINAMICS DC Master Power Modules (power units)
- Other drive components, such as
 - Power supply
 - Filter
 - Reactor, etc.
- The connection between SIMOTION D and the SINAMICS S120 Motor Modules which is implemented with DRIVE-CLiQ in a star topology to ensure axis redundancy (see the application example "Topology of container quay crane" → "Hardware configuration").
- A CU320-2 Control Unit for open and closed-loop control of the parallel infeed (up to 4 infeed units)
- One or more SINAMICS S120 Line Modules (in SIMOCRANE Basic Technology, the infeed unit is separately controlled by the SIMATIC S7, see the application example "Topology of container quay crane" → "Hardware configuration").

Hardware configuration

The hardware configuration based on the example of a container quay crane on the SIMOTION/SINAMICS platform is shown in the figure below.

The performance of the SIMOTION D hardware allows all crane technologies, not only Basic Technology V3.0, but also Advanced Technology, e.g. sway control (SIMOCRANE Sway Control), to be operated from one controller. The individual crane technologies build on each other systematically.

Additional crane technologies of SIMOCRANE are described in Chapters SIMOCRANE Advanced Technology, SIMOCRANE CMS Crane Management System and SIMOCRANE Solutions.



Topology of container quay crane

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

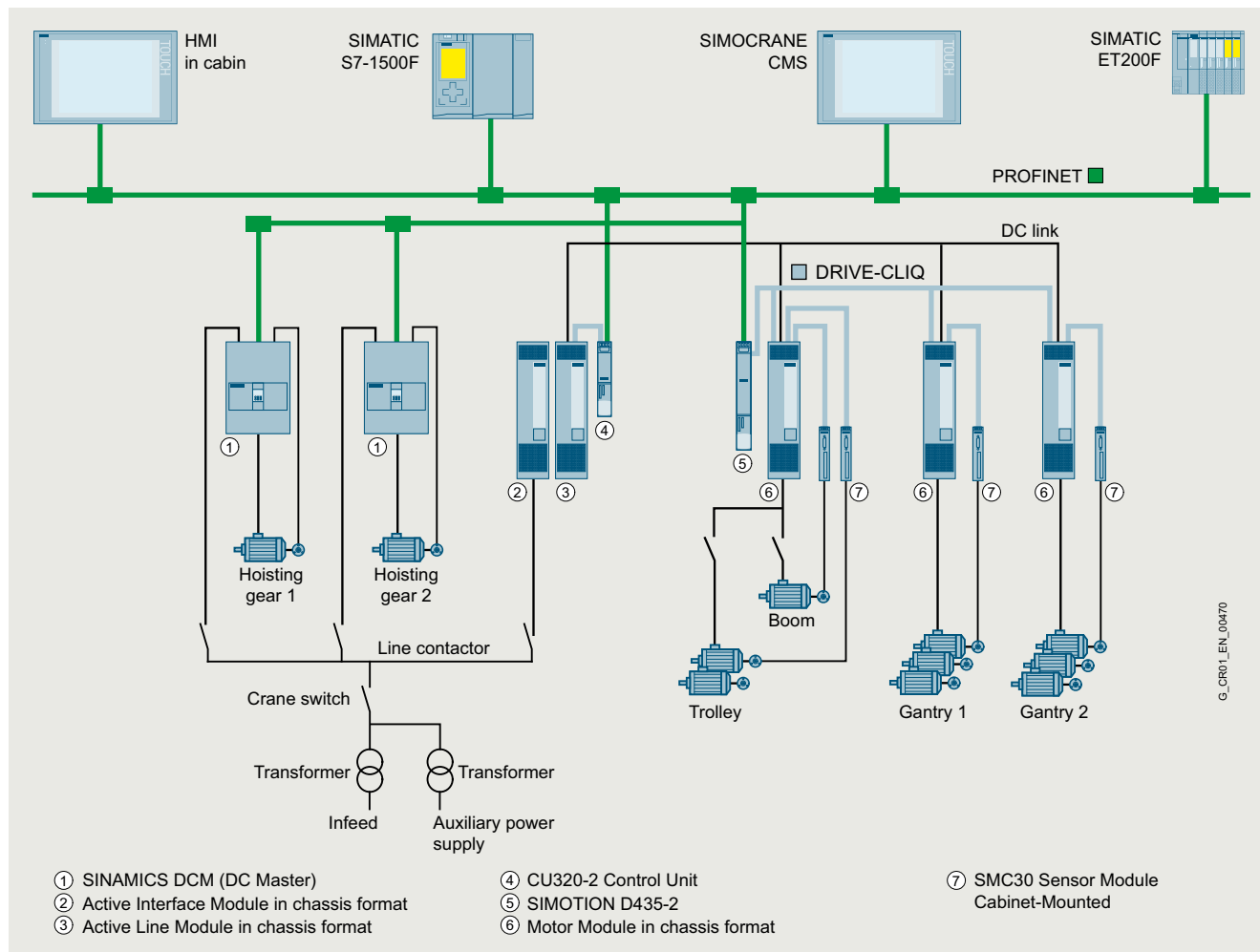
Motion Control

Design

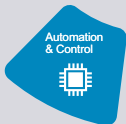
Configurations with mixed three-phase AC drives (DC/AC) and DC drives (DC/DC) are possible in the SIMOCRANE Basic Technology V3.0. Applications such as these are

frequently found in modernization projects (see the application example "Container quay crane").

2



Topology of a container quay crane with mixed three-phase AC and DC drives (DC/AC)



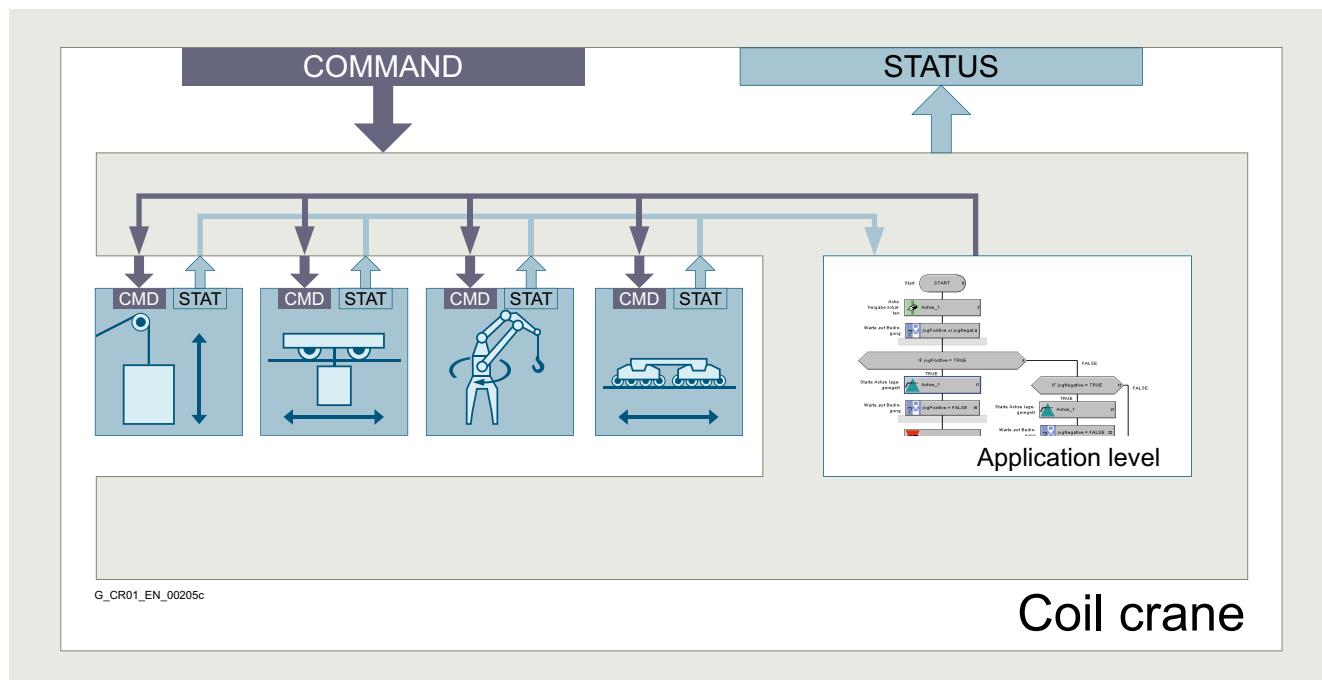
Design

SIMOCRANE Basic Technology software

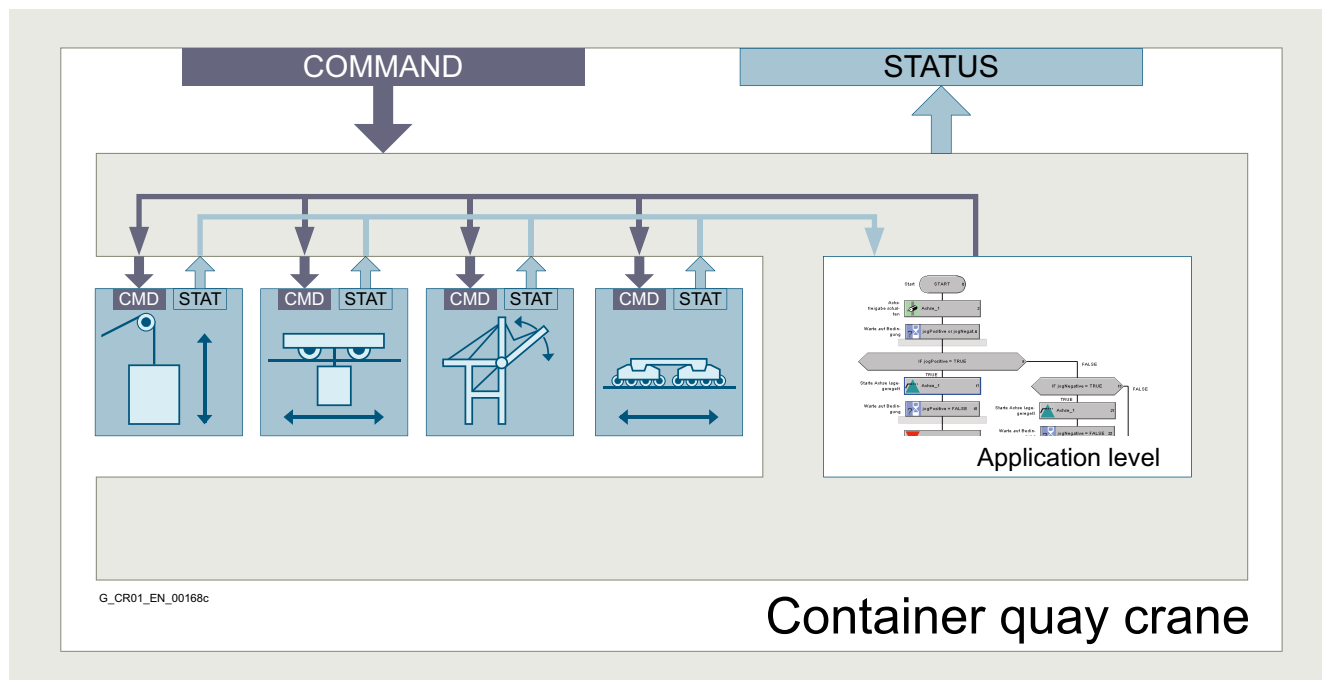
The SIMOCRANE Basic Technology V3.0 package not only provides the basic functionality, the SIMOTION Motion Control technology package (for positioning, synchronous operation, etc.) and standard libraries, but also the Crane Basic Technology V3.0 package complete with 2 libraries. The package also contains several complete standard applications for cranes.

The modular software concept makes it easier to automate different crane types. With the help of the open software, all crane-specific technologies or functions can be supplied to the user in the form of function blocks. The software structure is shown for a coil crane, a container quay crane and a ship unloading crane in the following examples. Each axis of motion is mapped using a function module in the software. Controlling and coordinating the axes are realized at the application level.

2



Function blocks for coil crane



Function blocks for container quay crane

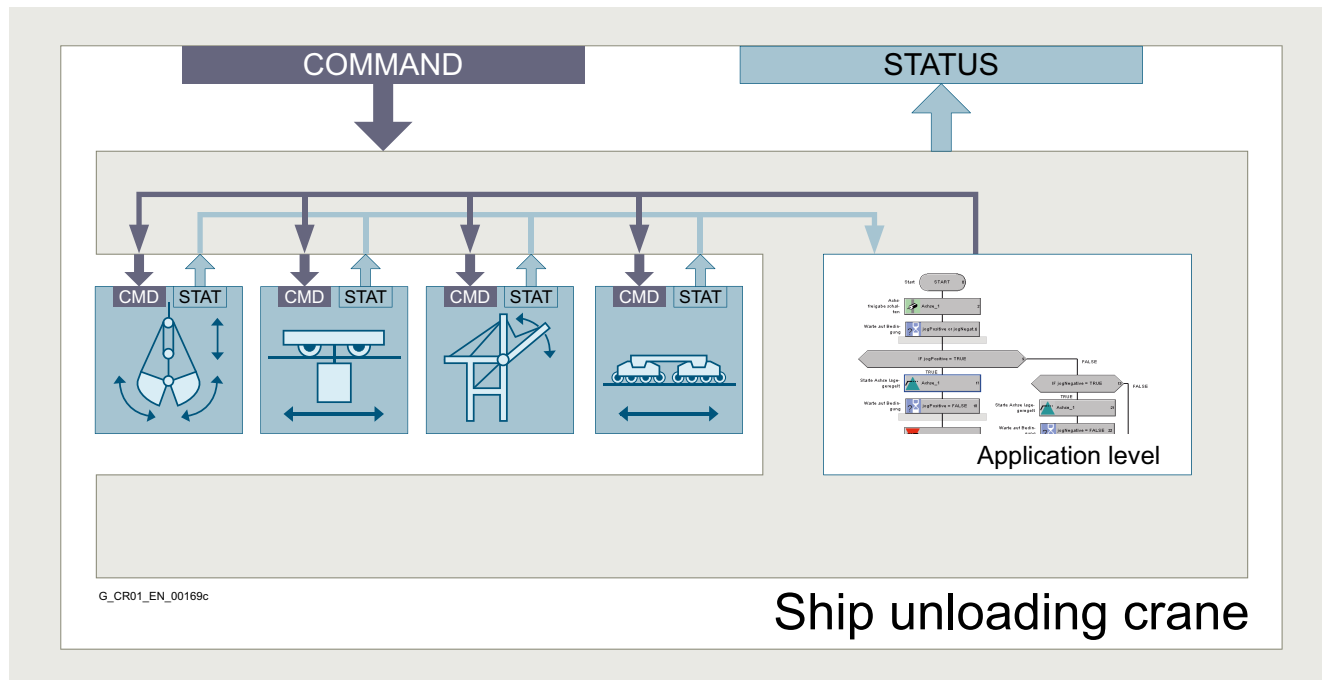
SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

Motion Control

Design

2



Function blocks for ship unloading crane

Each function module (e.g. hoist) has two MCC units and one DCC chart. Two application programs created in the MCC call the necessary function blocks from the "Cranes FB Library" for execution of the function module (e.g. operating mode management). In a program created by DCC, the setpoint channel for velocity and acceleration/deceleration is set up that takes into account the crane-specific technology (e.g. load-dependent field weakening) cyclically.

The standard application is created according to crane type, e.g. "Container quay crane". For "ready-to-run" users, only parameterization is necessary. For "ready-to-apply" users, this provides the starting point for individual expansions and adaptation to address specific crane applications.



Selection and ordering data

Scope of delivery

The SIMOCRANE Basic Technology V3.0 package offers a control system with hardware and software for various crane applications.

Description	Article No.
SIMOCRANE Basic Technology V3.0 For SIMOTION D435-2 consisting of 1 item each • Hardware - SIMOTION D435-2 DP/PN • CompactFlash card with current firmware version and licenses - SIMOTION MultiAxes (for Motion Control) - SIMOTION SIMOCRANE Basic Technology (for functions in the Crane DCC Library) • CD-ROM with - Setup with Crane DCC Library and online help - Crane FB Library - Standard applications, e.g. for a ship to shore crane (STS) or a grab ship unloader (GSU), etc. - SIMOTION D4x5-2 V4.3.1 and SINAMICS V4.5 firmware - Documentation	6AU1660-4AA20-0AA0

Supplementary components

Depending on the application, the following components can be supplied for the open-loop and closed-loop control:

Description	Article No.
SIMOTION CX32-2 (SINAMICS Controller Extension for SIMOTION D435-2)	6AU1432-2AA00-0AA0
SINAMICS DRIVE-CLIQ Hub Module DMC20	6SL3055-0AA00-6AA1
SINAMICS SMC 30 Sensor Module Cabinet-Mounted	6SL3055-0AA00-5CA2
SINAMICS TM31 Terminal Module	6SL3055-0AA00-3AA1

SINAMICS S120 drive systems, motors and connection systems are not included in the package (see Chapter 8 "Drive systems" and Chapter 9 "Motors for cranes"). These components must be ordered separately.

Further information on selection and ordering of supplementary components can be found in the following catalogs:

- D 21.4 – SINAMICS S120, SINAMICS S220 and SIMOTICS
- PM 21 – SIMOTION Equipment for Production Machines
- IK PI – Industrial Communication

Spare parts

The SIMOCRANE Basic Technology V3.0 package offers the following spare parts for crane applications.

Description	Article No.
CompactFlash card with license for SIMOCRANE Basic Technology V3.0 For SIMOTION D435-2 With licenses for different crane applications	6AU1660-7AA20-0AA0

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at <https://support.industry.siemens.com/cs/ww/en/ps/20087>

You can find further information about Crane Application Notes on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

The latest information about SIMOTION products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/14505>

The latest information about SINAMICS products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/13229>

Notes on licensing

The license depends on the serial number of the memory card (CompactFlash card). The crane application software cannot run without a valid license. Licensing is managed via Siemens Web License Manager.

www.siemens.com/automation/license

Training

Siemens Cranes offers crane-specific training

www.siemens.com/simocrane-learning

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

Hardware SIMOTION D435-2 Control Unit

Overview



SIMOTION D is the compact, drive-based version of SIMOTION based on the SINAMICS S120 converter family.

With SIMOTION D, the PLC, Motion Control functions and technology functions as well as the SINAMICS S120 drive software run on a common control hardware.

SIMOTION D435-2 DP/PN (STANDARD performance) are Control Units for multi-axis applications in the power range for up to 32 axes.

Benefits

- Cost-effective thanks to the integration of PLC, Motion Control functions and technology functions directly in the drive
- Employs the innovative SINAMICS S120 design
- Compact design reduces control cabinet size
- Ideally suited to modular and distributed machine concepts
- User-friendly operation
- Variable networking via a wide range of communication interfaces:
 - Industrial Ethernet, PROFIBUS DP and PROFINET IO on-board
- Powerful thanks to a range of technology functions
- Very simple engineering, from drive commissioning to open-loop control applications and Motion Control applications
- Easy to service thanks to CompactFlash card, which can be easily replaced and contains all data (programs, data, drive parameters)
- Very fast response as the interfaces between PLC and Motion Control are no longer required



Design

Interfaces

Display and diagnostics

- LEDs to display operating states and errors
- 3 measuring sockets
- Service switch and mode selector
- Diagnostics button

Onboard I/O

- 12 digital inputs
- 16 digital inputs/outputs (max. 16 as high-speed measuring inputs, max. 8 as high-speed output cams)

Communication

- 6 × DRIVE-CLiQ
- 2 × Industrial Ethernet (3 × Industrial Ethernet for D4x5-2 DP), of which one interface easily accessible at the module front
- 2 × PROFIBUS DP
- 1 × PROFINET IO (1 interface with 3 ports, with D4x5-2 DP/PN only)
- 2 × USB

Data backup

- 1 × slot for SIMOTION CompactFlash card

Further interfaces:

- Terminals for 24 V electronics power supply

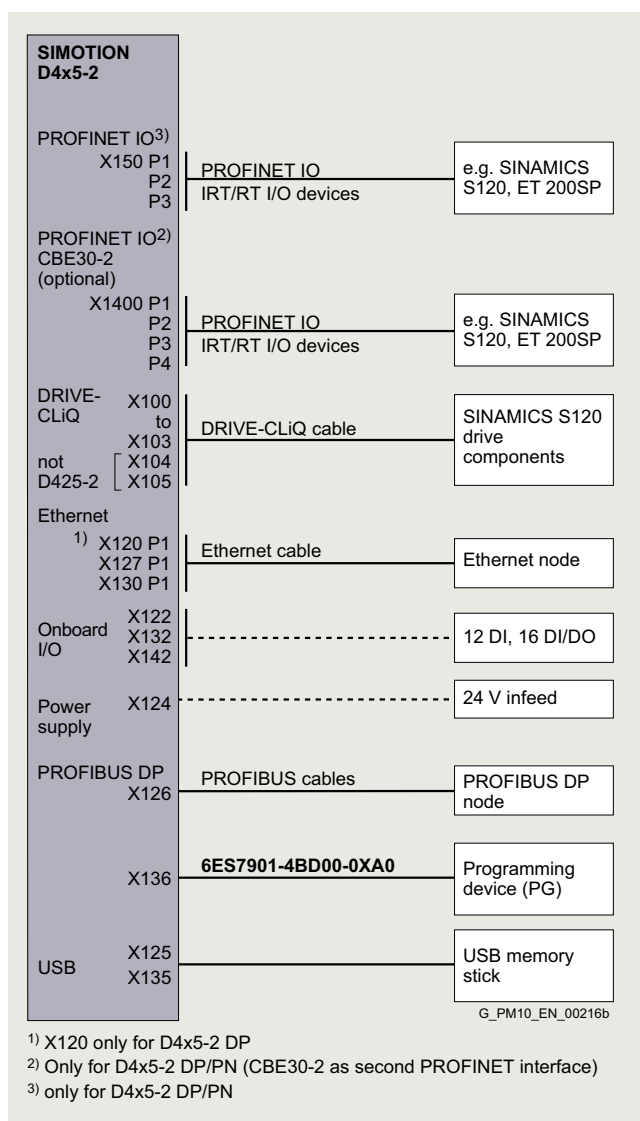
Option modules

With the TB30 Terminal Board, the SIMOTION D4x5-2 Control Units can be extended with 4 digital inputs, 4 digital outputs, 2 analog inputs and 2 analog outputs. The TB30 Terminal Board is plugged into the option slot on the Control Unit. Using the CBE30-2 Communication Board for PROFINET IO, it is possible to equip the SIMOTION D435-2 DP/PN Control Units with a 2nd PROFINET interface with 4 ports.

Applications for a 2nd PROFINET interface:

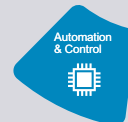
- 2 separate networks (e.g. one local and one higher-level network)
- Address space can be doubled to 2 × 4 Kbyte
- Maximum number of connectable devices can be doubled to 2 × 64
- Separated to create a fast and a slow bus system/execution system to efficiently utilize the control performance
 - PROFINET onboard: SERVO_{Fast} and IPO_{Fast}
 - PROFINET via CBE30-2: SERVO/IPO/IPO2

Integration



Connection overview SIMOTION D4x5-2

The maximum permissible cable lengths should be taken into account when planning the cable layout. Functional faults can occur when using longer cables. The permissible length of PROFIBUS DP cables depends on the configuration. The DRIVE-CLiQ cables used for the SINAMICS S120 CU320-2 Control Unit can also be used for SIMOTION D4x5-2 Control Units.



SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

Hardware SIMOTION D435-2 Control Unit

Technical specifications

Article number		6AU1435-2AD00-0AA0
Product brand name		SIMOTION
Product type designation		D435-2 DP/PN
Performance class for motion control system		STANDARD Performance
Version of the motion control system		Multiple-axis system
PLC and motion control performance		
Number of axes maximum		32
Minimum PROFIBUS cycle clock	ms	1
Minimum PROFINET send cycle clock	ms	0.25
Minimum servo cycle clock	ms	0.25
Minimum interpolator cycle clock	ms	0.25
Minimum servo cycle clock note		0.25 ms for SERVO or SERVO-FAST
Integrated drive control		
Maximum number of axes for integrated drive control		
• Servo		6
• Vector		6
• V/f		12
• Note		Alternative control modes; drive control based on SINAMICS S120 CU320-2, firmware version V4.x/V5.x
Memory		
RAM (work memory)	Mbyte	105
Additional RAM work memory for Java applications	Mbyte	20
RAM disk (load memory)	Mbyte	50
Retentive memory	kbyte	364
Persistent memory (user data on CF)	Gbyte	1.5
Communication		
DRIVE-CLiQ Interfaces		6
USB Interfaces		2
Industrial Ethernet Interfaces		2
PROFIBUS Interfaces		2
• Note		Equidistant and isochronous; Can be configured client or server
PROFINET Interfaces		1
• Note		1 interface with 3 ports onboard; 1 interface with 4 ports optional via CBE30-2; functionality: supports PROFINET IO with IRT and RT; configurable as PROFINET IO Controller and/or Device; supports media redundancy (MRP and MRPD)
General technical data		
Fan		Double fan/battery module included in scope of delivery
DC supply voltage		
• Rated value	V	24
• Permissible range	V	20.4 ... 28.8
Consumed current typical	mA	1 000
• Note		With no load on inputs/outputs, no 24 V supply via DRIVE-CLiQ and PROFIBUS interface
Making current, typ.	A	5
Power loss, typ.	W	24
Ambient temperature, during		
• Long-term storage	°C (°F)	-25 ... +55 (-13 ... +131)
• Transport	°C (°F)	-40 ... +70 (-40 ... +158)
• Operation	°C (°F)	0 ... 55 (32 ... 131)
- Note		Maximum installation altitude 4000 m (13124 ft) above sea level. Above an altitude of 2000 m (6562 ft), the maximum ambient temperature decreases by 7 °C (12.6 °F) per 1000 m (3281 ft).
Relative humidity during operation	%	5 ... 95
Air pressure	hPa	620 ... 1 060
Degree of protection		IP20 / UL open type
Height	mm (in)	380 (14.96063)
Width	mm (in)	50 (1.9685)
Depth	mm (in)	270 (10.62992)
• Note		When the spacer is removed 230 mm (9.05 in) deep
Net weight	g (lb)	3 700 (8.1571)



Technical specifications

Article number		6AU1435-2AD00-0AA0
Product brand name		SIMOTION
Product type designation		D435-2 DP/PN
Performance class for motion control system		STANDARD Performance
Version of the motion control system		Multiple-axis system
Digital inputs		
Number of digital inputs		12
DC input voltage		
• Rated value	V	24
• For signal "1"	V	15 ... 30
• For signal "0"	V	-3 ... +5
Electrical isolation		Yes
• Note		Yes, in groups of 6
Current consumption for "1" signal level, typ.	mA	9
Input delay time for		
• Signal "0" → "1", typ.	µs	50
• Signal "1" → "0", typ.	µs	150
Digital inputs/outputs		
Number of digital I/Os		16
Parameterization possibility of the digital I/Os		can be parameterized - as DI - as DO - as probe input (max. 16) - as cam output (max. 8)
If used as an input		
DC input voltage		
• Rated value	V	24
• For signal "1"	V	15 ... 30
• For signal "0"	V	-3 ... +5
Electrical isolation		No
Current consumption for "1" signal level, typ.	mA	9
Input delay time for		
• Signal "0" → "1", typ.	µs	5
• Signal "1" → "0", typ.	µs	50
Measuring input reproducibility	µs	5
Measuring input resolution	µs	1
If used as an output		
Load voltage		
• Rated value	V	24
• Permissible range	V	20.4 ... 28.8
Electrical isolation		No
Current carrying capacity for each output, max.	mA	500
Leakage current, max.	mA	2
Output delay for		
• Signal "0" → "1", typ.	µs	150
• Signal "0" → "1", max.	µs	400
• Signal "1" → "0", typ.	µs	75
• Signal "1" → "0", max.	µs	150
- Note		Data for Vcc = 24 V; load 48 Ohm; "1" = 90 % VOut, "0" = 10 % VOut
Cam output reproducibility	µs	10
Cam output resolution	µs	1
Switching frequency of the outputs for		
• Resistive load, max.	kHz	4
• Inductive load, max.	Hz	2
• Lamp load, max.	Hz	11
Short-circuit protection		Yes
Additional technical data		
Back-up of non-volatile data		
• Of retentive data		unlimited buffer duration
• Of real-time clock, min.	d	4
• Note		longer buffer duration of the real-time clock using a battery inserted in the double fan/battery module
Approvals		
• USA		cULus
• Canada		cULus
• Australia		RCM (formerly C-Tick)
• Korea		KCC
• Russia, Belarus and Kazakhstan		EAC

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

Hardware SIMOTION CX32-2 Controller Extension

Overview

2



The SIMOTION CX32-2 Controller Extension is a module in the SINAMICS S120 booksize format. It enables the extension of the drive-side computing performance of the SIMOTION D4x5-2 Control Units.

The SIMOTION CX32-2 Controller Extension extends the drive computing performance by up to 6 vector or 12 V/f axes. This allows the number of axes of a multi-axis system to be increased according to the requirements of the application.

If required, up to 5 SIMOTION CX32-2 Controller Extensions can be operated on one SIMOTION D435-2 Control Unit.

The SIMOTION CX32-2 Controller Extension is connected to the SIMOTION D435-2 via DRIVE-CLiQ.

Note:

The SIMOTION CX32-2 Controller Extension can only be used with SIMOTION D4x5-2 Control Units. Operation with SIMOTION D4x5 Control Units is not possible.

Technical specifications

Article number		6AU1432-2AA00-0AA0
Product brand name		SIMOTION
Product type designation		CX32-2
Version of the motion control system		Controller Extension
Integrated drive control		
Maximum number of axes for integrated drive control		
• Servo		6
• Vector		6
• V/f		12
• Note		Alternative control modes; drive control based on SINAMICS S120 CU320-2, firmware version V4.x/V5.x
Communication		
DRIVE-CLiQ Interfaces		4
General technical data		
Fan		No fan
DC supply voltage		
• Rated value	V	24
• Permissible range	V	20.4 ... 28.8
Consumed current typical		
• Note	mA	300 With no load on inputs/outputs, no 24 V supply via DRIVE-CLiQ interface
Making current, typ.		A 1.6
Power loss, typ.		W 7
Ambient temperature, during		
• Long-term storage	°C (°F)	-25 ... +55 (-13 ... +131)
• Transport	°C (°F)	-40 ... +70 (-40 ... +158)
• Operation	°C (°F)	0 ... 55 (32 ... 131)
- Note		Maximum installation altitude 4000 m (13124 ft) above sea level. Above an altitude of 2000 m (6562 ft), the maximum ambient temperature decreases by 7 °C (12.6 °F) per 1000 m (3281 ft).
Relative humidity during operation		% 5 ... 95
Air pressure		hPa 620 ... 1 060
Degree of protection		IP20 / UL open type
Height		mm (in) 380 (14.96063)
Width		mm (in) 25 (0.98425)
Depth		mm (in) 270 (10.62992)
• Note		When the spacer is removed 230 mm (9.05 in) deep
Net weight		g (lb) 2 600 (5.73202)



Technical specifications

Article number		6AU1432-2AA00-0AA0
Product brand name		SIMOTION
Product type designation		CX32-2
Version of the motion control system		Controller Extension
Digital inputs		
Number of digital inputs		6
DC input voltage		
• Rated value	V	24
• For signal "1"	V	15 ... 30
• For signal "0"	V	-3 ... +5
Electrical isolation		Yes
• Note		Yes, in groups of 6
Current consumption for "1" signal level, typ.	mA	3.5
Input delay time for		
• Signal "0" → "1", typ.	µs	50
• Signal "1" → "0", typ.	µs	150
Digital inputs/outputs		
Number of digital I/Os		4
Parameterization possibility of the digital I/Os		parameterizable as DI, as DO, as probe input (max. 4)
If used as an input		
DC input voltage rated value	V	24
Electrical isolation		No
Current consumption for "1" signal level, typ.	mA	3.5
Input delay time for		
• Signal "0" → "1", typ.	µs	5
• Signal "1" → "0", typ.	µs	50
Measuring input reproducibility	µs	5
Measuring input resolution	µs	1
If used as an output		
Load voltage rated value	V	24
Electrical isolation		No
Current carrying capacity for each output, max.	mA	500
Leakage current, max.	mA	2
Output delay for		
• Signal "0" → "1", typ.	µs	150
• Signal "0" → "1", max.	µs	400
• Signal "1" → "0", typ.	µs	75
• Signal "1" → "0", max.	µs	100
- Note		Data for Vcc = 24 V; load 48 Ohm; "1" = 90 % VOut, "0" = 10 % VOut
Switching frequency of the outputs for		
• Resistive load, max.	kHz	4
• Inductive load, max.	Hz	2
• Lamp load, max.	Hz	11
Short-circuit protection		Yes
Additional technical data		
Back-up of non-volatile data of retentive data		unlimited buffer duration
Approvals		
• USA		cULus
• Canada		cULus
• Australia		RCM (formerly C-Tick)
• Korea		KCC
• Russia, Belarus and Kazakhstan		EAC

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

SIMOTION SCOUT Engineering Software

Overview

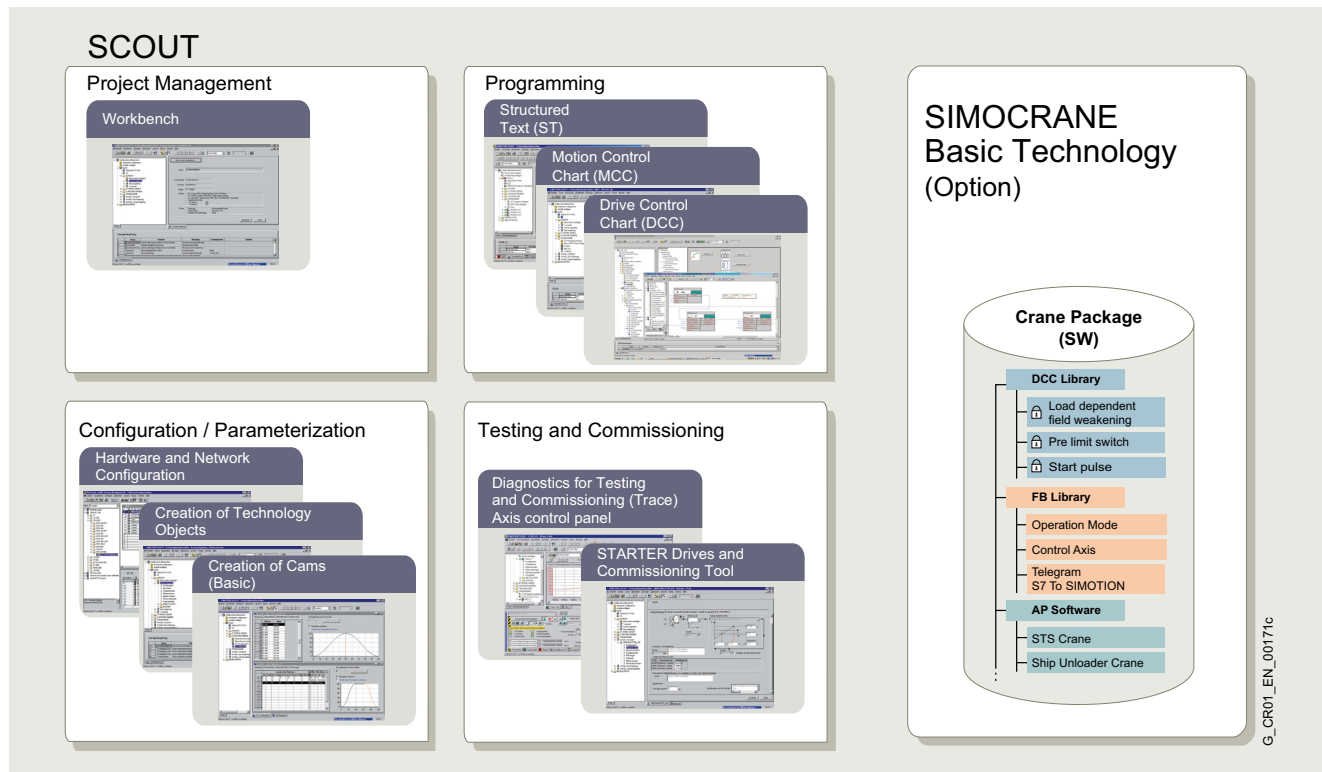
SCOUT is the engineering software for SIMOTION that is integrated in STEP 7. SCOUT contains all the tools required for configuration, parameterization, programming, testing, diagnostics and commissioning of SIMOTION and SINAMICS.

Structured Text

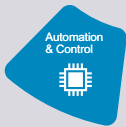
The high-level language ST (Structured Text) provides all language elements as text commands. This allows well-structured applications to be created.

Crane-specific operations, such as operating mode assignment and management, message frame processing, etc. have been programmed in ST as function blocks and are stored in the "Crane FB Library".

SIMOTION SCOUT



SIMOTION SCOUT with crane application



Overview

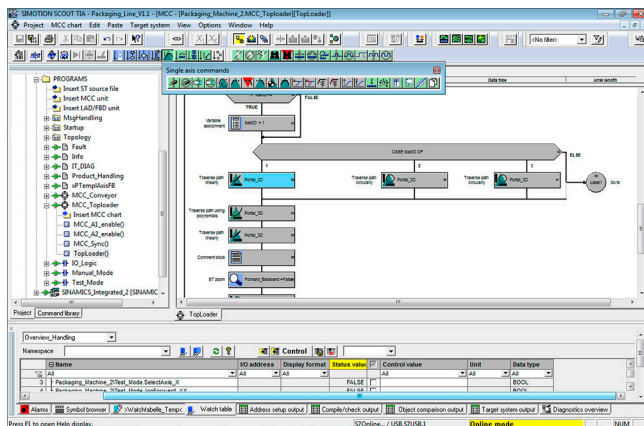
Motion Control Chart (MCC)

Motion Control Chart (MCC) is a "flow diagram language" that can be used to graphically formulate the process procedures in machines or cranes in a simple manner. The result is one or more flow diagrams, comprising MCC blocks that describe the time sequence of the individual function module. Due to its special means of expression, MCC (Motion Control Chart) is ideally suited to programming sequential processes.

Various MCC blocks are available for controlling the machine, for example, conditions must be fulfilled, I/O signals can be read or set, calculations can be formulated and different control structures such as condition (IF), cases (CASE) and loops (WHILE, REPEAT UNTIL) can be programmed.

All MCC blocks – a selection of the most important SIMOTION functions – are available in toolbars, see figure below.

In SIMOCRANE Basic Technology, MCC is implemented for the sequence control of every function module (e. g. hoist). This results in a clear flow chart for the drive-based control.



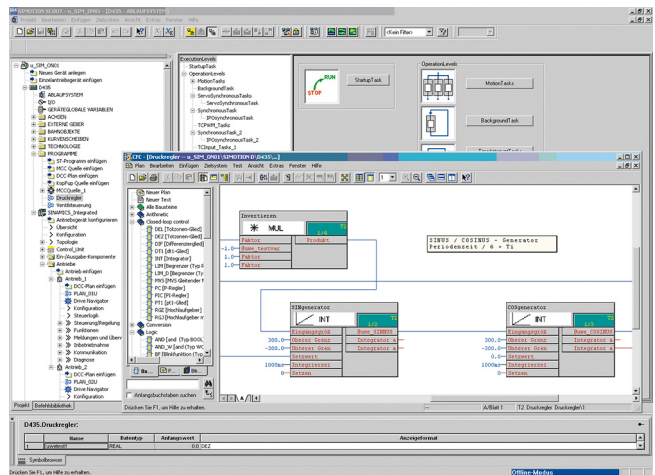
Motion Control Chart (MCC)

Optional Drive Control Chart (DCC) packages

The Drive Control Chart (DCC) option packages for SIMOTION and SINAMICS extend the possibilities for easy graphical configuration of technology functions using pre-defined function blocks.

Multi-instance capable function blocks are selected from a pre-defined library and graphically interconnected using drag and drop. The standard function block library comprises a large number of closed-loop control, arithmetic and logic blocks as well as extensive open and closed-loop control functions.

In the Crane DCC Library, individual crane-specific technologies (e. g. load-dependent field weakening) can be pre-configured using the SIMOTION standard DCC Library and encapsulated in individual macro modules. These Crane DCC blocks are used for setpoint conditioning (velocity, acceleration) of the function module (e. g. hoist) at the time-cycle level. In this manner, transparent closed-loop control related structures are shown and previously created blocks can be reused many times.



Drive Control Chart (DCC)

SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

SIMOTION SCOUT Engineering Software

Design

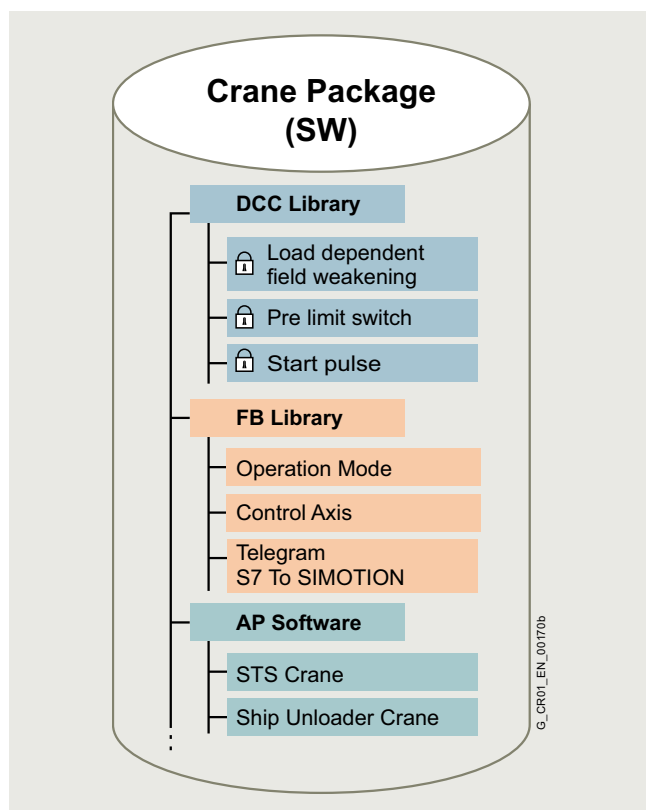
The function library

The "Crane DCC Library" comprises a collection of blocks (e. g. load-dependent field weakening) which are implemented as "Drive Control Charts (DCC)" blocks. DCC is a representation which supports graphic configuring and interconnecting. The functional scope of the crane library is described in detail in the section "Technology functions".

The "Crane FB Library" consists of a collection of blocks (e. g. Operation Mode) which have been programmed in "Structured Text" (ST). These function blocks are called up in the drive-based sequence control at the MCC level.

Standard applications

The standard applications comprise several ready-to-use configured function modules for different crane types, e. g. "Container quay crane" or "Ship unloading crane". These solutions are "ready-to-run" for the user who only needs to set the parameters appropriately. In the case of large-scale adaptation and expansion, these standard applications can be used as a starting point for "ready-to-apply". Expandability and flexibility have therefore been taken into account.



SIMOTION technology package

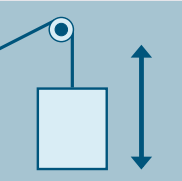
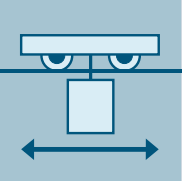
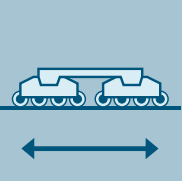
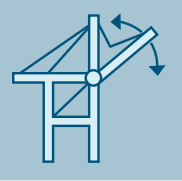
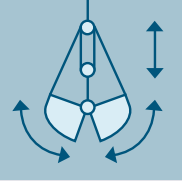
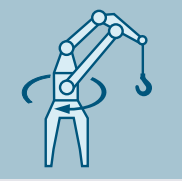


Design

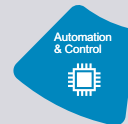
Function modules and operating modes

The application software has a modular structure according to crane types. An overview of the function modules, their

operating modes and technology functions used are shown in the following tables.

Function modules	Number of axes		Control modes	Operating modes
Hoist	4		- Positioning single axis - Leading-following operation - Synchronous operation	- Automatic - Manual - Speed controlled (jogging) - Sway control - Basic positioning
Trolley	2		- Speed controlled - Positioning single axis - Leading-following operation - Synchronous operation	- Automatic - Manual - Speed controlled (jogging) - Encoderless emergency mode - Sway control - Basic positioning
Gantry	2		- Speed controlled - Positioning single axis - Leading-following operation - Synchronous operation	- Automatic - Manual - Speed controlled (jogging) - Encoderless emergency mode - Basic positioning
Boom	1		Speed controlled	Speed controlled (jogging)
Holding and closing gear	4		- Speed controlled - Separate positioning with one axis (holding or closing gear) - Synchronous operation between both axes	- Speed controlled (jogging) - Sway control - Basic positioning
Slewing gear	1		- Speed controlled - Positioning	- Automatic - Manual - Speed controlled (jogging) - Encoderless emergency mode - Basic positioning

Overview of the function modules and operating modes



SIMOCRANE Standard Technology

SIMOCRANE Basic Technology V3.0

SIMOTION SCOUT Engineering Software

Design

Technology functions

No.	Function	Brief description
1	Load-dependent field weakening	Using the DCC block, a supplementary speed setpoint is calculated dependent on the load. This speed increase for partial loads above the rated speed is required for cranes to increase the handling capacity.
2	Prelimit switch (selectable limiting)	The velocity of the drive can be limited using the DCC block when a pre-defined prelimit switch is reached.
3	Start pulse	Using the DCC block, "load sag" is prevented when starting hoists with a suspended load.
4	Switch-over of the ramp-function generator in the field-weakening range and when selecting heavy-duty operation	Using the DCC block, the acceleration and deceleration times are modified for heavy-duty operation or in field weakening.
5	Current distribution monitoring	Using the DCC block, the current setpoint/actual values from the leading and following drive are monitored. A signal is generated if a specified difference is exceeded.
6	Slack rope controller	This function prevents a slack rope during a grab is closing in the goods being handled. It ensures a controlled digging of the grab into the bulk material to achieve maximum filling.
7	Current equalization control	When hoisting and lowering the closed grab, the tension levels in the holding and closing gear should be approximately the same. Using this DCC blocks the required total hoisting power is optimally distributed across the two drives.
8	Slewing velocity dependent on the length of overhang	The speed of the slewing gear is adapted depending on the luffing gear length of overhang in order to keep the circumferential velocity constant.
9	Ramp-up/ramp-down time dependent on the length of overhang + influence of the ramp-function generator dependent on the velocity	For cranes with luffing gear, with increasing length of overhang, the load torque for the slewing gear increases while accelerating. In order to avoid that the current limits are reached, the ramp-up and ramp-down times are linearly adapted as a function of the length of overhang.
10	Master switch	Using the DCC block, the drive can be moved with a fine sensitivity using the master switch for manual positioning.
11	Anti-slip control	The velocity between the motor encoder and the external encoder is monitored using the DCC block. If an excessively high velocity deviation occurs, the velocity or the acceleration is adapted in steps.
12	Heavy duty or constant field weakening	With the DCC block, the drive becomes capable of heavy-duty operation (HeavyDuty) or operation with constant field weakening (FieldWeak) through variation in the velocity.
13	Monitoring for overspeed	For hoist applications, using the DCC block, an overspeed condition is monitored or a setpoint-actual value deviation is detected (this is not a fail-safe function).
14	Monitoring the setpoints	The DCC block is used to monitor whether the velocity, acceleration or deceleration have been reduced between the command being output from the S7 and implementation in the drive. Further, it is monitored as to whether the drive is in field weakening.
15	Continuous load measurement	This DCC block is required for grab cranes. A continuous load measurement is carried out to guide the crane driver if the grab is not visible. The message "Grab touchdown" is also displayed.
16	Grab monitoring	In the case of closing gear, the block DCC GrabMonitor can be used to detect bulky load material.
17	Time-optimized positioning for a single axis	Using the SIMOTION system function, the drive can be moved to the target position as quickly as possible and precisely with the specified maximum velocity and acceleration/deceleration.
18	Leading-following closed-loop torque control	Leading-following operation is used if 2 motors are connected to a common shaft. The leading drive operates either closed-loop position controlled or closed-loop speed controlled depending on the operating mode. The following drive only operates closed-loop torque controlled. The leading drive sends the torque as torque setpoint to the following drive.
19	Synchronous operation	Synchronous operation control is used if 2 motors are connected to a common load. Depending on the operating mode, the leading and following drives operate either closed-loop position controlled or closed-loop speed controlled. The following drive receives a speed or position setpoint depending on the operating mode from the master via a gear (gear ratio 1:1). The functional scope has been expanded with the implementation of flying referencing/homing, offset compensatory control, establishing/canceling fixed offset, and cornering movement.
20	Tandem operation	Tandem operation is an extension of the synchronous operation control mode. Synchronous operation motion control takes place between 2 groups. In each group, 2 drives can be coupled in leading-following closed-loop torque control or also in synchronous operation. The function is suitable to address applications for both harbor cranes, such as a double spreader STS container crane or large ship unloaders with 4 drum grabs, as well as industrial cranes with several hoists and trolleys.
21	Cornering movement	Using this function, cornering movement for crane long travel (gantry) can be executed in closed-loop speed controlled operation.
22	Brake test	The mechanical brake function (e. g. hoist) should be regularly checked using this function. To do this, the axis moves against the closed brake with a certain torque setpoint in order to check the braking capability of the brake.
23	Basic positioning	This is a positioning that does not use the position controller of the axis but is calculated in the Crane FB Library; it is suitable for systems that tend to be subject to mechanical vibration, such as trolleys on STS cranes.

Crane-specific technology functions



Overview

SIMOCRANE Drive-Based Technology is drive-based and offers a compact functional scope within the SINAMICS environment. Highlights of SIMOCRANE Drive-Based Technology are fast commissioning by using standard applications and a high degree of flexibility through the appropriate adaptation possibilities.

SIMOCRANE Drive-Based Technology encompasses the following features:

- All of the functions that have been proven in practice and required for mid-performance applications are available on the SINAMICS platform for parameterization
- Pre-configured standard applications for hoist and trolley/gantry with control via PROFIBUS/PROFINET via I/O signals ("ready-to-run", only have to be parameterized using script)
- Can be adapted to customer-specific requirements – "ready-to-apply" (for adaptation by the user).

The SIMOCRANE Drive-Based Technology V1.0 SP2 HF1 package comprises the following components:

CompactFlash card

- With the standard firmware version for SINAMICS S120 (V5.1)

CD-ROM with

- Cranes DCC blocks
- Standard applications for single-axis application and multi-axis application
- Documentation

Features

- Supports the standard SINAMICS firmware V5.1
- Supports the SINAMICS PM240-2 Power Modules (frame sizes FSA to FSG)
- Supports the temperature sensor Pt1000
- Application example for single axes (CU310-2) and multiple axes (CU320-2) available

	Manual control with individual fine feeling (Analog master controller)
Enables drive movement with high precision via a directly connected master switch for manual positioning.	
	Smart-slow-down (selectable limitation)
Allows you to limit the drive speed when reaching a predefined prelimit switch.	
	Load sag prevention (Start pulse)
Prevents "load sag" when starting hoist gear with a suspended load.	
	Possible add-on with DBSC
Performance enhancement with sway control function.	

	Adaptive speed to operate at peak performance (Load-dependent field weakening)
Calculates additional speed setpoints, depending on the load. Partial loads automatically run at a higher speed than full loads.	
	Overspeed monitoring
Monitors overspeed or detects deviations between the speed setpoint and actual values.	
	Digital master controller
Up to 4 speed levels can be defined for simple operation.	
	Current distribution monitoring
Compares the current setpoints or actual values of the leading and following drive and sends a message if a specified value is deviated.	

SIMOCRANE Standard Technology

SIMOCRANE Drive-Based Technology

Motion Control

Benefits

- Crane technology embedded in the drive
- Fast commissioning
- Use of standard applications

Application

SIMOCRANE Drive-Based Technology complies with the challenges of mid-performance cranes in ports and industrial environments.

Design

A mid-performance crane application includes the following components:

Hardware

A distributed single-axis solution with SINAMICS S120 AC/AC drive and the corresponding Power Modules for hoist, trolley and gantry

- AC/AC drive comprising:
 - SINAMICS CU310-2 Control Unit
 - Power Module depends on the version of the Drive-Based Technology
 - SIMOCRANE Drive-Based Technology

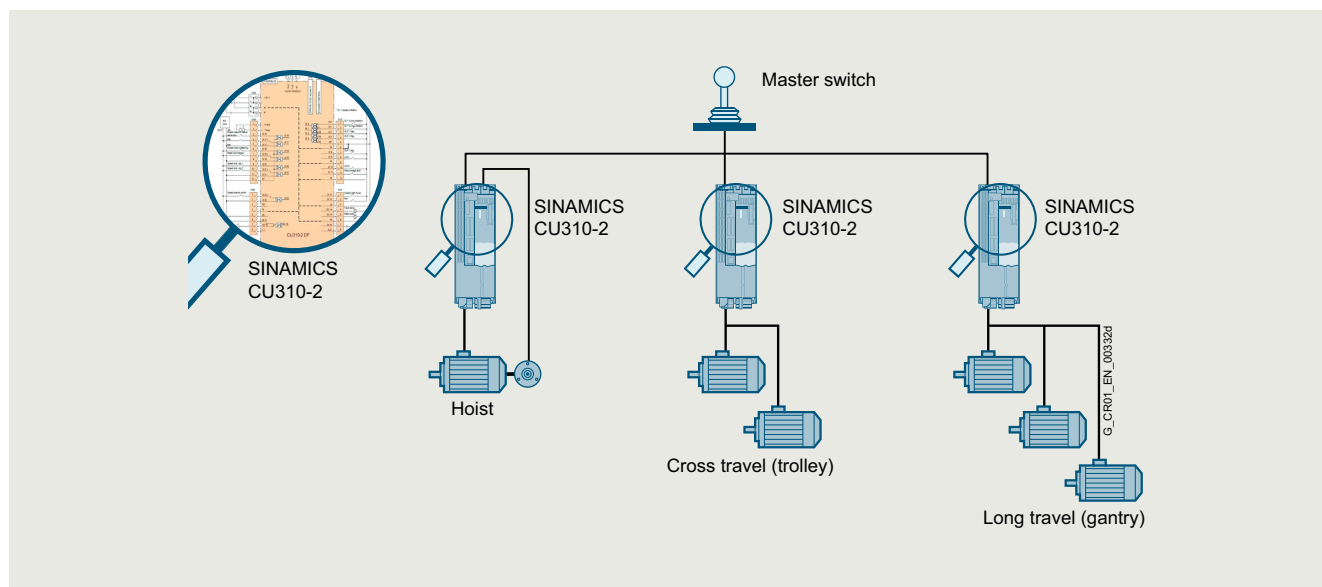
- Selectable control via onboard I/O terminals or PROFIBUS/PROFINET; when required, also additionally via the SINAMICS TM31 Terminal Module
- We strongly recommend that encoders are used for hoist applications

Hardware configuration

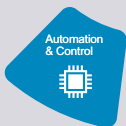
Typical hardware configurations used in mid-performance crane applications are shown in the following examples. It involves an overhead bridge crane (OHBC), controlled using I/O signals or using PROFIBUS DP communication.

It is especially important to note that the crane can be controlled just using the onboard I/O (see figure "Topology with onboard I/O") with SIMOCRANE Drive-Based Technology.

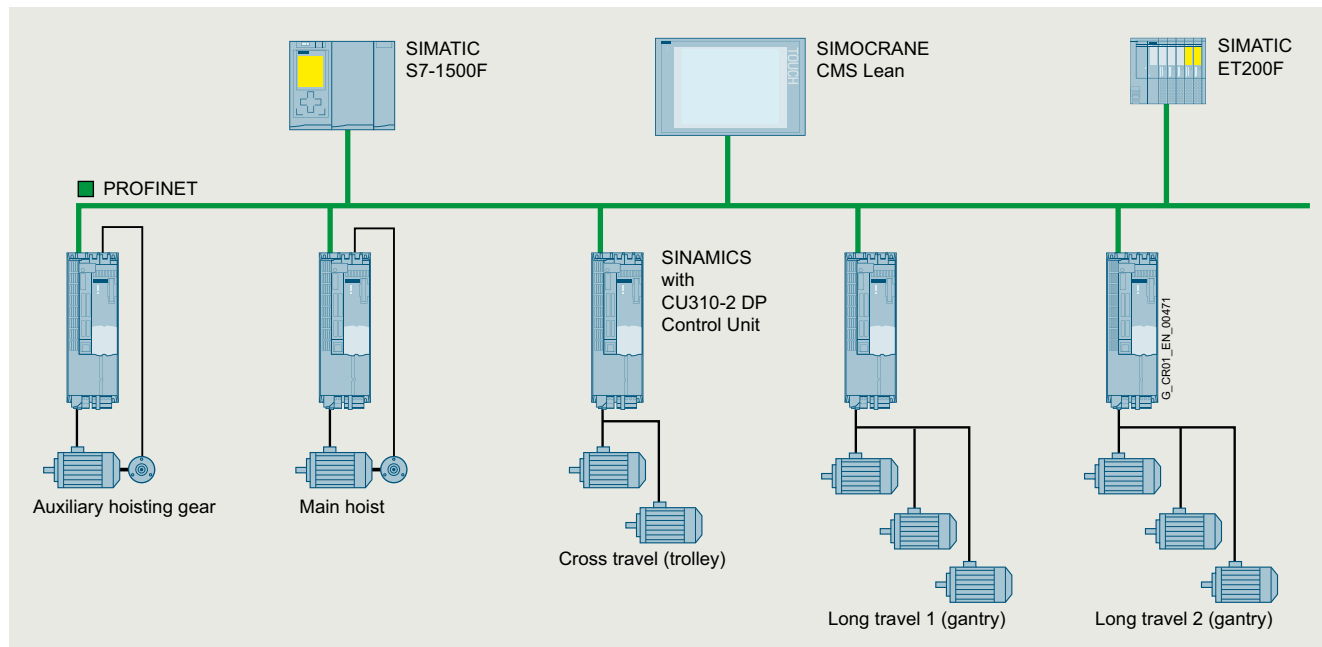
For hoist applications, an encoder is required for safety reasons.



Topology with onboard I/O



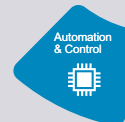
Design



Topology with PROFINET

Software

- Crane technology in DCC blocks, e. g. load-dependent field weakening, start pulse etc.
- Standard applications via PROFIBUS/PROFINET or via onboard I/O terminals for the single axis of the hoist, trolley or gantry (selectable using the appropriate scripts)
- SINAMICS functions, e. g.:
 - Leading-following closed-loop torque control
 - Brake control logic
 - Time-optimized positioning
 - Safety Integrated function
- Standard SINAMICS firmware V5.1 for crane applications. The following Power Modules and functions can be operated using this firmware:
 - Power Module in chassis format (4-quadrant operation with braking chopper)
 - PM240-2 Power Module (4-quadrant operation, FSA to FSG with braking chopper)
 - Safety Integrated functions
 - Vector control, V/f control



SIMOCRANE Standard Technology

SIMOCRANE Drive-Based Technology

Motion Control

Selection and ordering data

Scope of delivery

The scope of delivery of the SIMOCRANE Drive-Based Technology package includes:

Description	Article No.
SIMOCRANE Drive-Based Technology V1.0 SP2 HF1 For SINAMICS Control Unit CU310-2 and CU320-2 Each comprising 1 package • CompactFlash card with standard firmware version V5.1 • CD-ROM with - Cranes DCC blocks - Standard applications for single-axis and multi-axis - Documentation	6GA7270-1AA20-0AA0

Supplementary components

Description	Article No.
SINAMICS S120 CU310-2 DP Control Unit	6SL3040-1LA00-0AA0
SINAMICS S120 CU310-2 PN Control Unit	6SL3040-1LA01-0AA0
SINAMICS S120 CU320-2 DP Control Unit	6SL3040-1MA00-0AA0
SINAMICS S120 CU320-2 PN Control Unit	6SL3040-1MA01-0AA0
SINAMICS TM31 Terminal Module	6SL3055-0AA00-3AA1
SINAMICS STARTER V5.1 SP1 (DVD)	6SL3072-0AA00-0AG0
DCC SINAMICS V3.1 SP1 HF2 For single-axis applications and multi-axis applications	6AU1810-1HA31-1XA0

Drive systems, motors and connection systems for SINAMICS S120 are not included in the package (see Chapter 8 "Drive systems" and Chapter 9 "Motors for cranes"). These components must be ordered separately.

Additional information on selecting and ordering supplementary components is provided in the following catalogs:

- D 31.1 – SINAMICS Converters for Single-Axis Drives – Built-In Units
- D 21.4 – SINAMICS S120, SINAMICS S220 and SIMOTICS
- PM 21 – SIMOTION Equipment for Production Machines
- IK PI – Industrial Communication

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

You can find further information about Crane Application Notes on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

The latest information about SIMOTION products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/14505>

The latest information about SINAMICS products, product support and FAQs can always be found on the Internet at

<https://support.industry.siemens.com/cs/ww/en/ps/13229>

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning



Overview

The user-friendly STARTER commissioning tool can be used for:

- Commissioning
- Optimization
- Diagnostics

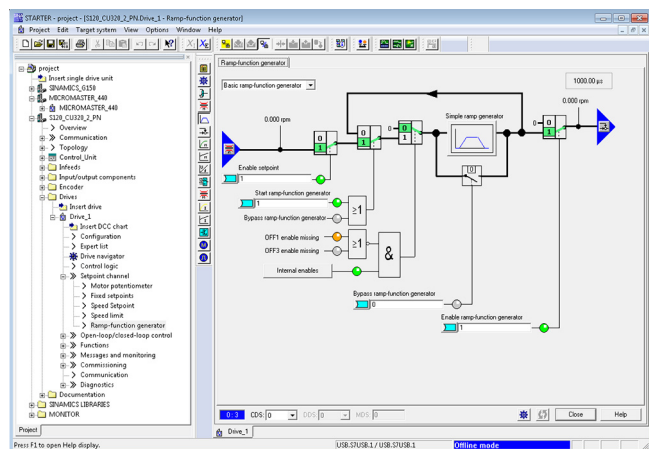
This software can be operated either as a standalone PC application, integrated in SIMATIC STEP 7 with TIA compatibility via Drive ES Basic, as well as integrated in the SIMOTION Engineering Software SCOUT. In both cases, basic functions and handling are identical.

First commissioning is guided by a wizard which makes all the basic settings in the drive. Therefore, getting a motor up and running is merely a question of setting a few of the drive parameters as part of the drive configuration process. The travel commands can be simply entered from the PC via the control panel.

The individual settings are made using graphic parameterizing screen forms, which precisely visualize the principle of operation of the drive (see figure "STARTER project navigator"), or as before, using the expert list (see figure "Parameter assignment using the expert list").

In addition, the following functions are available for optimization purposes:

- Self-optimization of the controller settings
- Trace to precisely record the signals



STARTER project navigator

Application

Crane-specific applications

Using STARTER, various pre-configured standard applications for various crane applications are configured, for example:

- Single-axis application for the hoist, trolley and gantry with control via PROFIBUS DP, via external I/O terminals or even via just the onboard I/O
- Two-axis application for master-slave closed-loop torque control
- Can be selected using a script screen form (see figure "Script screen form to configure the axis, control and type of master switch")

For users, these solutions are "ready-to-run", i.e. they only have to appropriately set the parameters based on the parameter list (see figure "Parameter assignment using the expert list").

The screenshot shows a web browser window titled 'http:// - SIMOCRANE Drive Based Technology - Siemens AG'. The main content area displays the following text:

SIMOCRANE Drive-Based Technology

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

Path and Name for Logfile

Select the drives in your project

☐ HOIST
☒ GANTRY / TROLLEY

Select the communication in your project

☐ PROFIBUS DP
☒ ONBOARD I/O

Select the master switch setpoint in your project

Attention only for ONBOARD I/O communication

☐ Analog master-switch
☒ Digital master-switch

Script screen form to configure the axis, control and type of master switch

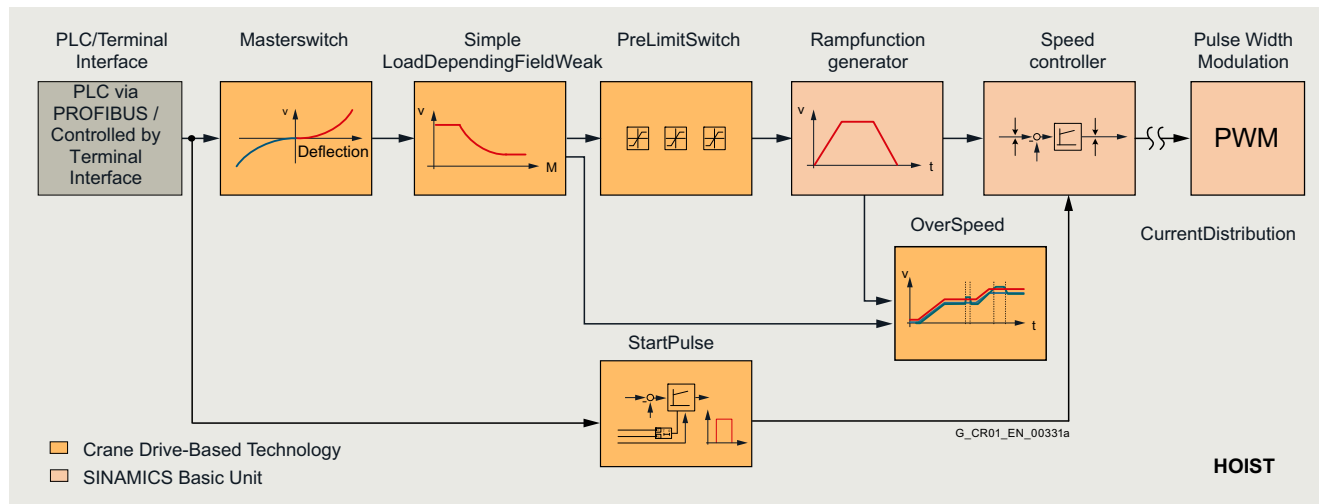
SIMOCRANE Standard Technology

SIMOCRANE Drive-Based Technology

Engineering Software

Application

2



Speed channel of the hoist axis with control via PROFIBUS DP after running the script file

Parameter ID	Parameter text	Value	Unit
P20000	Hardware sampling time variable	0.250	ms
P20001	MasterSwitch_vPreSpeedParameter (%)	DriveAxis_12055.1	
P20002	MasterSwitch_vPreDeflection	0	
P20003	MasterSwitch_vPreDeflection	0	
P20004	MasterSwitch_v1SpeedParameter (%)	5.000	
P20005	MasterSwitch_v1DeflectionParameter (%)	5.000	
P20006	MasterSwitch_v2SpeedParameter (%)	10.000	
P20007	MasterSwitch_v2DeflectionParameter (%)	10.000	
P20008	MasterSwitch_v3SpeedParameter (%)	25.000	
P20009	MasterSwitch_v3DeflectionParameter (%)	25.000	
P20010	MasterSwitch_v4SpeedParameter (%)	50.000	
P20011	MasterSwitch_v4DeflectionParameter (%)	50.000	
P20012	MasterSwitch_v5SpeedParameter (%)	75.000	
P20013	MasterSwitch_v5DeflectionParameter (%)	75.000	
P20014	MasterSwitch_v6SpeedParameter (%)	100.000	
P20015	MasterSwitch_v6DeflectionParameter (%)	100.000	
P20016	MasterSwitch_v7SpeedParameter (%)	100.000	
P20017	MasterSwitch_v7DeflectionParameter (%)	100.000	
P20018	OverSpeed_vSpeedPoint (%)	DriveAxis_12758	
P20019	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20020	OverSpeed_vRampFunction (%)	DriveAxis_12759	
P20021	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20022	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20023	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20024	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20025	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20026	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20027	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20028	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20029	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20030	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20031	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20032	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20033	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20034	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20035	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20036	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20037	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20038	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20039	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20040	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20041	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20042	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20043	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20044	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20045	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20046	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20047	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20048	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20049	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20050	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
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P20060	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
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P20062	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20063	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20064	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20065	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20066	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20067	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
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P20072	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20073	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20074	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20075	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20076	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20077	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20078	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20079	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20080	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20081	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20082	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20083	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20084	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20085	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20086	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
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P20089	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20090	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20091	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20092	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20093	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20094	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20095	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20096	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20097	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20098	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20099	OverSpeed_vActualSpeed (%)	DriveAxis_12759	
P20100	OverSpeed_vActualSpeed (%)	DriveAxis_12759	

Parameter assignment using the expert list

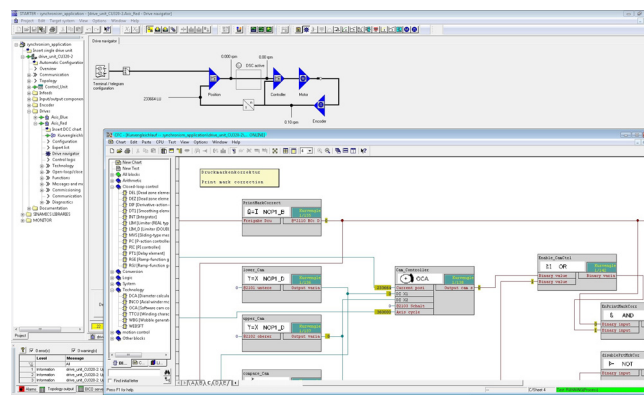
In the case of individual adaptations and expansions, these standard applications can be used as a starting point for "ready-to-apply" applications. The Drive Control Chart (DCC) offers users the best option for making individual adaptations to address their precise requirements.

Optional Drive Control Chart (DCC) packages

With the optional Drive Control Chart (DCC) packages, available for SINAMICS, for simple graphic configurations it is possible to extend the technological functions using pre-defined function blocks. Multi-instance function blocks are selected from a pre-defined library and graphically interconnected using drag and drop. The standard function block library includes a large number of open-loop, arithmetic and logic blocks as well as comprehensive open-loop and closed-loop control functions. DCC provides users with a new dimension to individually adapted specific functions of his machine. Further, DCC is installed in the STARTER commissioning tool.

Note:

DCC must be selected when installing the STARTER commissioning tool. A license is required to generate and edit plans.



DCC graphic editor

The crane DCC blocks are preconfig

ured using the standard SINAMICS DCC Library. Each individual crane-specific technology (e.g. load-dependent field weakening) is optimally preconfigured in the crane DCC blocks, and encapsulated as individual macro block. These crane DCC blocks are used to process the speed setpoint channel of an individual axis (e.g. hoist with control via PROFIBUS DP after running the script file) and fast monitoring at the cycle level. In this way, clear control loops are presented, and the same crane DCC blocks can always be reused for various axes in various projects.



Design

Standard applications

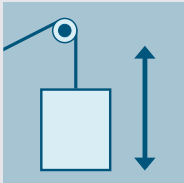
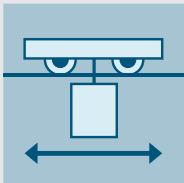
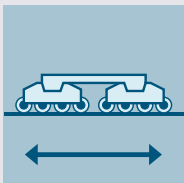
The standard applications encompass various pre-configured projects, which are ready for use to address various crane applications:

- Single-axis application for hoist, trolley and gantry with control via the onboard terminal strip or via PROFIBUS DP
- Two-axis application for leading-following closed-loop torque control

- Setpoint via a digital and an analog master switch
- Selectable using a script screen form

These solutions are suitable for "ready-to-run" applications (parameterized) or "ready-to-apply" applications (DCC). As a consequence, expandability and flexibility have been taken into account.

Crane-specific function modules

Function modules	Axis	Function
Hoist		• Load-dependent field weakening • Prelimit switch • Start pulse • Master switch (digital or analog) • Monitoring for overspeed • Current distribution monitoring
Trolley		• Master switch (digital or analog) • Prelimit switch • Monitoring for overspeed • Current distribution monitoring
Gantry		• Master switch (digital or analog) • Prelimit switch • Monitoring for overspeed • Current distribution monitoring

Overview of the crane technology at each axis

Technology functions

No.	Technology	Brief description
1	Load-dependent field weakening	Calculates the supplementary speed setpoints dependent on the load. When compared to full loads, partial loads automatically operate at a higher speed.
2	Prelimit switch (selectable limiting)	Allows the drive velocity to be limited when a pre-defined prelimit switch is reached.
3	Start pulse	Prevents "load sag" when hoists start with a suspended load.
4	Current distribution monitoring	Compares the current setpoints or actual values from the leading and following drive, and issues a signal for a deviation from a specified value.
5	Master switch (digital or analog)	Facilitates a high drive travel precision via a directly connected master switch for manual positioning.
6	Monitoring for overspeed	Monitors for overspeed or detects deviations between speed setpoints and actual values.
7	Time-optimized positioning for a single axis	Allows the drive to be precisely traversed to the target position with the specified, maximum velocity and acceleration/deceleration within the shortest time.
8	Leading-following closed-loop torque control	When 2 motors operate on a common shaft, the leading drive issues the torque setpoint for the slave. The leading drive operates either closed-loop speed controlled or position controlled. The leading-following drive must be networked as part of the application (application engineering).
9	Brake control	The simple or extended brake control allows the user to parameterize rather than program the control. The combination of start pulse and brake control simplifies the engineering and commissioning for the user.
10	Safety Integrated	If required, the SINAMICS Safety Integrated Basic and Extended Functions are available for the user, e. g. STO, SLS.

SIMOCRANE Standard Technology

Notes

2

SIMOCRANE Advanced Technology



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Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit

www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

www.siemens.com/cert.



SIMOCRANE Advanced Technology

SIMOCRANE Energy Storage System Management

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Overview

SIMOCRANE Energy Storage System Management (ESSM) is a global executable STEP 7 library. It therefore offers a fast and simple method to implement a control-based software solution for an energy storage system for operation on a SINAMICS S120 DC link. The energy storage system comprises up to 8 bidirectional SINAMICS DCP power converters of the same rating class connected in parallel and a lithium-ion energy storage device. SINAMICS DCP power converters of rating class 120 kW and 250 kW are supported.

The SIMOCRANE ESSM STEP 7 library provides operating modes, functions and a standardized interface for the modular design and scalability of an energy storage system in a crane system. SIMOCRANE ESSM also offers a standardized interface to the crane application.

Typical use cases for an energy storage system in crane systems:

- Electrification of mobile cranes, e.g. rubber tired gantry (RTG) cranes, harbor mobile cranes (HMC), by setting up a controlled DC link from the battery
- Hybridization of fuel-operated cranes (RTG, HMC), e.g. to use a diesel generator in start/stop operation combined with the battery
- Handling of dynamic peak-load requirements, e.g. to reduce the necessary line connection power
- Undervoltage supply, e.g. to buffer line supply failures

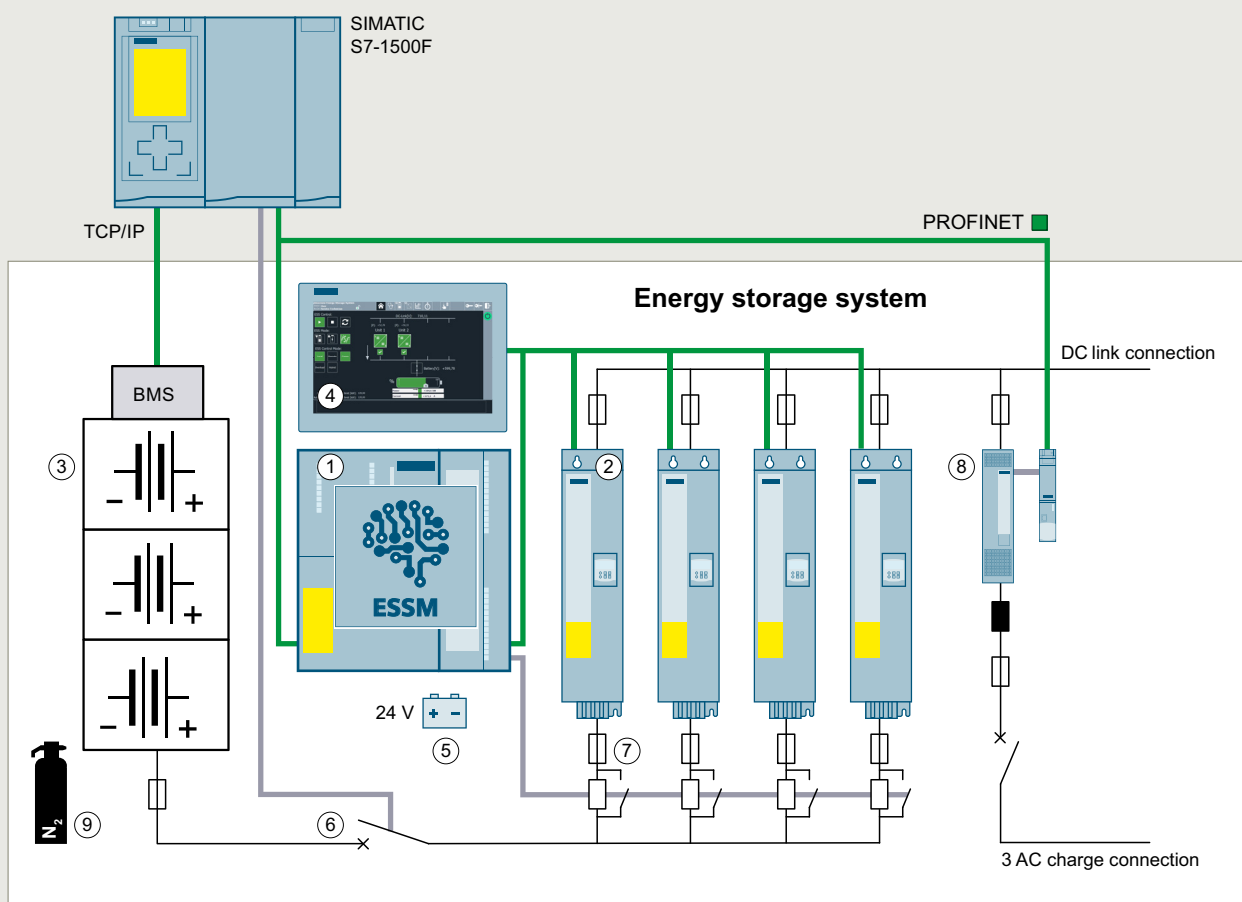
Benefits

SIMOCRANE Energy Storage System Management (ESSM) minimizes the software engineering for an energy storage system by providing:

- the operating modes Blackstart, Peak Shaving and Manual charge and discharge.
- the control of the SINAMICS DCP, which are used as a power converter for the energy exchange between the battery and the DC link of the SINAMICS S120 drive system
- a standardized interface for remote or local access for easy and fast connection to the crane controller
- a standardized interface for local access for easy and fast integration of an HMI Panel
- integrated service functions for easy and fast commissioning of the energy storage system using an HMI Panel
- monitoring and protection functions for the battery in relation to its state of charge
- various monitoring systems such as hardware and process value monitoring, plausibility check of the control and set-points and extensive system diagnostics

With SIMOCRANE ESSM, a software solution for the typical applications of an energy storage system in crane applications can be implemented easily and fast.

Application



- | | |
|--|--|
| ① SIMATIC PLC with SIMOCRANE ESSM | ⑥ DC main switch |
| ② SINAMICS DCP | ⑦ Pre-charging input circuit |
| ③ Battery module with integrated battery management system (BMS) | ⑧ SINAMICS S120 Infeed with Control Unit |
| ④ SIMATIC HMI Panel | ⑨ Battery fire protection e.g. Sinorix |
| ⑤ Starter battery | |

SIMOCRANE Energy Storage System Management (ESSM) is used in an energy storage system that uses batteries as a storage medium and SINAMICS DCP converters for bidirectional energy exchange between batteries and the DC link of the SINAMICS S120 drive line-up.

SIMOCRANE Advanced Technology

SIMOCRANE Energy Storage System Management

Design

The SIMOCRANE Energy Storage System Management (ESSM) is realized as a globally executable SIMATIC STEP 7 library comprising functions, function blocks and data types. For operation a valid license key is required for the encrypted functions.

The library and the Operating Instructions are available as download from Siemens Industry Online Support.
A license certificate with license key is available for order.

Note:

To generate the license key, the serial number (10-digit code) of the SIMATIC Memory Card must be specified when ordering. The use of SIMOCRANE ESSM is then possible with this SIMATIC Memory Card.

The number of license certificates with license key for the same SIMATIC Memory Card depends on the number of SINAMICS DCPs to be operated:

Number of SINAMICS DCPs	Required number of license certificates with license key
1 to 2	1
3 to 4	2
5 to 6	3
7 to 8	4

The STEP 7 library and the Manual are available as download from Siemens Industry Online Support (registration required).

Hardware

Certain hardware requirements must be met for the use of SIMOCRANE ESSM.

- SIMATIC S7 CPU1515 as of firmware $\geq$ V2.8
- SIMATIC S7 Memory Card with a memory capacity $\geq$ 4 Mbyte
- SIMATIC S7-1500, digital input module DI 16x24VDC HF
- SIMATIC HMI Panel
- SINAMICS DCP as of firmware version 1.4 HF2

SIMOCRANE ESSM supports the operation of a maximum of 8 SINAMICS DCPs connected in parallel.

The communication with the PLC of the crane controller system takes place via PROFINET. Accordingly, the PLC of the crane controller must be equipped with a PROFINET interface.

Software

To use the STEP 7 library provided by the SIMOCRANE ESSM, a STEP 7 Professional license is required on the engineering PC. The TIA Portal V17 or higher is required for engineering. A valid license key must be available for the operation of SIMOCRANE ESSM.

Function

Operating modes

SIMOCRANE Energy Storage System Management (ESSM) provides the following operating modes:

Blackstart

The "Blackstart" operating mode is used when the energy storage system is the only energy supply for the crane system and the SINAMICS drive line-up. The SINAMICS DC link is pre-charged and regulated from the battery. The SINAMICS DCPs take on the role of a regenerative supply unit in this case. Excess energy is extracted from the DC link and transferred to the battery. An energy deficiency in the DC link is compensated by extracting energy from the battery.

Peak Shaving

The operating mode Peak Shaving is used when the energy storage system is connected to a SINAMICS drive line-up with a regulated control infeed (SINAMICS S120 Active Line Module) on the SINAMICS DC link of the drive system. With appropriate dimensioning, load peaks of the drive line-up can be compensated by the energy storage system.

Manual charge and discharge

The operating mode manual charge and discharge serves to charge the battery from the line supply/charging station. A power setpoint for charging and discharging can be entered in the energy storage system.

Functionality

The following functions are implemented within the operating modes:

Overload

The function "Overload" makes it possible to use the overload capability of the SINAMICS DCP.

Service function

The "Service function" is used for commissioning the SIMOCRANE ESSM software. The "Service function" allows to set important parameters, limits and setpoints. In service mode, the energy storage system is controlled from the local operator station.

Emergency mode

The "Emergency mode" function enables the operation of the energy storage system with a reduced number of SINAMICS DCPs than originally configured. In the event of a fault, after electrical separation of the power connections, the corresponding SINAMICS DCP can be deselected via the remote or local interface in order to be able to continue operating the crane system with lower power.



Function

Dynamic SOC limitation

The function "Dynamic SOC limitation" is used to realize the operation of the battery within a parameterizable "State Of Charge" (SOC).

Hardware and process value monitoring

The hardware monitoring serves to protect the SINAMICS DCPs and the energy storage device. The switching operations of contactors and circuit breakers, as well as the specified limits are monitored. If a fault is detected, e. g. an upward limit violation of battery current/voltage, a request to immediately disconnect the battery is issued.

Plausibility of control and setpoints

The system-relevant block inputs are monitored for plausibility. Faulted or implausible parameterizations are limited to the maximum system limits. A diagnostics message is always issued in the event of an incorrect parameterization. In critical cases, this can also result in the immediate shutdown of the system.

System diagnostics

The SIMOCRANE ESSM software includes a comprehensive diagnostics system which signals system states to the higher-level crane control system and the local operator interface. The diagnostics system consists of warnings, fault messages and status information.

Remote/Local user interface (switchable)

The SIMOCRANE ESSM software includes a remote and a local user interface. The higher-level control of the crane system communicates with the energy storage system via the remote user interface. An HMI Panel communicates with the energy storage system via the local user interface. Via the local user interface, it is possible to take over control sovereignty for the energy storage system and return it to the higher-level control. Service function can be selected in "local" mode, e. g. for commissioning the SIMOCRANE ESSM software.

High Dynamic

The "High Dynamic" function is an add-on function for the operating mode "Peak Shaving". The "High Dynamic" function can be used to increase the dynamic response when switching between the boost and recuperation modes.

Bypass

The "Bypass" function makes it possible to switch off initial voltage monitoring in the operating mode "Blackstart". This allows the energy storage system to be started independently of the DC link voltage.

Energy measurement

SIMOCRANE ESSM features an operating hours counter and energy meters. The energy balance (energy flow via the SINAMICS DCPs) can be diagnosed locally. The total energy sum and the energy per direction (charging/discharging) can be measured and differentiated. It is also possible to start an individual measurement. An operating hours counter is also implemented.

Selection and ordering data

Description	Article No.
SIMOCRANE Energy Storage System Management (ESSM)	6GA7235-0AA00-0AA0
License certificate with license key for the use of the SIMATIC S7 library SIMOCRANE ESSM V01.XX for the activation of maximum 2 SINAMICS DCPs	
<u>Note:</u>	
To generate the license key, the serial number (10-digit digit code) of the SIMATIC Memory Card must be specified when ordering. The use of SIMOCRANE ESSM is then possible with this SIMATIC Memory Card.	

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

You can find further information about Crane Application Notes on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

The latest information about SINAMICS products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/13229>

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning



SIMOCRANE Advanced Technology

SIMOCRANE ECO Technology

3

Overview

Crane configurations with diesel generators in conventional constant-speed mode with their high fuel consumption and unnecessary environmental pollution are a thing of the past.

With SIMOCRANE ECO Technology, the diesel generator runs in tune with the energy requirements of crane operation at optimum speed without any reduction in performance. Operation of the diesel generator with load-dependent speed control results in a reduction in fuel consumption and emissions.

With SIMOCRANE ECO Technology as the basis, Siemens has established the trend for fuel saving and emission reduction for cranes with diesel generators and therefore sets the standard today.

Benefits

Energy and cost saving

The most important, reliable and low-cost source of future energy is energy saving. Depending on the configuration of the drive system, the crane type, plant layout and operating conditions in the terminal, the new SIMOCRANE ECO Technology supports significant savings in actual fuel consumption of the crane. The ECO configuration with its specially developed energy management software is designed such that all demands are satisfied with regard to operating cranes with diesel generators. Through ECO Technology, energy flow within the system can be optimized.

Experience gained from the operations of numerous terminals worldwide demonstrates that terminal operators can save considerable quantities of fuel by implementing SIMOCRANE ECO Technology with the same operating conditions, the same structure and throughput. With integrated energy storage, even higher savings are possible. Investments in the ECO system are soon amortized by these savings. Furthermore, the considerable reduction in fuel consumption reduces CO₂ emissions by the same amount.

Flexible configurations

Siemens has bundled its expertise in a software package that utilizes the standard industrial drives platform SINAMICS and which can therefore be individually adapted to the situation and requirements of the crane.

Benefits of SIMOCRANE ECO Technology

- Savings in operating costs due to reduced fuel consumption
- Reduction in the CO₂ balance of the crane due to reduced fuel consumption
- Reduction in the noise emission due to variable load-dependent motor speeds
- Smaller spare parts inventories due to the use of standard Siemens components
- Lower maintenance costs
- Easier modernization of existing cranes

Application

SIMOCRANE ECO Technology is not only a powerpack system for rubber tired gantry (RTG) cranes, but also for all electrically operated cranes with diesel generators, such as straddle carriers, diesel-electric container bridges, mobile and floating cranes as well as driverless transport systems (AGV and 1-over-1 straddles).

The core component of power management is an easily operated software package that can be integrated into SIMOCRANE Basic Technology.

The crane configuration comprises SINAMICS and SIMATIC standard products. With this concept, ECO configurations can be aligned with environmental protection goals with optimum results with regard to cost savings, performance and viability.

Design

SIMOCRANE ECO Technology is power management software. It is designed for use in cranes and vehicles that are operated with an engine and an AC generator (diesel generator). These components are used to generate the energy for performing movements and for infeed of auxiliary energy.

SIMOCRANE ECO Technology can be easily implemented with SIMOCRANE Basic Technology. In this case, special ECO blocks are simply linked to SIMOCRANE Basic Technology blocks. The SIMOCRANE ECO Technology can also be used without the SIMOCRANE Basic Technology.

ECO Technology varies the speed of the engine in accordance with the actual energy required for the purpose of optimizing the fuel consumption. As compared with cranes operating with constant speed engines, or cranes with 2 speeds, fuel consumption is reduced in every operating mode.

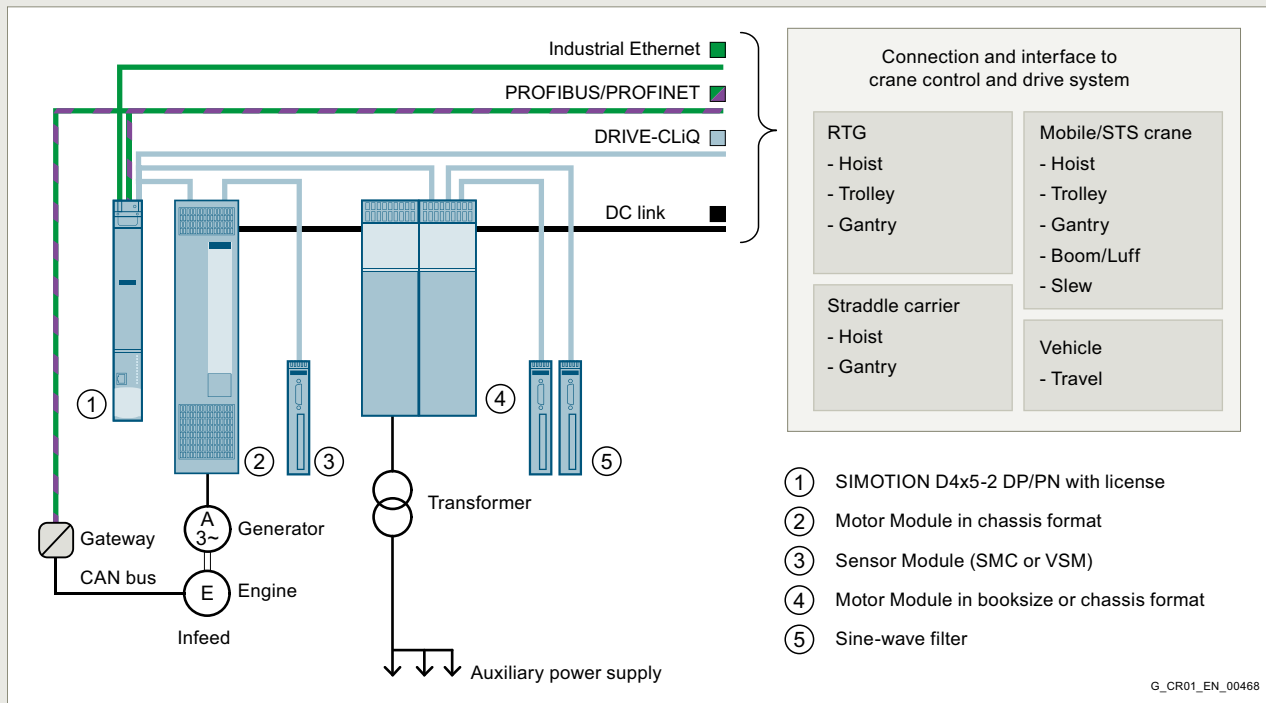
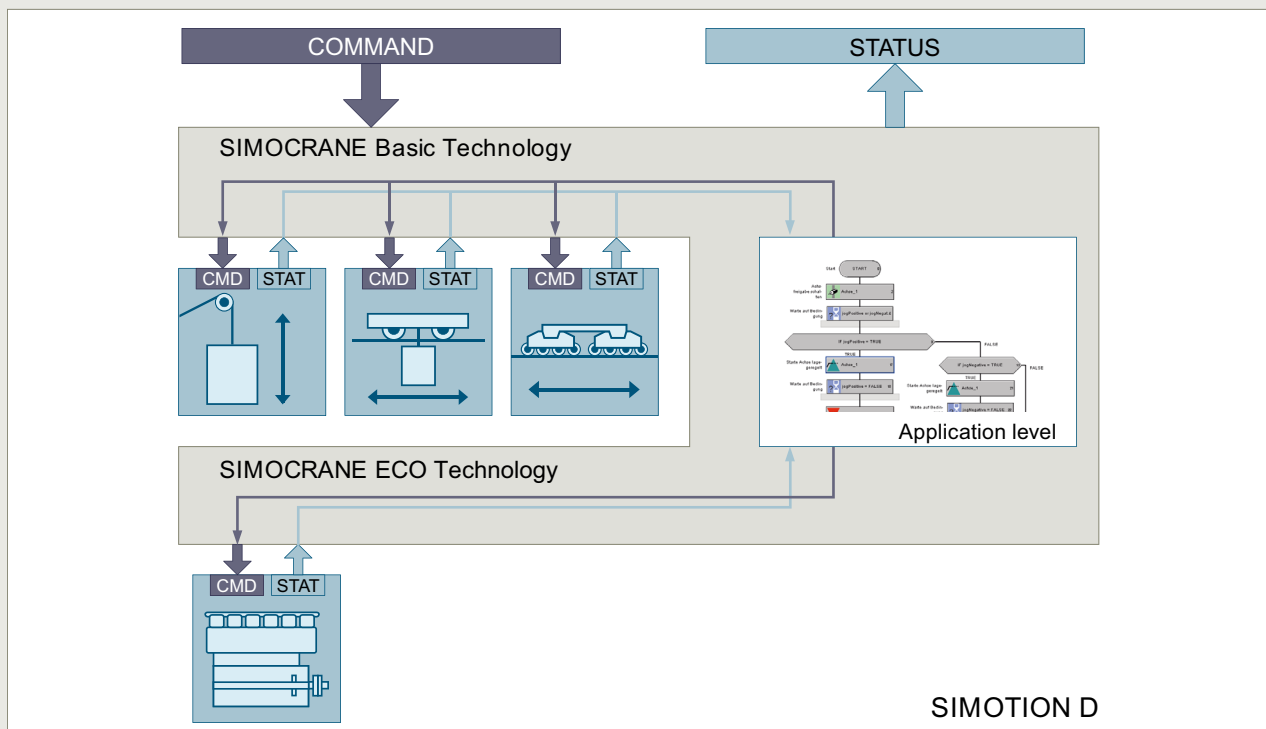
Hardware

SIMOCRANE ECO Technology is provided exclusively as a software package. Certain prerequisites are, however, necessary for the hardware configuration.

The overview diagram below shows the core of the ECO configuration with the main components that are required for an ECO package:

Design

3



SIMOCRANE ECO Technology configuration

SIMOCRANE Advanced Technology

SIMOCRANE ECO Technology

Design

Additional explanation of the numbered points in the diagram:

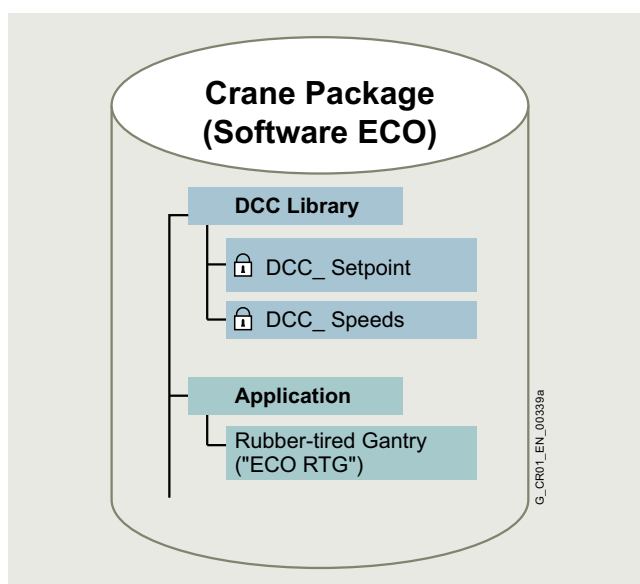
- ① A SIMOTION D4x5-2 DP or PN is required for executing the licensed SIMOCRANE ECO Technology software.
- ② For the infeed, a standard Chassis Motor Module must be selected from the SINAMICS S120 series. Selection is based on the same criteria as for selection of a Basic Line Module (BLM) or Active Line Module (ALM). The ECO software sets specific parameters for the Motor Module. It is important to note that the Motor Module is self-commutated to ensure that a low input voltage is added to the expected DC-link voltage. When an externally-excited synchronous generator is used in place of a permanent-magnet synchronous generator, a reactor may be necessary. See the Engineering Manuals for advice.
- ③ Depending on the generator type selected, a Sensor Module (SMC) is required for acquisition of the encoder signals of the generator, or a Voltage Sensing Module (VSM) for acquisition of the infeed voltage.
- ④ A stable auxiliary supply must be realized with Active Line Module, Active Interface Module and Voltage Sense Modules. Selection must take into account the average power/current consumption and the maximum power/current consumption of all components connected to the auxiliary supply. For this operation mode of the Active Line Module the license "Grid droop control" (S02) is needed.

Software

SIMOCRANE ECO Technology is available as a software package that contains:

- DVD with
 - Setup for installing the ECO DCC Library and online help
 - Standard application
 - Documentation
- ECO Technology V1.0 license

The software package contains the ECO DCC Library and a complete ECO standard application. This DCC Library comprises a collection of blocks that are implemented as "Drive Control Charts" (DCC) function blocks. DCC is a form of representation which supports graphic configuring and interconnecting. The detailed functional scope of the ECO crane library is shown in the graphic below.



Technology package

The standard application contains the ready-to-use application software for an RTG crane (ECO RTG). This solution can be used immediately; it only needs to be parameterized. Through adaptation and expansion, this solution can be used as a basis for further applications.



Technical specifications

Product designation	SIMOCRANE ECO Technology for SIMOTION D4x5-2
Type	6GA7230-0AA00-0AA0
Scope of delivery	• ECO Technology V1.0 license • DVD with - ECO Technology DCC blocks - Standard application - Documentation - ECO Technology V1.0 license

Selection and ordering data

Description	Article No.
SIMOCRANE ECO Technology V1.0 for SIMOTION D4x5-2	6GA7230-0AA00-0AA0
Comprising 1 package each of:	
• ECO Technology V1.0 license • DVD with - ECO Technology DCC blocks - Standard application - Documentation	

Supplementary components

Description	Article No.
SIMOTION SCOUT V5.2 SP1	6AU1810-1BA52-1XA0
Option package	
Drive Control Chart (DCC) V3.2 SP1 for SIMOTION/SINAMICS	6AU1810-1JA32-1XA0

Drive systems, motors and connection systems for SINAMICS S120 are not included in the package (see Chapter 8 "Drive systems" and Chapter 9 "Motors for cranes"). These components must be ordered separately.

Additional information on selecting and ordering supplementary components is provided in the following catalogs:

- D 21.4 – SINAMICS S120, SINAMICS S220 and SIMOTICS
- PM 21 – SIMOTION Equipment for Production Machines
- IK PI – Industrial Communication

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

You can find further information about Crane Application Notes on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

The latest information about SINAMICS products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/13229>

Notes on licensing

The license depends on the serial number of the memory card (CompactFlash card). The SIMOCRANE ECO Technology application software cannot run without a valid license. Licensing is managed using the Siemens Web License Manager that guides the user step-by-step through the installation process.

www.siemens.com/automation/license

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

Overview

During every acceleration or braking process of a crane, swaying is excited in the load.

The electronic SIMOCRANE Sway Control Systems ensure that these load oscillations are eliminated, so that crane transport can be performed quickly, without danger, and without any damage to the transported goods.

The SIMOCRANE Sway Control System is available in both as a standalone system using the SIMOTION C Motion Controller, and as an integrated system using the SIMOTION D Motion Controller and the SIMOCRANE Basic Technology. Additionally, Siemens provides also a mid-range solution, which is based on SINAMIICS CU320-2 for harbor and industrial cranes.

Depending on the task to be performed and the environmental conditions, the sway control systems can be implemented with or without SIMOCRANE CenSOR camera measuring systems.



Harbor crane system



Industry crane system

Benefits

For the handling and transport tasks of cranes, the trend is toward an ever higher productivity, safety and quality. This is achieved with an increasing number of automatic functions of which electronic sway control systems represent an important component.

There are many reasons for using electronic sway control, such as:

- To increase the productivity of the crane system
- To reduce damage
- To prevent accidents
- To simplify the crane structure
- To implement total/partial automation of the crane system
- To extend the service life of crane systems
- Continuous load damping no longer depends on subjective factors
- Simplified operation for crane operators regardless of their experience
- To relieve crane operators

Application

The sway control system is fit for new cranes, but it can also be applied for modernizing existing cranes.

SIMOCRANE Sway Control Systems can also be used in cranes in which drive technology and higher-level controllers from other manufacturers are installed.

The preconditions for the use of SIMOCRANE Sway Control Systems (CeSAR standalone) are the availability of a crane controller and continuously controllable drives. In all cranes, encoders are required for the hoisting gear and for the axes to be positioned if automatic positioning is required.

SIMOCRANE CenSOR camera measuring systems can assist the sway control system to work perfectly in case of external disturbance like wind or initial sway.

SIMOCRANE Sway Control Systems are suitable for the following crane types:

- Overhead bridge cranes (OHBC)
- Rubber tired gantry (RTG) cranes
- Rail mounted gantry (RMG) cranes
- Container (STS – ship to shore) cranes
- Grab/Ship unloader (GSU) cranes



Design

Five different SIMOCRANE Sway Control Systems with varying functionality and focus are available to meet the requirements of different applications. All high-performance systems can be expanded by the camera measuring system.

The camera measuring system comprises a camera and a reflector. The camera system can compensate for disturbances caused by external factors, e.g. wind, or sway caused by load lift at an inclined angle.

	SIMOCRANE SC integrated STS, GSU	SIMOCRANE CeSAR standalone STS, GSU	SIMOCRANE SC integrated OHBC, Gantry crane	SIMOCRANE CeSAR standalone OHBC, Gantry crane	SIMOCRANE Drive-Based Sway Control
Crane type	STS, GSU	STS, GSU	OHBC, Gantry crane	OHBC, Gantry crane	OHBC, Gantry crane
Operating modes					
• Manual mode (MAN)	✓	✓	✓	✓	✓
• Manual mode with Soft Approach (MAN)	✓	✓	–	–	–
• Positioning (POS)	✓	✓	✓	✓	✓
• Positioning with Detour Control	–	–	–	✓	–
• Sway neutralization (SNL/SND)	✓	✓	✓	✓	–
• Trim, list and skew control (TLS)	✓	✓	–	–	–
• Skew damping	✓	✓	✓	–	–
• Semi-automatic mode (SAM)	✓	✓	–	–	–
Axis control	Hoist/trolley	Hoist/trolley	Trolley/gantry and hoist/slewing gear	Trolley/gantry and hoist	Trolley or gantry
Hardware platform	SIMOTION D ¹⁾	SIMOTION C	SIMOTION D ¹⁾	SIMOTION C	SINAMICS S ¹⁾
Camera measuring system					
• Camera	SIMOCRANE CenSOR ²⁾	SIMOCRANE CenSOR ²⁾	SIMOCRANE CenSOR ²⁾	SIMOCRANE CenSOR ²⁾	–
• Reflector type ²⁾	Retroreflector	Retroreflector	Retroreflector	Retroreflector	–

– Not possible

✓ Included in the scope of delivery

SIMOCRANE SC integrated Sway Control System

The SIMOCRANE SC integrated sway control system is a software solution that is used on the central SIMOTION D motion controller. The system is currently available in the following variants:

- Overhead bridge cranes/gantry cranes (application in three axes in direction of trolley, long travel and rotation/hoist)
- Container cranes STS/grab cranes GSU (application in two axes in trolley and hoist directions)

SIMOCRANE CeSAR standalone Sway Control System

The SIMOCRANE CeSAR standalone Sway Control System is an autonomous system that can be used in any controller and drive landscape. The system has the same functional scope as the integrated solution:

- Overhead bridge cranes/gantry cranes (application in three axes in direction of trolley, long travel and hoist)
- Container cranes STS/grab cranes GSU (application in two axes in trolley and hoist directions)

SIMOCRANE Drive-Based Sway Control

SIMOCRANE Drive-Based Sway Control is a drive-based solution for mid-range crane applications based on SINAMICS for harbor and industry cranes. The system is not possible to be used together with the SIMOCRANE CenSOR camera measuring system.

SIMOCRANE CenSOR camera measuring system

The SIMOCRANE CenSOR camera measuring system can be used with the SIMOCRANE Sway Control Systems for high performance, depending on the task to be performed and the environmental conditions.

¹⁾ Hardware not included in scope of delivery. For more information about the scope of delivery, see section "SIMOCRANE Basic Technology".

²⁾ Separately available accessories.

SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

Function



SIMOCRANE Sway Control System

The SIMOCRANE Sway Control System is based on calculations of a mathematical oscillation model. When a camera is used, the parameters hoisting height, sway angle and skew angle are determined by means of optical contact-free measurement and are incorporated in the calculation model. If the measuring signal of the camera fails, only the states of the oscillation model are used.

Damping of the load sway is performed by influencing the traversing speed for each axis individually. When using the positioning mode, the defined target positions are automatically approached with sway control after enabling. The axis is controlled in such a way that the load sway is eliminated not only when the maximum speed is reached, but also at the target position. All sway resulting from the travel motion is largely eliminated. If a camera is also used, sway resulting from external forces – such as inclined lift or wind – can be almost completely compensated.

Operating modes

The following operating modes and functions are available for the general and automation application areas:

- Manual mode (**MAN**)
 - Soft Approach as option for collision prevention
- Positioning (**POS**)
 - Detour Control with consideration of obstacles as option for OHBC
- Sway neutralization
 - Load position (**SNL**¹⁾)
 - Trolley position (**SND**²⁾)
- Trim, list and skew control (**TLS**)
- Skew damping
- Semi-automatic mode (**SAM**)

The operating mode is selected (depending on the functional scope) by the PLC by setting the appropriate control bit.

Manual mode (MAN)

In the manual mode, the speed is specified manually from a higher-level controller. The trolley is accelerated or decelerated to the set speed in such a way that the load sway has been eliminated when the set speed is reached.

Sway control is active in manual mode either throughout the complete traverse, or only during at stop.

A new function Soft Approach is added to the manual mode to assist crane drivers for approaching softly the target position with minimal risk of collision. This function can be well applied for smart slow-down of a trolley and for soft landing of a hoist.

Positioning (POS)

In the positioning mode, the higher-level controller or the internal encoder can specify a target position for each individual axis. This position is approached automatically after enabling. The axes are controlled in such a way that the load sway is eliminated not only when the maximum speed is reached, but also at the target position. The direct path between the current position and the target position must be free of obstacles.

Sway neutralization (SNL/SND)

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

Sway neutralization is linked to a positioning function. The target position is either the current trolley position (**SND**) or the load position (**SNL**) at the time the sway neutralization is activated.

Sway neutralization results in slight travel movements to both sides of the target position.

The position of the load is acquired by the camera measuring system.

¹⁾ **SNL**: Sway neutralization load position

²⁾ **SND**: Sway neutralization trolley position



Function

Additional functions for ship to shore cranes

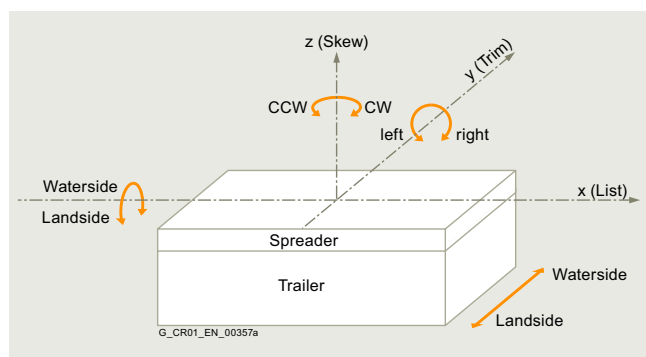
Trim, list and skew control (TLS control)

TLS control controls the trim, list and skew positions of a spreader.

The TLS control function assumes that

- the length or
- the pivot points

of the 4 support cables of a spreader can be adjusted by hydraulic cylinders, or an additional electric system with the aid of the camera.



Schematic diagram of TLS movements

Each cylinder can be traversed individually for calibration purposes. Through actuation of these hydraulic cylinders in pairs, the spreader can be tilted to the left or right (trim), inclined towards the waterside or landside (list) or rotated in a clockwise or counter-clockwise direction (skew). All of these TLS movements can be carried out simultaneously. The specified positions of all 4 cylinders can be saved as zero positions and approached again. For TLS positioning, either the last TLS position at the landside (LS) and at the waterside (WS) or the last TL position at the LS and at the WS with an externally definable rotational position can be approached.

The TLS control function is subdivided into two categories, each of which requires a separate license:

- TLS Basic modes
 - Cylinder inching
 - Approach zero position without skew damping
 - TLS inching without skew damping
- TLS Advanced modes
 - Cylinder inching
 - Approach zero position with skew damping
 - TLS inching with skew damping
 - TLS positioning with skew damping
 - Skew damping

Skew damping

Skew damping is an electronic anti-sway function which eliminates the skewing motion of the spreader by means of the hydraulic cylinder control or an additional electric system. The skewing motions are recorded by the same camera as for sway. In the conventional mechanical design, TLS positioning as well as skew damping is performed via the hydraulic system. In a combined mechanical system using a hydraulic system and an electrical system, TLS positioning is performed via the hydraulic system and only skew damping is performed by the electrical system. This ensures more efficient and more dynamic damping.

Semi-automatic mode (SAM)

The semi-automatic mode allows the system to be set up so that the load is traversed along an optimal trajectory. The trajectory is specified to ensure that the spreader or grab does not collide with the crane structure or with containers or other obstacles, and also reaches its target position rapidly and accurately. This operating mode can be used for ship to shore cranes (STS) and ship unloaders (GSU). A seamless switchover between manual mode (MAN) and SAM makes different operation possible.

The obstacles are stored in the system as blocked regions and traversing is only permitted outside these areas. Depending on the starting point and the target position, the fastest possible trajectory is generated from the data about the blocked regions. Both axes (trolley and hoist) must be operated coordinately in the semi-automatic mode.

The container profile can be specified externally by a 2D/3D laser system or a bay scanner (point laser) connected to the crane controller or acquired internally by learning during the motion.

The trajectory is calculated on the basis of a layout of the working area in which blocked regions are defined. Blocked regions are individual or several combined obstacles or also areas which the crane must not enter for safety reasons to avoid collisions. A distinction is made between fixed and variable blocked regions.

A blocked region is described by two trolley positions and one hoisting position.

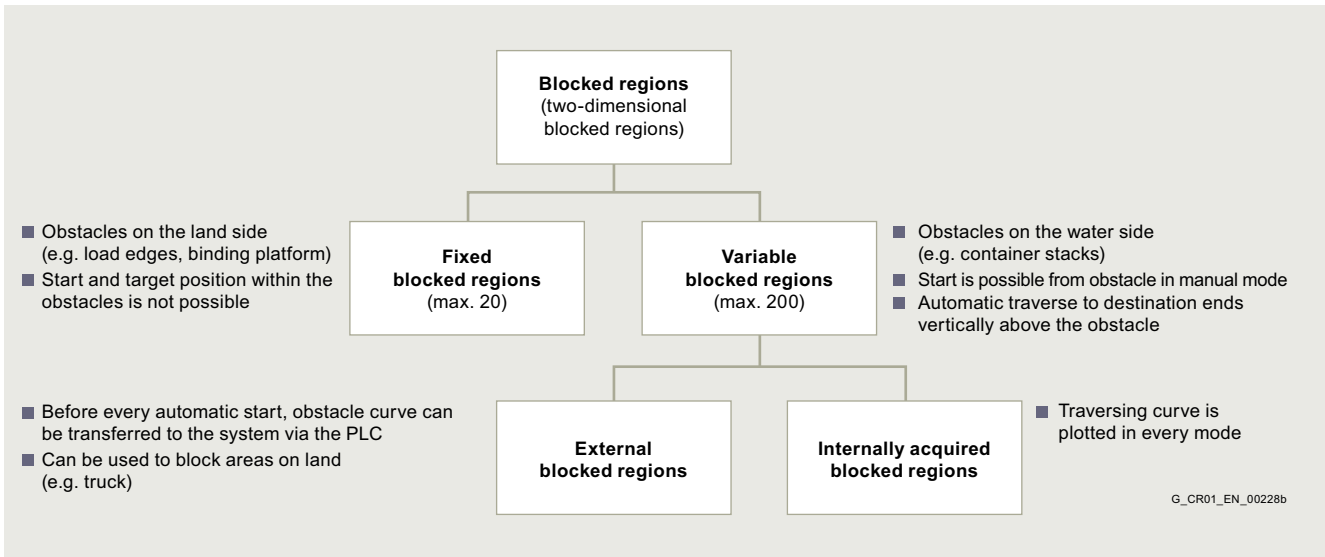
The types of blocked regions and their purposes are shown in the following graphic.

SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

Function

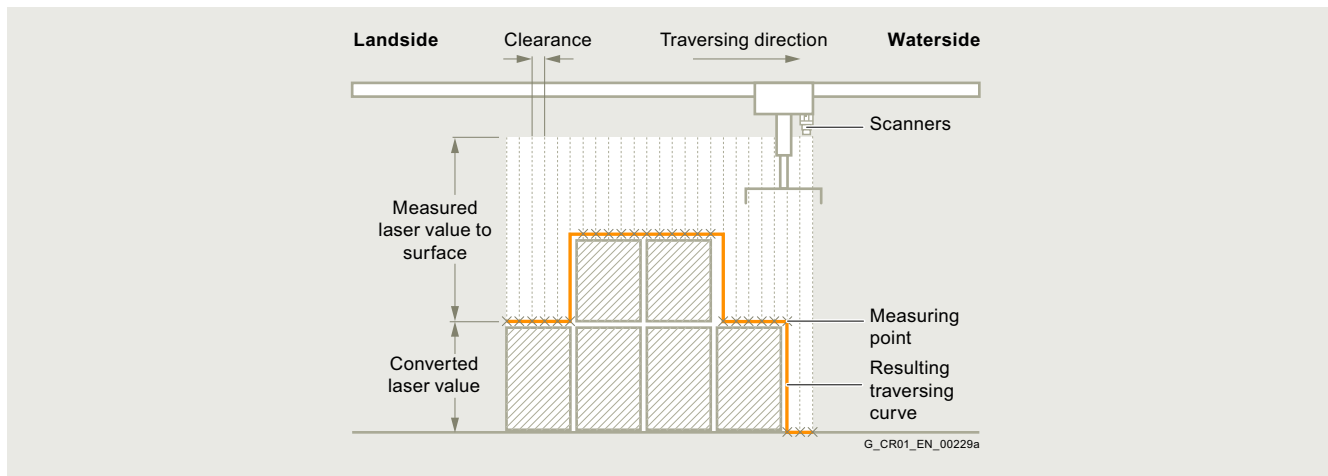
3



Layout of blocked regions

If a bay scanner is used, the signal of the obstacle height is evaluated in addition to the traveled curve. The distance from the scanner to the surface of the container stack is measured (see graphic below, dashed lines).

This value must be converted to a laser value in the PLC which corresponds to the distance from the scanner to the top edge of the container stack at this point (see graphic below; converted laser value). The vertical distance between 2 valid measuring points is set to the height of the highest measuring point.



Measurement of the height of the container stack with the laser scanner

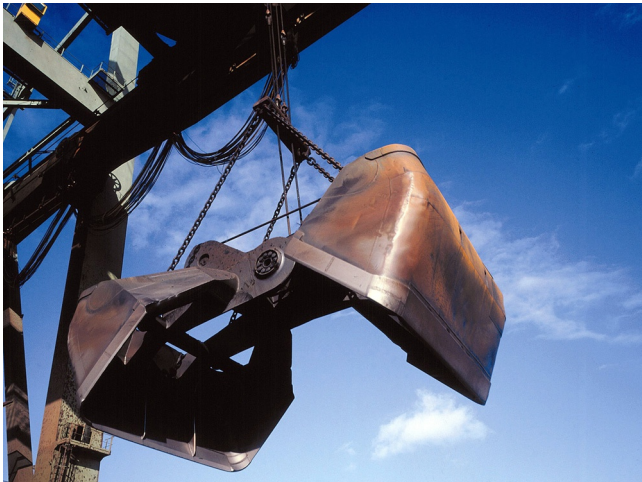


Function

Additional functions in the grab crane application area

Semi-automatic mode with unloading on the fly

In the ship unloader application (GSU), unloading on the fly utilizes the maximum swaying of a grab when unloading bulk goods and saves turnover time in this way. The trolley is decelerated before reaching the target position while the grab is swinging to the target (e.g. hopper). During swaying over the target area, the grab is opening for unloading. As soon as the grab reaches its target position, the trolley starts to travel back. In this way the trolley eliminates the stop time for unloading over the hopper and the grab remains longer over the hopper area.



Grab crane (GSU)

Additional functions for application OHBC, Gantry crane

This application is designed for industry overhead bridge cranes (OHBC) and gantry cranes with two axes in the plane (trolley, gantry) and an additional axis (hoisting gear).

Either manual mode (MAN: a speed setpoint is set on the master switch) or positioning mode (POS: a target position is set), can be selected. The operating mode of each axis can be switched over on the fly, e.g. from manual mode to positioning mode and vice versa, while the axis is moving.

Each axis can move independently from the other axes without consideration of any obstacles.

The sway neutralization mode (SNL & SND) can be applied to eliminate swaying movements of the load from standstill for both trolley and gantry separately in case of existing camera.

Detour Control

The Detour Control with coordination of trolley and gantry is newly provided inside positioning mode to travel around obstacles for collision prevention. The trajectory can be calculated and optimized by the Sway Control System with given target position and defined obstacles. The path can also be specified by a higher-level controller via some intermediate targets. In addition, the Detour Control can consider special areas with limited speed for safe operation. Parts of obstacles can be activated or deactivated for flexible usage of the same area. A predefined safety clearance around an obstacle provides a buffer zone for smart slow-down to avoid collisions.



Note:

Various licenses which cover combinations of the operating modes described above are available for the sway control systems (see [Selection and ordering data](#)).

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

You can find further information about Crane Application Notes on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

SIMOCRANE Advanced Technology

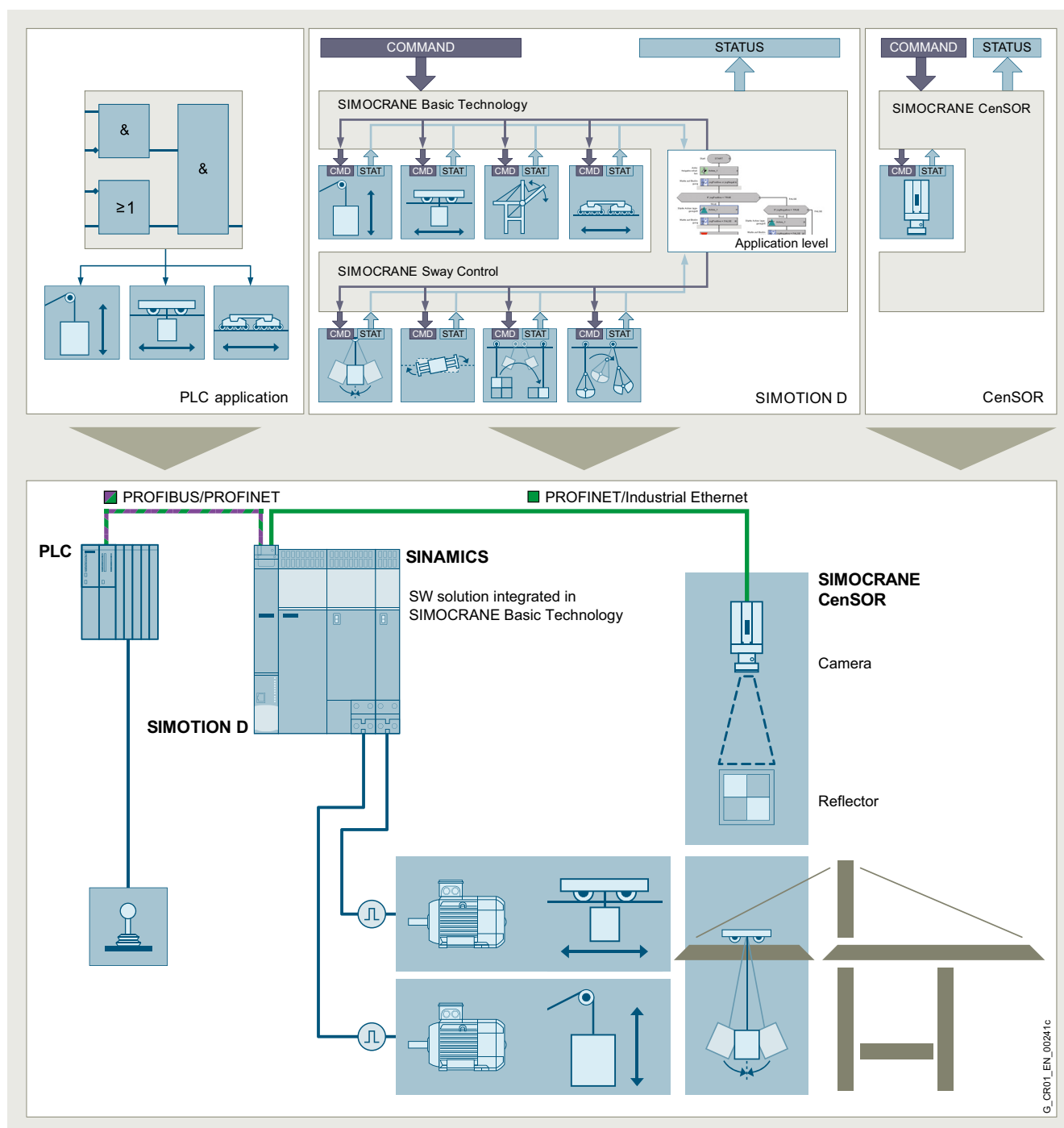
SIMOCRANE Sway Control

SIMOCRANE SC integrated STS, GSU Sway Control System

Design

The sway control system SIMOCRANE SC integrated STS, GSU comprises a software solution that is based on SIMOCRANE Basic Technology V3.0 and the motion controller SIMOTION D435-2 DP/PN. Special sway-control function blocks are combined with Basic Technology function blocks with reference to applications, see the Figure "Configuration of SIMOCRANE SC integrated for an STS application".

Commissioning and parameterization of sway control is performed using the SIMOCRANE CeCOMM diagnostics program. The engineering software comprises the same tools as for Basic Technology, SIMOTION SCOUT and Drive Control Chart (DCC). For acquisition of the external disturbance variables, the SIMOCRANE CenSOR camera measuring system can be optionally connected to motion controllers. Commissioning and parameterization of the camera is also performed using the web-based user interface.



Configuration of SIMOCRANE SC integrated for an STS application

G_CR01_EN_00241c



SIMOCRANE SC integrated STS, GSU Sway Control System

Technical specifications

Product designation	SIMOCRANE SC integrated STS, GSU Sway Control System	
Type	6GA7200-0AA01-0AA0	6GA7200-0AA01-1AA0
Scope of delivery	- Basic Control with operating modes: MAN, POS, SNL/SND, TLS Basic - DVD with - Software - Documentation - S7 project example - SIMOTION project examples	- Advanced Control with operating modes: Basic Control, SAM, TLS Advanced, MAN with Soft Approach - DVD with - Software - Documentation - S7 project example - SIMOTION project examples

Selection and ordering data

Description	Article No.
Basic Control for SIMOCRANE SC integrated STS, GSU consisting of - License with operating modes: MAN, POS, SNL/SND, TLS Basic - DVD with software, documentation, S7 project example and SIMOTION project examples	6GA7200-0AA01-0AA0
Advanced Control for SIMOCRANE SC integrated STS, GSU consisting of - License with operating modes: Basic Control, SAM, TLS Advanced, MAN with Soft Approach - DVD with software, documentation, S7 project example and SIMOTION project examples	6GA7200-0AA01-1AA0

The operating modes are described in section "Function".

SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

SIMOCRANE CeSAR standalone STS, GSU Sway Control System

Design

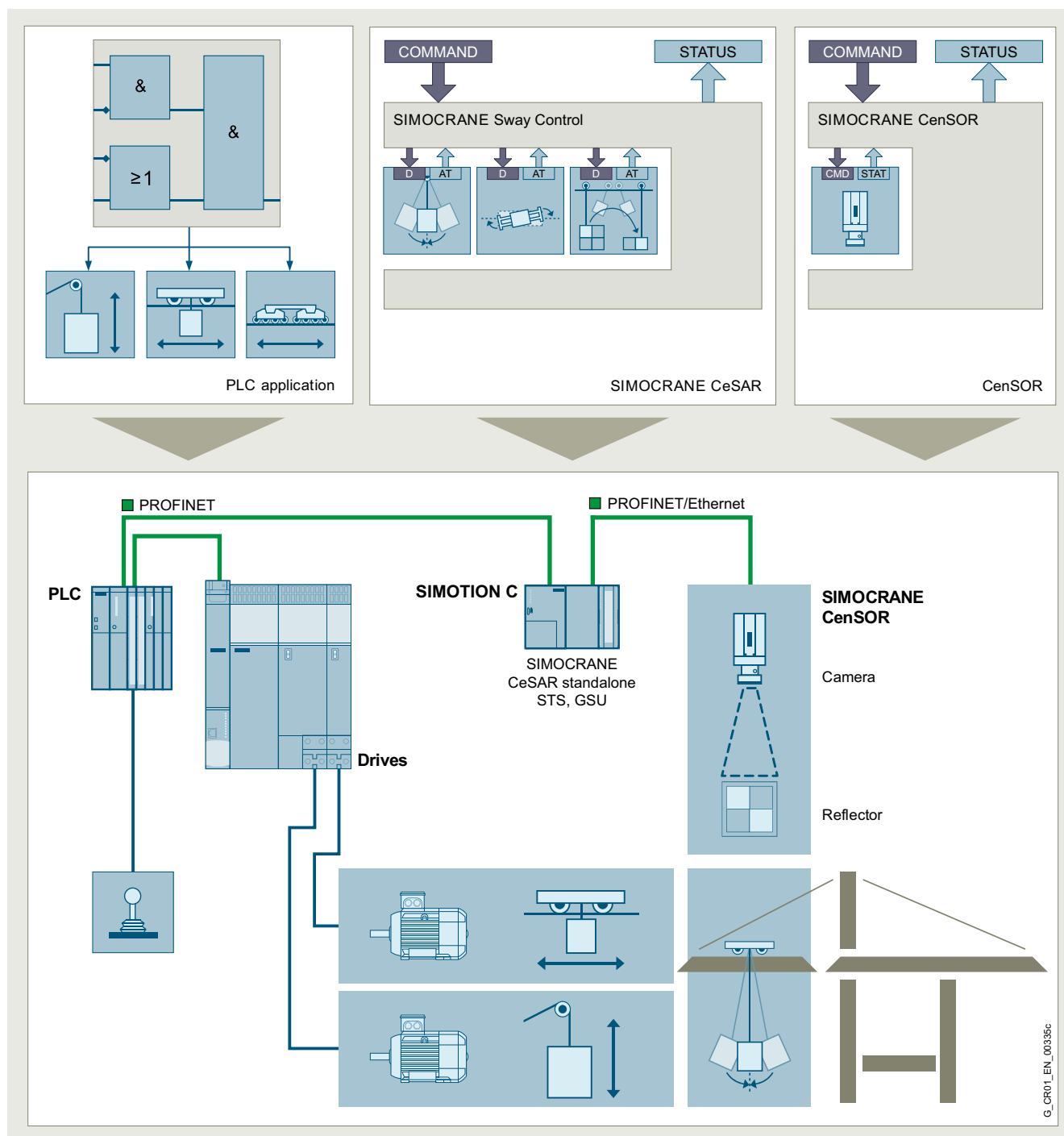
This is a standalone solution. The SIMOCRANE CeSAR standalone STS, GSU communicates with the crane controller (PLC) tasked with providing motion control functionality via the PROFIBUS/PROFINET interface.

The SIMOCRANE STS, GSU sway control system consists of the following components:

- SIMOTION C240 PN with integrated PROFIBUS/PROFINET interface

In systems with "sight", the SIMOCRANE CenSOR camera measuring system can be optionally connected to SIMOTION C.

Commissioning and parameterization of sway control is performed using the supplied SIMOCRANE CeCOMM diagnostics program.



Configuration with SIMOCRANE CeSAR standalone for an STS application

G_CR01_EN_00335c


SIMOCRANE CeSAR standalone STS, GSU Sway Control System
Technical specifications

Product designation	SIMOCRANE CeSAR standalone STS, GSU Sway Control System	
Type	6GA7200-1AA01-0AA0	6GA7200-1AA01-1AA0
Scope of delivery	• SIMOTION C240 PN • MMC card (SW + license for operating modes: MAN, POS, SNL/SND, TLS Basic) • Standard mounting rail • License certificate • CD-ROM with - Documentation - S7 project example	• SIMOTION C240 PN • MMC card (SW + license for operating modes: Basic Control, SAM, TLS Advanced, MAN with Soft Approach) • Standard mounting rail • License certificate • CD-ROM with - Documentation - S7 project example

Selection and ordering data

Description	Article No.
Basic Control for SIMOCRANE CeSAR standalone STS, GSU consisting of • SIMOTION C240 PN • MMC card (SW + license for operating modes: MAN, POS, SNL/SND, TLS Basic) • Standard mounting rail • License certificate • CD-ROM with documentation and S7 project example	6GA7200-1AA01-0AA0
Advanced Control for SIMOCRANE CeSAR standalone STS, GSU consisting of • SIMOTION C240 PN • MMC card (SW + license for operating modes: Basic Control, SAM, TLS Advanced, MAN with Soft Approach) • Standard mounting rail • License certificate • CD-ROM with documentation and S7 project example	6GA7200-1AA01-1AA0

The operating modes are described in section "Function".

SIMOCRANE Advanced Technology

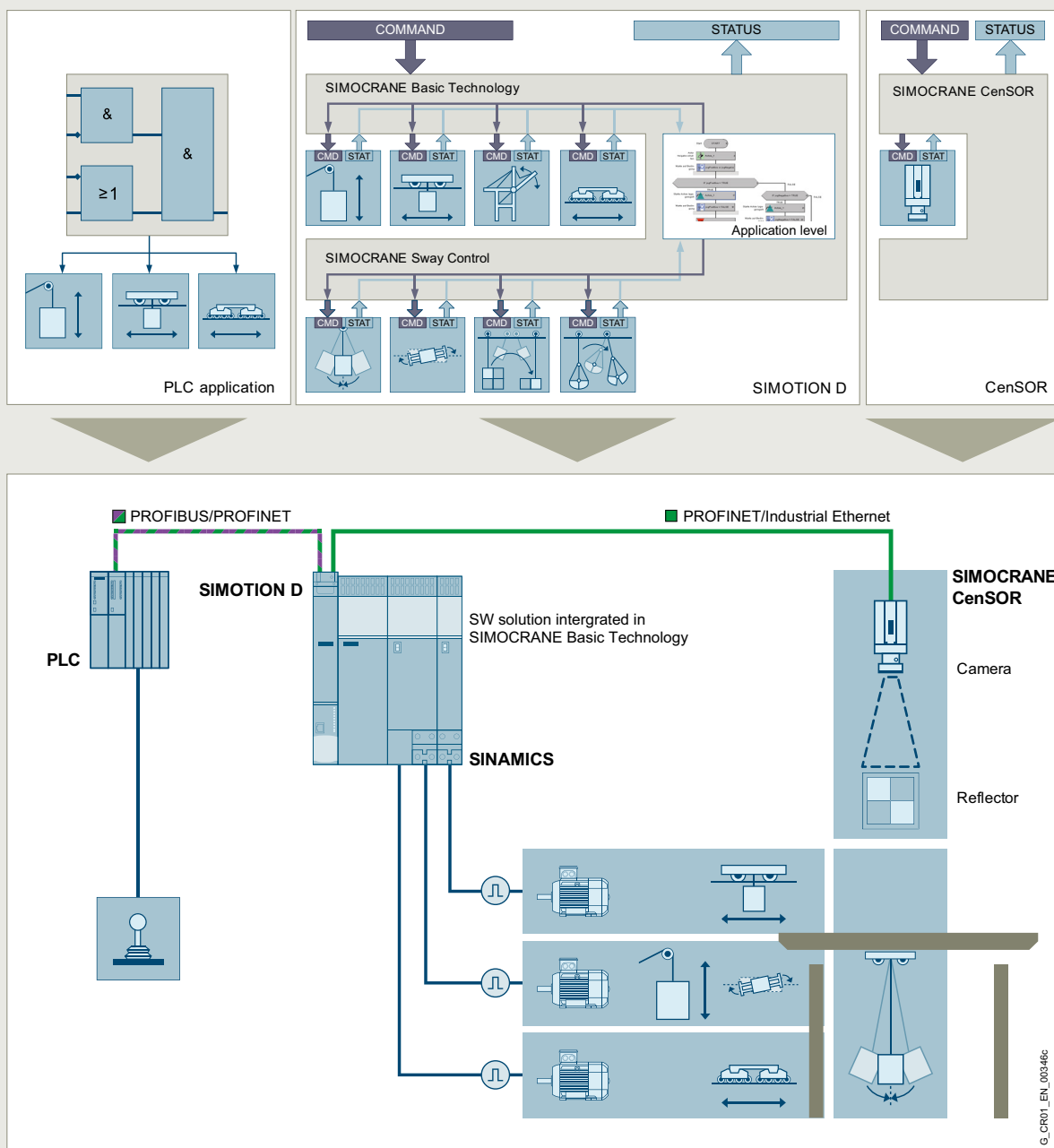
SIMOCRANE Sway Control

SIMOCRANE SC integrated OHBC, gantry crane Sway Control System

Design

The sway control system SIMOCRANE SC integrated OHBC, gantry crane comprises a software solution that is based on SIMOCRANE Basic Technology V3.0 and the motion controller SIMOTION D435-2 DP/PN. Special sway-control function blocks are combined with Basic Technology function blocks with reference to applications, see the Figure "Configuration of SIMOCRANE SC integrated for a bridge crane application".

Commissioning and parameterization of sway control is performed using the supplied SIMOCRANE CeCOMM diagnostics program. The engineering software comprises the same tools as for Basic Technology, SIMOTION SCOUT and Drive Control Chart (DCC). For acquisition of the external disturbance variables, the SIMOCRANE CenSOR camera measuring system can be optionally connected to motion controllers. Commissioning and parameterization of the camera is also performed using the web-based user interface.



Configuration of SIMOCRANE SC integrated for a bridge crane application

Support for slewing gear

This configuration can support not only a trolley axis and a gantry axis, but also slewing gear. The previous hoist axis is replaced for this purpose by the slewing gear axis.

With the slewing gear axis, it is possible to damp rotational vibration of the rotary axis (also applies to hook slewing gear). For cranes with hook slewing gear, automatic positioning of the slewing gear is possible, if a shaft encoder is used.


SIMOCRANE SC integrated OHBC, gantry crane Sway Control System
Technical specifications

Product designation	SIMOCRANE SC integrated OHBC, gantry crane Sway Control System	
Type	6GA7200-0AA00-0AA0	6GA7200-0AA00-2AA0
Scope of delivery	• Basic License with operating modes: MAN, POS, SNL/SND • CD-ROM with - Software - Documentation - S7 project example - SIMOTION project example	• Manual license with operating modes: MAN • CD-ROM with - Software - Documentation - S7 project example - SIMOTION project example

Selection and ordering data

Description	Article No.
Basic license for SIMOCRANE SC integrated OHBC, gantry crane consisting of • License with operating modes: MAN, POS, SNL/SND • CD-ROM with software, documentation, S7 project example, SIMOTION project example	6GA7200-0AA00-0AA0
Manual license for SIMOCRANE SC integrated OHBC, gantry crane consisting of • License with operating mode: MAN • CD-ROM with software, documentation, S7 project example, SIMOTION project example	6GA7200-0AA00-2AA0

The operating modes are described in section "Function".

SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

SIMOCRANE CeSAR standalone OHBC, gantry crane Sway Control System

Design

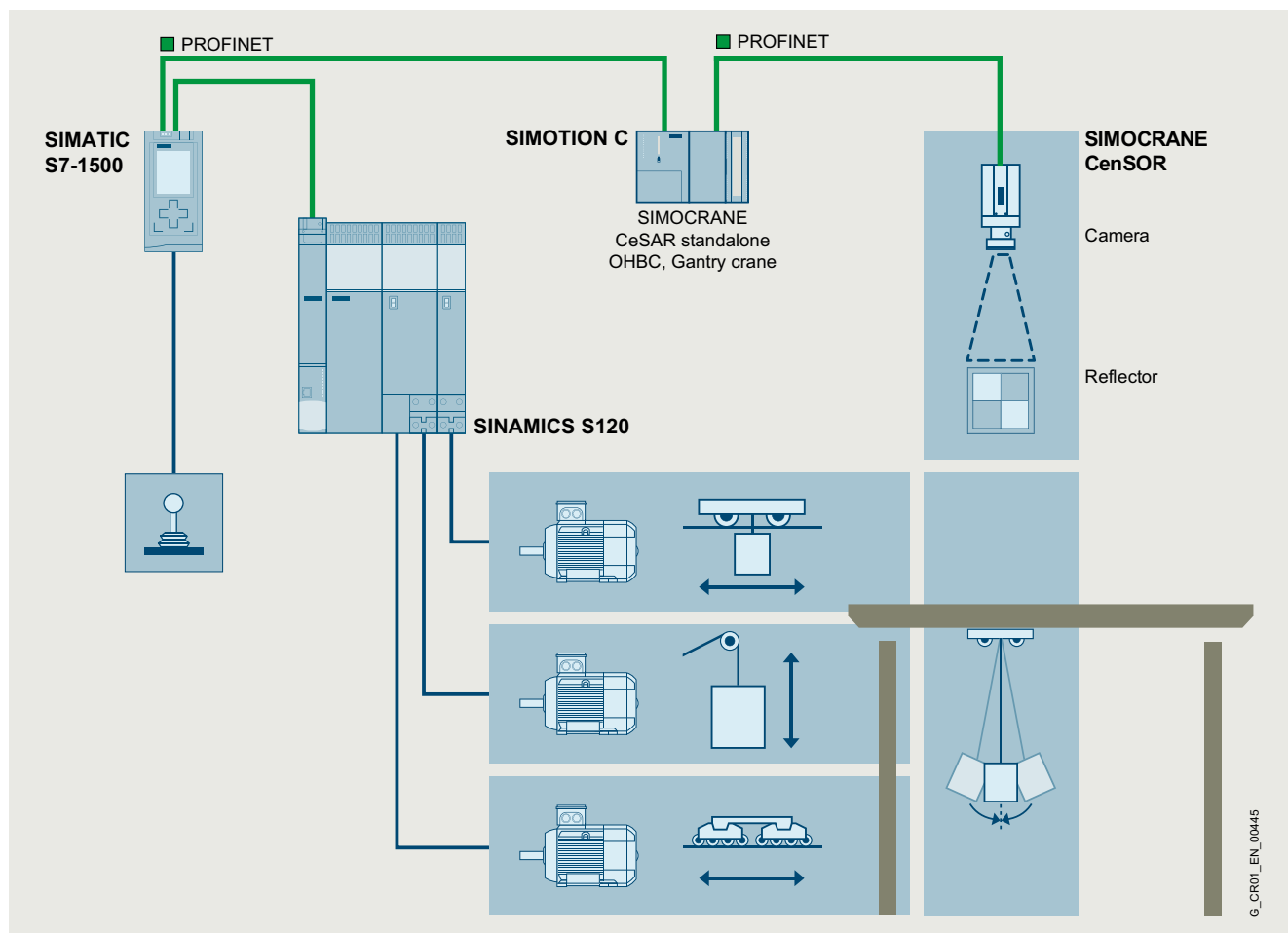
The sway control system is a standalone solution, which can be applied for new cranes and to retrofit cranes. The SIMOCRANE CeSAR standalone OHBC, gantry crane communicates with the crane controller (PLC) to provide crane-specific motion control functionality either via the PROFINET or the PROFIBUS DP interface.

The sway control system SIMOCRANE CeSAR standalone OHBC, gantry crane consists of the following main components:

- SIMOTION C240 PN with integrated PROFINET and PROFIBUS interface
- Micro Memory Card (MMC) with all required licenses and pre-configured application
- Standard mounting rail

Depending on customer requirements, the SIMOCRANE CenSOR camera measuring system can be optionally connected to SIMOTION C240 PN for closed-loop sway control. As a result, the initial sway and external or unexpected disturbance can be considered and removed.

Commissioning and parameterization of sway control is performed using the SIMOCRANE CeCOMM commissioning and diagnostics program. Commissioning of camera is performed using the web-based user interface.



Configuration SIMOCRANE CeSAR standalone OHBC, gantry crane

A highlight of the latest version V4.8 is the "Detour Control" for automated OHBC and gantry cranes. With the Detour Control, the trolley and gantry can be coordinately moved along a calculated time-optimized trajectory, with consideration of obstacles for collision prevention or/and limited speed areas for safe operation. The path can also be given via intermediate targets one after another by a higher-level controller.

Some of the predefined obstacles (blocked regions) can be enabled or disabled after the movement with Detour Control has been started. In this case, for collision prevention the trajectory will be updated immediately for trolley and gantry to travel around the newly enabled obstacle or stop before it depending on the current dynamics.

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SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

SIMOCRANE CeSAR standalone OHBC, gantry crane Sway Control System

Technical specifications

Product brand name	SIMOCRANE	SIMOCRANE	SIMOCRANE
Product variant	CeSAR standalone OHBC, gantry crane	CeSAR standalone OHBC, gantry crane	CeSAR standalone OHBC, gantry crane
Product designation	Sway Control System	Sway Control System	Sway Control System
Type of license	Advanced License	Basic License	Manual License
Type	6GA7200-1AA00-1AA0	6GA7200-1AA00-0AA0	6GA7200-1AA00-2AA0
Scope of delivery	• SIMOTION C240 PN • MMC (SW + license for operating modes: MAN, POS <u>with</u> Detour Control, SNL/SND) • Standard mounting rail • License certificate • DVD with - Documentation - Application example	• SIMOTION C240 PN • MMC (SW + license for operating modes: MAN, POS <u>without</u> Detour Control, SNL/SND) • Standard mounting rail • License certificate • DVD with - Documentation - S7 project example	• SIMOTION C240 PN • MMC (SW + license for operating mode: MAN) • Standard mounting rail • License certificate • DVD with - Documentation - S7 project example

Selection and ordering data

Description	Article No.	Description	Article No.
Advanced License for SIMOCRANE CeSAR standalone OHBC, gantry crane consisting of • SIMOTION C240 PN • MMC (SW + license for operating modes: MAN, POS <u>with</u> Detour Control, SNL/SND) • Standard mounting rail • License certificate • DVD with software, documentation and application examples	6GA7200-1AA00-1AA0	Manual License for SIMOCRANE CeSAR standalone OHBC, gantry crane consisting of • SIMOTION C240 PN • MMC (SW + license for operating mode: MAN) • Standard mounting rail • License certificate • DVD with documentation and S7 project example	6GA7200-1AA00-2AA0
Basic License for SIMOCRANE CeSAR standalone OHBC, gantry crane consisting of • SIMOTION C240 PN • MMC (SW + license for operating modes: MAN, POS <u>without</u> Detour Control, SNL/SND) • Standard mounting rail • License certificate • DVD with software, documentation and S7 project example	6GA7200-1AA00-0AA0	The operating modes are described in section "Function".	

SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

SIMOCRANE CenSOR camera measuring system V3.0

Design

SIMOCRANE CenSOR camera measuring system V3.0

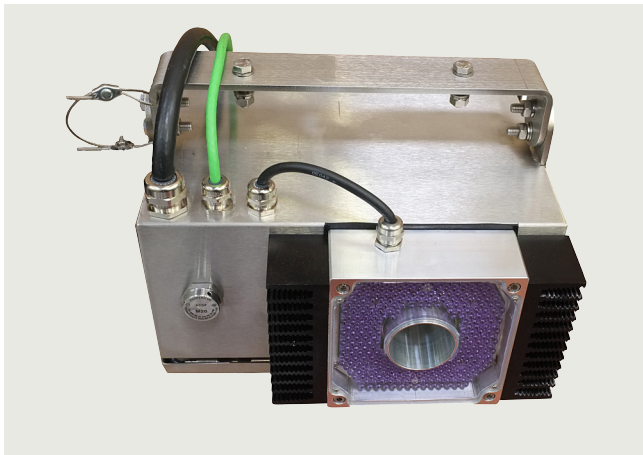
In the version 3.0 the existing camera MV440 SR has been replaced by its successor camera SIMATIC MV540 H CRANES. The new camera is equipped with a powerful multi-core processor and a CMOS sensor chip. Therefore, it has a high resolution, a long range and a large memory. With the new outdoor camera, the working range has been extended to 75 m.

The algorithms to measure the sway and the skew angle were extended and optimized to achieve more precise and stable measure results. In addition, the second reflector can be mounted optionally for reaching high accuracy of skew measurement at great distance, for example, auto-landing on a truck for ship-to-shore crane.

Furthermore, it is possible in version 3.0 to have more calibration data sets and to switchover them by using PROFINET connection. This function makes sway control possible to position exactly and rapidly in different spreader configuration or at different heights (e.g. at lashing platform or on truck).

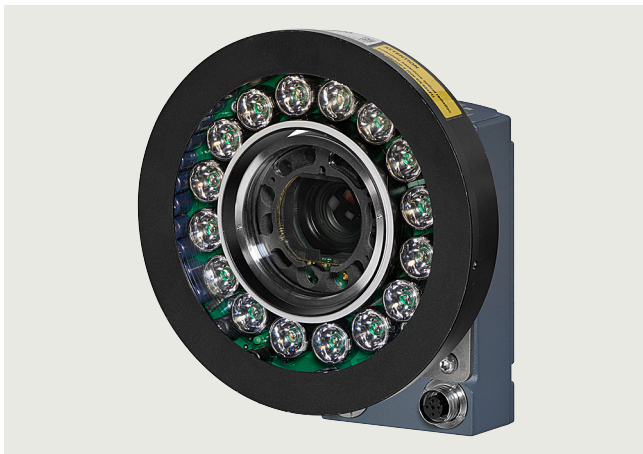
The SIMOCRANE CenSOR camera measuring system V3.0 is available in two different variants:

- Outdoor variant: The camera is installed in a stainless-steel enclosure as the previous version. This variant is suitable for outdoor applications. This variant is equipped with the 35 mm lens and cables in 15 m length.



SIMOCRANE CenSOR camera measuring system V3.0 for outdoor use

- Indoor variant: The camera is supplied without an enclosure and is ideally suited to applications inside buildings. This variant is only available for the 25 mm lens with a 10 m cable length.



SIMOCRANE CenSOR V3.0 camera measuring system for indoor use

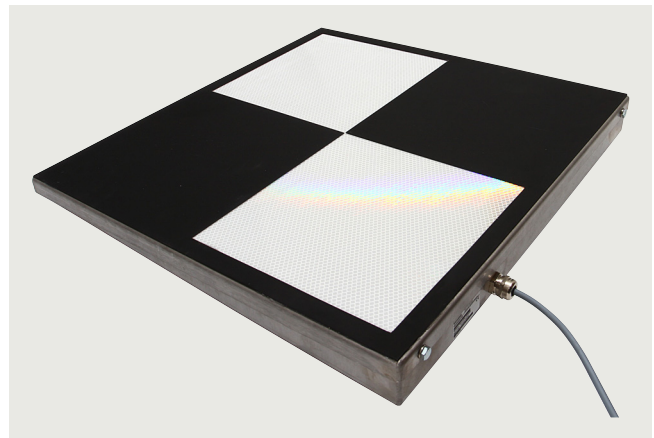
The new camera measuring system SIMOCRANE CenSOR V3.0 is functionally compatible with the previous version SIMOCRANE CenSOR V2.0 HF4.

In case of replacement, the new camera must be recommissioned after being replaced. The communication interface is compatible to current Sway Control application examples. The interface could be adapted on demand to use the new functions in version 3.0.

For replacement, an additional adapter cable is required for both the outdoor variant (Article No. 6GF3500-8BA20) and for the indoor variant (Article No. 6GF3500-8BD10).

Reflector

When using a camera measuring system a reflector is also required which is attached to the load suspension device.



Retroreflecting reflector with heater

The size of the reflector depends on the maximum distance to be measured by the camera. The camera measuring system determines the offset and speed of the reflector in a plane perpendicular to the camera axis and the rotation of the reflector around the camera axis. The combination of two reflectors can achieve a very high measuring accuracy of the skew angle even at greater distances up to 75 m.

The reflectors are specially designed to handle vibrations and ambient conditions that typically occur on cranes and are attached to the load suspension device.

The reflectors are equipped with a heating system to melt snow.


Technical specifications
SIMOCRANE CenSOR camera measuring system V3.0

Product designation		SIMOCRANE CenSOR V3.0	
Type		6GA7202-2AA10-1BF1	6GA7202-2AA22-0BA1
		Camera measuring system for SIMOCRANE Sway Control System	Camera measuring system for SIMOCRANE Sway Control System
Version		Outdoor	Indoor
Design of image sensor/camera		CMOS chip 1.3 megapixel, 1280 × 1024	CMOS chip 1.3 megapixel, 1280 × 1024
Type of image capture		Global shutter with manual or automatic exposure time	Global shutter with manual or automatic exposure time
Current consumption (at 24 V DC)	mA	200	200
Camera enclosure		Stainless-steel enclosure	–
• Supply voltage		24 V DC/10 A pulse-resistant	
Permissible ambient temperature			
• Ambient temperature	°C	-25 ... +50	±0 ... +50
• Storage	°C	-30 ... +70	-30 ... +70
Dimensions			
• Width	mm	300	142
• Height	mm	215	158
• Depth	mm	250	147
Degree of protection		IP54	IP67 (acc. to IEC 60529)
Weight, approx.	kg	17.2 (without connection cable)	1 (without connection cable)

Reflectors

Product designation		SIMOCRANE CenSOR retroreflector V3.0	
Type		6GA7201-1AA01-0AA0	6GA7201-1AA02-0AA0
Dimension W (width)	mm	300	500
Heater		Yes	Yes
Reflector type		Retroreflector	Retroreflector
Supply voltage	V	230	230
Rated output	W	80	500
Permissible ambient temperature			
• Storage and transport	°C	-30 ... +70	-30 ... +70
• Operation	°C	-25 ... +70	-25 ... +70
Permissible relative humidity (without condensation)	%	5 ... 95	5 ... 95
Degree of protection acc. to DIN EN 60529 (IEC 60529)		IP53	IP53
Reflector dimensions			
Dimensions			
• Width	mm	312	504
• Height	mm	312	504
• Depth	mm	72	78
Weight, approx.	kg	4.6	10.7
Integration in the crane controller		See Operating Manual	See Operating Manual
Scope of delivery		Reflector	Reflector



SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

SIMOCRANE CenSOR camera measuring system V3.0

Technical specifications

Reflectors and lenses for SIMOCRANE CenSOR camera measuring systems V3.0

The reflector size used depends on the hoisting height of the crane and the requirement of accuracy.

Focal length of the lens for the outdoor and the indoor variant	35 mm
Resolution (relative to the distance)	0.14 mm/m
Field length in the X direction (trolley)	10°
Field length in the Y direction (gantry)	8°
Measuring range in the X direction (trolley, relative to the distance)	176 mm/m
Measuring range in the Y direction (gantry, relative to the distance)	140 mm/m
Maximum hoisting height of the retroreflectors for the outdoor and the indoor variant	
Retroreflector 300 × 300	Up to 50 m
Retroreflector 500 × 500	Up to 75 m

Selection and ordering data

SIMOCRANE CenSOR V3.0 camera measuring system

Description	Article No.
SIMOCRANE CenSOR V3.0 Outdoor camera measuring system for sway and skew angle measurement in stainless-steel enclosure, with 35 mm lens and 15 m cable	6GA7202-2AA10-1BF1
SIMOCRANE CenSOR V3.0 Indoor camera measuring system for sway and skew angle measurement, without enclosure, with 35 mm lens and 10 m cable	6GA7202-2AA22-0BA1
SIMOCRANE CenSOR retroreflector V3.0 • Reflector 300 × 300 mm, with heating till 50 m • Reflector 500 × 500 mm, with heating till 75 m	6GA7201-1AA01-0AA0 6GA7201-1AA02-0AA0
Supplementary components	
Power adapter cable for the SIMOCRANE CenSOR V3.0 outdoor camera measuring system Plug-in cable for the installation of the MV540 H CRANES Configured on both sides M16 12-pin to M12 12-pin Length, approx.: 50 cm	6GF3500-8BA20
Adapter cable for the SIMOCRANE CenSOR V3.0 indoor the camera measuring system Plug-in cable for the connection of the external ring light on the MV540 H CRANES Connections: 1 × M12 12-pole socket, 1 × M12 12-pole connector and 1 × M12 4-pole socket Length: 25 cm	6GF3500-8BD10



Overview

SIMOCRANE Drive-Based Sway Control is embedded in Siemens drive system – SINAMICS. With its interfaces the software can be easily integrated into the SINAMICS setpoint channel.

SIMOCRANE Drive-Based Sway Control encompasses the following features:

- Sway is damped during manual travel. After the axis has stopped or reached a constant velocity, a little or no load sway remains
- The drive is moving sway-controlled to a specified target position. The sway damping factor can be set as needed
- The target position can be changed on the fly
- Both operating modes can be switched over on the fly
- Safe behavior in limit switch area
- Used for cross travel (trolley) or long travel (gantry) with/without encoder for manual mode. An encoder is required for positioning mode.
- Applied for both single-axis solution with AC/AC drive corresponding SINAMICS PM240-2 Power Module, Power Module in chassis format and multi-axis solution with common DC link corresponding SINAMICS S120 in booksize format and chassis format.
- Pre-configured standard application on DVD for trolley or gantry with control via I/O signals ready-to-run (only have to be parameterized using Basic Operator Panel or SINAMICS Webserver)
- Can be adapted to customer-specific requirements ready-to-apply (for adaptation by the user)
- Can be used for upgrading the existing crane with sway control function in different levels

SIMOCRANE Drive-Based Sway Control can be applied stand-alone or with the SIMOCRANE Drive-Based Technology. Both technologies together provide a complete solution within the SINAMICS world for most mid-performance crane applications.



Benefits

- Crane technology embedded in the drive
- Sway damping with high quality and productivity
- Positioning with high accuracy and efficiency
- Scalable to meet different requirements (Manual Control or Basic Control)
- Relieves a crane operator for safe operation
- Reduces stress on mechanical construction
- Possible for both distributed single-axis or centralized multi-axis configuration
- Fast commissioning
- Use of standard applications
- Low cost

Application

SIMOCRANE Drive-Based Technology meets the challenges of mid-performance cranes in industrial and harbor environments.

Design

A mid-performance crane application includes the following components:

Hardware

A distributed single-axis solution or a centralized multi-axis solution for trolley and gantry

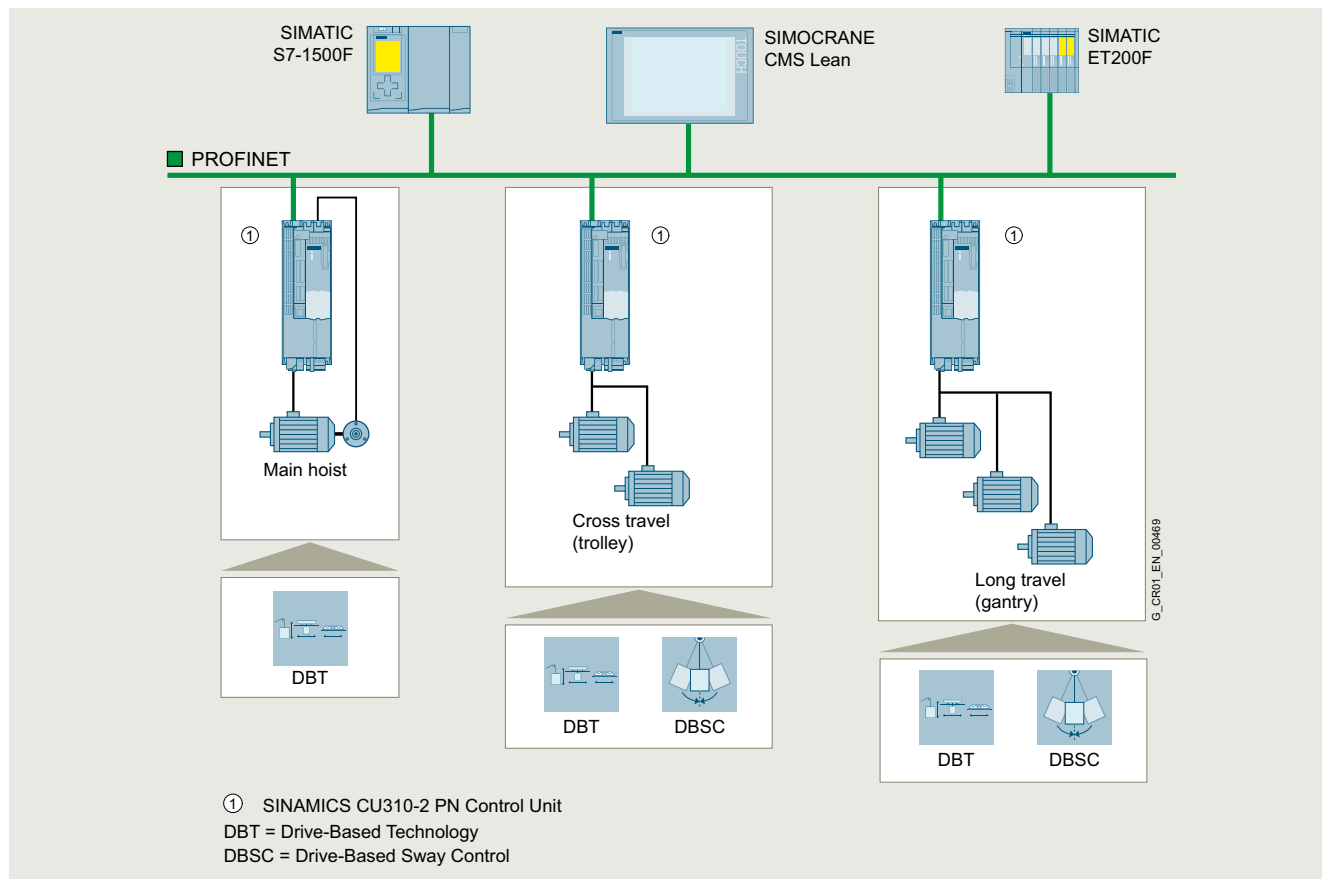
- AC/AC drive comprises SINAMICS CU310-2 Control Unit and PM240-2/PM Power Module in chassis format with SINAMICS V5.1 standard
- DC/AC drive comprises SINAMICS CU320-2 Control Unit and Motor Module in booksize format or chassis format with SINAMICS V5.1 standard
- Selectable control via onboard I/O terminals or PROFIBUS/PROFINET
- An encoder for hoist is request for providing pendulum length of trolley and gantry
- No encoder required for trolley and gantry only in manual mode; an encoder is required for positioning mode

SIMOCRANE Advanced Technology

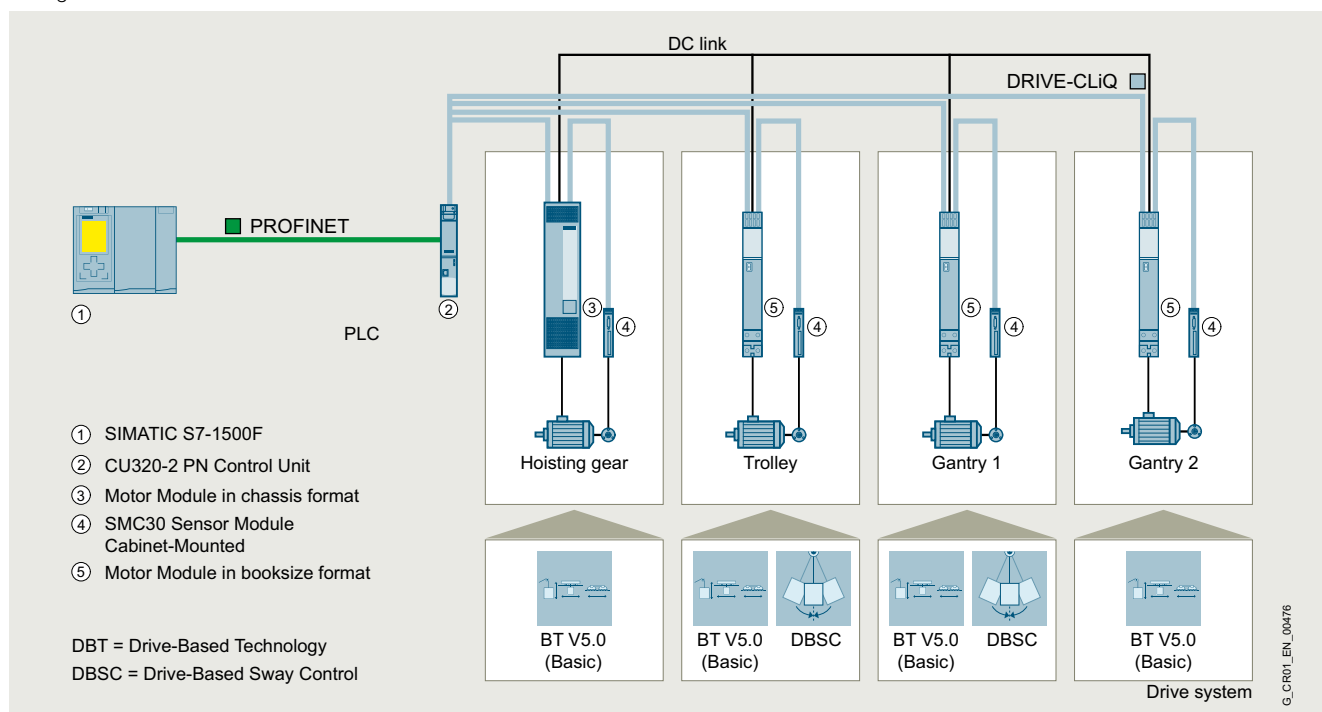
SIMOCRANE Sway Control

SIMOCRANE Drive-Based Sway Control**Design****Application configuration**

The SIMOCRANE Drive-Based Sway Control is directly embedded in SINAMICS S120 by using CU310-2 or CU320-2. The following figures show examples for single-axis application and multi-axis application.



Configuration with SINAMICS CU310-2 DP Control Unit



Configuration with SINAMICS CU320-2 PN Control Unit


Technical specifications

Product designation	SIMOCRANE Drive-Based Sway Control for single-axis applications Manual Control	SINAMICS SIMOCRANE Drive-Based Sway Control for multi-axis applications Manual Control	SIMOCRANE Drive-Based Sway Control for single-axis applications Basic Control	SINAMICS SIMOCRANE Drive-Based Sway Control for multi-axis applications Basic Control
Type	6GA7280-1AA10-0AB0	6SL3077-6AA00-2AB0	6GA7280-1AA20-0AB0	6SL3077-6AA00-3AB0
Scope of delivery	• CompactFlash card (CF card) • SINAMICS FW V5.1 standard • Required license key • DVD with: - STARTER installation file for Drive-Based Sway Control - Product documentation - Readme files - Application examples and description - License Certificate	• License Certificate • Download from SiePortal (https://support.industry.siemens.com/cs/ww/en/view/109483531) - Installation for DBSC - Standard applications - Application description	• CompactFlash card (CF card) • SINAMICS FW V5.1 standard • Required license key • DVD with: - STARTER installation file for Drive-Based Sway Control - Product documentation - Readme files - Application examples and description - License Certificate	• License Certificate • Download from SiePortal (https://support.industry.siemens.com/cs/ww/en/view/109483531) - Installation for DBSC - Standard applications - Application description

Selection and ordering data

Description	Article No.	Description	Article No.
SIMOCRANE Drive-Based Sway Control V1.0 SP2 for single-axis applications (Manual Control) including • CompactFlash card (CF card) • SINAMICS FW V5.1 • Required license key • DVD with - STARTER installation file for Drive-Based Sway Control - Product documentation - Readme files - Application examples and description for single-axis applications - License certificate	6GA7280-1AA10-0AB0	SIMOCRANE Drive-Based Sway Control V1.0 SP2 for single-axis applications (Basic Control) including • CompactFlash card (CF card) • SINAMICS FW V5.1 • Required license key • DVD with - STARTER installation file for Drive-Based Sway Control - Product documentation - Readme files - Application examples and description for single-axis applications - License certificate	6GA7280-1AA20-0AB0
SINAMICS SIMOCRANE Drive-Based Sway Control V1.0 SP2 for multi-axis applications (Manual Control) including • License certificate • SW download in SiePortal https://support.industry.siemens.com/cs/ww/en/view/109483531 <u>Note:</u> The CompactFlash card for CU320-2 Control Unit without Safety license and performance expansion in Firmware V5.1 (Article No.: 6SL3054-0FB10-1BA0) is <u>not included</u> in the scope of delivery.	6SL3077-6AA00-2AB0	SINAMICS SIMOCRANE Drive-Based Sway Control V1.0 SP2 for multi-axis applications (Basic Control) including • License certificate • SW download in SiePortal https://support.industry.siemens.com/cs/ww/en/view/109483531 <u>Note:</u> The CompactFlash card for CU320-2 Control Unit without Safety license and performance expansion in Firmware V5.1 (Article No.: 6SL3054-0FB10-1BA0) is <u>not included</u> in the scope of delivery.	6SL3077-6AA00-3AB0



SIMOCRANE Advanced Technology

SIMOCRANE Sway Control

SIMOCRANE Drive-Based Sway Control

Selection and ordering data

Supplementary components

Description	Article No.
SINAMICS S120 CU310-2 DP Control Unit	6SL3040-1LA00-0AA0
SINAMICS S120 CU310-2 PN Control Unit	6SL3040-1LA01-0AA0
SINAMICS S120 CU320-2 DP Control Unit	6SL3040-1MA00-0AA0
SINAMICS S120 CU320-2 PN Control Unit	6SL3040-1MA01-0AA0
CompactFlash card for CU320-2 Control Unit without Safety license	
Firmware V5.1	
• Without performance expansion	6SL3054-0FB10-1BA0
• With performance expansion	6SL3054-0FB11-1BA0
SINAMICS STARTER V5.1 SP1 (DVD)	6SL3072-0AA00-0AG0
DCC SINAMICS V3.1 SP1	6AU1810-1HA31-1XA0
(Full license)	

Drive systems, motors and connection systems for SINAMICS S120 are not included in the package (see Chapter 8 "Drive systems" and "SIMOTICS motors for cranes"). These components must be ordered separately.

Additional information on selecting and ordering supplementary components is provided in the following catalogs:

- D 31.1 – SINAMICS Converters for Single-Axis Drives – Built-In Units
- D 21.4 – SINAMICS S120, SINAMICS S220 and SIMOTICS
- PM 21 – SIMOTION Equipment for Production Machines
- IK PI – Industrial communication, distributed I/O, PROFIBUS

More information

Siemens product support

The latest information about SIMOCRANE products, product support (FAQs, Download) and application example can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

The latest information about SINAMICS products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/13229>

Notes on licensing

The license depends on the serial number of the memory card (CompactFlash card). The crane application software cannot run without a valid license. Licensing is managed via Siemens Web License Manager.

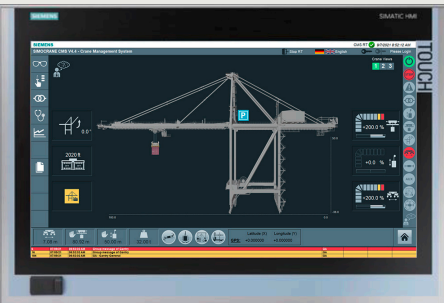
www.siemens.com/automation/license

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

SIMOCRANE CMS Crane Management System

**4/2 System overview**

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4/57 WinCC Add-on PM-MAINT on CMS/RCMS
4/59 WinCC/IDB – connection CMS and RCMS to other databases
4/60 WinCC/Connectivity Pack – sending data via OPC interfaces from CMS and RCMS to other system

Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit

www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

www.siemens.com/cert.

SIMOCRANE CMS Crane Management System

The information on the SIMOCRANE Crane Management System is based on the following software version:

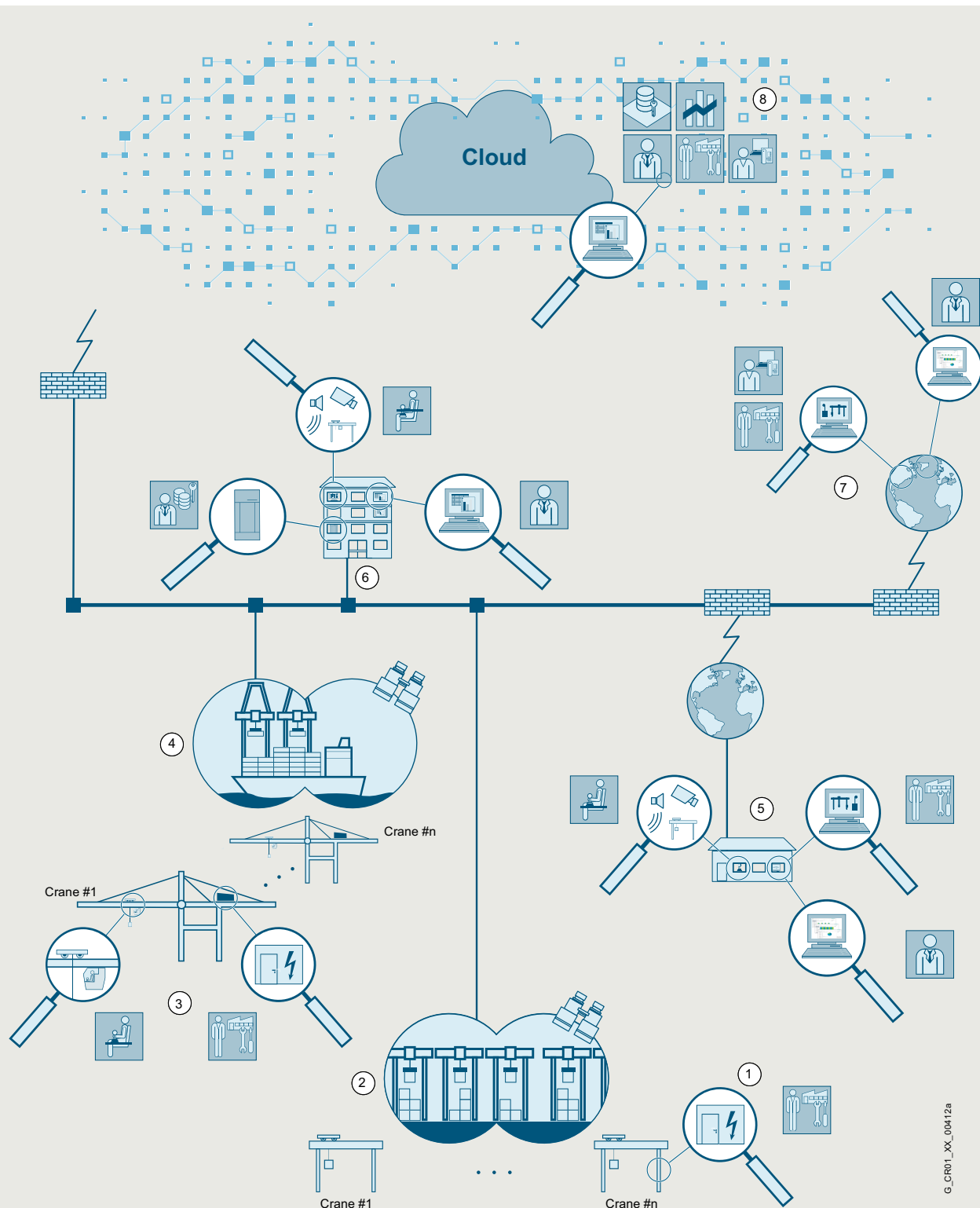
Crane Management System	SW version
CMS, RCMS and CCMS	4.4

SIMOCRANE CMS Crane Management System

System overview

System overview

Overview



Overview of SIMOCRANE CMS and RCMS solution-based Siemens components



Overview

The product overview describes the implementation of SIMOCRANE CMS (Crane Management System), and its scalability is presented below based on the example of a harbor crane system. The application fields range from the control center/control room including the Remote Crane Operating System (RCOS) through loading and unloading in the harbor area right up to the maintenance station with remote access options.

- ① CMS station in the electrical room of stacking cranes for maintenance technicians
- ② Remote access or remote control of stacking cranes in the stacking area of a container terminal via remote CMS station (RCMS) via web-client stations.
- ③ CMS station in the electrical room of ship-to-shore cranes for maintenance technicians and CMS web-clients are installed in the crane cabin for the crane driver. The server is equipped with an Microsoft SQL database for data logging and structuring of operating data for each crane (CMS station).
- ④ Remote access to ship-to-shore cranes in the plant area (quay) of a container terminal from RCMS or RCOS stations.
- ⑤ Remote access from the maintenance building for technicians and crane drivers via CMS web-client stations over internet/local network/intranet. Access of information via internet/intranet from cranes using CCMS (Centralized Crane Management System). Analyzing historical crane data and generating reports with RCMS.
- ⑥ Central administration building with system administration, data archiving and evaluation. Here the servers for data storage on long-term archiving are also installed, in single or redundant configuration. Remote operation of cranes and centralized system of RCMS and RCOS servers. Analyzing of historical crane data and generating reports with RCMS.
- ⑦ Remote access is possible by specialists over the internet, remote crane access over internet/local network/intranet connection to CMS or RCMS from control room or separate mobile stations connected to terminal network. Analyzing of historical crane data and generating reports with RCMS.
- ⑧ Storing CMS crane data in the Cloud. Web-based solution for displaying and evaluating crane and terminal data with mobile phones and tablets.

The SIMOCRANE CMS is the Crane Management System from Siemens for crane applications in harbor and industry market segments. The SIMOCRANE CMS is a PC-based SCADA application for crane drivers, maintenance personnel, crane operators and management level of crane terminal operators.

It provides the following main functions:

- Customizable user interface of the crane system
- Alarm/event reporting system and support for diagnostics
- Archiving system based on Microsoft SQL database
- Recording measured values for various operating parameters
- Recording and analysis of cargo handling data
- Recording and evaluation of operating hours and counters
- Preventive/ Condition based/Predictive maintenance
- Replay function (Playback function)
- Calculation of KPI for crane operation
- Reporting and data analysis of crane operating data and message system
- Support for operators and diagnostic functions on the remote crane stations
- Gaining information about the crane functions and cranes operation in the terminal
- Data analytics of cranes and terminal systems via the remote system (RCMS)
- Distribution of information for CMS and RCMS via web-based clients
- Connectivity to Cloud systems (Insight Hub)

SIMOCRANE CMS is a graphics-based, user-oriented system that supports users in a easy to understand manner during operation as well with troubleshooting and rectification of faults. The system can be used locally on the crane and remotely via internet/intranet connection.

By using SIMOCRANE CMS, the downtimes for a crane are shortened and the availability of cranes and the complete terminal is optimized. SIMOCRANE CMS provides the crane operator with important data for analysis. Changing states are signaled to the crane driver preemptively to prevent damage.

The system architecture is based on market standards and thus offers the facility for integrating into existing IT and automation landscapes. The SCADA package from Siemens, SIMATIC WinCC, is used as a development and RT platform for SIMOCRANE CMS.

SIMATIC WinCC has several available communication channels for connecting to automation systems of different manufacturers. Open interfaces allow connection to higher-level logistics systems (such as TOS) connectivity of other systems is to be realized via OPC UA or MQTT channel included in the WinCC delivery.



SIMOCRANE CMS Crane Management System

System overview

System overview

Benefits

- **Clear, graphical presentation of the crane and its components**
The most important parameters can always be read, and changing states are detected immediately.
- **Graphical User Interface (GUI) based on symbolic display**
Easy and clear GUI based on symbolic pictograms
- **Screens for day/night theme**
The theme of the application can be easily changed to day or night mode by a button on the application or according to the system clock.
- **Integrated diagnostics functions of S7 PLC and other SIMATIC components**
By using SIMOCRANE CMS in combination with SIMATIC components, the integration of CMS in Totally Integrated Automation concept from Siemens can be completely realized. Thanks to SCADA WinCC integration into the SIMATIC automation landscape, fast and easy advanced diagnostics functions are automatically integrated into the crane management system concept from Siemens.
- **Language-neutral, thanks to GUI symbols**
Users of different nationalities and with different training can utilize the information equally well.
- **Easy explanation of symbols due to tool tip text**
Text activation (tool tip text) when mouse over the symbols
- **UNICODE language support for runtime**
Support of Windows languages for switch of different languages in runtime
- **Transparent screen navigation and easy user guidance**
Simple navigation structure and user interface that leads the user to the destination in just a few steps. The design also supports touch screens.
- **Mobile web-client solution with WebUX technology**
Thanks to the WinCC WebUX technology, mobile devices (such as smartphones or tablets, etc.) can be used as web clients via predefined screens.
- **Replay function with integrated Playback standard delivered with the software**
Easy configuration and plenty of functions for Playback of CMS screens containing all data, as well as messages, trends, operator commands, etc.
- **Integrated screens and functions of other SIMOCRANE components**
Functions from other SIMOCRANE products or concepts are integrated into SIMOCRANE CMS. For example, SIMOCRANE SC or SIMOCRANE TPS functions are available to be monitored or directly activated from SIMOCRANE CMS screens. This integration is based on standard block functions and consists of library components which can be configured depending of project requirements
- **Advanced reporting**
Advanced reporting is included in the CMS Lean and CMS Advanced packages for CMS and RCMS, as well as in the web clients. Easy generating of reports by one mouse click. Extension with reporting functions on RCMS Analyzer for comprehensive reports.
- **Fast Trace of signals from the PLC and drives**
Advanced functions for trace of fast signals from drives and PLC; 3D representation of the signals and message trigger-based alarms
- **Preventive maintenance/life cycle monitoring**
Life cycles of crane equipment can be easily adjusted by the user and monitored. In addition, in cases where maintenance is required, the user can be warned to prevent unplanned downtimes. Adding new components on the imported list makes this feature easy to adapt by the user.
- **Calculation of KPI and other OEE parameter regarding the crane performance**
Standard KPIs delivered with SIMOCRANE CMS on CMS and RCMS level. Easy calculation for own defined KPIs or OEE regarding crane performance indicators; easy and comprehensive data representation in different graphics, e.g. Gantt Views, table controls and many other graphical representation
- **Easy to order CMS and RCMS package structure with own ordering number**
CMS Lean and CMS Advanced packages for covering all types of crane types on the harbor as well as for the industry market
- **Plenty of standard functions on board as well the possibility to customize own projects due to the flexible configuration of the CMS product and CMS application (user interface)**
Customers can define own standard based on integrated function into the CMS and RCMS
- **Open interfaces**
Apart from Siemens controllers, automation systems from other manufacturers are also supported. For integration into existing IT landscapes, the system offers standard interfaces, for example, for connection to a Terminal Operating System (TOS), based on OPC interfaces (OPC HDA, OPC DA, OPC A & E, OLE DB) or MQTT.
- **Data acquisition and archiving (Microsoft SQL database)**
Fault messages, position data and cargo handling data are acquired, archived and can be evaluated at any time. A Microsoft SQL database is supplied with the product as standard.
- **Scalability**
The system is equally suited to small crane systems in a minimal configuration and complex plant structures with numerous cranes which would normally be implemented in client/server structures.
- **Easy expandability**
The supplied tools allow the crane application to be adapted and expanded easily at any time. The system can also be expanded at any time with Add-on functions in the form of optional modules.
- **Redundancy on data storage for RCMS**
On RCMS server full redundancy can be applied as option to increase data availability in the terminal. Several Process Historian databases can be connected to one or multiple RCMS server and represent the data via web clients.
- **Customization of the web interface GUIs on RCMS**
The OEM, system integrator and/or the end customer can change any time the GUIs on the RCMS using a dedicated configuration access via the server on the RCMS in order to customize the views according to project requirements. The views can be changed any time, also after the system was commissioned enabling in this way a maximum flexibility for RCMS customization.
- **Configurable dashboards for RCMS**
With the new dashboards developed for a better user experience in RCMS, users can now easily monitor and compare KPI values or trends of tag values.



Benefits

- **Integration of reports on RCMS**

Reports with alarm, KPI or other data in the project can be easily generated in web-based RCMS with manual or automatic export functionality.

- **Connectivity to Cloud solutions**

The system topology design of CMS and RCMS based on SIMATIC components can enable to connect to cloud solutions via standard interfaces like OPC UA. Using a Cloud API with CMS or RCMS interface for CMS or RCMS, the specific KPIs or crane information can be transferred to Cloud solutions

- **Flexibility for configuration**

On CMS and RCMS stations the project configuration can be changed any time. Project requirements can be easily integrated thanks to configurations editors delivered with the software on CMS and RCMS. For RCMS, the configuration can be done via web server from any point in the terminal. No need of dedicated engineering stations or special configuration PCs.

- **Centralized database SQL on RCMS native 64 bit**

In the new architecture, the connectivity from cranes (CMS stations) is to be realized centralized on one server, central archiver, based on SIMATIC Process Historian from Siemens. This solution enables the storage of large amount of data for several years with no data loss. There is no limitation in data storage, only the hardware will be the only constrained in getting data on the RCMS stored. Concepts of data redundancy and data recovery are implemented in order to enhance data availability.

- **Product support and availability of expertise**

Worldwide use of this product ensures extensive support and fast response times

Application

The SIMOCRANE CMS (Crane Management System) is especially designed for use in crane applications, for both harbor and industrial environments. The SIMOCRANE CMS is a SCADA based product that can be used to adapt the system to different application cases such as the configuration of CMS single-user systems or the multi-user systems of networked CMS infrastructures. Independent functions are to be configured standalone, such as Replay/Playback function. The Replay feature can playback the data from long-term archiving into the screens on a CMS machine. Remote access possible from any point of connectivity to network of fixed web-clients or mobile web-clients (laptops, tablets)

SIMOCRANE CMS Crane Management System

System overview

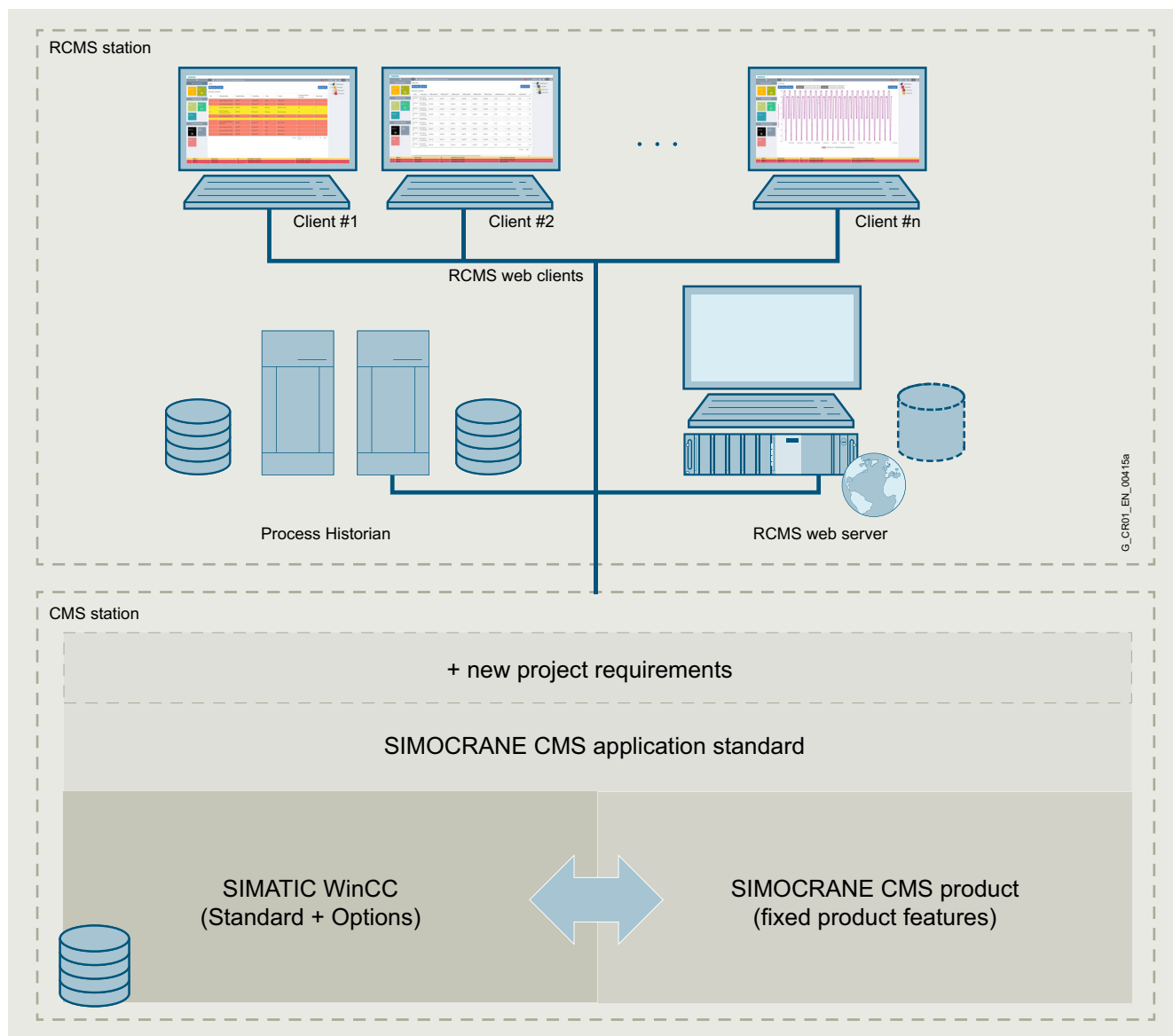
System overview

Design

SIMOCRANE CMS and RCMS package components

The SIMOCRANE (R)CMS package is a combination of different components. The scope of delivery of the SIMOCRANE CMS package comprises the CMS product components and a CMS

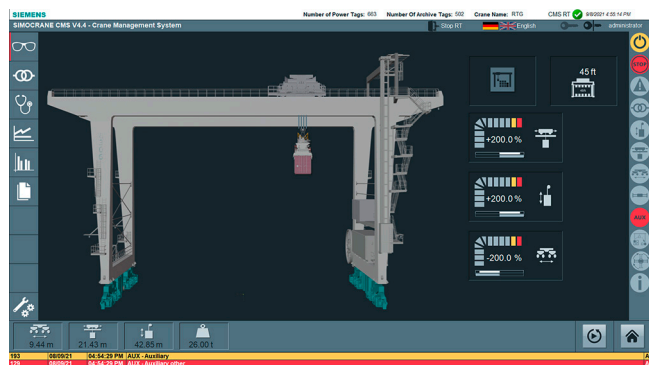
standard application. To understand the components of the CMS and RCMS package, please refer to the picture below.





Design

With the SIMOCRANE CMS package standard tools are provided to make the configuration for standard features based on customer requirements – for example messages, message instructions, replay screens, etc. In the CMS application part, the screens can be easily changed, or new objects can be added by need depending on the customer requirements (configuration of faceplates and objects, new crane configuration with different options for hoisting, etc.).



Example of a customized screen for an RMG crane

SIMATIC WinCC (SCADA)

SIMATIC WinCC is the SCADA system from Siemens. SIMATIC WinCC is used as platform for SIMOCRANE CMS product development. At the same time, WinCC is also used as Runtime (RT) license for CMS application (WinCC project example). It contains the basic functions for condition monitoring, the error message system and process value archiving in a Microsoft SQL database.

SIMATIC WinCC Options

WinCC optional packages such as WebNavigator and WebUX, can be used for remote access of data or evaluating data, reporting, KPI calculation.

SIMOCRANE CMS product (system software)

Based on the open interfaces of WinCC, the SIMOCRANE CMS system software package expands the standard system with the sector-specific crane technology functions. This covers, for example the acquisition and processing of cargo handling data, expanded diagnostic functions, Replay function (Playback), jump functions (PLC function blocks, documentation, screens, drawings, etc.), bulk engineering, connection protocol to a central CMS (RCMS), connection to graphical user interface based on CMS standard application.

SIMOCRANE RCMS product (system software)

SIMOCRANE RCMS is a web-based remote crane management system which can be used to display and evaluate the data of all the connected CMS stations. SIMOCRANE RCMS web server communicates with the SIMATIC Process Historian to visualize the data from the centralized database and displays it in the SIMOCRANE RCMS web clients.

SIMATIC Process Historian

The centralized database on the RCMS is based on SIMATIC Process Historian. The Process Historian includes a Microsoft SQL database full version including special modules for data management and data preprocessing. Operational crane data and messages are sent from each WinCC station to Process Historian via a direct channel embedded into the WinCC/Process Historian architecture.

SIPLUS CMS (X-Tools)

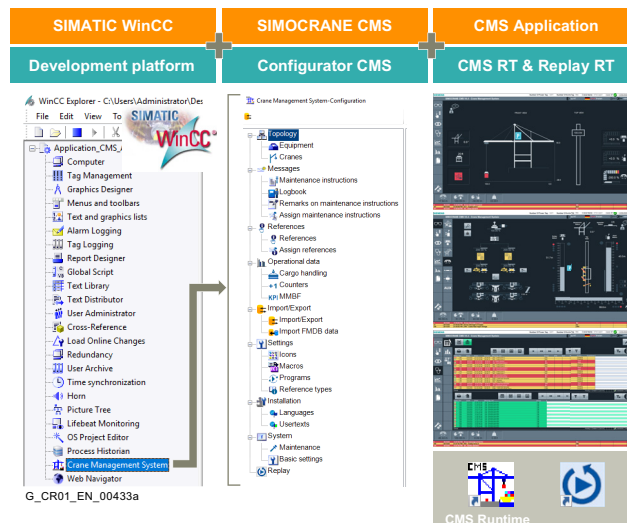
Using this software package, Fast Trace functions can be implemented for visualizing of high-speed signals.

SIMOCRANE CMS standard application

The product components named here are part of the tool kit for implementing the functionality of a crane management system. The scope of delivery also includes a standard application that demonstrates practical implementation. The standard CMS application is provided as an example project and it can be modified at any time and customized based on customer requirements. In the CMS standard application, the Replay Controller is also integrated. Controls can be customized, or the customer can add new functions when needed.

With the package SIMOCRANE CMS an example of application is provided on the installation software DVD in order to provide a standard user interface and application example for SIMOCRANE CMS.

This example is divided into two categories: One for CMS Lean package, including an example for a WinCC project with standard features for RTG/RMG cranes and OHBC industrial cranes. The CMS Advanced is a project example of a CMS application consisting of a WinCC project for a ship to shore (STS) crane. The standard application can be extended for a large number of variants for crane applications. An example for an STS crane (CMS Advanced) or RTG/RMG (CMS Lean) is provided and therefore makes starting a CMS project much easier. In the simplest case, it is sufficient to set parameters at the controller interface to obtain a fully functional crane management system ready to use with minimum engineering and configuration effort.



SIMOCRANE CMS and SIMOCRANE RCMS main components

Experience has shown that a number of functions often always remain almost the same in crane projects for crane management systems. This means that the modules can be reused in other projects as well. In some cases, project-dependent configurations are necessary in order to fulfill the customer requirements. Most of these requirements are related to CMS screens, which are part of the CMS standard application. The CMS system from Siemens is sufficiently open to allow the customer to fulfill these requirements with own project engineering work.

SIMOCRANE CMS Crane Management System

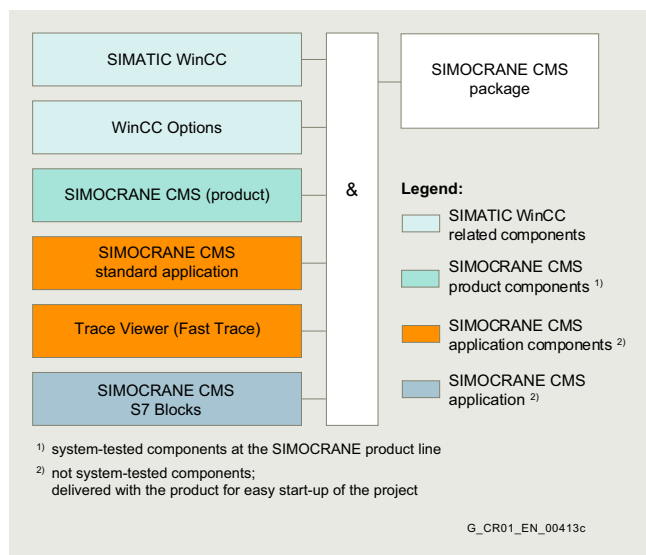
System overview

System overview

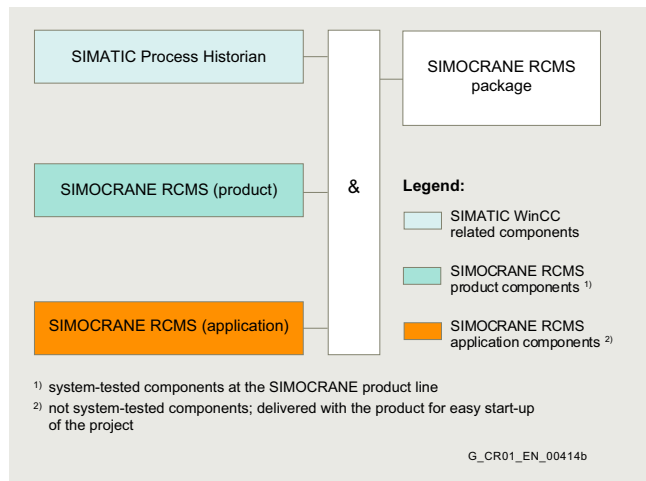
Design

The standard CMS application can cover the most commonly used harbor cranes (for example STS, RMG, RTG) and industrial cranes (for example ladle crane).

The CMS application is used by way of example and can be any time changed and adapted to the customer needs. In order to understand the components of the CMS package in detail, please refer to the picture below. In the figure, green components are crane specific items based on own development.



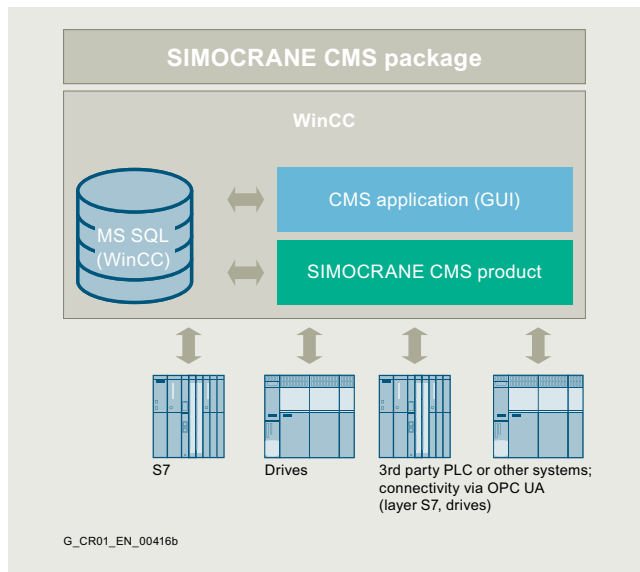
SIMOCRANE CMS product components



SIMOCRANE RCMS product components

Interface between PLC and drive components and CMS

The crane management system is connected directly to a PLC or drive components. In case of SIMOCRANE CMS, the channel used is an S7 channel available in WinCC for Siemens controllers S7-1500 and S7-1200 PLC with TIA Portal. 3rd party PLCs can also be connected via the driver included into WinCC communication channel. Standard communication channels, as OPC UA or OPC DA are to be used for standard data communication between PLC and WinCC database. OLE DB provider can be used for data base connectivity as well.



Interface between CMS and PLC and drive components

The interface is based on a defined standard based on a S7-1200/1500 controller. It is standardized on other SIMOCRANE-based products, such as Basic Technology (BT), Drive-Based Technology (DBT), Sway Control (SC), Truck Positioning System (TPS) and ECO Technology. The interface is provided in a separate document with the product delivery, where the detailed tags in WinCC and DB structure in S7 are described. When using the standard S7 channel from WinCC, advanced diagnostics functions can be generated and used directly in the CMS application project with a very limited effort. This makes it possible for diagnostics functions from the S7 layer to be integrated directly into the CMS level. Communication to CMS can be achieved via OPC UA when non-Siemens systems are used on the crane.



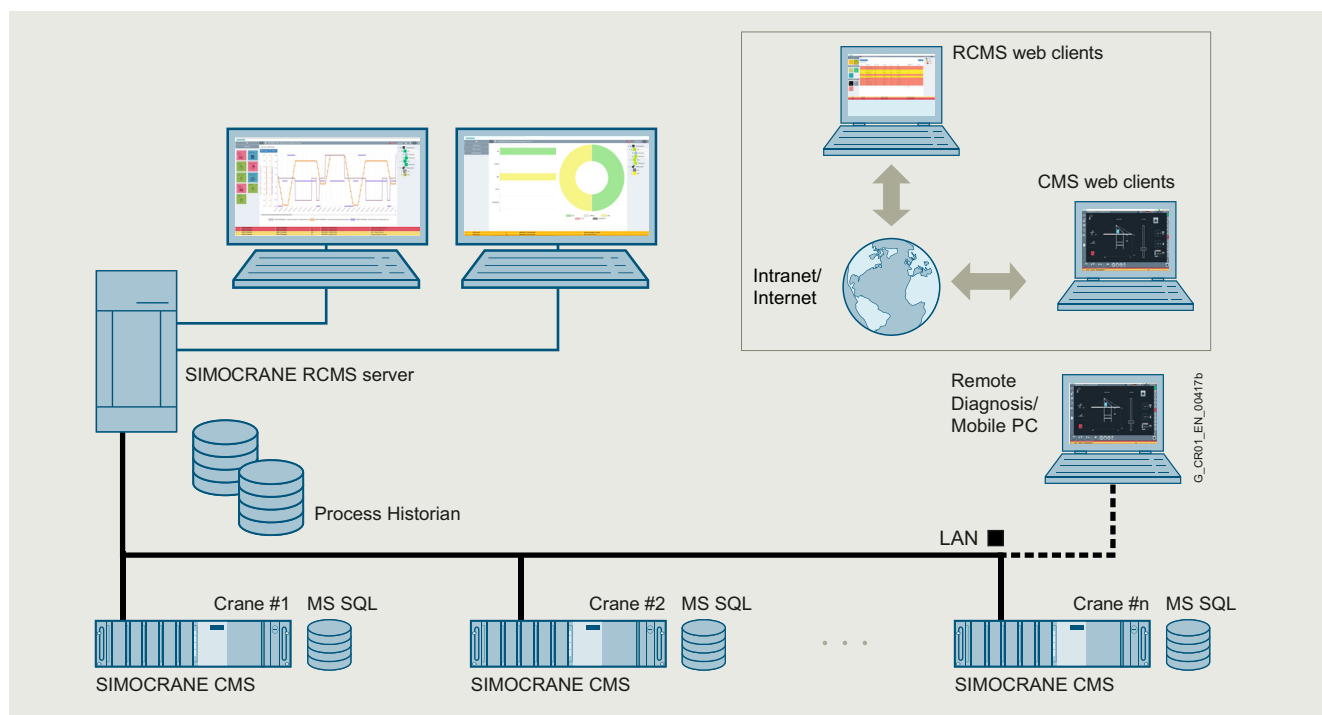
Design

Communication CMS stations to RCMS (Remote CMS)

The communication between CMS Lean/CMS Advanced stations and RCMS station(s) is based on a proprietary protocol included and delivered with the product SIMOCRANE CMS. For the communication between CMS and RCMS it is not necessary to buy a separate channel, the communication between CMS and RCMS is automatically included in each CMS/WinCC station. The connectivity to RCMS is to be realized first via the Process Historian database from the cranes.

The number of the CMS stations connected to the RCMS is depended of the hardware capacity of the Process Historian database. There is no restriction on the software side, for neither Process Historian nor RCMS. The dimensioning of the hardware for the Process Historian and RCMS should be considered during engineering and project specification. [For further details please contact the hotline product support for SIMOCRANE CMS.](https://support.industry.siemens.com/cs/my/srm?lc=en-WW)

<https://support.industry.siemens.com/cs/my/srm?lc=en-WW>
(Search item → SIMOCRANE CMS)



Overview of the configuration of SIMOCRANE CMS stations and RCMS station (redundant database)

SIMOCRANE CMS Crane Management System

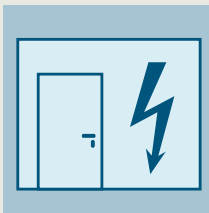
System overview

System overview

Design

Installation sites and environment

Electrical room



The drive and control technology and the CMS station are located in the electrical room (E-room). An industry-standard Rack PC or a Panel PC can be used as hardware platform. It is recommended that the embedded hardware of the new generation of Rack PC or Panel PC is used, i.e. with no moving parts such as fan or hard drive, using a SSD card instead. In this way high availability of the hardware components can be achieved. For the CMS located in the E-room the main user group is service and maintenance technicians. It is possible to call up detailed diagnostics information here, access documentation, circuit diagrams, S7 programmable data blocks, etc. Replay/Playback actions at CMS can be executed directly here on screen.

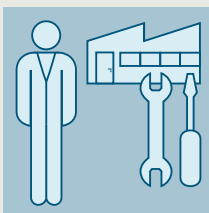
Crane driver cabin



The CMS operator panel in the crane driver cabin is preferably a Touch PC and primarily supports the crane operator during operation.

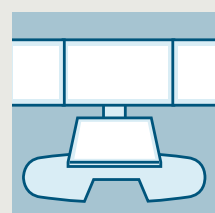
The crane driver receives information status and fault messages, the operating states and operating data, as well as basic diagnostics information. It is only possible to set the operating mode for the crane from the crane driver cabin; and this also applies to activation and deactivation of the SIMOCRANE advanced functions, such as SC or TPS.

Maintenance building/remote crane access



The maintenance and service technicians are based here on standby. They require remote access to the CMS systems of the cranes. This requires a standard PC which, as web client, can call up diagnostics and other information from every connected crane in the terminal. From maintenance building the Replay function can be activated and used on the CMS system. During remote cranes operation all the crane data and state changes can be monitored from central system due to CMS web-clients.

RCOS Operator



The Siemens Remote Control System (RCOS) allows for operating multiple cranes simultaneously from a remote environment. Using the latest camera zoom technologies together with an innovative assistance using automatic functions, the remote operator can work from an ergonomical improved and safe environment.

The RCOS Operator directly connects to the CMS via WinCC/ WebNavigator and see all the necessary information about the crane. Different access credentials are integrated on CMS and RCOS.

Control center/control room



The RCMS server is typically located in the control center in the case of a network of multiple cranes and with the requirement of a central data server for long-term archiving and consolidated evaluation. The RCMS server is located here and any further RCMS operator stations with remote access to the cranes.

Administrators, the plant operator, as well as maintenance and service technicians or crane drivers with remote control desks work here. The Replay function can be used via remote station, in web environment, to visualize the information from the past.

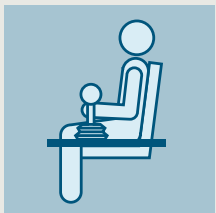
From an RCMS operator station, the terminal operator has a complete overview of the crane terminal and can quickly access an individual crane without the need to be physically on the crane. Monitoring walls technology can be utilized for full integration of CMS and RCMS WebClients with direct access to database and Archive system.



Design

User groups and functions

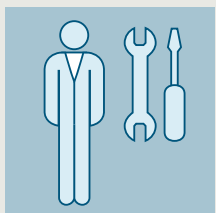
Crane driver



The crane driver/operator is provided with most essential data needed for operation. The straightforward arrangement provides this user group with the most important information about the operating state of the crane. It is important the operator is informed status, warnings and faults of the installation. He must be able to decide quickly whether they can reset and continue operation or it is a critical fault and technician should be informed.

Apart from presenting information, they can also make operational adjustments, i.e. by activating and deactivating options such as SIMOCRANE SC, SIMOCRANE TPS, etc.

Maintenance technician



This user group has specific knowledge of the system and can therefore call up more extensive diagnostics information for fast rectification of faults. Maintenance technicians must be able to quickly access the main sources of information that they require for fault rectification purposes. With regard to error messages, maintenance technicians can access specific circuit diagrams and manuals. The Replay function can also be activated and used by this user.

Terminal operator/manager



The terminal operator/manager is interested in statistical information and operating data. This user group is provided with this information content in the form of reports and statistics. The Replay function can also be used in the context of remote operation of the crane from a central control desk.

Administrator



The administrator has access to all authorizations and can set up and manage users. This usually comprises the personnel of the IT department of the plant operator.

SIMOCRANE CMS Crane Management System

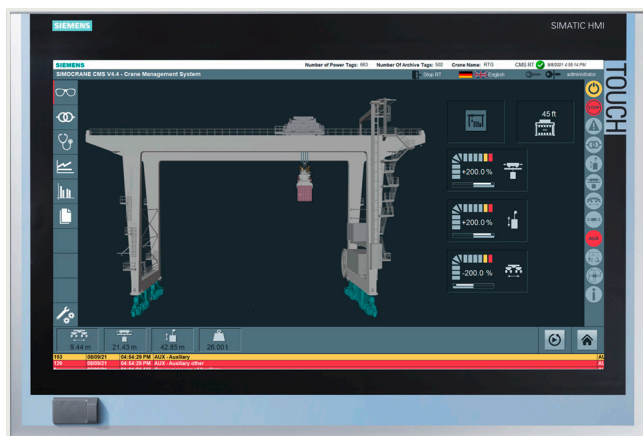
SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Overview

The package SIMOCRANE CMS V4.4 includes new functions and new optional packages compared to the previous version. The latest Microsoft Windows versions released for WinCC and Process Historian components are tested and released with Service Packs and regular software updates. It contains improvements related to previous versions and the CMS standard application (provided as an example project).

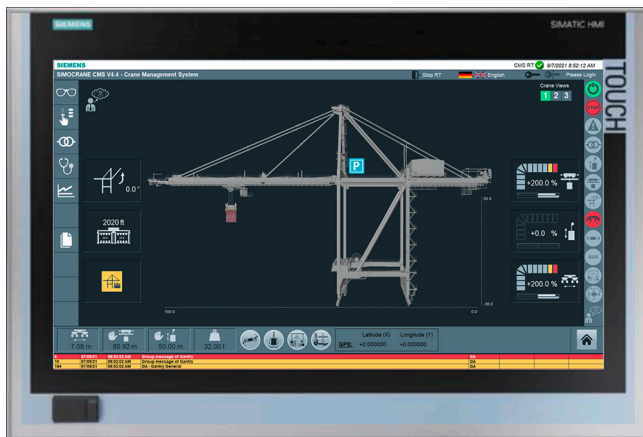
Three packages are available for SIMOCRANE CMS V4.4:

- **SIMOCRANE CMS V4.4 Lean package**, as to be used for crane types in harbor business, mainly for RTG, RMG, ASC as well as for industrial cranes. Other types of cranes can be defined and configured via the CMS application.



Example of a SIMOCRANE CMS Lean application screen

- **SIMOCRANE CMS V4.4 Advanced package**, as to be used mainly for crane types in a harbor as with STS and GSU. Other types of cranes can be defined and configured via the CMS application.



Example of a SIMOCRANE CMS Advanced application screen

- **SIMOCRANE RCMS V4.4 Connector package** is a low cost and easy-to-use application mainly developed to perform data transfer to RCMS or Cloud for applications that do not have a WinCC installation on the crane. The RCMS Connector application can be connected to any type of crane. For projects requesting the full scope of functions on CMS, it is recommended to use the CMS Lean or CMS Advanced application.



Example of a SIMOCRANE RCMS Connector application screen

For both SIMOCRANE CMS V4.4 Lean and Advanced packages, the CMS applications have been modified and tuned for the specific crane type, the CMS Lean is provided as an example for an RTG/RMG crane type and CMS Advanced is provided as an example for an STS crane type. Additionally, CMS Lean also contains an application for industrial cranes, including an integrated library that uses OHBC cranes as an example for the project start.

Please refer to the functional and delivery scope as described below for information on the new functions included in all packages.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Function

Delivery scope SIMOCRANE CMS V4.4 Lean and Advanced (standard package)

The SIMOCRANE CMS V4.4 Lean and Advanced packages consist of different bundles and a combination of WinCC Options and CMS/RCMS packages. The following bundles are delivered with standard package and options for CMS.

The following bundles are delivered with standard package and options for CMS.

- WinCC V7.5 (SP2) RT licenses
 - 2048 PowerTags/CMS Lean
 - 8000 PowerTags/CMS Advanced
- WinCC Archive Tags
 - 512 Archive Tags/CMS Lean
 - 1500 Archive Tags/CMS Advanced
- SIMOCRANE CMS V4.4 Configuration
- SIMOCRANE CMS V4.4 RT
- 1 license WinCC WebUX for mobile clients, monitor only (tablets, smartphones or a device which has a web browser supports HTML5)
- Crane condition monitoring
- Replay function (Playback)
- Message system and advanced fault diagnosis
- Acquisition of cargo handling data
- Acquisition of operating hours/counter values/timers
- Advanced reporting, KPI calculation and data aggregation with RCMS
- Export of archived data and messages from Microsoft SQL to Microsoft Excel
- Advanced S7 diagnostics of S7-1200/1500 PLC
- Integrated web server for SIMOTION, SINAMICS, and S7
- Integration of trace view web server of S7-1200 and 1500 PLC
- Maintenance instructions/notes (advanced message diagnostics)
- Microsoft SQL (full version) with long-term archiving
- STEP 7 block reference (advanced S7 diagnostics)
- Jump functions to different project components (S7 block functions, pictures, manual information, Microsoft Word, Microsoft Excel, videos, etc.)
- Connection to RCMS
- Connection to Cloud

Delivery scope SIMOCRANE RCMS V4.4 Connector (standard package)

The following bundle is delivered with the standard package for RCMS Connector.

- WinCC V7.5 (SP2) RT license (512 PowerTags)
- WinCC Archive Tags (512 Archive Tags)
- SIMOCRANE CMS V4.4 Configuration
- SIMOCRANE CMS V4.4 RT
- 1 license WinCC WebUX for mobile clients, monitor only (tablets, smartphones or a device which has a web browser supports HTML5)
- Acquisition of cargo handling data
- Acquisition of operating hours/counter values/timers
- Advanced reporting, KPI calculation and data aggregation with RCMS
- Microsoft SQL (full version) with long-term archiving
- Connection to RCMS
- Connection to Cloud

Options for SIMOCRANE CMS Lean package

SIMOCRANE CMS Lean + web clients

- Scope of CMS Lean standard package
- WinCC WebNavigator: an integrated web server for operation of one (1) or three (3) web clients in parallel with simultaneous connection) with monitoring and control functions (full functionality)

SIPLUS CMS Lean + Fast Trace (fast condition monitoring)

This option for fast data acquisition and recording is available in combination with the previously mentioned packages.

- Scope of CMS Lean standard package
- Fast Trace (up to 192 kHz per channel) based on SIPLUS CMS X-Tools software

Options for SIMOCRANE CMS Advanced package

SIMOCRANE CMS Advanced + web clients

- Scope of CMS Advanced standard package
- WinCC WebNavigator: integrated web server for the operation of three (3) web clients in parallel with simultaneous connection with monitoring and control functions (full functionality)

SIMOCRANE CMS Advanced + Fast Trace (fast condition monitoring)

This option for fast data acquisition and recording is available in combination with the previously mentioned packages.

- Scope of CMS Advanced standard package
- Fast Trace (up to 192 kHz per channel) based on SIPLUS CMS X-Tools software including IONs

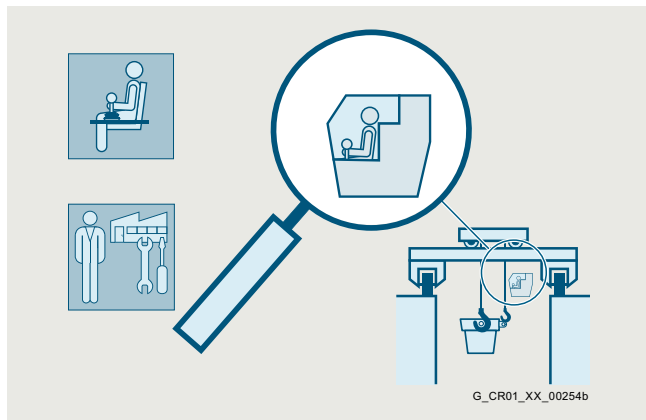
The extended functions are not included in the standard packages. They are optional and must be ordered according to system configuration and customer applications.

SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Single user

Overview



The local CMS station is directly located on the crane. Depending on the size of the crane, it comprises a single operator station (CMS Lean or CMS Advanced) or a web server for additional operator panels (CMS with web clients – WebNavigator). The CMS station is directly connected to the crane controller and acquires all the relevant operational data.

Examples:

- Ladle crane
- Goliath crane
- Slewing luffing crane

Customer requirements:

- Acquisition of productivity data and archiving
- Alarm/event reporting system with archiving
- Error logs and productivity data logs
- Replay function for Playback
- Visualization of the crane and individual components
- CMS display should be installed in the crane driver cabin

Example solution:

CMS Lean

Article No. **6GA7214-0AA00-0AA1**

Panel PC 477 as the HMI device and CMS PC for example (this article number can vary, depending of the Panel PC configuration: processor, RAM memory, hard drive as SSD, etc.):

Article No. **6AV7241-5DB05-0DA0**

Further information: See "Technical specifications", "Selection and ordering data" and the SIMATIC HMI Catalog ST 80.

Application

- Non-networked single-crane applications in which the focus is on the local application and less on remote access and data evaluation options. Visualization of crane components and the alarm/event system are the most important components here.

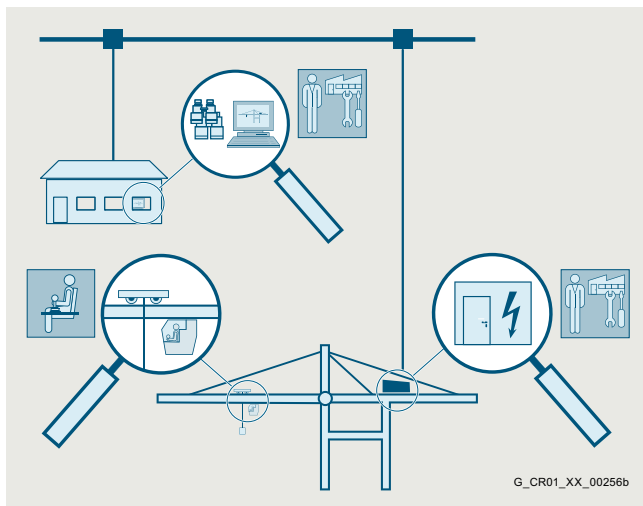


SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

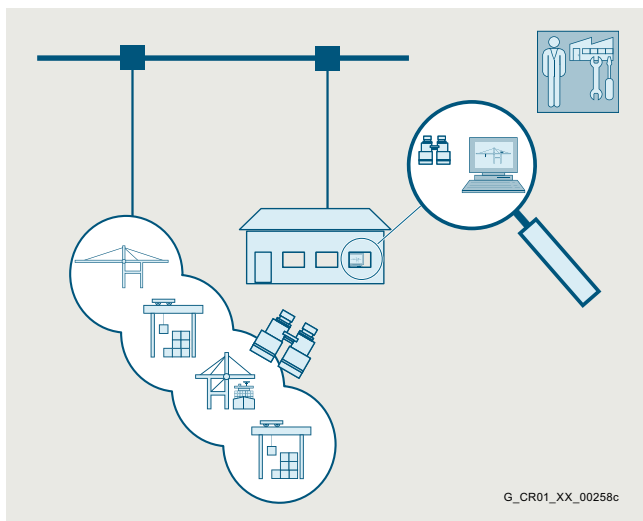
Multi user

Overview



For multi-user systems, standard CMS stations are to be used in combination with different options for remote access of data from different locations. Such options are mainly used for large cranes in the harbor terminals where several persons operate the system at the same time.

Remote access to the local CMS stations is also possible, this is also referred to as "Remote CMS" (RCMS) in the cranes sector. This is usually performed in a central maintenance building. In case of a fault, diagnostics information can be called up beforehand. In the best case scenario, a fault can be rectified in this way.



Use of several cranes with remote access

Customer requirements:

- Acquisition of productivity data and archiving
- Alarm/event reporting system with archiving
- Error logs and productivity data logs
- Replay of crane data (Playback function)
- Visualization of the crane and individual components
- CMS computer is installed in the electrical room
- Operator panel in the cabin
- Remote access from a maintenance building

Solution:

- SIMOCRANE CMS Lean with one (1) web client
Article No. **6GA7214-1AA00-0AA1**
or
SIMOCRANE CMS Advanced with one (3) web clients
Article No. **6GA7214-2AA00-0AA1**
- Panel PC 477 as operator panel for the crane driver and in the checker cabin, e.g.: Article No. **6AV7241-5DB05-0DA0**
- Rack PC 647 as the CMS PC in the electrical room, e.g.: Article No. **6AG4112-3DR02-0CA0**
- Standard PC in the maintenance building with remote crane access via Internet Explorer (Web)

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Multi user

Application

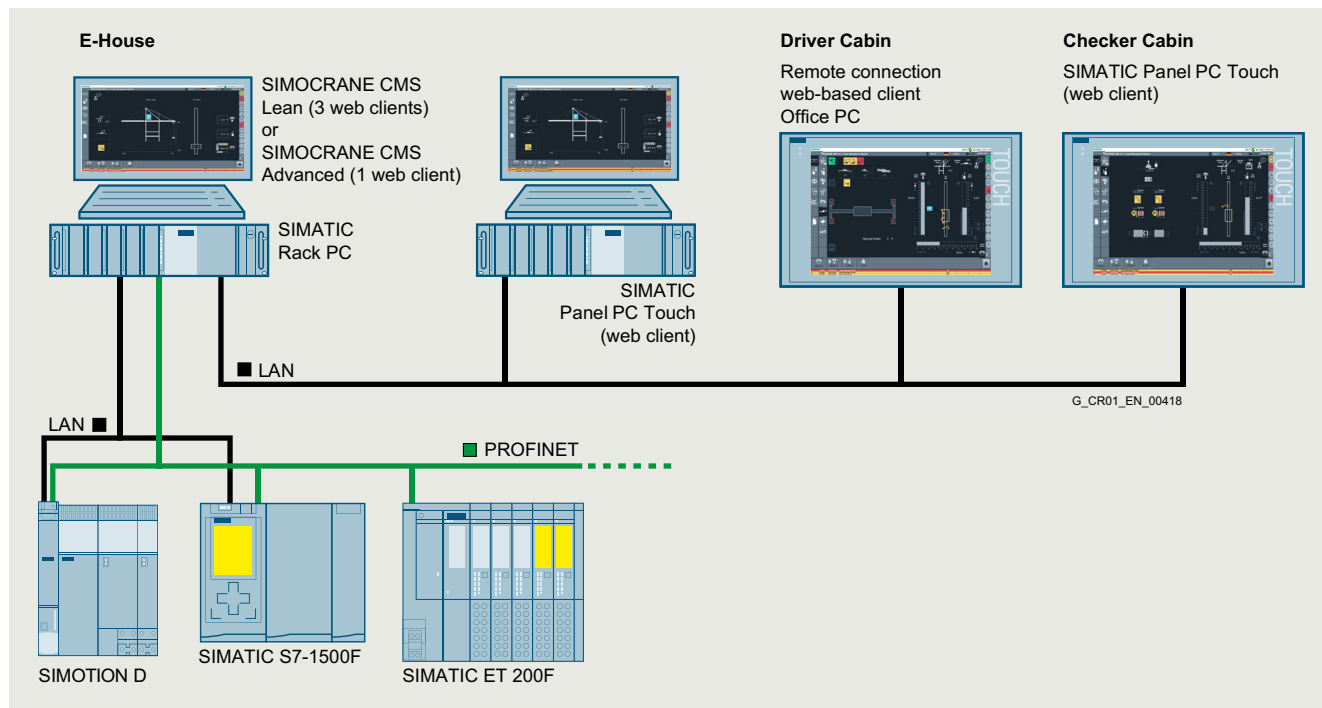
For multi-user systems, where several networked cranes of a similar or identical type are used.

It is important to be able to access each crane from a central location, e.g. a maintenance building or workshop because of long distances. Maintenance technicians want to be able to call up as much detailed information as possible in the event of a

fault to ensure that the correct tool or spare part can be prepared for on-site use.

Examples

Ship to shore cranes and grab cranes (bulk goods), as well other type of cranes like RTG, RMG in the harbor area



Topology of a SIMOCRANE CMS multi-user system (SIMOCRANE CMS Advanced with web clients)

Note:

This configuration can also be selected when more than one crane is used. Every crane can be connected to the remote PC office web-based client in the maintenance building, if necessary.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Standard package

Overview

The standard package of SIMOCRANE CMS Lean and CMS Advanced consists of functions integrated already in product and application as minimum for standard market requirements. By ordering the standard package, basic functions are realized for CMS Lean and CMS Advanced in order to fulfill different main requirements for crane management systems on the crane market. The main functions are briefly described in the next section.

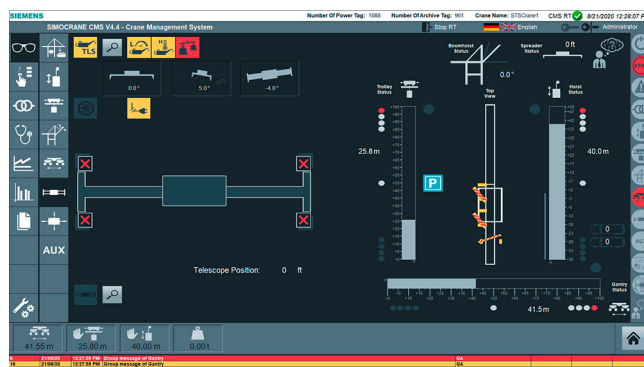
Function

Status display

The status display offers a symbol-oriented, graphical display of the crane and crane components including the current operating values and statuses. It is a very useful tool for the crane driver. Important displays are always in view, and detailed views can be called up in just a few steps. Although the interface is based on icons, moving the mouse over the elements in the screen shows detailed information and text can be visualized with order to receive information about the used symbols.

The status display screen provides supplementary information which will help the crane driver in his work. He is then capable of recognizing the cause of simple faults, such as interlocking for certain movements.

A status bar at the top of the screen displays fault states symbolically, and this is supplemented by text messages at the bottom of the screen.



Graphical status display for the spreader

4

SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Standard package

Function

Replay function (Playback)

The replay function allows for replaying the event when the critical fault occurs and gives an unmatched advantage during trouble-shooting helping in finding the root cause. The replay function is delivered in the standard basic package of SIMOCRANE CMS, both Lean and Advanced packages. This function enables personnel to visualize (Playback) the data in the screens from the past recorded in the database (similar to a DVD player). Thanks to a replay controller the user can set different parameters and navigate through the screens, for example: set time span for replayed data, use navigation buttons (play, stop, pause, back-forward, speed, etc.), and navigate through different replayed screens. The screens for the replay/playback function are freely configurable via Replay Configuration Editor.

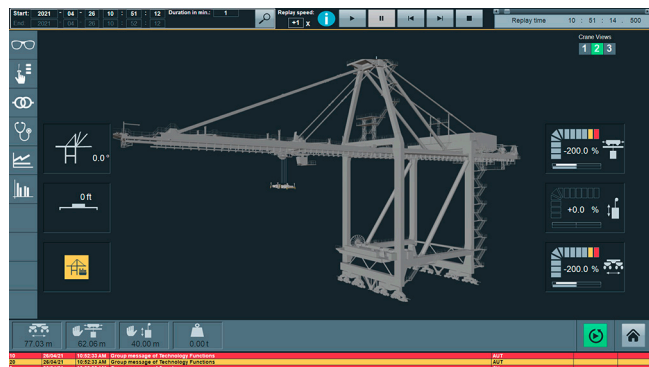
With the Replay Configuration Editor, you can make the following settings required for Replay:

- Maximum number of Archive Tags; see the SIMOCRANE CMS operating instructions.
- Select the pictures to be prepared for Replay
- Check one or more pictures prepared for Replay
- Repair pictures prepared for Replay
- Clean up tags that are no longer needed
- Deselect pictures
- You can expand and view the list of Picture Selector Tags (read only)

The Replay Configuration Editor checks whether the requirements for Replay have been met every time a picture is selected or repaired. The necessary tags and structures are checked for completeness.

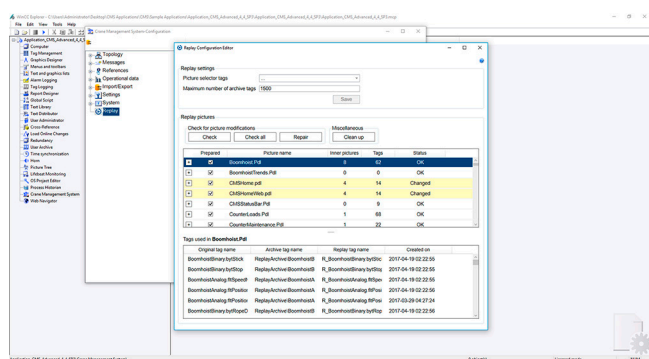
The following are required for Replay:

- ReplayControl structure
- Tags of the ReplayControl group with ReplayControl structure tags
- Tags of the ReplayControl group that are relevant for Replay
- Tags of the screens group that are relevant for Replay
- Tags of the settings group that are relevant for Replay
- ReplayArchive

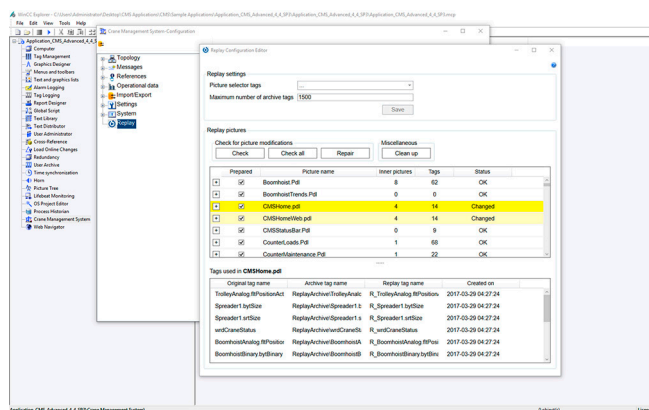


Example of a Replay home screen for a STS crane

The screens for the Replay/Playback function are freely configurable via Replay Configuration Editor. The Replay Configuration Editor is integrated into SIMOCRANE CMS product Configuration Editor. This enables the configuration of replay screens for the replay function in runtime visualization. The replay function works completely independent from the CMS RT function, which continuously collects the data from the field. The replay function works in parallel with CMS RT data acquisition and can be switched on or off via the graphical user interface any time the operator requires replay.



Replay Configuration Editor for a Replay screen configuration



Replay Configuration Editor – Replay screen automatic generation of modules by screen changes in WinCC project



SIMOCRANE CMS Crane Management System

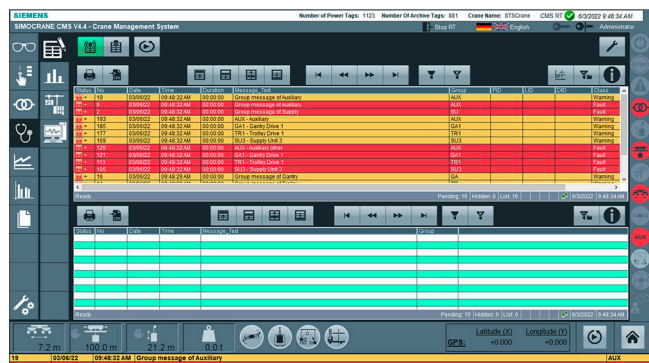
SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Standard package

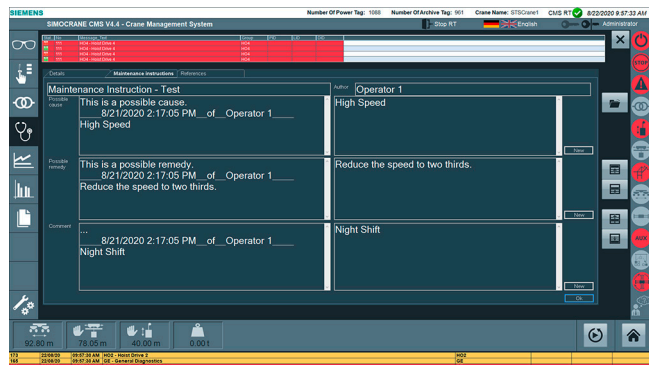
Function

Error messages and advanced diagnostics

In the event of a status change, warning or faults, the message system helps with troubleshooting and rectification. These functions support maintenance technicians with their work and help to reduce downtime. Detailed error lists present the course of the fault chronologically based on order of occurrence. Different filtering and sorting functions can be applied to perform functions of root cause analysis.



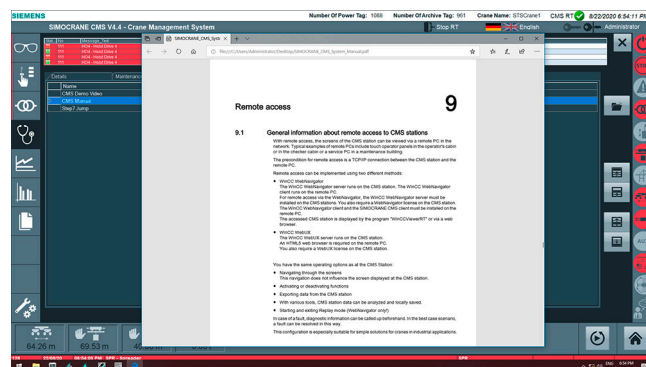
Example of a screen in the message system



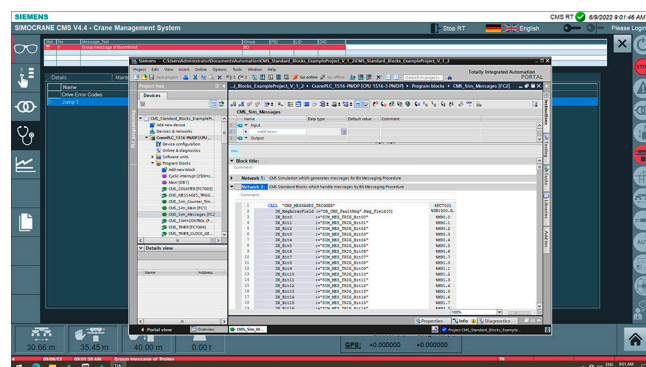
Example of a screen for maintenance instruction function Chronological Message Bar – message instructions

When an error message is selected, further sources of information can be accessed, such as:

- Maintenance instructions and notes
- Circuit diagrams, manuals, operating manuals, data sheets
- Screens, drawings, fault diagnostics
- Jump to different Microsoft programs, such as Microsoft Excel, Microsoft PowerPoint, Microsoft Word, etc.
- Jump to videos related to the message content
- Direct navigation and jump to the PLC program and block functions related to the fault message content



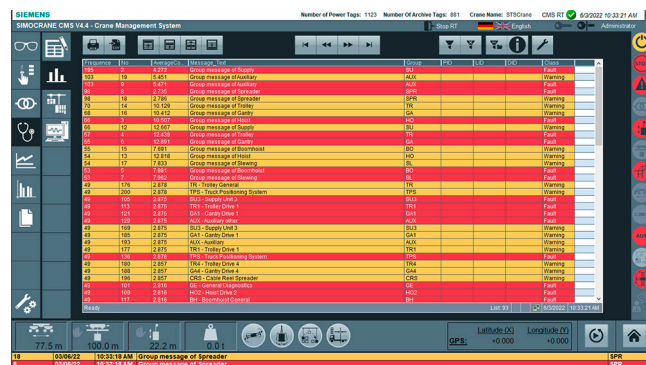
Jump functions to different CMS program content – in this example jump to manuals



Jump functions to different CMS program content – in this example jump to TIA program block functions

Apart from the chronological message list, there are also statistical views that provide information on the frequency and duration of faults (hit list). Also top 10 most frequent faults can be activated and sorted from all messages for each individual crane components, e.g. hoist, trolley, gantry, etc.

These make it easy to identify weak points and to obtain information about downtimes. Additionally, all original messages and preprocessed ones can be exported for further analysis in CSV format.



Example of statistical analysis (hit list) for messages

SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Standard package

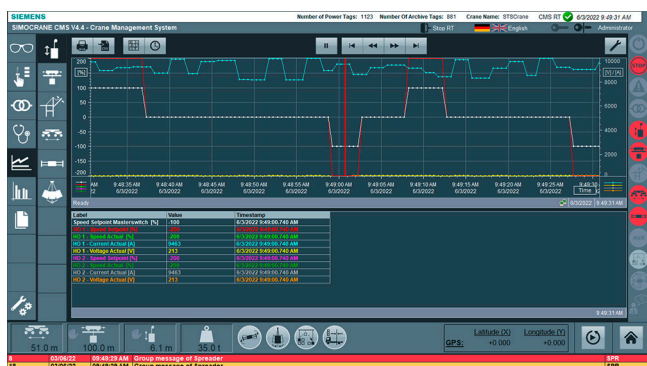
Function

Measured value acquisition

CMS continuously acquires and archives important parameters, such as

- Position values of different components of the crane – hoist, trolley, gantry, etc.
- Setpoint inputs and actual values
- Speed, velocity, etc.

These values can be displayed in the form of trend curves at any time, and easily configured in RT configuration editors, with no necessary know-how of engineering or complex programs.



Crane parameter value acquisition – extended configuration in RT environment

Cargo handling

The cargo handling data of a crane is acquired and archived in order of occurrence. The composition of the data fields (cargo handling data record) is freely configurable and can be adapted to every crane type.

An overview can be called up in the list form at any time at the press of a button.



Cargo handling data

Container handling list

The archived data can be made available to higher-level systems for further evaluation.

MMBF – Mean Moves Between Failures

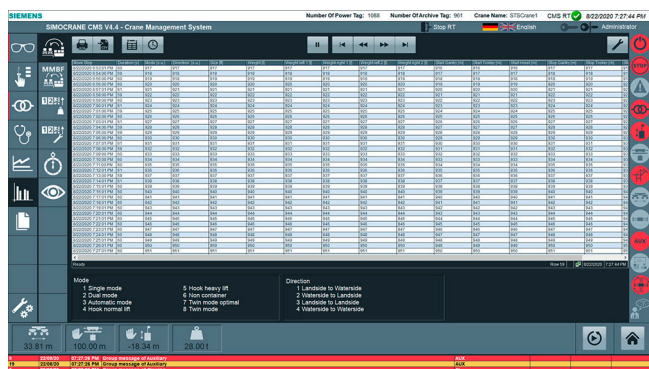
MMBF (cargo handling moves between failures) is one of the most important key performance indicators in crane technology. It provides information on the availability of the crane.

Runtime meter

Maintenance planning systems require counts from runtime meters and counters for the components with relevance to maintenance. These values are first acquired by the crane controller. The CMS acquires these values from the controller.

Preventive Maintenance Tool

For each CMS station on each individual crane the preventive Maintenance Tool offers the possibility to monitor crane components for replacement or maintenance activities to be planned. Also, counters defined for different crane components (e.g. hoist, trolley, etc.) can be monitored with their limit values using different representation and monitoring status based different icons change coloring. In this way, basic preventive maintenance functions can be easily performed and transferred to RCMS as central system.



Screen with move data of the containers operating hour counter



Screen with limit monitoring of the counters

With this function it is possible to process already defined operating hours and counter values and process them according planned maintenance. These values can be initialized and modified in the PLC controller via the CMS user interface. CMS provides predefined screens and interface for configuration purposes of the Preventive Maintenance module, which can be easily adapted by the maintenance team with limited effort.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Standard package

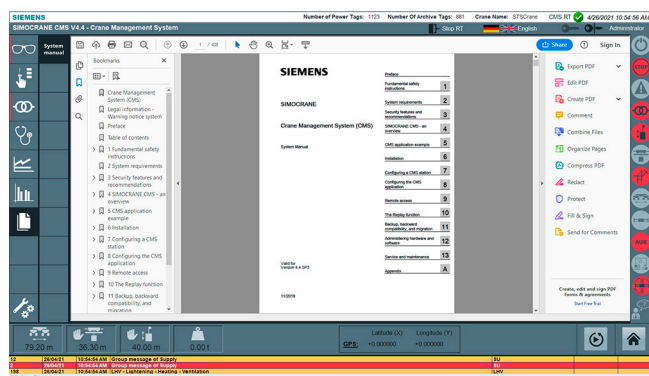
Function

Reporting lists

A simple form of report output is integrated into the system. The following reports can be generated in the standard format:

- Current or archived fault reports
- Report of cargo handling data
- MMBF report

The tools that are available with WinCC allow the reports included as standard to be adapted or expanded at any time. The reports can be also redesigned based on customer requirements or different templates for generation of own reports.

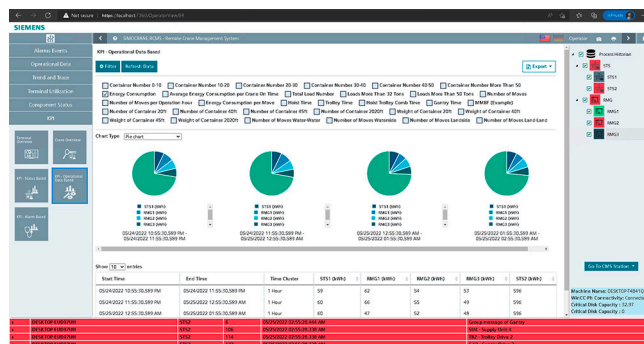


Report of the alarms in a PDF file

This report as PDF format can be printed out directly to a PDF generator or printer.

Advanced reporting, KPI calculation, and data mining

On each CMS and RCMS station advanced reporting generation can be processed. This report is based on the integration of different information regarding messages, operational data (e.g. move data, MMBF, counters, timers), statistics, data mining and any other information provided from other systems in the terminal. The report can be generated directly from RCMS in different layouts, containing information about each crane for CMS station or a group of cranes as desired by the operator/maintenance team. The integrated report generator provides high degree of customization.



Example of report in RCMS

SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Option package

Overview

Additional functions can be offered via optional packages of SIMOCRANE CMS. These functions can be taken in project depending of customer requirements. SIMOCRANE CMS offers maximum flexibility for adding extra functions to the standard package. In the next section a brief overview of optional packages of SIMOCRANE CMS is presented. In order to offer additional functionality together with the SIMOCRANE CMS package, the combination between CMS and other Add-ons from SIMATIC family can be offered. For more information please refer to the section "Additional components".

Function

Multi-user system – web clients

Using the optional package WinCC WebNavigator, the CMS station can be expanded with additional operator stations. A typical application is an operator panel in the crane driver cabin or at another place in the crane, e.g. checker cabin.

Access is, however, also possible from the outside provided that the CMS station on the crane is accessible over the network or the internet.

The access rights can be individually configured for each operator station and each user.

WinCC WebNavigator is provided as an option for the CMS Lean and CMS Advanced packages.



Example of a screen of a web client with WebNavigator

The CMS Advanced offers 3 web clients. For CMS Lean two options are offered: (1) with one web client or (2) with 3 web clients. If more web clients are needed for the local CMS, additional clients by WinCC can be ordered separately.

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.



SIMOCRANE CMS Crane Management System

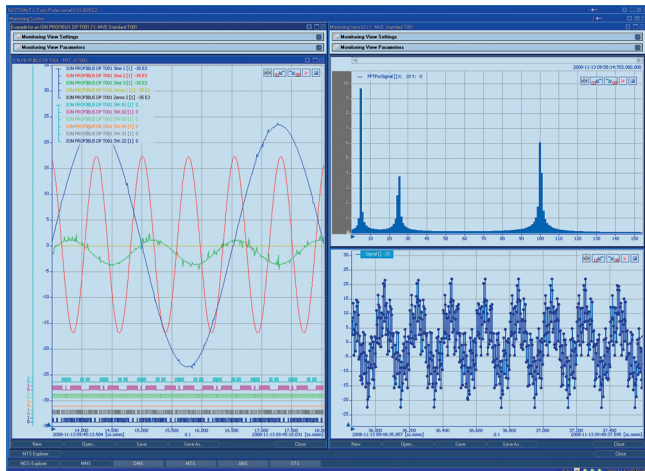
SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Option package

Function

Condition monitoring including Fast Trace function with SIPLUS CMS

An important source of information in the event of a fault is the signal profile of: speed, torque, current, and voltage, this in combination with a selection of important digital signals such as: limit switches, commands, etc.



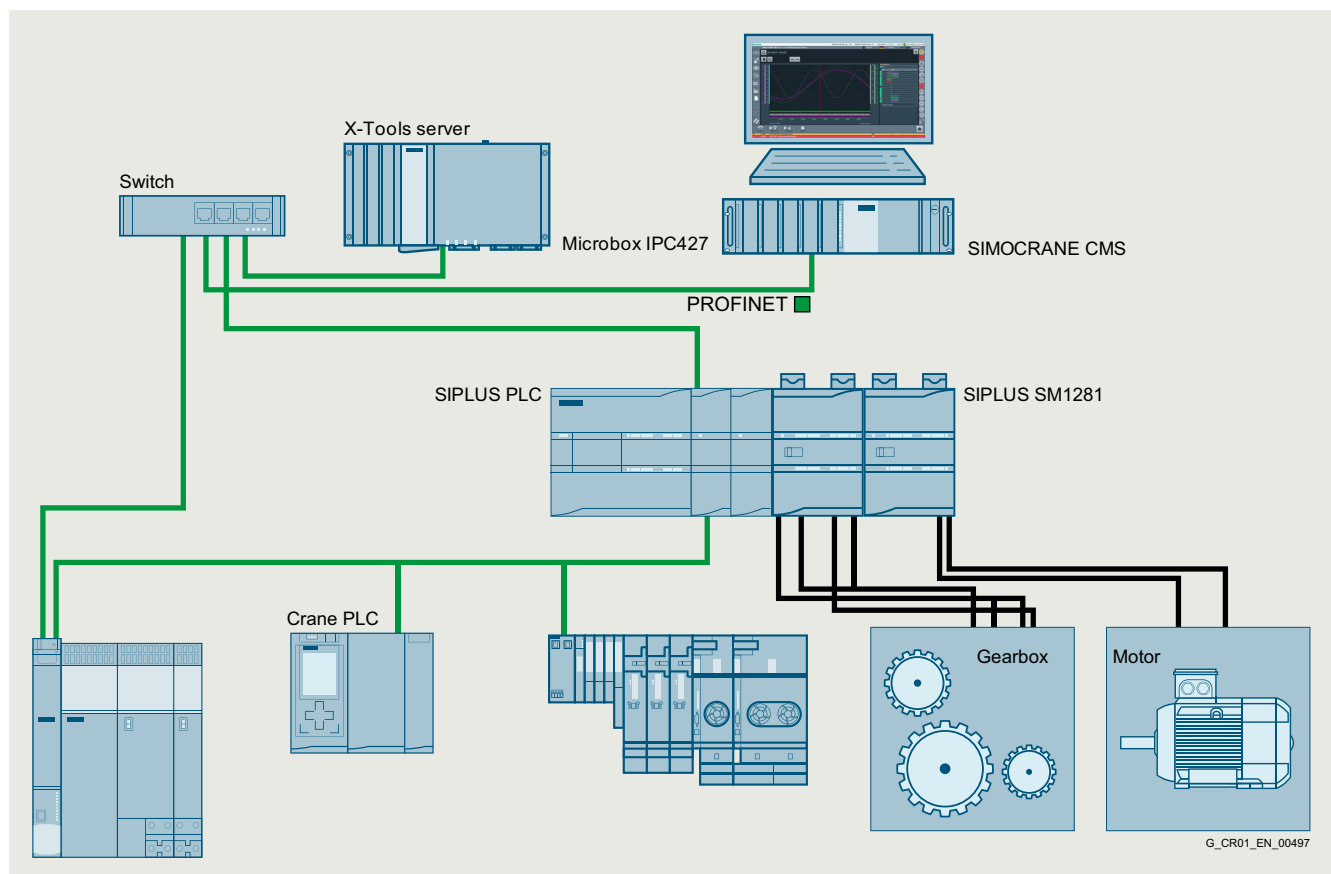
Example of screen in X-Tools for Fast Trace function

Most of these are dynamic variables. If an error occurs, the system plots the signal profile for a predefined number of signals and saves them for a period before and after the error.

SIPLUS CMS with X-Tool software used for this application is a high-performance software package. As well as recording trace data, the "X-Tools" program is included in the scope of delivery offers high-performance tools for data analysis and continuous monitoring of operating parameters. This component is integrated into the SIMOCRANE CMS user interface in such a manner that values stored in the context of an error message can be retrieved. No special training required for using this functionality.



Trace display in WinCC



Configuration of Fast Trace



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Option package

Function

IONs – Input-Output Nodes

SIPLUS CMS offers Input-Output Nodes "IONs" for acquiring measured values. These are hardware or software modules that acquire the measured values. The software nodes, IONs are included in the standard software X-Tools when this option is ordered. The hardware for IONs should be ordered separately, it is not part of the optional package in CMS Basic. Such hardware depends of the project configuration.

With the numerous hardware IONs in the SIPLUS product range, measured values can be acquired directly where they occur. This avoids incorrect interpretations which may result due to the time taken to transmit them via a controller. Sampling rates of up to 40 kHz (analog) or 50 kHz (binary) are possible using hardware IONs.

Software IONs

SIPLUS CMS records the data directly from the SIMATIC S7 and SIMOTION controllers using appropriate software IONs (Input-Output Nodes). The sampling rate using software IONs depends on the controller platform used. A "cycle-synchronized" trace can thus be achieved.

PROFIBUS ION

The PROFIBUS ION, also known as "Spy", is particularly versatile. This module can be used to record any values which pass via the PROFIBUS. The spy is a totally passive node and affects neither the bus nor the cycle time of controllers. The sampling rate that can be achieved is the PROFIBUS cycle. The PROFIBUS ION should be ordered separately.

Selection criteria

Software ION characteristics

- For an integrated SIMATIC S7 or SIMOTION complete solution
- Up to 172 channels (signals or values) per controller
- Sampling rate up to the minimum cycle time of the controller (depending on the quantity structure)
- No additional hardware components required
- Communication via existing Ethernet interfaces

PROFIBUS ION (PROFIBUS Spy) characteristics

- Independent of the controller used
- Expansion capability regarding the number of signals
- Sampling rate in the PROFIBUS cycle
- No resources required on the controller side (cycle time, memory)
- Communication over IEEE (interface required in the PC)



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Recommended hardware configuration

Configuration

Hardware configurations from the SIMATIC IPC and SIMATIC Panel PC range are recommended for SIMOCRANE CMS Lean and CMS Advanced software packages. In accordance with the recommendations, alternative computer hardware can also be used.

Please check the chosen hardware configuration in combination with CMS software components.

Recommended hardware configurations for CMS

SIMOCRANE CMS Lean or CMS Advanced for a RCMS Connector station on the crane (package/single-user station)

SIMATIC Touch PC version
e.g. SIMATIC Panel PC 677
Used as operator panel in the crane driver cabin
Suitable for 5 g shock load
Alternative solutions:
SIMATIC Panel PC 477,
SIMATIC IPC427 Microbox
Embedded hardware
(no fan, no other movable parts)

Front panel	Touch 15" or greater
Processor	Core i3, or better performance (recommended i5)
Memory configuration	Minimum 4 GB (recommended 8 GB)
Hard drive	RAID1, 2 × 500 GB, or more
Optical drives	DVD±R
Communications interfaces	Ethernet (PROFIBUS)
Other interfaces	USB
Operating system	Microsoft Windows 10 (64 bit)

SIMOCRANE CMS Lean or CMS Advanced for a RCMS Connector station on the crane (package/single-user station)

SIMATIC Rack PC version
e.g. SIMATIC Rack PC 647
Suitable for 5 g shock load
Additionally, monitor min. 1280 × 1024 dpi or widescreen format
Alternative solutions:
SIMATIC Panel PC477,
SIMATIC IPC427 Microbox
Embedded hardware
(no fan, no other movable parts)

Processor	Core i5, or better performance
Memory configuration	Minimum 4 GB (recommended 8 GB)
Hard drive	RAID1, 2 × 500 GB, or more
Optical drives	DVD±R
Communications interfaces	2 × Ethernet (PROFIBUS)
Other interfaces	USB
Operating system	Microsoft Windows 10 (64 bit)

SIMOCRANE CMS Lean or CMS Advanced for a RCMS Connector operator panel on the crane

Web client for the CMS computer
SIMATIC Touch PC version
e.g. SIMATIC Panel PC 477
Used as operator panel in the crane driver cabin or checker cabin
Suitable for 5 g shock load
Preferably diskless

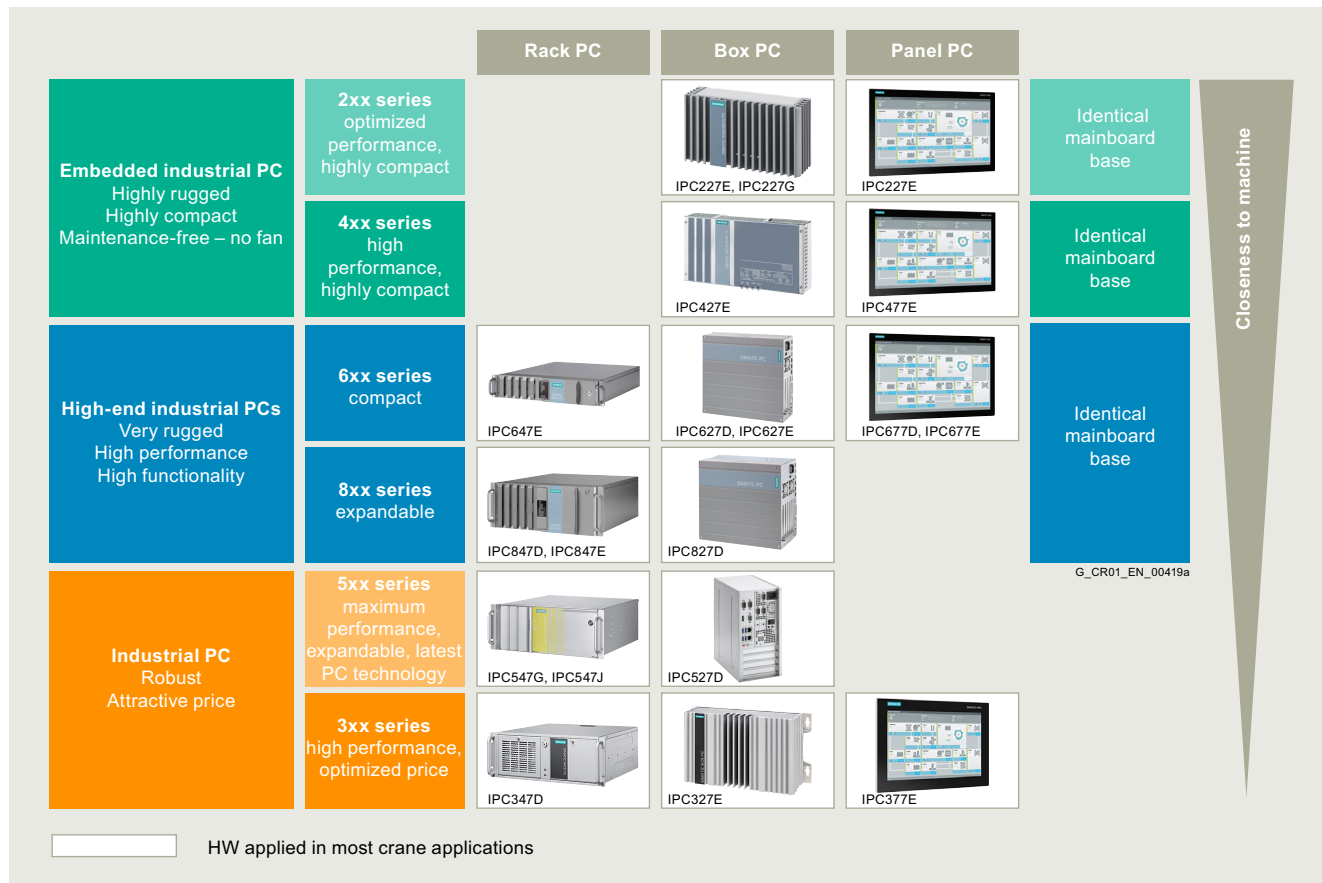
Front panel	Touch 15" or greater
Processor	Core i3, or better performance
Memory configuration	Minimum 4 GB (recommended 8 GB)
Mass storage	SSD 128 GB (Solid State Card)
Communications interfaces	Ethernet
Other interfaces	USB
Operating system	Microsoft Windows 10 (64 bit)

SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

Recommended hardware configuration

Configuration



Industrial hardware from SIMATIC family IPC and Panel PCs from Siemens used for SIMOCRANE CMS and RCMS stations on local station or/and remote stations)



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE CMS Lean

Technical specifications

Ordering packages	SIMOCRANE CMS Lean			
	Standard (single user)	Standard + web client (multi user) 1 web client	Standard + web clients (multi user) 3 web clients	Standard + Condition Monitoring (Fast Trace)
Type	6GA7214-0AA00-0AA1	6GA7214-1.A00-0AA1	6GA7214-2.A00-0AA1	6GA7214-.BA00-0AA1
Configurable presentation				
Crane types	✓	✓	✓	✓
• Industrial cranes (e.g. ladle crane)	✓	✓	✓	✓
Drives	✓	✓	✓	✓
• Hoist	✓	✓	✓	✓
• Gantry	✓	✓	✓	✓
• Trolley	✓	✓	✓	✓
• Slewing gear ¹⁾	✓	✓	✓	✓
Load suspension device	✓	✓	✓	✓
• Grab ¹⁾	✓	✓	✓	✓
• Hook ¹⁾	✓	✓	✓	✓
• Single, twin, tandem spreader	✓	✓	✓	✓
• Gripping tongs ¹⁾	✓	✓	✓	✓
Add-on modules	✓	✓	✓	✓
• Sway Control settings	✓	✓	✓	✓
• Truck Positioning settings ¹⁾	✓	✓	✓	✓
Condition monitoring				
Crane components	✓	✓	✓	✓
• Crane overview	✓	✓	✓	✓
• Boom	✓	✓	✓	✓
• Gantry drives	✓	✓	✓	✓
• Spreader	✓	✓	✓	✓
Positions	✓	✓	✓	✓
Limit switches	✓	✓	✓	✓
Weight	✓	✓	✓	✓
Drives	✓	✓	✓	✓
• Setpoint/actual values	✓	✓	✓	✓
• Brakes	✓	✓	✓	✓
Rope drums	✓	✓	✓	✓
• Safety brakes	✓	✓	✓	✓
Wind	✓	✓	✓	✓
• Rail clamps	✓	✓	✓	✓
• Interlock bolts	✓	✓	✓	✓
Interlocks	✓	✓	✓	✓
• Operation-specific	✓	✓	✓	✓
• Emergency OFF	✓	✓	✓	✓
• Access (doors)	✓	✓	✓	✓
Main power supply	✓	✓	✓	✓
Operator functions				
Counter handling	✓	✓	✓	✓
Sway Control modes ¹⁾	✓	✓	✓	✓
Truck Positioning modes ¹⁾	✓	✓	✓	✓
Error diagnostics				
Approx. 100 typical, pre-configured crane error messages ²⁾	✓	✓	✓	✓
Display of pending and historical messages	✓	✓	✓	✓
Statistical message overview ("hit list")	✓	✓	✓	✓
Symbolic error status display	✓	✓	✓	✓
Graphical assignment in the status display	✓	✓	✓	✓
Call up of supplementary information	✓	✓	✓	✓
• Documents (examples only)	✓	✓	✓	✓
• Screens (examples only)	✓	✓	✓	✓
• Circuit diagrams (examples only)	✓	✓	✓	✓
STEP 7 network and function blocks entry point (symbolic or absolute)	✓	✓	✓	✓
Process values to accompany messages (e.g. positions)	✓	✓	✓	✓
SIMATIC S7 web server (CPU diagnostics, CPU-dependent)	✓	✓	✓	✓
SIMOTION web server integration (version dependent)	✓	✓	✓	✓



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE CMS Lean

Technical specifications

Ordering packages	SIMOCRANE CMS Lean			
	Standard (single user)	Standard + web client (multi user) 1 web client	Standard + web clients (multi user) 3 web clients	Standard + Condition Monitoring (Fast Trace)
Type	6GA7214-0AA00-0AA1	6GA7214-1.A00-0AA1	6GA7214-2.A00-0AA1	6GA7214-.BA00-0AA1
Operating data acquisition				
Acquisition of cargo handling data ("Moves")	✓	✓	✓	✓
Acquisition of operating hours	✓	✓	✓	✓
Acquisition of load and maintenance counters	✓	✓	✓	✓
Acquisition of MMBF	✓	✓	✓	✓
Acquisition of setpoint/actual values for position data	✓	✓	✓	✓
Logging functions				
Report for pending messages	✓	✓	✓	✓
Report for historical messages	✓	✓	✓	✓
Cargo handling data record (moves)	✓	✓	✓	✓
Runtime meter report	✓	✓	✓	✓
Counter report	✓	✓	✓	✓
Graphical data evaluation	✓	✓	✓	✓
System features				
2048 Process Tags	✓	✓	✓	✓
512 Archive Tags	✓	✓	✓	✓
Communication channels	✓	✓	✓	✓
• SIMATIC S7 (PROFIBUS, Ethernet)	✓	✓	✓	✓
• SIMOTION (Ethernet)	✓	✓	✓	✓
• OPC	✓	✓	✓	✓
Remote crane access	–	✓	✓	–
• Multi-user capability	–	✓	✓	–
• Multi-user capability (3 clients including remote crane access 6GA7214-2.A00-0AA1)	–	–	✓	–
• Display and full remote operation	–	✓	✓	–
Replay function (Playback)	✓	✓	✓	✓
Fast Trace signal analysis ³⁾	–	–	–	✓
Microsoft SQL Server standard delivered with CMS Lean	✓	✓	✓	✓

– Not included in the scope of delivery

✓ Included in the scope of delivery

¹⁾ Configuration optional with additional screens to be integrated.

²⁾ More messages can be defined depending on the application.

³⁾ For vibration analysis extra hardware is necessary depending on the application. Please contact Application Support for more details.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE CMS Lean

Selection and ordering data

Description	Article No.
SIMOCRANE CMS V4.4 Lean with current service pack version contains: • SIMOCRANE CMS V4.4 RT (Runtime license) • SIMOCRANE CMS V4.4 Configuration • WinCC 7.5 SP2 RT, 2048 PowerTags (software installation and license) • 512 Replay Archive Tags • S7-CMS communication data blocks • CMS V4.4 standard application, configurable (WinCC project example "ready to apply", RMG, RTG, ASC, industrial cranes, CMS HMI interface) <u>Runtime languages:</u> Multi-language interface supported UNICODE • European: De, En, It, Fr, Es, Ru, etc. – standard • Asia: Ch, Ch. trad, Jp., Ko. etc. – on request <u>Scope of functions:</u> • Crane condition monitoring • Replay function (Playback) • Message system and advanced fault diagnosis • Cargo handling acquisition • Acquisition of operating hours/counter values/timers • CMS application/WinCC project with pre-defined modules; full customizable • Automatic backup of archives • WebUX remote access via internet/intranet to CMS for mobile devices (smartphones, tablets etc.)¹⁾ • Preventive maintenance module/limit monitoring list of crane components • Advanced S7 diagnosis • Integrated web server for SIMOTION, SINAMICS and S7 • Maintenance Instructions/Notes (advanced message diagnostics, cause of faults) • Microsoft SQL (full version) with long-term Archiving • STEP 7 block reference (advanced S7 diagnostics) • Jump functions to different project components (S7 block functions, pictures, manual information, Microsoft Word, Microsoft Excel, videos, etc.) • Advanced reporting, data aggregation, KPI calculation • Screens for day/night theme • Connection to RCMS (Process Historian) • Connection to Cloud²⁾ 1 WebUX web client is included in the standard package	

Description	Article No.
Single user (Standard) • Crane condition monitoring – standard, Trace min. 500 ms sample rate • Fast crane condition monitoring, Trace < 500 ms sample rate – Trace Viewer/X-Tools Professional with SW IONs S7/SIMOTION	6GA7214-0AA00-0AA1 6GA7214-0BA00-0AA1
Multi-user (WebNavigator) Standard + 1x CMS web client • Crane condition monitoring – standard, Trace min. 500 ms sample rate • Fast crane condition monitoring, Trace < 500 ms sample rate – Trace Viewer/X-Tools Professional with SW IONs S7/SIMOTION	6GA7214-1AA00-0AA1 6GA7214-1BA00-0AA1
Multi-user (WebNavigator) Standard + 3x CMS web clients • Crane condition monitoring – standard, Trace min. 500 ms sample rate • Fast crane condition monitoring, Trace < 500 ms sample rate – Trace Viewer/X-Tools Professional with SW IONs S7/SIMOTION	6GA7214-2AA00-0AA1 6GA7214-2BA00-0AA1

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More information

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

→ Product Examples → (enter search term) SIMOCRANE

Additional information about Crane Application Notes can be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

→ Application Examples → (enter search term) Crane

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

¹⁾ One license incl. in scope of delivery. Additional licenses on request.

²⁾ On request. Done via MQTT and CMS Agent. For further details please contact the hotline product support for SIMOCRANE CMS: <https://support.industry.siemens.com/cs/my/srm?lc=en-WW> Search item → SIMOCRANE CMS)



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE CMS Advanced

Technical specifications

Ordering packages	SIMOCRANE CMS Advanced		
	Standard (single user)	Standard + 3 web clients (multi user)	Standard + Condition Monitoring (Fast Trace)
Type	6GA7214-0AB00-0AA1	6GA7214-1AB00-AA1	6GA7214-AB00-1AA1
Configurable presentation			
Crane types	✓	✓	✓
• STS ¹⁾	✓	✓	✓
• RMG/RTG	✓	✓	✓
Drives	✓	✓	✓
• Hoist	✓	✓	✓
• Gantry	✓	✓	✓
• Trolley	✓	✓	✓
• Slewing gear ²⁾	✓	✓	✓
Load suspension device	✓	✓	✓
• Grab ²⁾	✓	✓	✓
• Hook ²⁾	✓	✓	✓
• Single, twin, tandem spreader	✓	✓	✓
• Gripping tongs ²⁾	✓	✓	✓
Add-on modules	✓	✓	✓
• Sway Control settings	✓	✓	✓
• Truck Positioning settings ²⁾	✓	✓	✓
Condition monitoring			
Crane components	✓	✓	✓
• Crane overview	✓	✓	✓
• Boom	✓	✓	✓
• Gantry drives	✓	✓	✓
• Spreader	✓	✓	✓
Positions	✓	✓	✓
Limit switches	✓	✓	✓
Weight	✓	✓	✓
Drives	✓	✓	✓
• Setpoint/actual values	✓	✓	✓
• Brakes	✓	✓	✓
Rope drums	✓	✓	✓
• Safety brakes	✓	✓	✓
Wind	✓	✓	✓
• Rail clamps	✓	✓	✓
• Interlock bolts	✓	✓	✓
Interlocks ²⁾	✓	✓	✓
• Operation-specific	✓	✓	✓
• Emergency OFF	✓	✓	✓
• Access (doors)	✓	✓	✓
Main power supply	✓	✓	✓
Operator functions			
Counter handling	✓	✓	✓
Sway Control modes ²⁾	✓	✓	✓
Truck Positioning modes ²⁾	✓	✓	✓
Error diagnostics			
Approx. 100 typical, pre-configured crane error messages ³⁾	✓	✓	✓
Display of pending and historical messages	✓	✓	✓
Statistical message overview ("hit list")	✓	✓	✓
Symbolic error status display	✓	✓	✓
Graphical assignment in the status display	✓	✓	✓
Call up of supplementary information	✓	✓	✓
• Documents (examples only)	✓	✓	✓
• Screens (examples only)	✓	✓	✓
• Circuit diagrams (examples only)	✓	✓	✓
STEP 7 network and function blocks entry point (symbolic or absolute)	✓	✓	✓
Process values to accompany messages (e.g. positions)	✓	✓	✓
SIMATIC S7 web server (CPU diagnostics, CPU-dependent)	✓	✓	✓
SIMOTION web server integration (version dependent)	✓	✓	✓



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE CMS Advanced

Technical specifications

Ordering packages	SIMOCRANE CMS Advanced		
	Standard (single user)	Standard + 3 web clients (multi user)	Standard + Condition Monitoring (Fast Trace)
Type	6GA7214-0AB00-0AA1	6GA7214-1AB00-AA1	6GA7214-AB00-1AA1
Operating data acquisition			
Acquisition of cargo handling data ("Moves")	✓	✓	✓
Acquisition of operating hours	✓	✓	✓
Acquisition of load and maintenance counters	✓	✓	✓
Acquisition of MMBF	✓	✓	✓
Acquisition of setpoint/actual values for position data	✓	✓	✓
Logging functions			
Report for pending messages	✓	✓	✓
Report for historical messages	✓	✓	✓
Cargo handling data record (moves)	✓	✓	✓
Runtime meter report	✓	✓	✓
Counter report	✓	✓	✓
Graphical data evaluation	✓	✓	✓
System features			
8000 Process Tags	✓	✓	✓
1500 Archive Tags	✓	✓	✓
Communication channels	✓	✓	✓
• SIMATIC S7 (PROFIBUS, Ethernet)	✓	✓	✓
• SIMOTION (Ethernet)	✓	✓	✓
• OPC	✓	✓	✓
Remote crane access	–	✓	✓
• Multi-user capability	–	✓	–
• Display and full remote operation	–	✓	–
Replay function (Playback)	✓	✓	✓
Fast Trace signal analysis ⁴⁾	–	–	✓
Microsoft SQL Server standard delivered with CMS Advanced	✓	✓	✓

– Not included in the scope of delivery

✓ Included in the scope of delivery

¹⁾ Standard delivered with CMS Advanced application. Adaptable for other crane types by adjusting the configuration.

²⁾ The configuration is optional with additional screens to be integrated.

³⁾ More messages can be defined depending on the application.

⁴⁾ For vibration analysis extra hardware is necessary depending on the application. Please contact Application Support for more details.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE CMS Advanced

Selection and ordering data

Description	Article No.
SIMOCRANE CMS V4.4 Advanced with current service pack version contains: • SIMOCRANE CMS V4.4 RT (Runtime license) • SIMOCRANE CMS V4.4 Configuration • WinCC 7.5 SP2 RT, 2048 PowerTags (software installation and license) • 512 Replay Archive Tags • S7-CMS communication data blocks • CMS V4.4 standard application, configurable (WinCC project example "ready to apply", RMG, RTG, ASC, industrial cranes, CMS HMI interface) <u>Runtime languages:</u> Multi-language interface supported UNICODE • European: De, En, It, Fr, Es, Ru, etc. – standard • Asia: Ch, Ch. trad, Jp., Ko. etc. – on request <u>Scope of functions:</u> • Crane condition monitoring • Replay function (Playback) • Message system and advanced fault diagnosis • Cargo handling acquisition • Acquisition of operating hours/counter values/timers • CMS application/WinCC project with pre-defined modules; full customizable • Automatic backup of archives • WebUX remote access via internet/intranet to CMS for mobile devices (smartphones, tablets etc.)¹⁾ • Preventive maintenance module/limit monitoring list of crane components • Advanced S7 diagnosis • Integrated web server for SIMOTION, SINAMICS and S7 • Maintenance Instructions/Notes (advanced message diagnostics, cause of faults) • Microsoft SQL (full version) with long-term Archiving • STEP 7 block reference (advanced S7 diagnostics) • Jump functions to different project components (S7 block functions, pictures, manual information, Microsoft Word, Microsoft Excel, videos, etc.) • Advanced reporting, data aggregation, KPI calculation • Screens for day/night theme • Connection to RCMS (Process Historian) • Connection to Cloud²⁾ 1 WebUX web client is included in the standard package	

Description	Article No.
Single user (Standard) • Crane condition monitoring – standard, Trace min. 500 ms sample rate • Fast crane condition monitoring, Trace < 500 ms sample rate – Trace Viewer/X-Tools Professional with SW IONs S7/SIMOTION	6GA7214-0AB00-0AA1 6GA7214-0AB00-1AA1
Multi-user (WebNavigator) Standard + 1x CMS web client • Crane condition monitoring – standard, Trace min. 500 ms sample rate • Fast crane condition monitoring, Trace < 500 ms sample rate – Trace Viewer/X-Tools Professional with SW IONs S7/SIMOTION	6GA7214-1AA00-0AA1 6GA7214-1BA00-0AA1
Multi-user (WebNavigator) Standard + 3x CMS web clients • Crane condition monitoring – standard, Trace min. 500 ms sample rate • Fast crane condition monitoring, Trace < 500 ms sample rate – Trace Viewer/X-Tools Professional with SW IONs S7/SIMOTION	6GA7214-1AB00-0AA1 6GA7214-1AB00-1AA1

More information

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<https://support.industry.siemens.com/cs/ww/en/ps/20087>

→ Product Examples → (enter search term) SIMOCRANE

Additional information about Crane Application Notes can be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

→ Application Examples → (enter search term) Crane

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

¹⁾ One license incl. in scope of delivery. Additional licenses on request.

²⁾ On request. Done via MQTT and CMS Agent. For further details please contact the hotline product support for SIMOCRANE CMS: <https://support.industry.siemens.com/cs/my/srm?lc=en-WW>
 Search item → SIMOCRANE CMS)



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE RCMS Connector

Technical specifications

Ordering package	SIMOCRANE RCMS Connector
Type	Standard (single user) 6GA7215-1AA00-0AA01
Configurable presentation	
Crane types	✓
• STS ¹⁾	✓
• RMG/RTG ¹⁾	✓
• Industrial cranes (e.g. ladle crane) ¹⁾	✓
Drives	✓
• Hoist	✓
• Gantry	✓
• Trolley	✓
• Slewing gear ²⁾	✓
Load suspension device²⁾	✓
• Grab ²⁾	✓
• Hook ²⁾	✓
• Single, twin, tandem spreader	✓
• Gripping tongs ²⁾	✓
Add-on modules ²⁾	✓
• Sway Control settings ²⁾	✓
• Truck Positioning settings ²⁾	✓
Condition monitoring	
Crane components ²⁾	✓
• Crane overview ²⁾	✓
• Boom ²⁾	✓
• Gantry drives ²⁾	✓
• Spreader ²⁾	✓
• Positions ²⁾	✓
Limit switches ²⁾	✓
Weight ²⁾	✓
Drives ²⁾	✓
• Setpoint/actual values ²⁾	✓
• Brakes ²⁾	✓
Rope drums ²⁾	✓
• Safety brakes ²⁾	✓
Wind ²⁾	✓
• Rail clamps ²⁾	✓
• Interlock bolts ²⁾	✓
Interlocks ²⁾	✓
• Operation-specific ²⁾	✓
• Emergency OFF ²⁾	✓
• Access (doors) ²⁾	✓
Main power supply ²⁾	✓
Operator functions	
Counter handling	✓
Sway Control modes ²⁾	✓
Truck Positioning modes	✓
Error diagnostics	
Approx. 100 typical, pre-configured crane error messages ³⁾	✓
Display of pending and historical messages	✓
Statistical message overview ("hit list")	✓
Symbolic error status display)	–
Graphical assignment in the status display	–
Call up of supplementary information	–
• Documents (examples only)	–
• Screens (examples only)	–
• Circuit diagrams (examples only)	–
STEP 7 network and function block entry point (symbolic or absolute)	–
Process values to accompany messages (e.g. positions)	–
SIMATIC S7 web server (CPU diagnostics; CPU-dependent)	–
SIMOTION web server integration (version dependent)	–



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE RCMS Connector

Technical specifications

	Ordering package	SIMOCRANE RCMS Connector
	Type	Standard (single user) 6GA7215-1AA00-0AA01
Operating data acquisition		
Acquisition of cargo handling data ("Moves")		✓
Acquisition of operating hours		✓
Acquisition of load and maintenance counters		✓
Acquisition of MMBF		✓
Acquisition of setpoint/actual values for position data		✓
Logging functions		
Report for pending messages		✓
Report for historical messages		✓
Cargo handling data record (moves)		✓
Runtime meter report ²⁾		✓
Counter report ²⁾		✓
Graphical data evaluation		–
System features		
512 Process Tags		✓
512 Archive Tags		✓
Communication channels		✓
• SIMATIC S7 (PROFIBUS, Ethernet)		✓
• SIMOTION (Ethernet)		✓
• OPC		✓
Remote crane access		–
• Display and full remote operation		–
Replay function (Playback)		–
Fast Trace signal analysis ⁴⁾		–
Microsoft SQL Server standard delivered with RCMS Connector		✓

– Not included in the scope of delivery

✓ Included in the scope of delivery

¹⁾ Compatible with all types of cranes are without any special visualization.

²⁾ The configuration is optional with some basic screens.

³⁾ More messages can be defined depending on the application.

⁴⁾ For vibration analysis extra hardware is necessary depending on the application. Please contact the Application Support for more details.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS Lean, CMS Advanced and RCMS Connector

SIMOCRANE RCMS Connector

Selection and ordering data

Description	Article No.
SIMOCRANE RCMS V4.4 Connector with current service pack version contains • SIMOCRANE RCMS V4.4 RT (Runtime license) • SIMOCRANE RCMS V4.4 Configuration • WinCC 7.5 SP2 RT, 512 PowerTags (software installation and license) <u>Runtime and configuration languages:</u> Multi-language interface supported UNICODE • European: De, En, It, Fr, Es, Ru, etc. – standard • ASIA: Ch, Ch. traditional, Jp, Ko, etc. – on request <u>Scope of functions:</u> • S7-CMS communication data blocks • Connection of non-Siemens CMS to RCMS • CMS V4.4 RCMS Connector application • Connection to RCMS (Process Historian)	6GA7215-1AA00-0AA1

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

→ Product Examples → (enter search term) SIMOCRANE

Additional information about Crane Application Notes can be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

→ Application Examples → (enter search term) Crane

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

Training

Siemens Cranes offers crane-specific training courses:

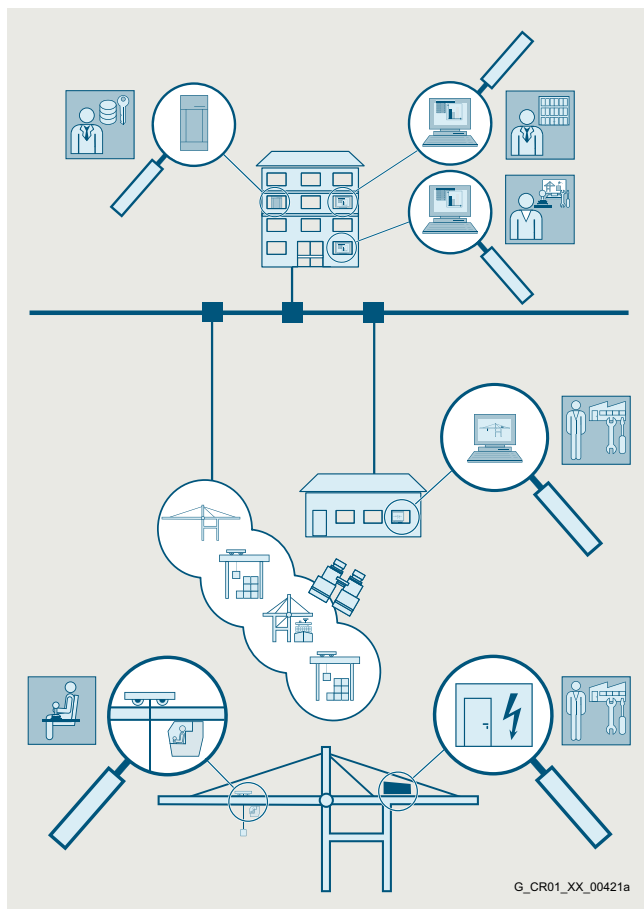
www.siemens.com/simocrane-learning.

SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Overview

RCMS single station and server-client architectures – central and remote CMS configurations



Example of architecture for local and remote crane management system based on SIMOCRANE CMS/RCMS product

Larger plants/terminals typically have a control room with one or more stations, used to monitor the entire plant/terminal. The data from all subordinate local CMS stations is collected and evaluated in the control room.

In combination with a multi-user system on the crane, remote access to the local CMS stations is also possible here. RCMS Clients can be also accessed from RCOS control desks.

Depending on the number of lower-level CMS stations and the volume of data which is to be recorded and archived for the entire plant/terminal, one or more servers will be required. In this case, the RCMS server records the data for the local CMS stations of the crane and then makes it available to the central CMS operator stations, called RCMS clients too.

The RCMS server is used as an application server for central software components such as for maintenance planning, down-time monitoring, advanced reporting etc. Also storing crane data in redundant server system.

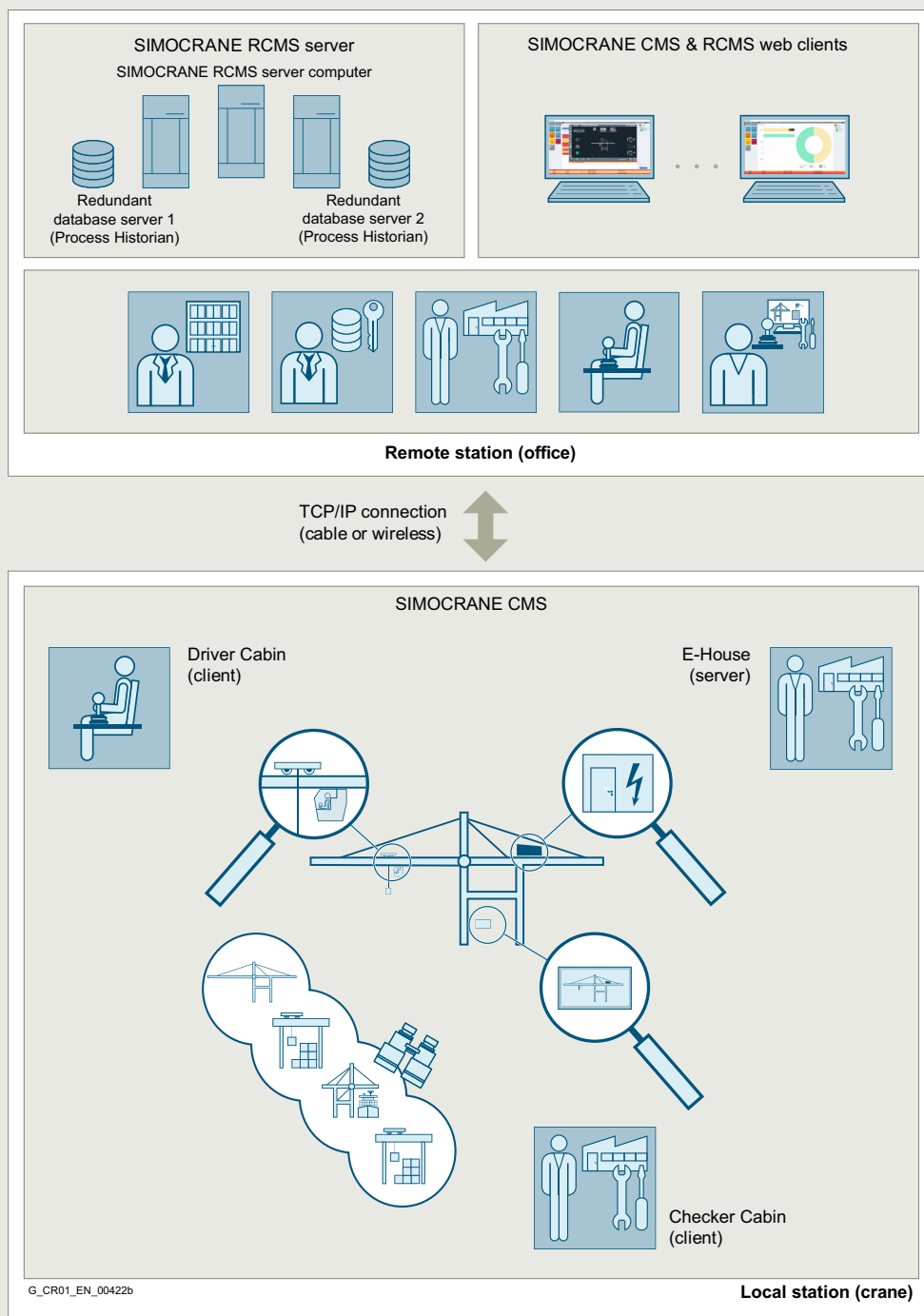
Customer requirements:

- Acquisition of productivity data and archiving for each crane
- Alarm/event system with archiving for each crane
- Error logs and productivity data logs
- Visualization of the crane and individual components
- Replayed data of the crane (Playback function)
- CMS in the electrical room
- Operator panel installed in the cabin
- Remote crane access
- A central server must record and archive the data from all cranes with long-term archiving using SQL database
- A central server might have redundant SQL database servers
- Graphical evaluations must be possible in the control center about productivity, error statistics and availability

Solution of configuration using SIMOCRANE CMS and RCMS configuration:

- SIMOCRANE CMS (Lean with 3x web clients– WebNavigator/WebUX)
Article No. **6GA7214-2AA00-0AA1**
on each crane
- SIMOCRANE CMS (Advanced with 3x web clients – WebNavigator/WebUX)
Article No. **6GA7214-1AB00-0AA1**
on each crane
- SIMOCRANE RCMS server with single central database station (with 1x RCMS web client)
Article No. **6GA7215-0AA00-0AA1**
- SIMOCRANE RCMS server with redundant central database stations (with 1x RCMS web client)
Article No. **6GA7215-0AA00-0AB1**
- SIMOCRANE RCMS 3x web clients (with 1, 3, 5, 10, 25 clients, amount alternatives)
Article No. **6GA7215-0AB00-0BA1**
- SIMOCRANE RCMS Connector (without web clients)
Article No. **6GA7215-1AA00-0AA1**

Overview



Example for solution configuration for a STS crane using SIMOCRANE CMS and RCMS

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

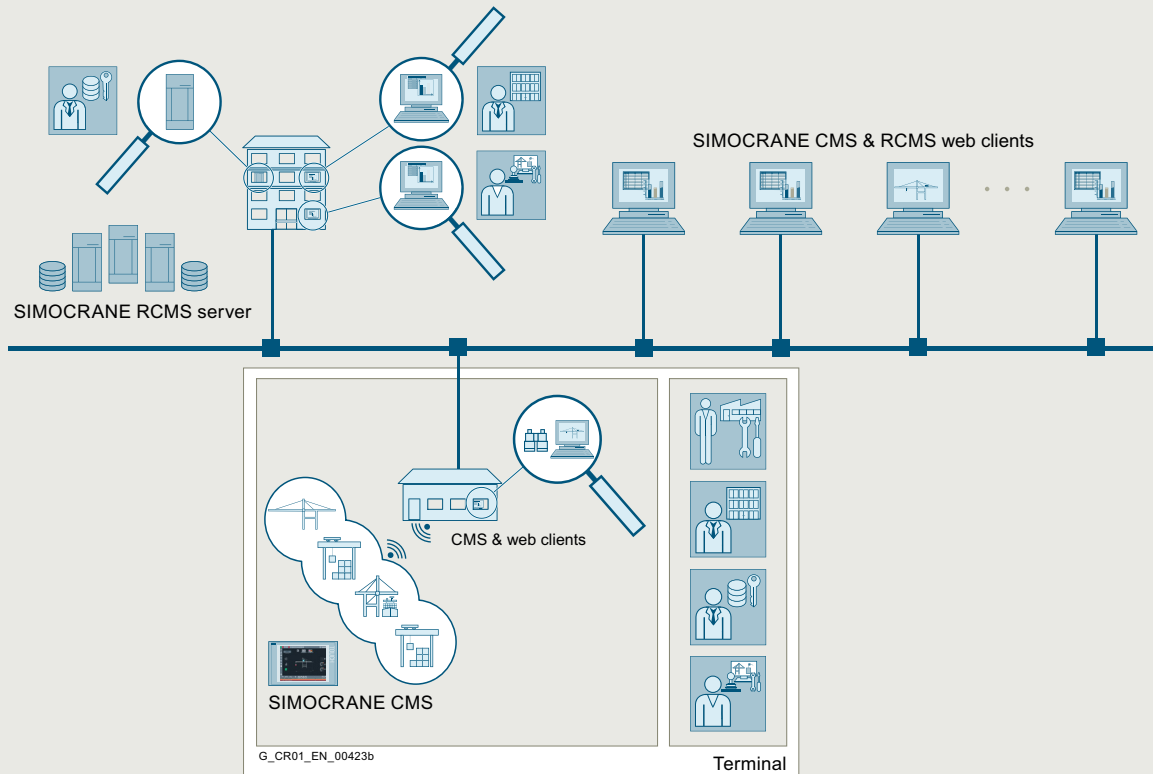
Remark:

The SIMOCRANE RCMS is standard package includes one RCMS web client with full access to the screens and all components of the RCMS web server. Additional web clients can be added by buying extra web clients, for example 3, 5, 10 and 25 web clients can be connected to one RCMS single station. All web clients work in parallel, accessing the information at the same time. Different configurations using web clients can also be added based on customer requirements. RCMS web clients are web-based, installation is not needed. All the CMS data can be accessed by RCMS web clients.

SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Overview



Typical configuration for SIMOCRANE RCMS station with redundant database servers and web clients

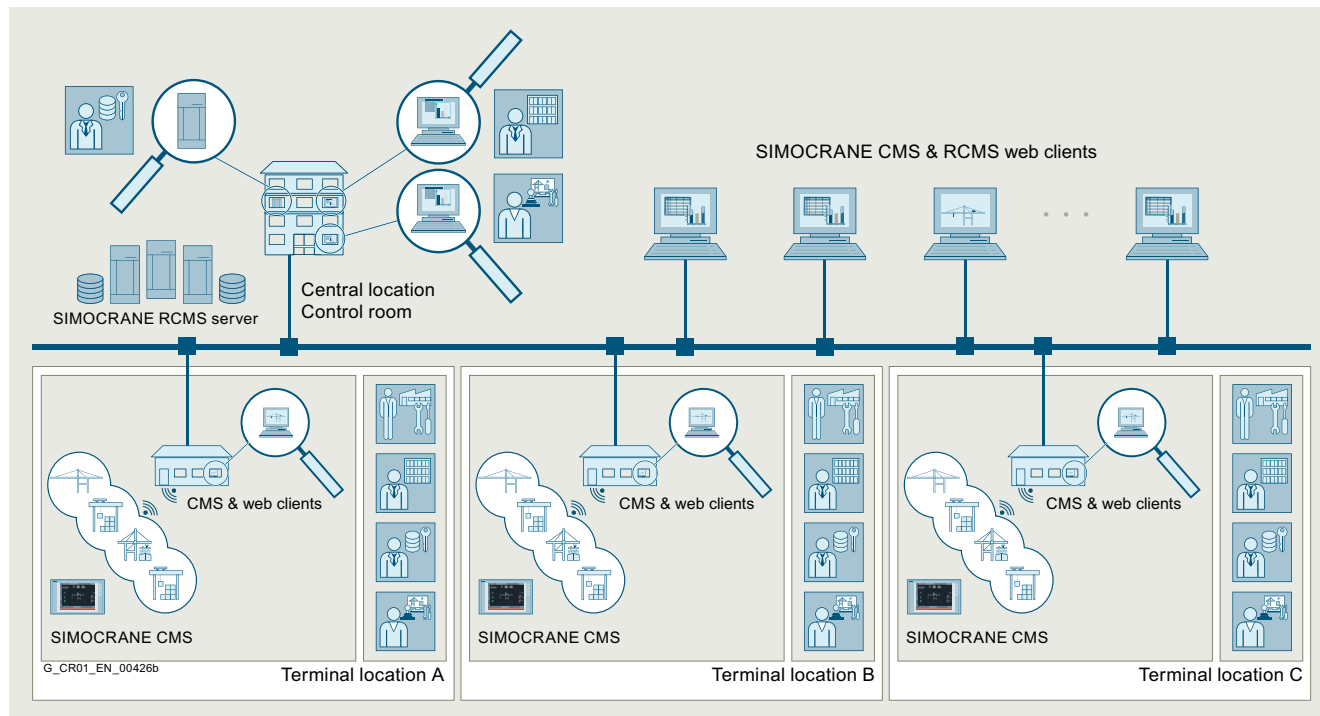


Overview

Control Room solutions using SIMOCRANE CMS and RCMS

Using the standard package in combination with optional packages of SIMOCRANE CMS and RCMS products, control room solutions can be provided. Such solutions are based on software and hardware packages in different combinations depending on customer requirements related to the number of client stations being used for data access, number of RCMS servers used in the data center mainframe architecture systems, number of web clients with simultaneous access to different Microsoft SQL databases in SIMOCRANE CMS stations or RCMS servers, etc.

For control room solutions, hardware systems based on SIMATIC IPC and Panel PC with multi-touch functionality are integrated together with SIMOCRANE CMS and RCMS software solutions. Siemens can provide different solutions for state-of-the-art control room solutions, using robust industrial hardware systems with large data storage capabilities, mirroring RAID controllers, back-up systems, redundant hardware equipment for achieving highest system availability for any harsh industrial conditions.



Example of control room solution for connection of different SIMOCRANE CMS and RCMS stations distributed through different locations

SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Application

- Large harbor crane systems, such as seen on container terminals

In addition to the diagnostic possibilities on the individual crane, productivity data acquisition and reporting play a decisive role. The availability of acquired cargo handling data, downtimes as

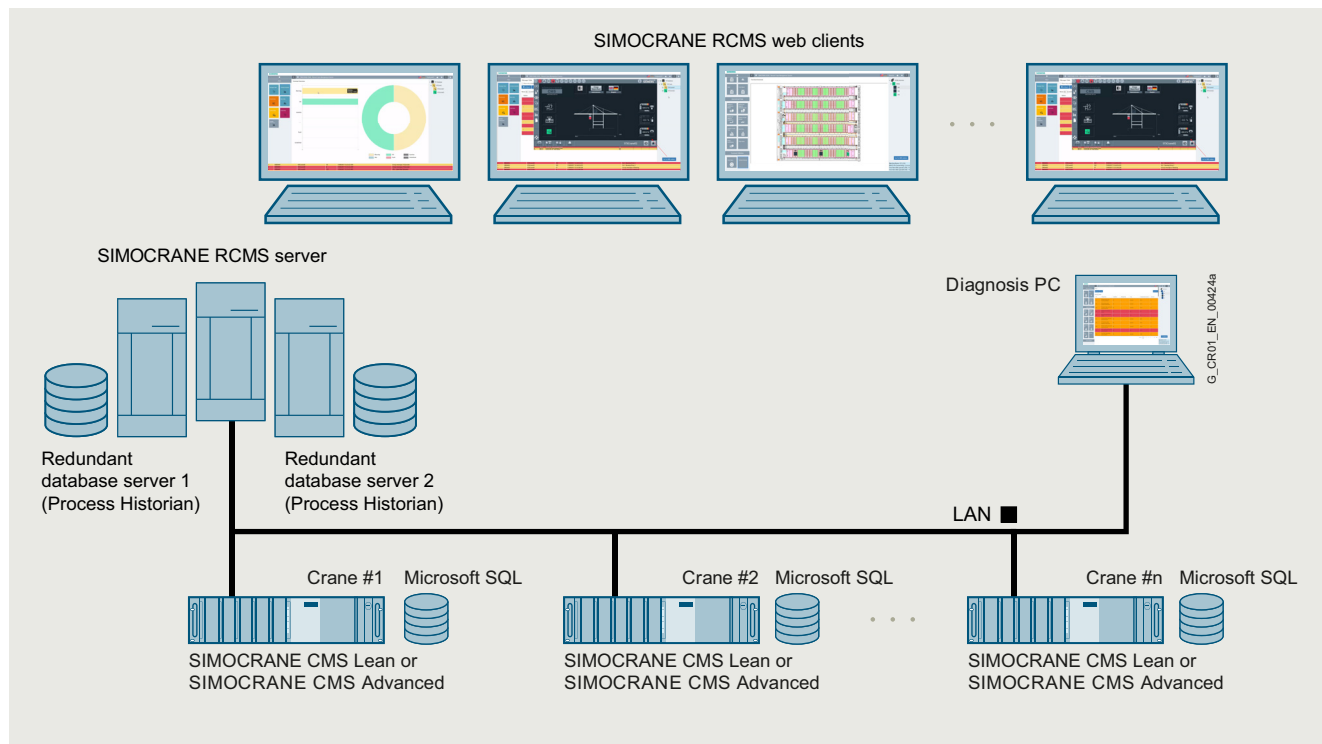
well as performance data are important aspects regarding crane terminal operation and data mining.

Examples

- Ship to shore cranes and grab ship unloaders (bulk goods) in the harbor area

Design

SIMOCRANE RCMS architecture



Topology of SIMOCRANE RCMS standard (with redundant database option) package (one web client included in the standard package)

Remarks:

SIMOCRANE RCMS is delivered standard with one RCMS web client. Additional web clients can be ordered separate, to a maximum of 25 web clients.

The customer has maximum flexibility regarding the access of information from each RCMS station. When needed, additional RCMS clients can be added or control room solution can be built in order to access the information from RCMS Microsoft SQL database. RCMS is equipped with a Process Historian database server (Microsoft SQL database) included standard in the RCMS package. This includes data storage with long-term archive capabilities (Automatic Failover Redundancy) integrated into the SCADA WinCC system.

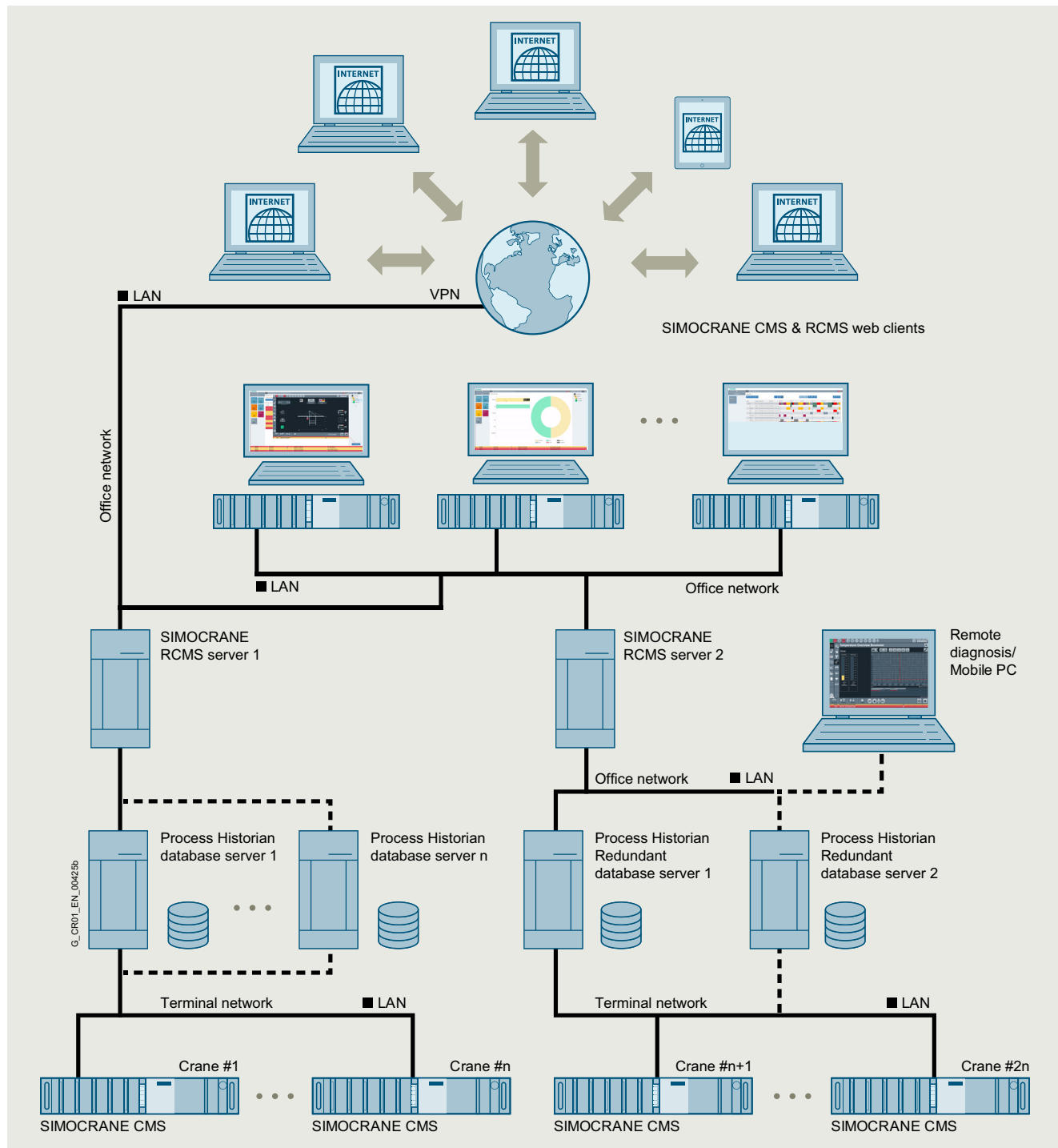
Design

RCMS server – single or redundant Process Historian architectures

With this configuration, the server is also the central operator station with access to the lower-level CMS systems or the server is connected to multiple clients.

Multiple RCMS server stations can be used in order to distribute the information to different RCMS client systems. The RCMS clients are web clients, which can be used without platform dependent. CMS clients data are stored on redundant Process Historian database servers to prevent any data loss. This way, the up time of the RCMS is increased.

Using standard internet or intranet web-based connections, fat or thin clients can be connected to different terminal access points in order to access the data from RCMS server and Process Historian (Microsoft SQL) database, long-term archived server. These web-based clients can be mobile devices as PC tablets or smart phones using modern mobile technologies for data access in intranet or/and internet environment. The connection via internet/intranet is encrypted in order to provide secure connections from the mobile devices.



RCMS multiple server-clients configuration architecture

SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Function

RCMS server and Process Historian database

The central CMS functions concern the operation of CMS operator stations in central control rooms. In the context of harbor cranes, the term "RCMS" (Remote CMS) has become established.

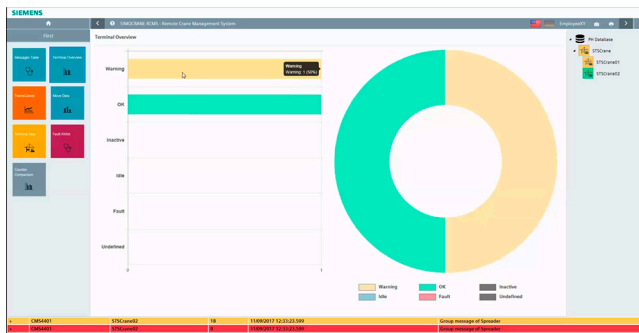
As well as offering remote access to the CMS stations of the cranes, the central RCMS offers additional functions such as:

- Plant-wide crane overview
- Remote access to individual cranes
- Central data acquisition and analytics
- Message overview of all cranes with filtering and crane selection for comparison functions
- Availability overview and Gantt charts
- Performance evaluation, KPI calculations, advanced reporting, dashboards
- Replay/Playback from RCMS on each CMS using web client functionality
- Long-term archiving in Process Historian (Microsoft SQL) database on RCMS
- Database redundancy
- Cargo handling acquisition
- Acquisition of operating hours /counter values/timers/moves/MMBF

Plant-wide crane overview

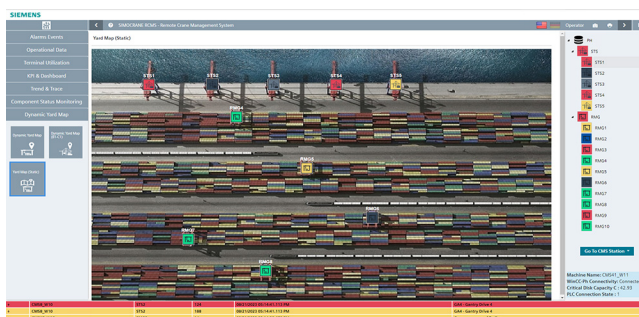
The RCMS focuses on the entire plant, not the single crane. Cranes of the same type can be compared, and weak points therefore be detected. The determination of KPIs (Key Performance Indicators) and overviews of operating modes, downtimes etc. plays a key role at this point.

Given the volume of information that must be displayed, we would recommend using large screens or even multi-screen mode. The system also supports the use of the large screens, commonly used in the control rooms of large industrial plants or control centers.



Example of a screen for SIMOCRANE RCMS – statistical overview

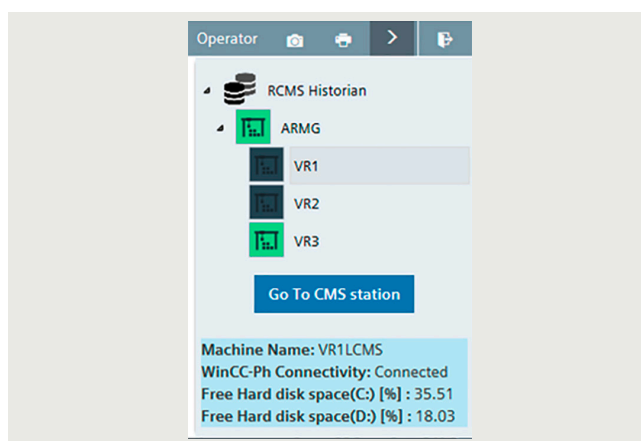
An alternative display is the hierarchic view as a Node Tree. The different types of crane are displayed here in groups. The status of the individual cranes is visualized using different colors.



Example of a screen for RCMS – Node Tree Manager and cartographical overview

Remote access to individual cranes

In the crane overview node tree, a crane can be selected and the CMS interface of selected crane can be displayed via remote access. Full access of the crane is possible from RCMS via Web-Navigator option on CMS station.

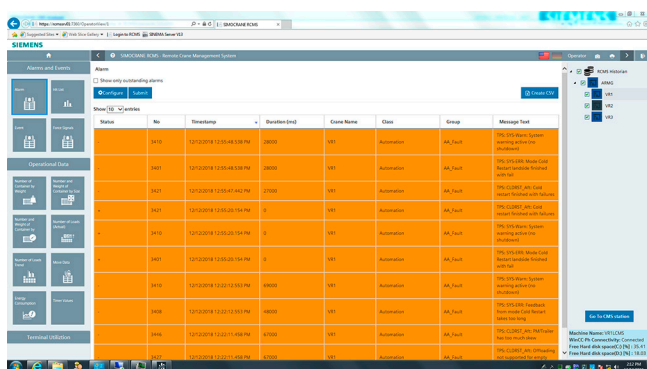


Example of a Node Tree and integrated remote access of CMS from RCMS ("Go To CMS station" button)

Function

Central data acquisition and analytics

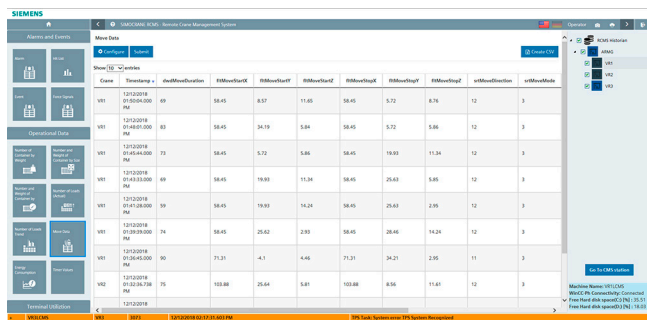
The cargo handling data, error messages, and counter values acquired for each crane are synchronized with the RCMS server. This server makes the consolidated data for all assigned cranes available for further evaluations. All data from different cranes (CMS stations), e.g. operational data, tags, messages, are sent to the remote CMS. The remote CMS (RCMS) is also considered as "central station", which means the data from all cranes and terminal systems are collected to a central station. The RCMS has the Process Historian (Microsoft SQL) database with long-term archive integrated with CMS station. This means the data is stored for long term in the Process Historian (Microsoft SQL) database. The configuration for segments and data backup is to be configured at the beginning of the project for RCMS configuration. The system can be configured with Redundant Process Historian (Microsoft SQL) database. For more details please refer to the CMS manuals and WinCC information on the support site. On the RCMS a central fault message system is used to perform statistics and filtering of fault messages for each crane in the terminal. Statistical analysis for all messages can be performed in the message window on RCMS station. Comprehensive message evaluation can be performed as well in the WinCC message system in combination with CMS and RCMS message tables from Microsoft SQL.



SIMOCRANE RCMS – message list for selected cranes

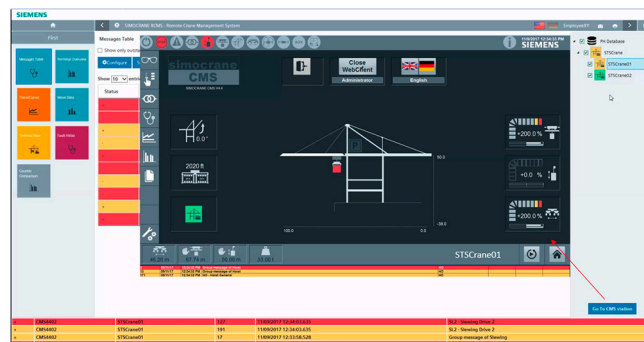


SIMOCRANE RCMS – message hit list for selected cranes



Crane operating data on SIMOCRANE RCMS – list with moves per crane

Using the Node Tree Manager structure on the RCMS, information about operational data for each crane can be obtained when clicking in the Node Tree on the required crane. An overview with the most important data is shown in a tabular format including selection and filtering. Data export can be performed on each individual crane or multiple cranes via Node Tree Manager.



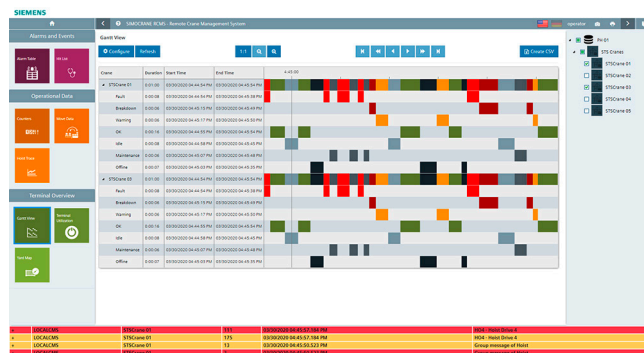
Example of integrated remote access of CMS into RCMS

Each crane can be accessed in parallel remotely from RCMS in order to visualize the screens from each local CMS. Full access to screens as well full commands can be obtained from the RCMS via WebNavigator option installed on each CMS. Several sessions in parallel can be started from RCMS and parallel statistical data overview can be performed from RCMS individually for each CMS. The sessions can be started at the same time in different sessions from RCMS and CMS – when the operator is operating the crane from a local CMS, different information can be visualized remotely on the RCMS. Parallel session number is limited with WebNavigator license number and hardware capabilities.

Availability overview and Gantt charts

The CMS continuously logs the operating states of the crane. This enables the operator to determine the availability of the cranes at any time and to detect weak points. The information is visualized in a Gantt chart with information about statuses of the cranes on the RCMS station. The overview of the Gantt chart can be visualized for each crane or for more crane sin parallel. In this way data from different cranes can be easily compared and analyzed.

The crane availability can be visualized and extra information can be obtained by clicking on each crane from Node Tree. Different time intervals can be chosen in order to visualize the information from the past at any desired time interval.



Gantt chart of cranes availability

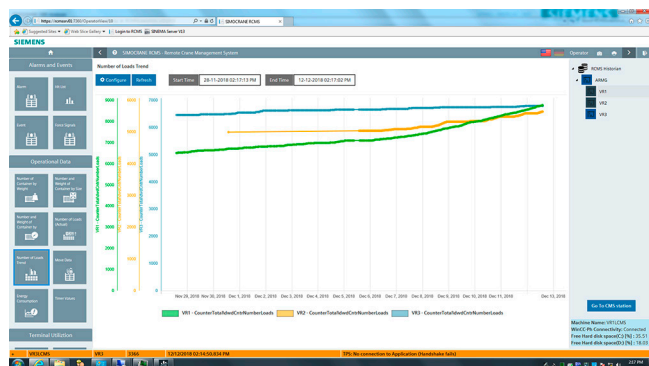
SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Function

Performance evaluations

In addition to the operating states, the system also acquires counter values. This allows the KPIs (Key Performance Indicators) to be determined, which provide information regarding the reliability and performance of a crane.



Trends representation in RCMS

Crane	Start/Stop	Start/Stop	Start/Stop	Start/Stop	Start/Stop	Start/Stop	Start/Stop	Start/Stop	Start/Stop
V01	12/10/2019 00:17:57.326 PM	734	345	584	10	0	20	19	902
V02	12/10/2019 00:17:57.326 PM	698	328	945	10	0	36	22	918
V03	12/10/2019 00:17:57.326 PM	903	457	1229	11	0	28	26	1096
V04	12/10/2019 00:17:57.326 PM	734	345	584	10	0	20	19	902
V05	12/10/2019 00:17:57.326 PM	698	328	945	10	0	36	22	918
V06	12/10/2019 00:17:57.326 PM	903	457	1229	11	0	28	26	1096
V07	12/10/2019 00:17:57.326 PM	734	345	584	10	0	20	19	902
V08	12/10/2019 00:17:57.326 PM	698	328	945	10	0	36	22	918
V09	12/10/2019 00:17:57.326 PM	903	457	1229	11	0	28	26	1096

Timer values table in SIMOCRANE RCMS

In addition to a number of predefined calculation algorithms, plant-specific calculation formulas can be stored. The data can be in different ways represented (tabular form, graphics in several scale axes, filtering of data, etc.)

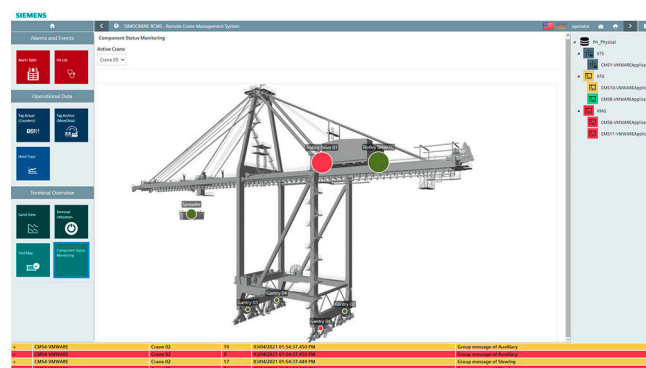
Crane Name	Tag Name	Value	Latest Timestamp
V01	LoadCounterLoad	171	12/10/2019 00:16:02.058 PM
V02	LoadCounterLoad	8707	12/10/2019 00:16:02.058 PM
V03	LoadCounterLoad	10885	12/10/2019 00:16:02.058 PM
V04	LoadCounterLoad	86	12/10/2019 00:16:02.058 PM
V05	LoadCounterLoad	5440	12/10/2019 00:16:02.058 PM
V06	LoadCounterLoad	8602	12/10/2019 00:16:02.058 PM
V07	LoadCounterLoad	111	12/10/2019 00:16:02.058 PM
V08	LoadCounterLoad	6795	12/10/2019 00:16:02.058 PM
V09	LoadCounterLoad	11747.75	12/10/2019 00:16:02.058 PM

Table representation of the number of loads for each crane

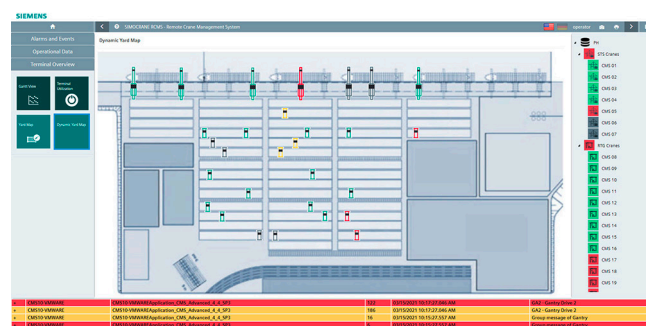
When needed, the data and KPIs can be exported to a tabular form as a CSV or PDF format. Data can be filtered, or export of all data can be chosen. This can be done for each representation and defined KPI formula and algorithm. The KPI algorithms and calculation formulas can be changed any time the operator needs to add or to change the calculation.

No.	Timestamp	Duration	Crane Name	Class	Group	Message Text
1	12/10/2019 00:16:02.058 PM	1000	V01	Load	Load	Load Counter Load
2	12/10/2019 00:16:02.058 PM	1000	V02	Load	Load	Load Counter Load
3	12/10/2019 00:16:02.058 PM	1000	V03	Load	Load	Load Counter Load
4	12/10/2019 00:16:02.058 PM	1000	V04	Load	Load	Load Counter Load
5	12/10/2019 00:16:02.058 PM	1000	V05	Load	Load	Load Counter Load
6	12/10/2019 00:16:02.058 PM	1000	V06	Load	Load	Load Counter Load
7	12/10/2019 00:16:02.058 PM	1000	V07	Load	Load	Load Counter Load
8	12/10/2019 00:16:02.058 PM	1000	V08	Load	Load	Load Counter Load
9	12/10/2019 00:16:02.058 PM	1000	V09	Load	Load	Load Counter Load

SIMOCRANE RCMS – event list view of the selected cranes



Crane components status monitoring is a feature in RCMS which can be used to generate new screens with pictures that can be selected by user (also 3D pictures) with status of defined components for cranes, or crane components, monitoring. In this way the engineer can define freely different components on each crane and represent them as pictograms on each picture. When status is changed, due to parameters on PLC level or drives, the operator will see in the views a change on color as status or can see it as a number. This function has a huge degree of customization, with many possibilities to generate pictures for every crane connected to RCMS and display them on RCMS according to project requirements.



The Dynamic Yard Map represents the cranes connected to RCMS in a yard map (cartographical representation) as a dynamic representation for each position and status (color change of icons). Each crane can be freely defined as own icon (either STS type, or RTG, RMG, etc.) and change the status on color, as defined during configuration in the project. The same configuration can be applied for industry cranes as well. The cranes can move according to their own position on the map, using a mechanism via GPS coordination data or crane position delimited by cartographical reference points. Different map areas can be represented, using different navigation structures. In this way the operator can receive in one overview the status of all cranes at a time or can be provided with detailed information for each crane type, used for vessel or on land with clear indication if the crane is on fault or not and for how long.



SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Function

Database redundancy

With RCMS V4.4 system can be configured with a redundant Process Historian (Microsoft SQL) database. In this configuration there is one RCMS server and two separate database servers which store the data identically. By configuring the CMS stations and RCMS server according to this setup, the user can use this functionality without any additional engineering. In the case of a network problem between the CMS and Process Historian servers, after the connection is reestablished data synchronization is performed. If there is a problem on the one of the redundant Process Historian servers, after the problem is solved, the system synchronizes itself to the other Process Historian server without any additional engineering or management tasks.

User-friendly dashboards

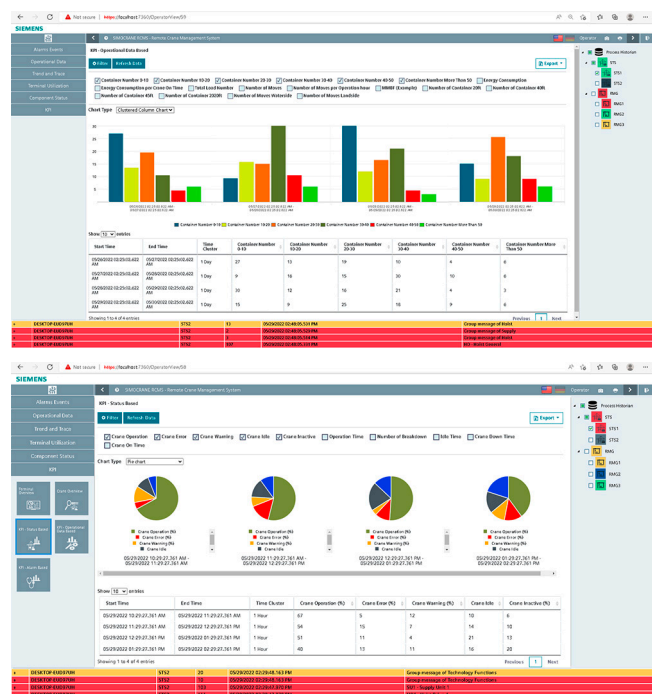
With the new dashboards design the user experience on RCMS is extended on a new level. The users can easily monitor and compare KPI values or trends of tag values on their own designed dashboards. On the RCMS Configurator the user has the full freedom of defining own templates according to project requirements. Intuitive design elements are incorporated and RCMS Configurator can modify any time own projects with own credentials. After modifications via Configurator, the changes are taken automatically online on RCMS web clients with no need of engineering stations, making the application changeable online very easy and comfortable.



Key performance indicators and data mining

Reports with alarm, KPI or other data in the project can be easily generated in web-based RCMS with manual or automatic export functionality. The new generation of KPIs and reporting functions are integrated completely into RCMS environment, with full web-based functionality and access of information. The new integration of Analyzer on RCMS enhances the functions on data mining and data processing using advanced filtering mechanism. Generation of reports for fault messages being displayed in different formats can be accessed via the RCMS web clients terminal wide with full integration for the RCMS functions.

The KPI calculation is fully customizable, the user being able to generate own KPIs as needed for their day to day performance analysis. The modifications can be done online on RCMS server, with no additional engineering stations needed. Only the credentials as configurator are to be activated and assigned to the users connected to RCMS. Integration of the Node Tree Manager window makes possible to navigate and access data instantly based "on the fly" calculations of KPI data of any kind. The data mining can be used not only by crane operational teams, but also can be used by maintenance crew managers and technicians. In this way root cause analysis scenarios can be defined setting different filters and exploring data for online calculations. Additional data preprocessing capabilities on CMS/WinCC can extend the level of analyzing functions on RCMS for better data mining scripting algorithms in online modus for each crane. All data and processed information can be stored centralized on Process Historian and accessed via specific tools integrated on RCMS and Process Historian central archiver.





SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Recommended hardware configurations for RCMS

Configuration

Hardware configurations from the SIMATIC IPC and SIMATIC Panel PC range are recommended for SIMOCRANE CMS and RCMS software packages. In accordance with the recommendations, alternative computer hardware can also be used.

Please check the chosen hardware configuration in combination with RCMS software components.

Recommended hardware configurations for RCMS

SIMOCRANE RCMS server

SIMATIC IPC647 or IPC847 or Office PC
1 - 2 displays if necessary, preferably widescreen format

Processor	Core i7, or better performance
Memory configuration	Minimum 16 GB
Hard drive	RAID1, 2 × 1 TB or more
Optical drives	DVD±R
Graphics card	2 × DVI or 2 × VGA
Communications interfaces	2 × Ethernet
Other interfaces	USB
Operating system	Microsoft Windows Server 2008 R2 (64 bit) and Microsoft Windows Server 2019

SIMOCRANE Process Historian (Microsoft SQL) database server

SIMATIC IPC847

Processor	Xeon E-2176G, or better performance
Memory configuration	Minimum 64 GB RAM
Hard drive	RAID1, 3 × 2 TB or more
Optical drives	DVD±R
Graphics card	2 × HDMI or 1 × DisplayPort
Communications interfaces	2 × Gigabit Ethernet
Other interfaces	USB
Operating system	Microsoft Windows Server 2016 (64 bit) and Microsoft Windows Server 2019

SIMOCRANE RCMS client

SIMATIC IPC647 or IPC847 or Office PC
1 - 2 displays if necessary, preferably widescreen format

Processor	Core i5 (8th Generation), or better performance
Memory configuration	Minimum 8 GB RAM
Hard drive	1 TB or more (as option RAID controller)
Optical drives	DVD±R
Graphics card	2 × HDMI or 2 × DisplayPort
Communications interfaces	1 × Ethernet
Other interfaces	USB
Operating system	Microsoft Windows 10 (64 bit) or Microsoft Windows 11
Web browser	Chrome or Microsoft Edge

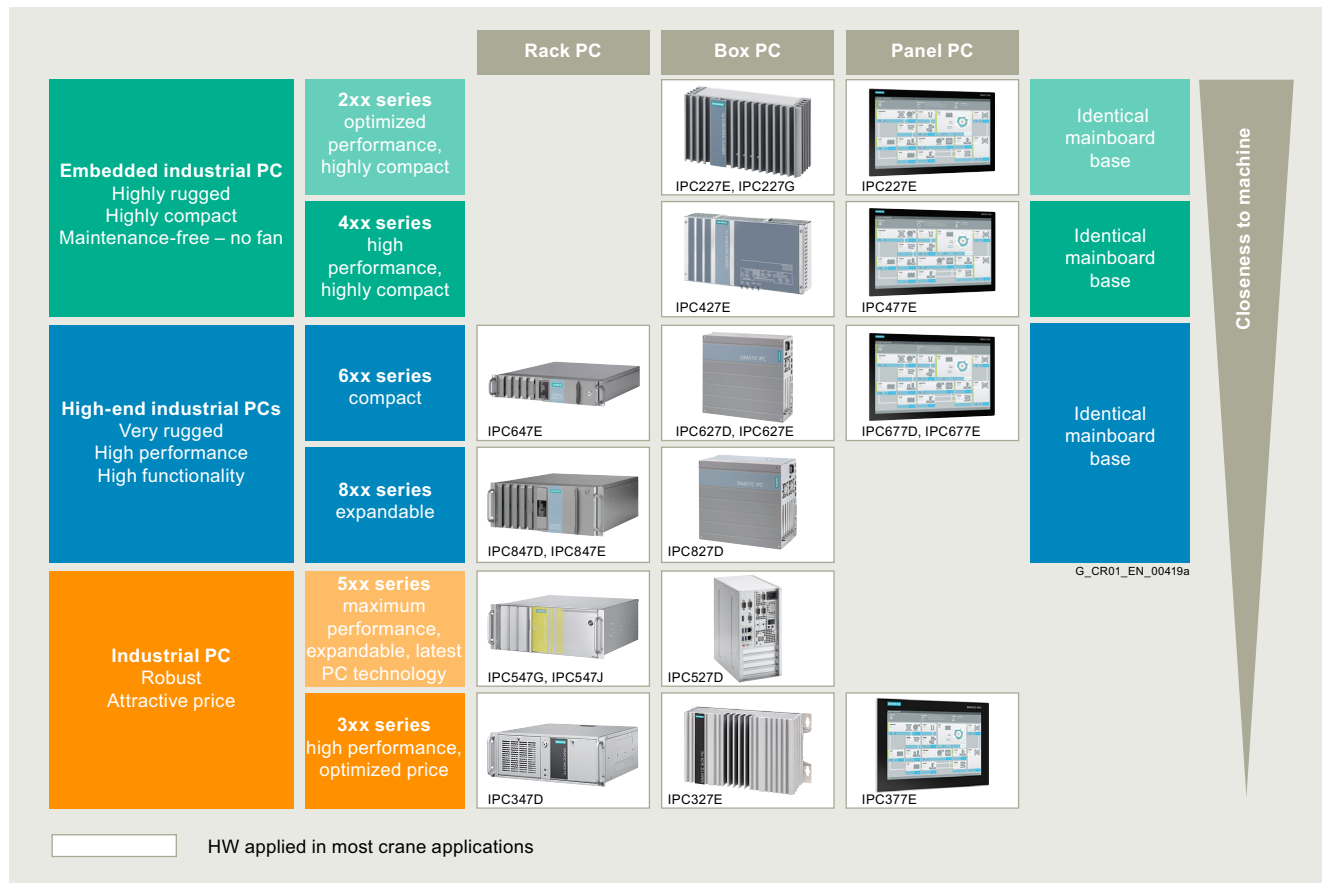


SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Recommended hardware configurations for RCMS

Configuration



Industrial hardware from SIMATIC family IPC and Panel PCs from Siemens used for SIMOCRANE CMS and RCMS stations on local station or/and remote stations)



SIMOCRANE CMS Crane Management System

SIMOCRANE RCMS

Recommended hardware configurations for RCMS

Technical specifications

Ordering packages	SIMOCRANE RCMS server		
	Single Process Historian server (1 web client)	Redundant Process Historian server (1 web client)	Additional web clients (1, 3, 5, 10, 25 client number alternatives)
Type	6GA7215-0AA00-0AA01	6GA7215-0AA00-0AB1	6GA7215-0AB00-0.A1
Crane overview			
Cartographic plant overview (example only map can be adapted)	✓	✓	✓
• Zooming and scrolling possible	✓	✓	✓
• Dynamic position display	✓	✓	✓
• Status display (operation, fault, maintenance, etc.)	✓	✓	✓
• Call up of detailed information per crane	✓	✓	✓
Hierarchical tree structure for cranes and types	✓	✓	✓
• Status display (operation, fault, maintenance, etc.)	✓	✓	✓
• Call up of detailed information per crane	✓	✓	✓
Remote access			
Remote access to the CMS of the selected crane	✓	✓	✓
Calling up the trace data for a crane	✓	✓	✓
Performing Replay/Playback from RCMS via web client	✓	✓	✓
Performance evaluations			
Operating status overview as Gantt chart	✓	✓	✓
• Downtimes overview	✓	✓	✓
• Operating times	✓	✓	✓
• Maintenance	✓	✓	✓
Performance evaluation for cargo handling data	✓	✓	✓
• Cargo handling per hour	✓	✓	✓
• Evaluation based on handled cargo (e.g. container sizes)	✓	✓	✓
• Evaluation based on weights moved	✓	✓	✓
KPIs per crane/central access	✓	✓	✓
• KPIs for a group of cranes or entire terminal	✓	✓	✓
• MMBF values (Mean Moves Between Failures)	✓	✓	✓
• Customer-specific KPIs (fully configurable)	✓	✓	✓
• Fault analysis and data mining	✓	✓	✓
Graphic evaluations			
Message statistics	✓	✓	✓
Counter and operating hours values	✓	✓	✓
Cargo handling data as tables or graphics	✓	✓	✓
Messages for the assigned cranes	✓	✓	✓
Long-term archiving (Microsoft SQL database)			
Operating hours values	✓	✓	✓
Counter and operating hours values	✓	✓	✓
Customer-specific values (configurable)	✓	✓	✓
Database redundancy	✓	✓	✓
System features			
Web clients for remote screens and data access (1 x web client)	✓	✓	–
Web clients for remote screens and data access (additional web clients to a max. of 25)	✓	✓	–
Unlimited Archive Tags (hardware can have limits)	✓	✓	–
• Data evaluation & advanced reporting	✓	✓	✓
• Crane Performance & KPI calculation	✓	✓	✓
CMS to RCMS connection ¹⁾	✓	✓	✓
Process Historian (Microsoft SQL) database (long-term archiving) delivered standard with RCMS	✓	✓	✓

– Not included in the scope of delivery

✓ Included in the scope of delivery

¹⁾ Maximum number of CMS stations connected to one RCMS depends of data volume and maximum data handling by WinCC and Process Historian (Microsoft SQL) database (to be checked in CMS manuals). For further details please contact the hotline product support for SIMOCRANE CMS: www.siemens.com/automation/support-request (Search Item → SIMOCRANE CMS)



Selection and ordering data

Description	Article No.
SIMOCRANE RCMS web server (Process Historian central Microsoft SQL database) for 1x RCMS client with current service pack version contains • SIMOCRANE RCMS V4.4 RT (Runtime View license) • SIMOCRANE RCMS V4.4 Configurator (web server) • Microsoft SQL integrated into Process Historian • Advanced reporting, dashboards, KPI calculation, export functions • Redundancy on Process Historian server Runtime and configuration languages: Multi-language interface supported UNICODE <u>Scope of functions:</u> • Central message and advanced fault diagnosis in Microsoft SQL database • Cranes and terminal overview (Tree Manager, plant model) • Remote diagnostics of cranes via terminal overview and Node Tree Manager • Remote maintenance of CMS stations • Plant monitoring functions with integrated visuals • Standard 1x RCMS web client • Remote access to cranes (individual or in parallel) • Cargo handling acquisition • Acquisition of operating hours /counter values/ timers • Data aggregation • Gantt view planning and monitoring • Advanced reporting • Web dashboards • Export of data and messages to Microsoft Excel • Advanced S7 diagnosis on CMS from RCMS • Web server for SIMOTION, SINAMICS and S7 remote from RCMS • Microsoft SQL including long-term Archive server and backup	
Single server and redundancy • Single RCMS server (single Process Historian database)	6GA7215-0AA00-0AA1
• Redundant RCMS server (redundant Process Historian database)	6GA7215-0AA00-0AB1
SIMOCRANE RCMS V4.4 web clients with current service pack version contains • Visualization of data and messages on web client via dashboards • SIMOCRANE RCMS V4.4 RT and Configuration (runtime, configuration, communication to CMS stations) • Multi-language support • SIMOCRANE RCMS V4.4 RT and Configuration (runtime, configuration, communication to CMS stations) • License count on the RCMS server (combinations between different RCMS client licenses possible)	
<u>Number of RCMS clients:</u> (different licenses can be combined) • 1 RCMS web client (Standard) • 3 RCMS web clients • 5 RCMS web clients • 10 RCMS web clients • 25 RCMS web clients	6GA7215-0AB00-0AA1 6GA7215-0AB00-0BA1 6GA7215-0AB00-0CA1 6GA7215-0AB00-0DA1 6GA7215-0AB00-0EA1
SIMOCRANE RCMS V4.4 development package with current service pack version contains • SIMOCRANE RCMS V4.4 Configuration (web server) • SIMATIC Process Historian 2014 (SP3)	6GA7217-0AA00-1AA1

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

→ Product Examples → (enter search term) SIMOCRANE

Additional information about Crane Application Notes can be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/ae>

→ Application Examples → (enter search term) Crane

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

SIMOCRANE CMS Crane Management System

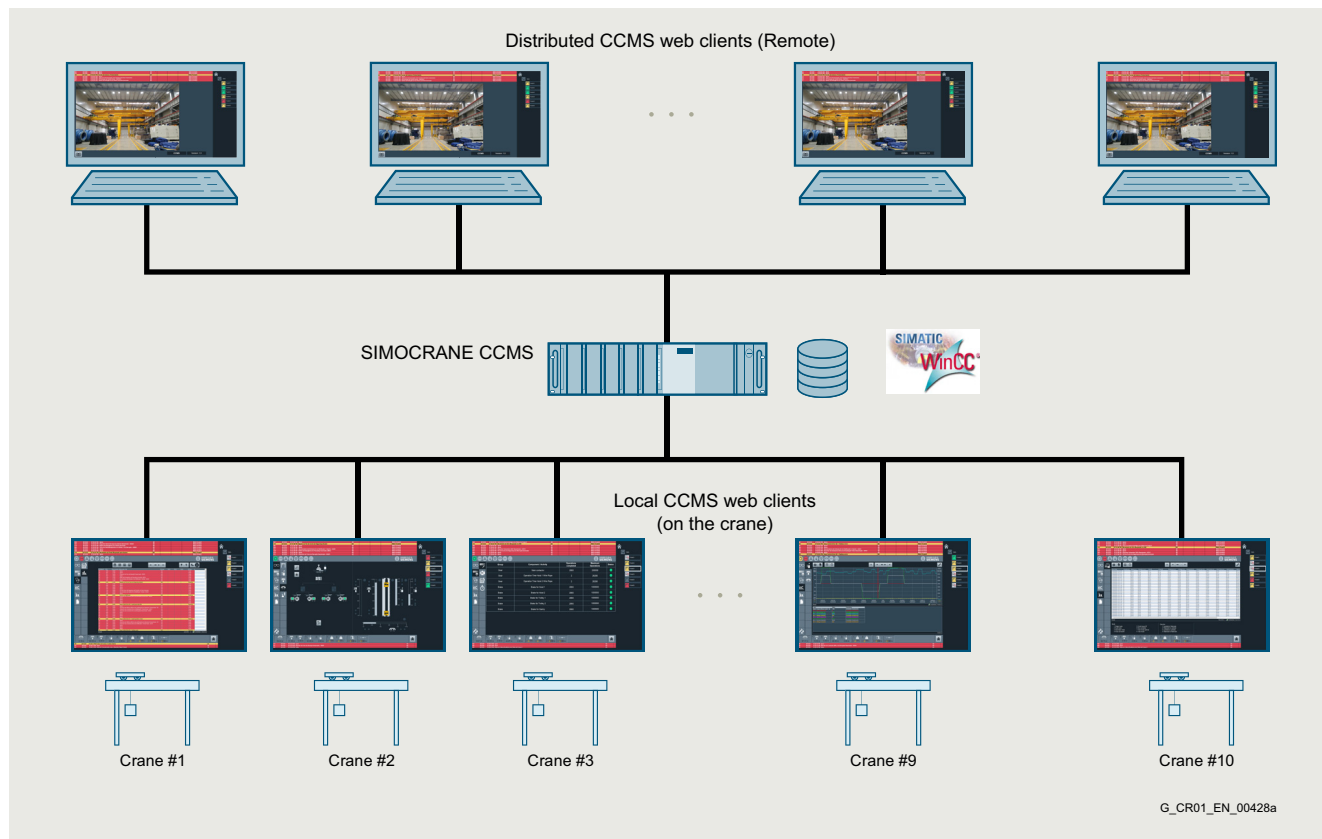
SIMOCRANE CCMS Centralized Crane Management System

Overview

Thanks to the SIMOCRANE CCMS solution as Centralized Crane Management System communication from cranes to a centralized system for data centralization and performing diagnosis and crane maintenance is possible. The solution is offering maximum configuration flexibility for one central system to connect the crane PLC directly to the CCMS system. Using server-client architecture based on web interfaces the information can be distributed on the maintenance or management team for extracting the most important information from the crane operation. This configuration of CCMS is to be used for

industry cranes. The application can be generated for maximum 10 connected cranes, type of OHBC.

At the same time, the web clients can be activated on each crane from the centralized CCMS station to retrieve data from each specific crane number related to PLC or drives and motors for performing crane operation and maintenance easy and fast. Mobile devices with switch function from one crane to another from one mobile client can be used for easily accessing the information from one mobile web client from each crane.



Example architecture for SIMOCRANE CCMS with web clients

Connectivity to each crane PLC is possible directly from one station CCMS. Each CCMS can be connected and configured to up

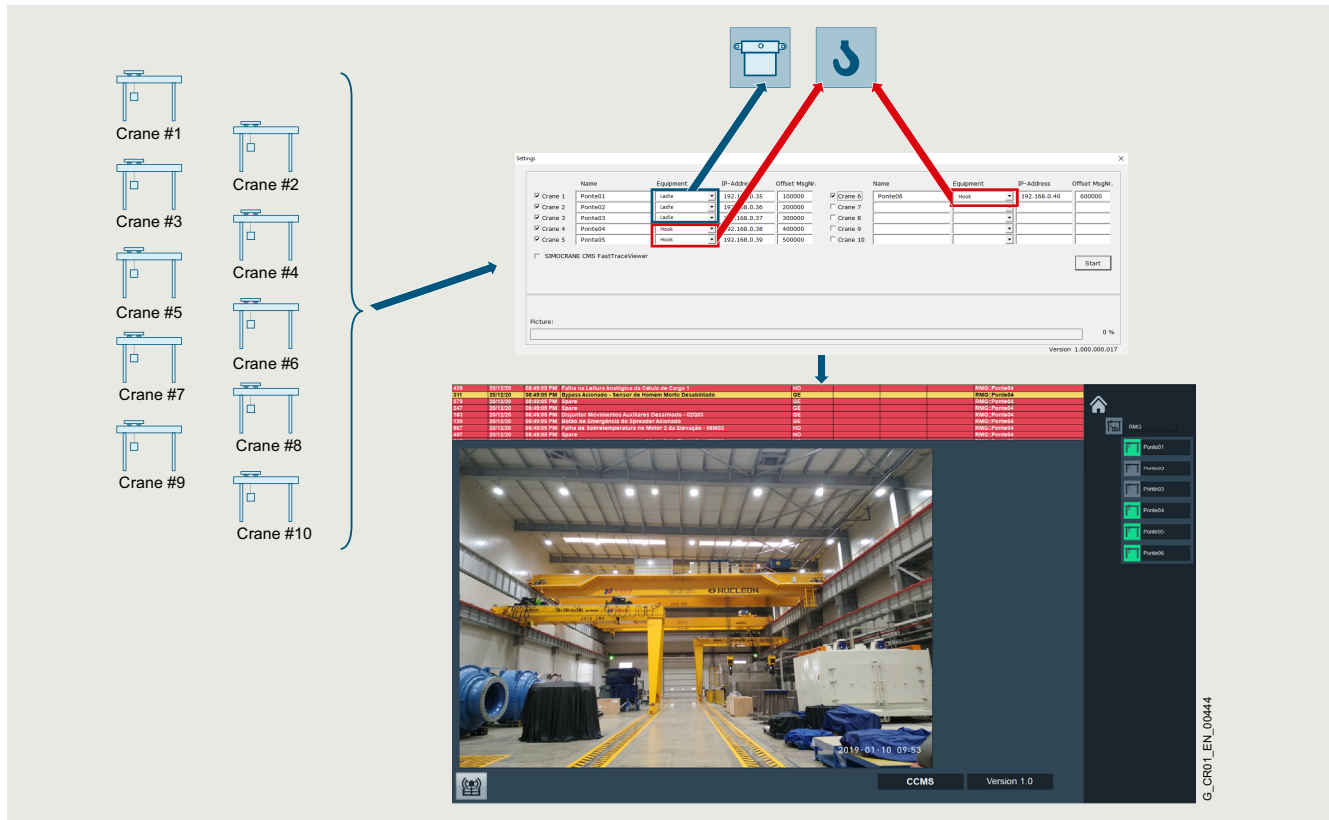
to 10 cranes. It is also possible to access information from more than one CCMS station in parallel.

Benefits

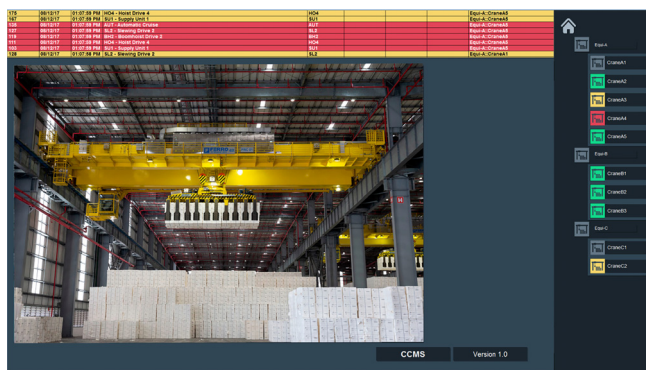
The benefits of using the SIMOCRANE CCMS solution from Siemens consist mainly in:

- Centralized solution for CMS from industry cranes for diagnosis and data logging
- Reduced number of hardware used in the configuration for SCADA solutions
- Centralized engineering and database on CCMS PC
- Web client remote access to all cranes from different access points
- Access to cranes with mobile devices (phones, tablets, ...)
- Direct connection from PLC & diagnosis
- Integrated Siemens solution for TIA (Totally Integrated Automation)
- Centralized project engineering with the possibility to download functions to crane data and message system
- Replay function used similar to local CMS direct from CCMS stations
- Distributed databases of CCMS for connectivity of a large number of cranes (in different configuration of multiple CCMS stations)
- Connectivity of CCMS stations to RCMS for centralized database for long-term archiving is possible
- CCMS stations KPI calculation and advanced reporting functions from RCMS can be provided via RCMS clients

Design



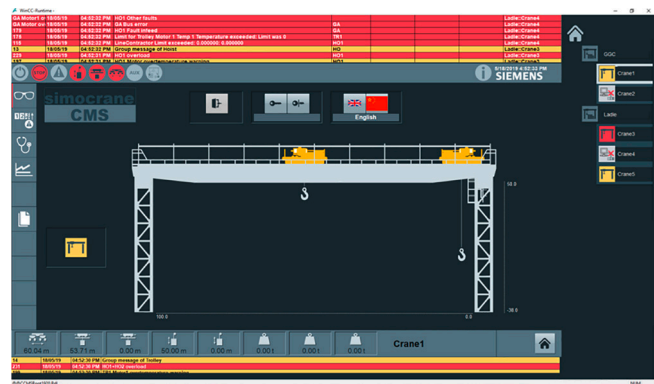
Using CCMS for direct connectivity to PLC the archive system is not anymore built on the crane itself but a centralized basis. CCMS is capable to distinguish between different PLC/cranes based on offset assignment. This attribute is specific to CCMS stations to keep crane ID saved into the Microsoft SQL database.



Example of the main screen of a CCMS station – overview of Node Tree Manager plant model

When clicking on the Node Tree Manager, the plant model on CCMS stations, it is possible to connect to a specific crane, by just clicking the crane icon. An integrated function using web server IIS technology will connect to the local station facilitating the local activation of CMS with connectivity to the central database CCMS.

When connecting to the crane from CCMS, information from the local crane is obtained, regarding e.g. condition monitoring of crane components, hoist, trolley, gantry status, fault messages. For each access to the local information security access rights can be used via user administration.



Example of the main screen of a crane on the SIMOCRANE CCMS station

SIMOCRANE CMS Crane Management System

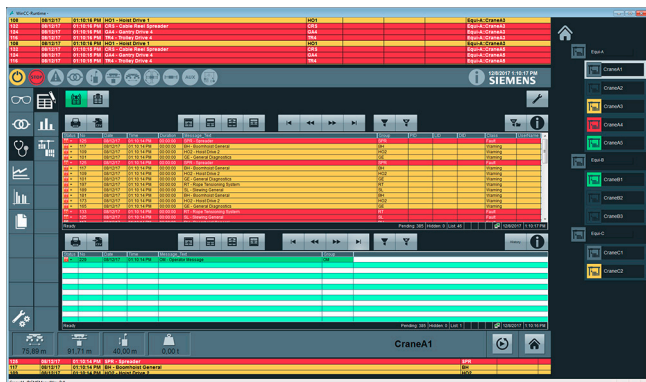
SIMOCRANE CCMS Centralized Crane Management System

Design

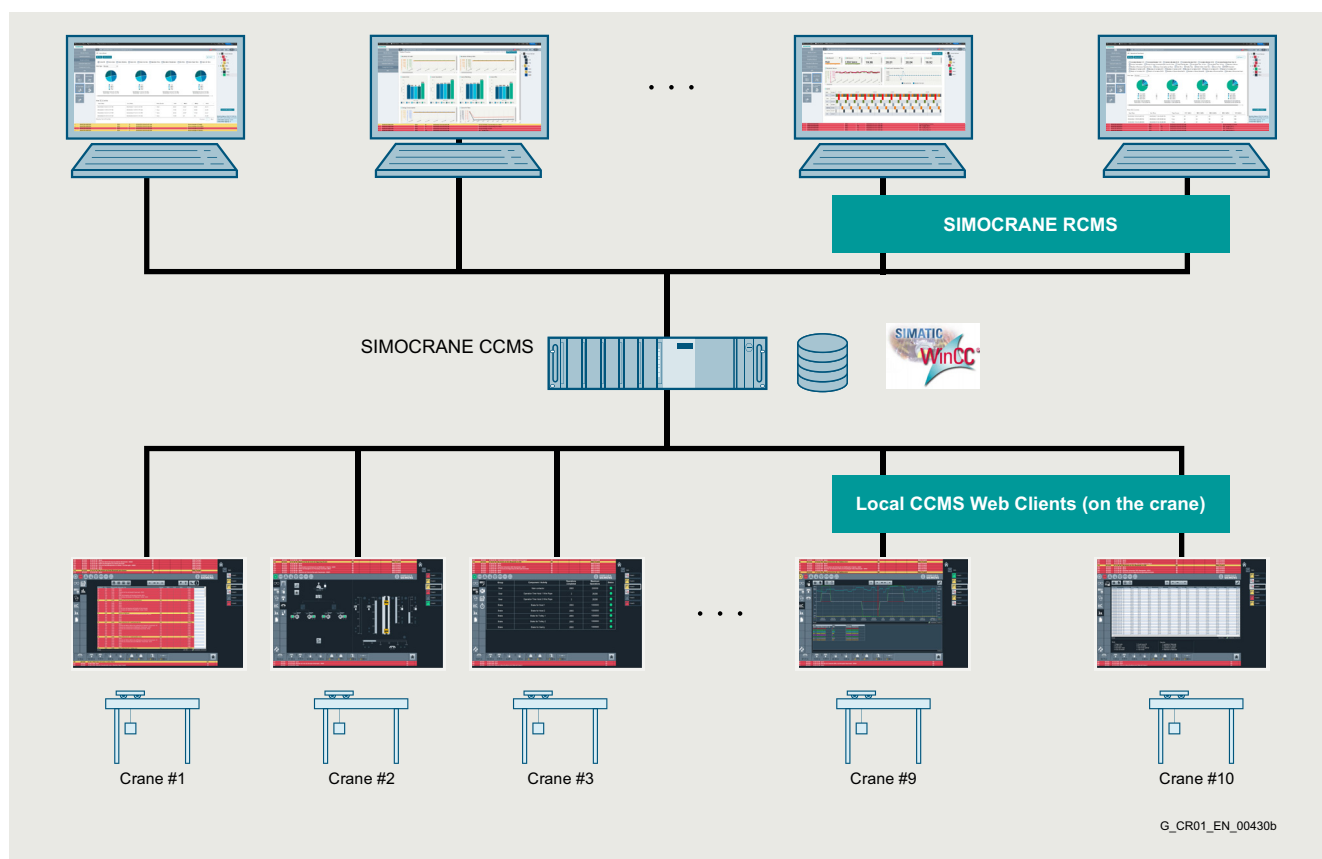
Using CCMS technology of the centralized database, the fault message system is assigning for each crane a specific offset and ID label to identify each crane based on local crane information. The parameters on each crane identification are automatically generated via CCMS configurator.

From the CCMS station, the data can be retrieved either on the local crane assignment or via the centralized message system for an overview of all messages in one view. Later, filtering actions and statistical overviews can be applied. Because the fault and messages number can vary, or can be relatively high for all cranes, the CCMS will cluster the messages in special tables on Microsoft SQL to later analyze and extract the information fast.

The data from a centralized CMS (CCMS) station can also be displayed on RCMS.



Example of the message screen of a crane on the CCMS station



Connectivity of a SIMOCRANE CCMS station to RCMS

G_CR01_EN_00430b



SIMOCRANE CMS Crane Management System

SIMOCRANE CCMS Centralized Crane Management System

Function

Delivery scope SIMOCRANE CCMS V4.4 (standard package)

The following bundles are delivered with standard package and options for SIMOCRANE CCMS.

- 1 license WinCC WebUX for mobile clients, monitor only (tablets, smartphones or a device which has a web browser supports HTML5)
- SIMOCRANE CMS V4.4 Configuration
- SIMOCRANE CMS V4.4 RT
- Crane condition monitoring
- Replay function (Playback)
- Central message system and advanced fault diagnosis
- Node Tree Manager for the cranes
- Remote maintenance of the cranes
- Acquisition of cargo handling data
- Acquisition of operating hours/counter values/timers
- Advanced reporting, KPI calculation and data aggregation (RCMS)
- Dashboards, Business Intelligence Tools (available on RCMS)
- Distributed information of advanced reporting via web clients (option for CMS Lean and CMS Advanced)
- Export of archived data and messages from Microsoft SQL to Microsoft Excel
- Advanced S7 diagnostics of S7-1200/1500 PLC
- Integrated web server for SIMOTION, SINAMICS, and S7
- Integration of trace view web server of S7-1200 and 1500 PLC
- Maintenance Instructions/Notes (advanced message diagnostics)
- Microsoft SQL (full version) with long-term archiving
- STEP 7 block reference (advanced S7 diagnostics)
- Jump functions to different project components (S7 block functions, pictures, manual information, Microsoft Word, Microsoft Excel, videos, etc.)
- Connection to RCMS

Options for SIMOCRANE CCMS standard package

CCMS WebClients for local (crane) and remote access (office) via WebNavigator (option, not included in the standard package).

SIMOCRANE CCMS 2000

Scope of SIMOCRANE CCMS standard package:

- WinCC V7.5 (SP2) RT license (2048 PowerTags)
- WinCC Archive Tag license (1500 Archive Tags)

SIMOCRANE CCMS 8000

Scope of SIMOCRANE CCMS standard package:

- WinCC V7.5 (SP2) RT license (8000 PowerTags)
- WinCC Archive Tag license (5000 Archive Tags)

Technical specifications

Ordering packages	SIMOCRANE CCMS 2000	SIMOCRANE CCMS 8000
Type	6GA7214-0AB00-0AB1	6GA7214-0AB00-0BB1
Configurable presentation		
Crane types	✓	✓
• Industrial cranes (e.g. ladle crane)	✓	✓
Drives	✓	✓
• Hoist	✓	✓
• Gantry	✓	✓
• Trolley	✓	✓
• Slewing gear ¹⁾	✓	✓
Load suspension device	✓	✓
• Hook	✓	✓
• Grab ¹⁾	✓	✓
• Single, twin, tandem spreader ¹⁾	✓	✓
• Gripping tongs ²⁾	✓	✓
Condition monitoring		
Crane components	✓	✓
• Crane overview	✓	✓
• Gantry drives	✓	✓
• Lifting gear	✓	✓
Positions	✓	✓
Limit switches	✓	✓
Weight	✓	✓
Drives	✓	✓
• Setpoint/actual values	✓	✓
• Brakes	✓	✓
Rope drums	✓	✓
• Safety brakes	✓	✓
Wind	✓	✓
• Rail clamps	✓	✓
• Interlock bolts	✓	✓
Interlocks	✓	✓
• Operation-specific	✓	✓
• Emergency OFF	✓	✓
• Access (doors)	✓	✓
Main power supply	✓	✓



SIMOCRANE CMS Crane Management System

SIMOCRANE CCMS Centralized Crane Management System

Technical specifications

Ordering packages	SIMOCRANE CCMS 2000	SIMOCRANE CCMS 8000
Type	6GA7214-0AB00-0AB1	6GA7214-0AB00-0BB1
Operator functions		
Counter handling	✓	✓
Error diagnostics		
Approx. 100 typical, pre-configured crane error messages ²⁾	✓	✓
Display of pending and historical messages	✓	✓
Statistical message overview ("hit list")	✓	✓
Symbolic error status display	✓	✓
Graphical assignment in the status display	✓	✓
Call up of supplementary information	✓	✓
• Documents (examples only)	✓	✓
• Screens (examples only)	✓	✓
• Circuit diagrams (examples only)	✓	✓
STEP 7 network and function block entry point (symbolic or absolute)	✓	✓
Process values to accompany messages (e.g. positions)	✓	✓
SIMATIC S7 web server (CPU diagnostics; CPU-dependent)	✓	✓
SIMOTION web server integration (version dependent)	✓	✓
Operating data acquisition		
Acquisition of operating hours	✓	✓
Acquisition of load and maintenance counters	✓	✓
Acquisition of setpoint/actual values for position data	✓	✓
Logging functions		
Report for pending messages	✓	✓
Report for historical messages	✓	✓
Runtime meter report	✓	✓
Counter report	✓	✓
Graphical data evaluation	✓	✓
System features		
2048 Process Tags	✓	–
8000 Process Tags	–	✓
1500 Archive Tags	✓	–
5000 Archive Tags	–	✓
Communication channels	✓	✓
• SIMATIC S7 (PROFIBUS, Ethernet)	✓	✓
• SIMOTION (Ethernet)	✓	✓
• OPC	✓	✓
Client connection with WinCC/WebNavigator or WinCC/WebUX ³⁾	✓	✓
Microsoft SQL Server standard delivered with CCMS	✓	✓

– Not included in the scope of delivery

✓ Included in the scope of delivery

¹⁾ The configuration optional with additional screens to be integrated.

²⁾ More messages can be defined depending of the application.

³⁾ This requires an extra license outside of the standard packages.



SIMOCRANE CMS Crane Management System

SIMOCRANE CCMS Centralized Crane Management System

Selection and ordering data

Description	Article No.
SIMOCRANE CCMS standard package <u>Runtime languages:</u> Multi-language interface supported UNICODE • European: De, En, It, Fr, Es, etc. – standard • Asia: Ch, Ch. trad, Jp., Ko. etc. – on request <u>Scope of functions:</u> • CCMS application for maximum of 10 cranes • Central message and advanced fault diagnosis in Microsoft SQL database • Cranes Node Tree Manager CCMS (plant model) • Remote maintenance of cranes • Remote access to cranes, individual or in parallel • Cargo handling acquisition • Acquisition of operating hours /counter values/ timers • Data aggregation • Advanced reporting • KPIs and OEE calculation • Web Dashboards for mobile devices via WebUX • Export of data and messages to Microsoft Excel • Advanced S7 diagnosis • Web server SIMOTION, SINAMICS and S7 remote from cranes • Connectivity to RCMS V4.4 • Microsoft SQL including long-term archive server + backup • Connection to RCMS • Connection to Cloud	
SIMOCRANE CCMS 2000 V4.4 contains • WinCC V7.5 SP2 RT 2048¹⁾ • WinCC Archive 1500 Tags²⁾ • SIMOCRANE CMS V4.4 (DVD)	6GA7214-0AB00-0AB1
SIMOCRANE CCMS 8000 V4.4 contains • WinCC V7.5 SP2 RT 8000¹⁾ • WinCC Archive 5000 Tags²⁾ • SIMOCRANE CMS V4.4 (DVD)	6GA7214-0AB00-0BB1

More information

Siemens product support

The latest information about SIMOCRANE products, product support and FAQs can always be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps/20087>

→ Product Examples → (enter search term) SIMOCRANE

Additional information about Crane Application Notes can be found on the internet at

<https://support.industry.siemens.com/cs/ww/en/ps>

→ Application Examples → (enter search term) Crane

Further information: See "Technical specifications", "Selection and ordering data" and SIMATIC HMI Catalog ST 80.

Training

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

¹⁾ Additional Power Tags can be ordered separately.
Please refer to the SIMATIC HMI Catalog ST 80 WinCC section.

²⁾ Additional Archive Tags can be ordered separately.
Please refer to the SIMATIC HMI Catalog ST 80 WinCC section.



SIMOCRANE CMS Crane Management System

SIMOCRANE CMS and RCMS upgrade packages

Overview

SIMOCRANE CMS and RCMS upgrade packages

Upgrade packages are offered for CMS and RCMS of older versions to install the latest version of SIMOCRANE CMS and SIMOCRANE RCMS V4.4 (SP5, latest Service Pack). There are separate article numbers for each component, e.g. CMS or RCMS to upgrade to the V4.4 based complete package of WinCC and CMS and/or RCMS. If there are already cranes equipped with versions CMS V4.2 or CMS V4.3 (SP1) via one ordering number the complete package can be upgraded and use latest functions and features developed with V4.4 version. Please refer to the customer support web page for more information.

When new cranes are added to the existing ones in the terminal which use CMS upgrade packages, the already installed CMS packages can be upgraded to the latest version available, to version 4.4 (SP5). The upgrade licenses for SIMOCRANE CMS Lean and CMS Advanced are still valid.

The following upgrade packages can be ordered:

- Upgrade license from SIMOCRANE CMS V4.2 and CMS V4.3 (SP1) to CMS V4.4 (SP5)

For the upgrade of CMS older versions to V4.4, upgrades for WinCC tags and options are delivered with the upgrade licenses. Please refer to the section CMS and RCMS ordering data specifications and upgrade packages.

When using SIMOCRANE upgrade licenses, please check CMS application project. For the migration of older versions, the migration of projects for CMS configuration and CMS application should be considered.

Selection and ordering data

Description	Article No.
SIMOCRANE CMS upgrade package V4.2, V4.3 (SP1), V4.4 SP1... SP4 to V4.4 SP5 with current service pack version contains • Upgrade to WinCC 7.x to V7.5 SP2 and options • CMS V4.4 RT + config. <u>Runtime languages:</u> Multi-language interface supported UNICODE <u>Scope of functions:</u> • SIMOCRANE CMS V4.4 SP5 (RT license + Configuration) • SIMOCRANE CMS V4.4 SP5 standard application, configurable (WinCC project example "ready to run", CMS HMI interface) • Upgrade of CMS V4.4 SP1... SP4 to V4.4SP5 also possible with this license. Ask for more details Siemens product support, SIMOCRANE CMS Hotline	6GA7216-0AB00-0AA1
SIMOCRANE RCMS V4.4 SP5 upgrade package with current service pack version Upgrade from older RCMS versions V4.4 SP1, SP2, SP3 and SP4 possible Delivered on DVD	6GA7210-1AB01-0AB0



SIMOCRANE CMS Crane Management System

Additional components

WinCC Add-on PM-MAINT on CMS/RCMS

Overview

Products that are listed below are not components of the SIMOCRANE CMS and RCMS packages. These additional components are recommended for performing extra tasks on the CMS or/and on the RCMS stations. The components described here can be ordered separately based on WinCC options and Add-ons.

Please read the technical specifications and ordering information at the specified internet address. Contact the CMS Application Support department for more information.

Email: applications.cranes.aud@siemens.com

Overview

WinCC Add-on PM-MAINT for maintenance jobs registration and handling on CMS/RCMS

This is a complete maintenance planning system that can be centrally implemented for the entire plant, or even be locally implemented on the crane locally. PM-MAINT is a maintenance management system from Siemens designed to be used close to the shop floor level. By providing various connectivity options to the existing automation landscape PM-MAINT, in addition to purely calendar based planning, also allows a performance-based planning of job maintenance that is based on real operating hours and operation cycles. PM-MAINT also supports the maintenance process for the recording of jobs and complete documentation of unplanned repairs by providing easy and comprehensible workflows that is easy to use.

Various views with convenient filter and formatting options can be personalized for individual users, user groups or globally for all users. Transparent access to your maintenance information is ensured with by web-compatible client-server architecture. At any time and from any location.

State	Type	Order Number	Name	Proposed Date	Planned Date	Object Number	Planned Order Number	Planned Order
Order 10	Calibrate probe	117440548	Calibrate probe	2/4/2012 9:43 AM	2/5/2012 9:43 AM	117440548	11777200	Calibrate probe
Order 11	Transmission	117440549	Transmission	2/4/2012 9:43 AM	2/5/2012 9:43 AM	117440549	11777201	Transmission
Order 12	General check	117440550	General check	2/4/2012 9:43 AM	2/5/2012 9:43 AM	117440550	11777202	General check
Order 13	Visual inspection pneumatic tubes	117440551	Visual inspection pneumatic tubes	2/4/2012 9:43 AM	2/5/2012 9:43 AM	117440551	11777203	Visual inspection pneumatic tubes
Order 14	General check	117440552	General check	2/4/2012 9:43 AM	2/5/2012 9:43 AM	117440552	11777204	General check

PM-MAINT user interface displaying the orders view

Benefits of PM-MAINT:

- Automatic calculation of the recommended maintenance dates under consideration of the utilization
- Optimum resource planning notification prior to order due date
- Clear display of planned orders, notifications and active orders with comfortable selection and filtering functions
- Central material list for required material and tools
- Linking of documents (graphs, photos, data sheet, etc.) to plant objects and planned orders
- Manual orders for planned activities (repairs)
- Long-term archive for all maintenance activities
- Microsoft Excel Plug-in for convenient mass data import
- Write back capability for maintenance metrics into HMI tags
- Multiple order feedbacks with recording of
 - Feedback Data (e.g. object state, type of performed action)
 - Cost and time input for personal
 - Cost and used quantities for material

State	Order Number	Name	Object Number	Object Occ	Object Chc	Interval	Orders	Last Date	Chc	Occ	Next date
(P)	11777211	Pneum	117440529			100 %	●●●●●				
(P)	11777212	Service	117440529			100 %	●●●●●				
(P)	11777213	Visual inspection	117440530			100 %	●●●●●				
(P)	11777208	Visual inspection pneumatic tubes	117440533	9476		34 %	●●●●●	Visual insp.	2/14/2012 10:37 AM	9422	1/25/2012 1
(P)	11777208	Change pneumatic tubes	117440536	4743		34 %	●●●●●				1/25/2012 1
(P)	11777204	Visual inspection pneumatic tubes	117440538	801		97 %	●●●●●		2/14/2012 10:38 AM	788	5/4/2012 11
(P)	11777205	Full screen	117440538	801		20 %	●●●●●				3/18/2012 6
(P)	11777203	Grease spindle	117440542								
(P)	11777202	Check of state	117440545								
(P)	11777201	Inspection	117440547			100 %	●●●●●	Inspection	2/14/2012 10:38 AM		5/14/2012 1

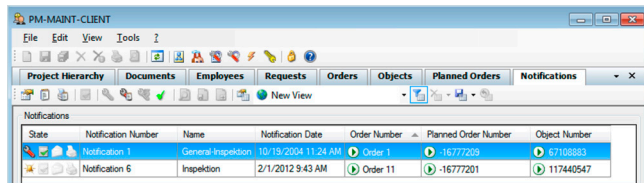
PM-MAINT user interface displaying planned orders view

SIMOCRANE CMS Crane Management System

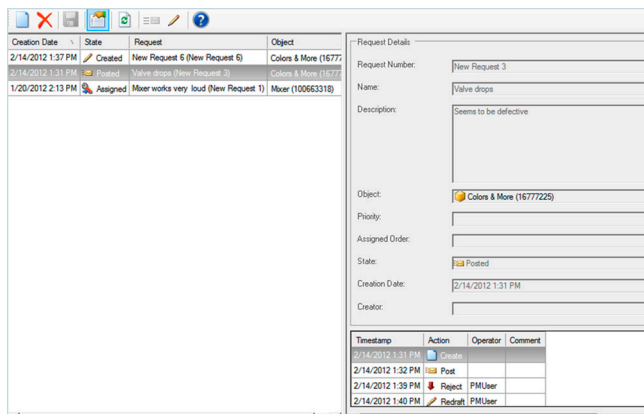
Additional components

WinCC Add-on PM-MAINT on CMS/RCMS

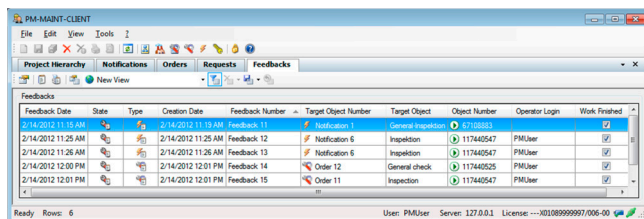
Overview



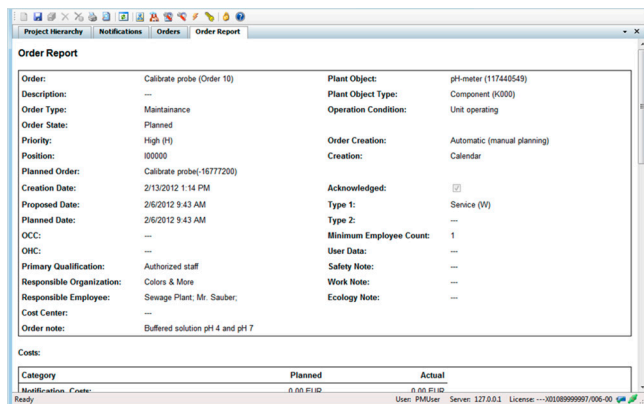
PM-MAINT user interface displaying notification view



PM-MAINT request control



PM-MAINT notifications listed in feedback view



PM-MAINT example of reporting

Description	Article No.
PM-MAINT V10 System package type S ⁷⁾ Single-user / Multi-user system server, including PM-SERVER ²⁾ and PM-AGENT ³⁾ Executable with: • SIMATIC WinCC V7 • SIMATIC WinCC (TIA Portal) RT Advanced (V13-V15) • SIMATIC WinCC (TIA Portal) RT Professional (V13-15)⁴⁾ Single license, runtime software (R-SW) incl. configuration system Languages: German/English, copy protection ¹⁾ Electronic manual on DVD Operating systems: • Windows 7/8.1 (32/64 bit) • Windows 10 (64 bit) • Windows 2008 R2 / 2012 R2 / 2016 (64 bit)	9AE7104-2SS30-1AA0¹⁾
PM-MAINT V10 System package type C ⁷⁾ Multi-user system client for system package type S Executable with: • SIMATIC WinCC (V7) • SIMATIC WinCC (TIA Portal) RT Advanced (V13-V15) • SIMATIC WinCC (TIA Portal) RT Professional (V13-15)⁴⁾ • Thin Client (without WinCC) Single license, runtime software (R-SW) Languages: German/English, copy protection ¹⁾ Operating systems: • Windows 7/8.1 (32/64 bit) • Windows 10 (64 bit) • Windows 2008 R2 / 2012 R2 / 2016 (64 bit)	9AE7104-4SC00-1AA0¹⁾

For further releases, please refer to the SIMATIC HMI Catalog ST 80. More information on the internet:
<https://new.siemens.com/global/en/products>

Note:

The runtime meters of CMS remain available independently of this Add-on and can also be provided for previously installed maintenance systems.

¹⁾ Please complete the purchase order for the copy protection delivery: **-Z U02** = Dongle for an USB port; **-Z S03** = License file. Default delivery includes an USB port dongle.
²⁾ Exclusively executable on the computer with the PM-MAINT SERVER.
³⁾ In the case of a WinCC multi-user system executable on the WinCC server.
⁴⁾ The legally binding released versions are documented in the latest released notes. Please look at the information on the internet:
<https://new.siemens.com/global/en/products>

⁵⁾ For details about the migration support for a user project, please contact the WinCC Competence Center. Phone: (+49) 621 456-3269
⁶⁾ For details about the migration support for a user project, please contact the WinCC Competence Center. Phone: (+49) 621 456-3269
⁷⁾ Subject to export regulations AL: N and ECCN: 5D992



SIMOCRANE CMS Crane Management System

Additional components

WinCC/IDB – connection CMS and RCMS to other databases

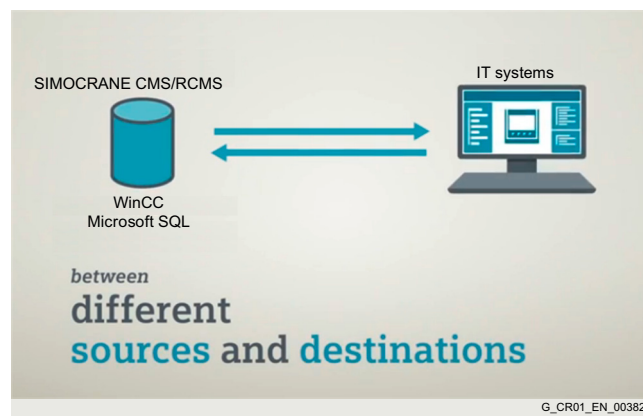
Overview

WinCC IndustrialDataBridge – connection CMS and RCMS to other databases

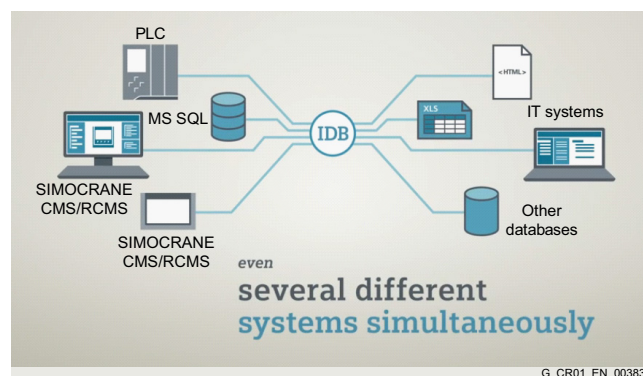
WinCC IndustrialDataBridge (WinCC/IDB) uses standard interfaces to link the automation level (controls) from CMS and RCMS stations to the IT world and to ensure a flow of information in both directions. Systems from different manufacturers can be integrated by using a variety of standard interfaces (e.g., OPC, OLE DB, SQL). The easy configuration (without programming) saves time and prevents errors. The integration into the CMS/WinCC system and its user administration as well as the alternative use as system service ensure the security of the transmission.

- Connection of CMS and RCMS/WinCC to databases and IT systems
- Support of standard interfaces (such as OPC, SQL, ODBC, OLE DB, Office formats) means there is no restriction to specific vendors
- High-performance, bidirectional data exchange between CMS/RCMS stations and different systems
- Runtime administration of data connections in CMS Application/ WinCC (also via Web) or via independent application running as system service
- Visualization of information on HTML pages
- Fast and reliable due to configuration instead of programming (errors are prevented)

Provider (data sources)	Consumer (data destinations)
	csv, txt
	Microsoft Excel 2003, 2007, 2010, 2013, 2016
Microsoft Access 2003, 2007, 2010, 2013, 2016	Microsoft Access 2003, 2007, 2010, 2013, 2016
Microsoft SQL Server 2005, 2008, 2008 R2, 2012, 2014, 2016	Microsoft SQL Server 2005, 2008, 2008 R2, 2012, 2014, 2016
My SQL 3.5, 5.1, 5.5, 5.6, 5.7	My SQL 3.5, 5.1, 5.5, 5.6, 5.7
Oracle 8i, 10g, 11g, 12c Release 2	Oracle 8i, 10g, 11g, 12c Release 2
OPC Data Access 3.0 OPC XML 1.0	OPC Data Access 3.0 OPC XML 1.0
	IDB OPC Server
Send/Receive	Send/Receive
WinCC V7.5 (via OLE DB), WinCC UserArchives V7.5	WinCC UserArchives V7.2, V7.3
WinCC RT Professional V13 SP1, V14, V15 (via OLE DB)	WinCC RT Professional V13 SP1, V14, V15 (via OLE DB)
	Configurable TXT/ HTML



System set-up using WinCC/Industrial Data Bridge data exchange based on source and destination



Example of connection of several systems and SIMOCRANE CMS/RCMS by using WinCC Industrial Data Bridge (IDB)

Description	Article No.
WinCC/IndustrialDataBridge V7.5	
• with 300 Tag license	6AV6362-4AD00-0BB0
• with 1000 Tag license	6AV6362-4AF00-0BB0
• with 3000 Tag license	6AV6362-4AH00-0BB0

SIMOCRANE CMS Crane Management System

Additional components

WinCC/Connectivity Pack – sending data via OPC interfaces from CMS and RCMS to other system

Overview

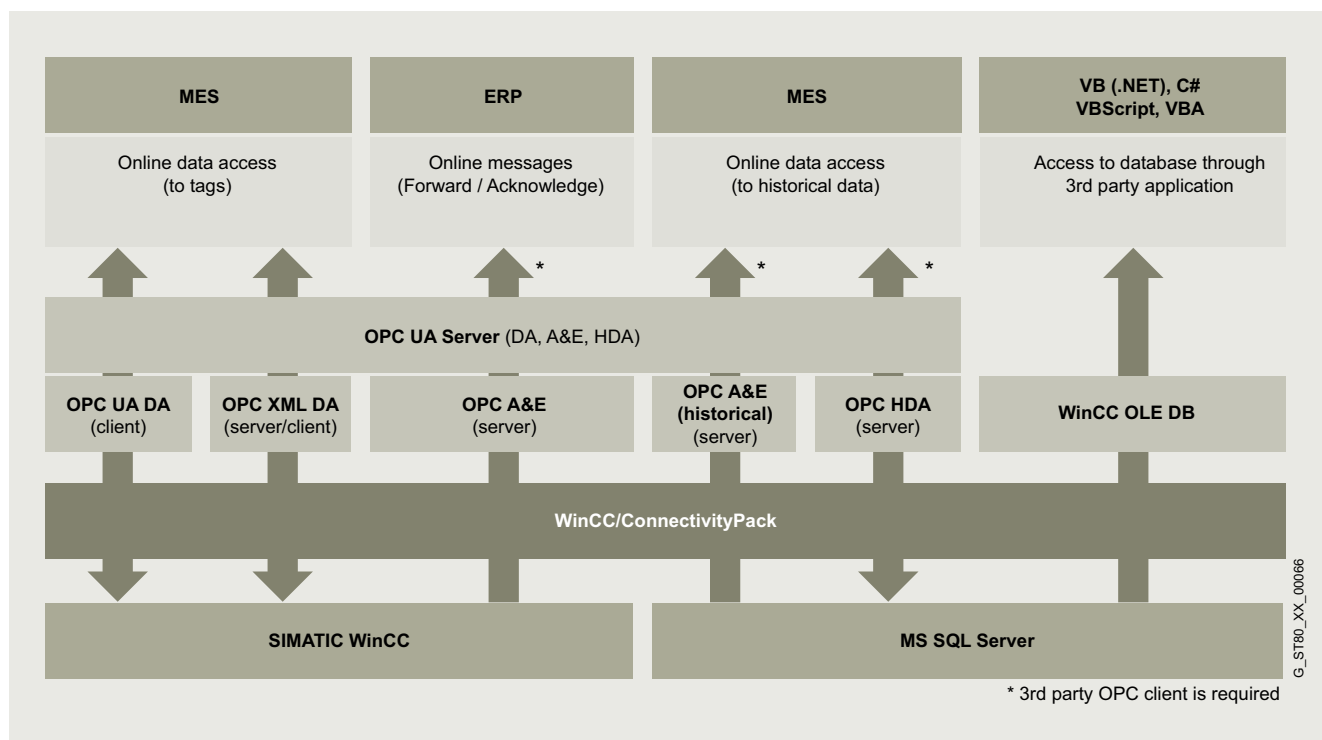
Connectivity Pack – sending data via OPC interfaces from CMS and RCMS to other systems

WinCC has as standard an integrated OPC DA 3.0 server (Data Access) that gives you access to all the online values in the SIMOCRANE CMS/RCMS system and, on the other hand, can read data from another application as a client – across the Web as well. The WinCC/Connectivity Pack offers additional options for already existed SIMOCRANE CMS and RCMS stations.

This means that the system can transfer pre-processed process and production data from a crane to higher level systems for information conditioning (e.g. Manufacturing Execution Systems,

Enterprise Resource Planning systems or Microsoft Office packages, e.g. Microsoft Excel, Microsoft Access, etc.) and TOS systems.

- Simple IT and business integration by means of standard interface from SIMOCRANE CMS and RCMS stations
- Access to online and historical data from any computer you wish via standard interfaces (OPC XML DA, OPC HDA, OPC A&E, WinCC OLE DB)
- Further processing or analysis of data on CMS/RCMS stations using separate tools is also possible



WinCC/Connectivity Pack

Access to messages and historical data from CMS and RCMS via OPC/WinCC OLE DB.

The WinCC/Connectivity Pack includes the OPC HDA 1.20 (Historical Data Access) and OPC A&E 1.10 (Alarm & Events) servers for accessing historical data from the WinCC archive system or for transferring/acknowledging messages. As an OPC XML DA 1.00 server, WinCC can even send data across platforms across the Web to PPS/MES systems; in the opposite direction, it can receive OPC XML DA client orders or recipe data. As an HDA server, WinCC makes historical data available from the WinCC archive system to other applications. The OPC client (e.g. a reporting tool) can specify the start and end times of a time interval and thus selectively request the data to be transferred. Apart from this, the client can request data that has already been conditioned from the HDA server, i.e. actively trigger data compression before the data is transferred. The OPC HDA server can also be used in redundant configurations.

Note:

Please refer to the SIMATIC HMI Catalog ST 80, for the exact version compatible with WinCC V7.5 SP2.

Description	Article No.
WinCC/Connectivity Pack V7.5 SP2 ¹⁾	6AV6371-1DR07-5AX0

¹⁾ This license is to be installed on each system with CMS/RCMS. If the other system has no WinCC license installed, Connectivity Pack/Station client should be installed. Please refer to WinCC Connectivity Pack documentation for more information.



5/2 Remote Control Operation

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- 5/3 Benefits
- 5/4 Functions
- 5/5 Application
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Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit

www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

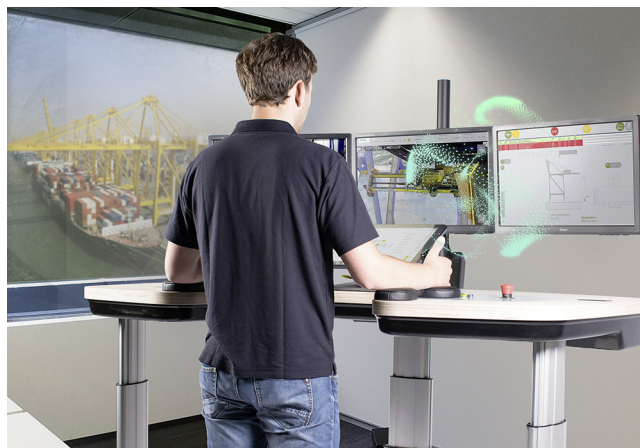
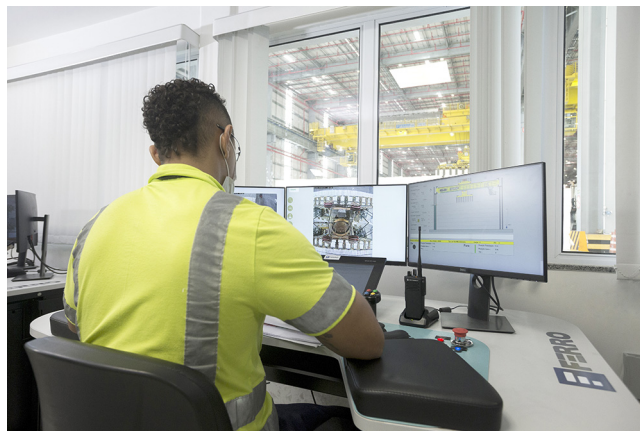
www.siemens.com/cert.

SIMOCRANE Solutions

Remote Control Operation

Overview

The Remote Control System (RCOS) provides maximized production with secure and safe crane operations. The solution is both suitable for harbor and industry cranes. In the harbor, RCOS provides an efficient solution to handle the growth in vessel and cargo handling capacity making it an ideal solution for integration in automated cranes. For industrial cranes it helps to improve productivity, safety and ergonomics. The Siemens' RCOS can work non-stop, providing a more consistent use of the crane, increasing its lifetime and reducing damage.





Benefits

Optimum crane performance

RCOS delivers a complete end-to-end crane control solution from operator login, carrying out operations, to operator logout. The remote control station can be situated anywhere on the plant when associated with a reliable and low latency network connection. RCOS assists operators to carry out their work assignments by presenting task-dependent information on a human-machine interface, which is tailored to the cognitive and physical capabilities of a human operator.

Safety and comfort

The system significantly improves the working environment and operator safety. RCOS-certified integrated safety solutions guarantee safe operation for people and equipment.

- Camera latency check ensures a minimum time delay between crane movements and screen viewing
- Frame rate detection ensures the video connection to the crane is reliable.
- Equipment check ensures the desk is connected to the selected crane.

More comfortable seats and a more collaborative workplace also contribute to personal health and welfare.



In addition to the daily comfort, there is an improvement of the operator's mobility during their basic tasks. All operations become more flexible and the shift changes become faster. The crane operator role becomes multi-layered and flexible. The smart screens on the remote control station automatically change the view to follow the movement controlled by the operator.



SIMOCRANE Solutions

Remote Control Operation

Functions

Any-to-any

Siemens Remote Control is based on the "any-to-any" principle, which enables the operator to logon to any connected crane from any connected desk¹⁾. This becomes even more powerful when a crane is equipped with semi-automatic functions allowing the crane to partly operate by itself and calls for the remote operator only when it requires manual operation.

Agnostic concept

Besides the ability to connect to different type of cranes, the Remote Control System also connects to different controller types and brands from e.g. different crane suppliers. This gives a terminal or plant the opportunity to standardize to one remote

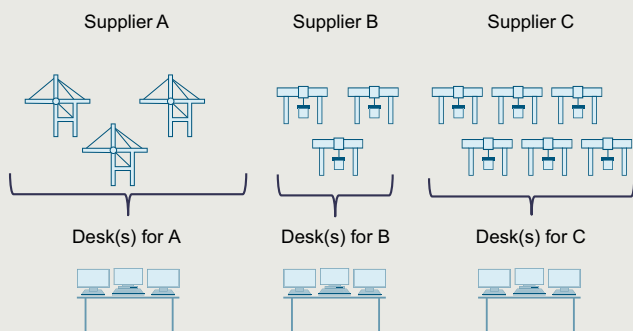
Pooling

Siemens "Pooling" system makes sure the crane is forwarded to a free desk when assistance is needed. Within Pooling it is also possible to redirect difficult or complicated tasks to remote operators that have the required skill set. In the same sense, simple tasks can be done by any operator.

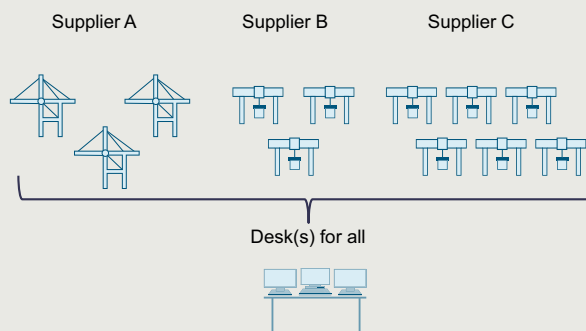
RCOS supports migrating terminals towards a fully automated process. The higher degree of automatic functions on the cranes, the fewer remote control stations or desks are required. More comfortable seats and a more collaborative workplace also contribute to personal health and welfare.

control platform. Resulting in many advantages like one user interface for all cranes, single system to maintain, any crane can be controlled from any desk and the best cybersecurity protection (cybersecurity compliant to IEC 62443).

Conventional solution



Crane supplier agnostic solution



G_CR01_EN_00494

¹⁾ Desk = Remote Control Station (RCS).



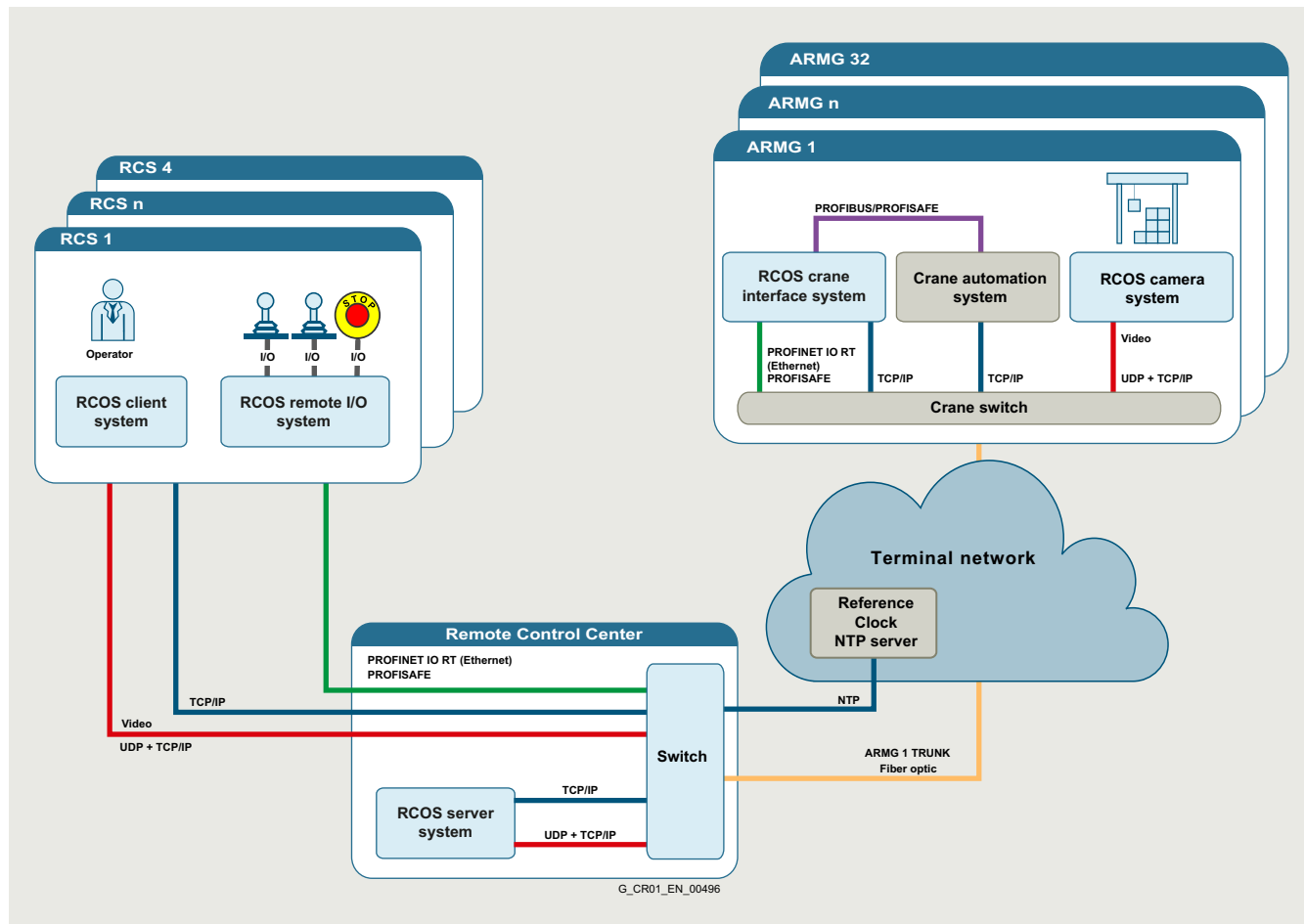
Application

Prerequisites for remote control

Siemens RCOS is applicable in a lot of environments. To be able to accommodate the RCOS system there are just a few prerequisites:

- A stable and fast network connection between the crane and the remote control station or remote control desk is mandatory for smooth operation.
- A dedicated office space for the remote control stations to stand with about 4 square meter per table minimum, space on the crane for a crane server and cameras pointed at the important areas for remote operation.

The Siemens Remote Control System offers not only the ability to connect to different type of cranes but also to connect to different controller types and brands from e.g. different crane suppliers. This gives a terminal the opportunity to standardize to one remote control platform. Resulting in many advantages like one user interface for all cranes, single system to maintain, any crane can be controller from any desk and the best cybersecurity protection.





SIMOCRANE Solutions

Remote Control Operation

Design

Technical system

The RCOS system consists of a remote control station and server in the "office" building and a combination of PLC software and cameras on the crane. The RCOS server and remote control stations are based on WinCC OA. WinCC OA will be provided with the RCOS system. Via a generator a standard program for the different type will be generated which then needs to be customized for the project.

Remote Control Station (RCS)

The operator uses the HMI on the RCS to control a crane from a remote location. To provide situational awareness to the operator, the RCS HMI provides live video streams from the remote controlled crane combined with graphical information shown in a SCADA graphical user interface. The RCS is also a SCADA client. The operator controls the crane via hardware and software controls. The hardware controls include an emergency stop push button, master controllers for controlling crane movement and buttons for frequently used crane functions. The software controls are suited for less frequently used RCS and crane functions. The operator uses a touch panel monitor to operate software controls.

RCOS cranes PLC interface

The RCOS crane PLC interface is an interface between:

- Remote Control Server System and the crane PLC
- RCS hardware controls and the crane PLC

The crane PLC interface contains the PLC logic for the RCOS system and interfaces directly with the basic crane controls in the crane PLC. The PLC interface is normally situated near/ next to the crane PLC and is connected to the crane PLC by PROFINET (PROFIBUS is also supported). The S7-1500 PLC program that will be provided needs to be customized for the application. The RCOS PLC program which will be provided can be integrated within the PLC of the crane or run standalone and needs as a minimum (S7-1515F-2PN).

RCOS supports cameras with ONVIF

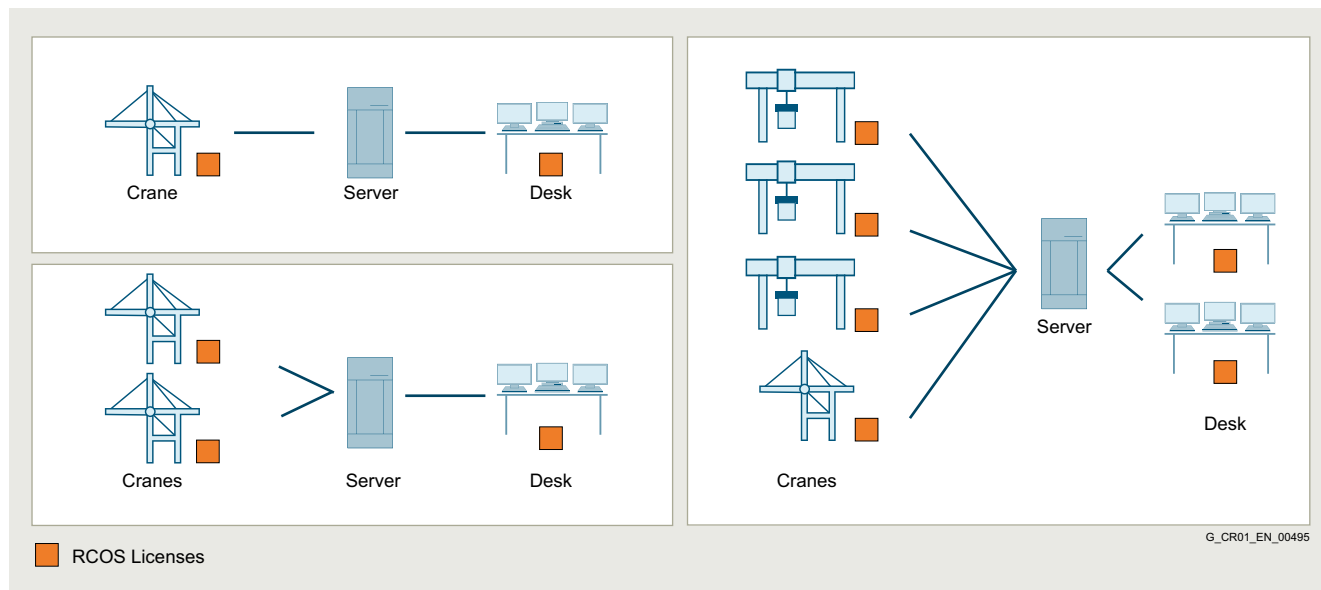
Within RCOS, the open ONVIF standard is implemented, this standard is supported by most camera suppliers. This means that camera's which support the ONVIF (Profile S) can be used in combination with RCOS. Cameras tested and approved by Siemens comply with the latency requirements for remote control.

5

Selection and ordering data

License concept

There are 2 license types for the desk and crane. For every desk and remote controlled crane a license is needed, see picture below.



There are 4 licenses available, one license per remote desk and one per crane. The licenses are according to the crane type – industrial or harbor crane.

- RCOS industry license fee per desk
- RCOS industry license fee per crane
- RCOS harbor license fee per desk
- RCOS harbor license fee per crane

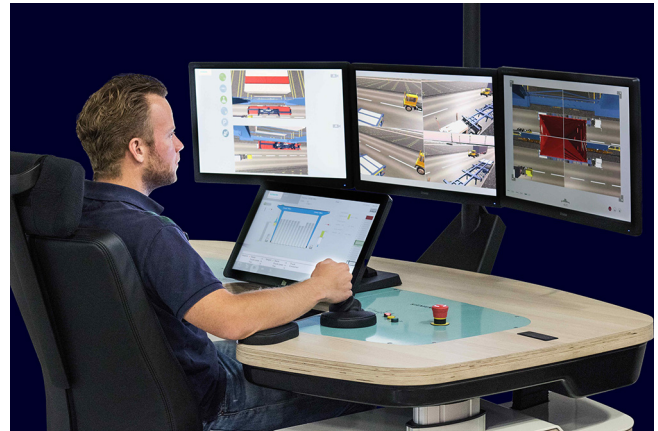


Overview

Remote Control Simulator for crane operator training

Experience the Siemens Remote Control Simulator platform firsthand. Thanks to digitalization, operator training can be optimized in a great way, without occupying the real crane and with no influence on production.

This advanced training desk provides a realistic environment for remote operators to enhance their skills and be certified to operate the crane. It serves as a valuable tool for training not only remote operators but also maintenance engineers. Additionally, it offers a comprehensive training solution with customized exercises on critical situations without risks for the operator. It is a real-time training simulator where the cranes PLC, SIMIT (actuator Simulation) and the real RCOS project is included.





SIMOCRANE Solutions

Sensor Modules

Overview

SIMOCRANE Sensor Modules are essential for crane automation. The modules are designed for fulfilling all kind of crane sensing tasks. The modules are designed as reliable assistant systems which guarantee smooth container handling. The tasks are categorized in typical solutions for crane automation such as:

- Alignment
- Collision Prevention
- Final Landing
- Profiling (Part of Collision Prevention)
- Detection
- Identification

SIMOCRANE sensor solutions are distinguished by standardized interfaces that contribute to easy integration into a Siemens crane control system. The modules are also suitable for integration as stand-alone solution into existing crane control systems.

More automation requires a variety of sensor technologies. SIMOCRANE Sensor Modules delivers the best technology for every application and crane type. The modules are based on laser, camera, or a combination of both. The software applications are designed for running on a real industrial PC hardware or in a virtualized environment.

SIMOCRANE stands for scalable technology modules for customers that pays attention to sustainability, usability, and reliability.

Siemens Cranes can rely on the many years of experience in crane automation and developing sensing systems. This know-how keeps the sensor solutions up to date so that they always meet the latest technology and security standards.



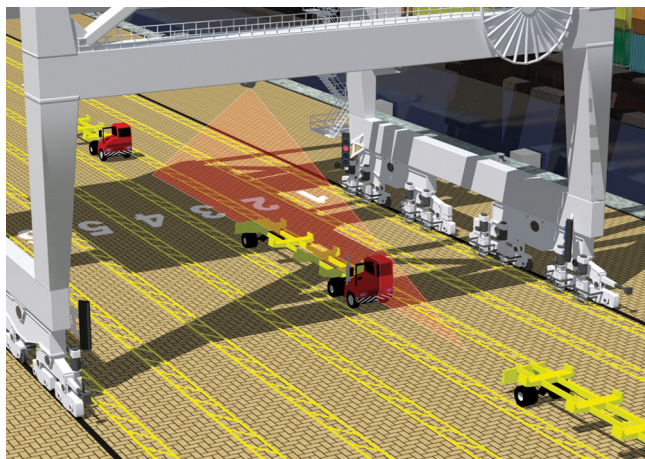
Overview

Alignment

Alignment stands for all kind of task where the crane needs to be aligned with a vehicle, like trucks, straddle carrier or other kind of container transport vehicle.

Truck Alignment

With SIMOCRANE Truck alignment, operations can be precisely and quickly executed. Transport equipment, e.g., trucks carrying containers must be loaded and unloaded simply and quickly. The prerequisite is that vehicles are well positioned under the crane. The alignment system is an intelligent, laser technology-based measuring system which has been designed to detect the position of containers and means of transport for highly precise positioning applications in harbor areas.



Example scene TPS under STS crane

Benefits

The system will provide an optimal workflow for handing over containers from the truck to the crane and vice versa. Furthermore, it provides:

- Save time for positioning trucks
- Save resources because the system guides the driver to its target position.
- Decreasing the risk of truck damages
- Flexible truck handling of internal and external trucks
- Automatic vehicle detection (no system update needed when expanding the truck fleet)
- Bi-directional lane operations
- Scan of multiple truck lanes with one sensor (sequentially)
- Scan of multiple truck lanes with multiple sensors (simultaneously)
- Scan data which enables (semi) auto landing on the truck
- Auto calibration with standard ISO container (no special equipment needed)

Application

SIMOCRANE truck alignment supports the positioning of truck designed for transporting ISO containers. The system can be installed on ship to shore cranes (STS) as well as on rail-mounted gantry cranes (RMG) and rubber-tired gantry cranes (RTG). For this purpose, at least one 3D sensor is mounted on the crane. The system determines the distance from the truck to its target container hand-over position.

This data enables precise positioning of the truck for container handling. SIMOCRANE truck alignment assists in the positioning of trucks:

- For picking up the container from the trailer, with the aim of positioning the spreader on the container.
- For placing the container on the container vehicle, with the aim of positioning the container on the trailer.

SIMOCRANE Solutions

Sensor Modules

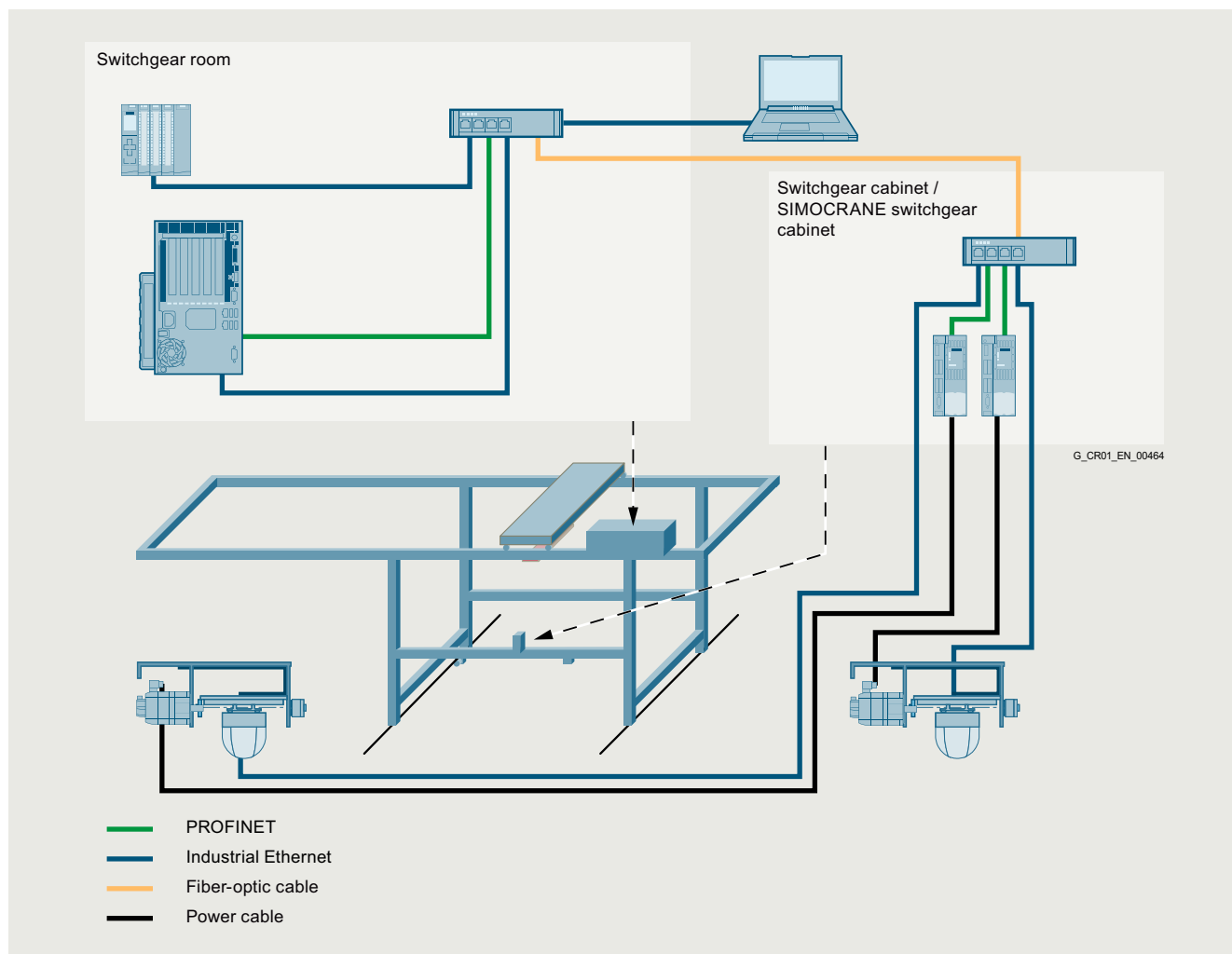
Alignment > Truck Alignment

Design

System design

The system is equipped with at least 1 laser scanner. The laser scanner is installed above the truck lane, so that the system can scan the scene from the top. It has interfaces with the crane con-

trol system and the 3D sensors. The following overview shows an example configuration of the system installed on an STS crane with two 3D sensors.



Example components of SIMOCRANE Sensor Modules TPS for STS crane

Mode of operation

Principle of operation

The 3D sensor first measures the container vehicle.

SIMOCRANE TPS distinguishes between 2 conditions:

- The system identifies an empty trailer and calculates the possible target positions for the container vehicle.
- The system recognizes a loaded container vehicle and identifies the container ISO size. Using this data, the system calculates the target position for the container vehicle.

SIMOCRANE truck alignment defines the target position of the container vehicle with this data and measures the distance of the container vehicle from the target position. SIMOCRANE Runtime passes this distance data to the crane control system. The crane control system guides the container vehicle to the target position, for example, by controlling traffic lights. The TPS process is completed, and the crane is ready for container handling.

Moreover, the TPS enables automatic handling by acquiring and providing the following data:

- Job specification, e.g., loading or unloading containers
- Loading status of the container vehicle (empty, partially loaded, or loaded)

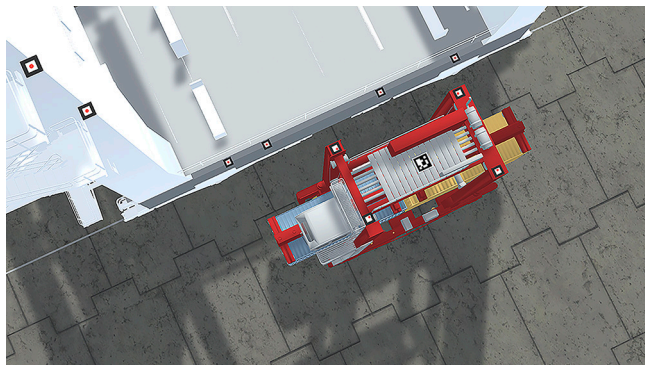


Overview

Alignment Solution Straddle Carrier

SIMOCRANE Alignment Solution provides assistance when positioning container transport vehicles:

- For placing the container, with the aim of placing the container at an exact position.



Benefits

- Bi-directional lane operations
- Vehicle identification by using ARUCO Marker where no RFID is needed
- Enables (semi) auto landing landside
- Auto calibration by using crane markers
- No persons are in the danger zone under the crane because of the fully automated guidance of the vehicles to their parking positions

Application

SIMOCRANE Alignment system determines the following for automatic positioning of a container transport vehicle:

- The positions of the markers of the container transport vehicle
- The positions of the markers of the crane

The markers must be in the detection area of the cameras for this purpose.

Design

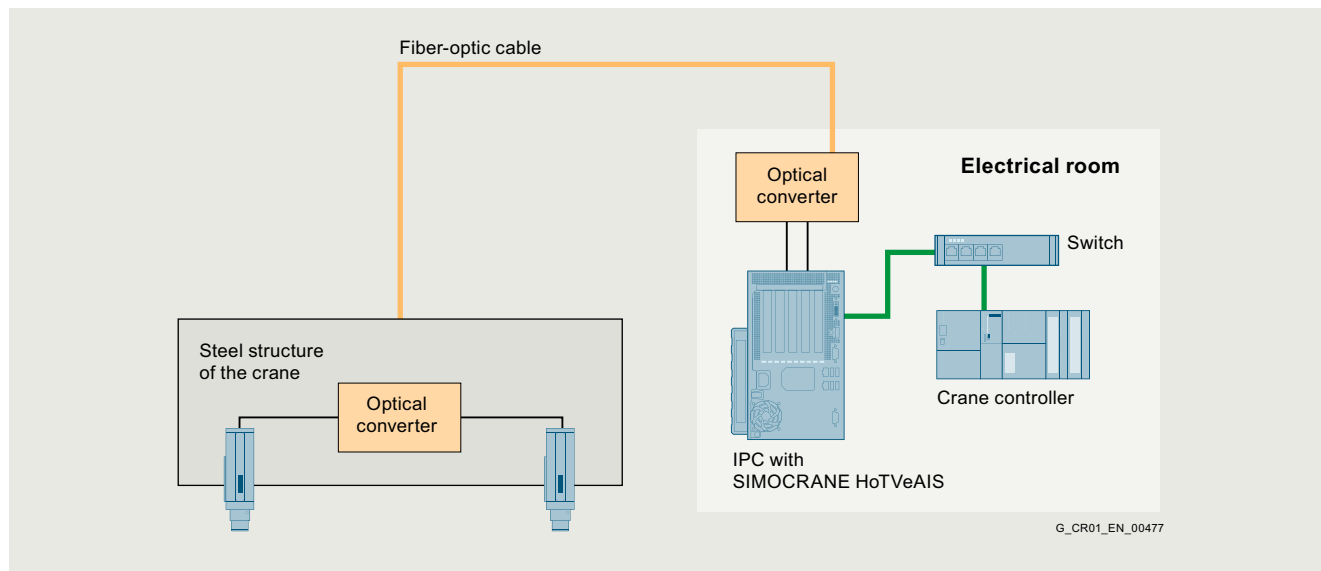
System design

SIMOCRANE Alignment Solution requires the following hardware:

- A powerful controller for deployment of the software (IPC or virtualized e.g., Hyper-V). It processes the video data and determines the container number.

The necessary performance and the type of computer depend on the customer requirements.

- Two network cameras mounted on the steel structure of the crane with top view
- Transmission components, e.g., switch, optical converter



SIMOCRANE Alignment Solution hardware components, with IP cameras

SIMOCRANE Solutions

Sensor Modules

Alignment > Alignment Solution Straddle Carrier

Mode of operation

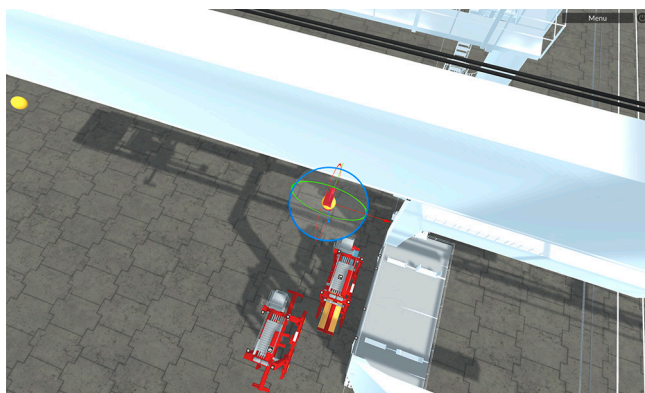
Principle of operation

Two cameras are mounted on the landside steel structure of the crane for this purpose. The cameras detect the container transport vehicle and the markers that are attached to the container transport vehicle and the crane.

SIMOCRANE Alignment Solution determines the distance between the container transport vehicle and the target position and transmits the data to the crane control system. This data allows the crane control system to precisely position the container transport vehicle for container handling.

On ship-to-shore cranes (STS cranes), SIMOCRANE Alignment Solution assist the driver with positioning the container transport vehicles:

- For placing the container, with the aim of placing the container at an exact position



STS crane with mounted cameras

Sequence

SIMOCRANE Alignment Solution works as follows:

- 1 The crane control system activates SIMOCRANE Alignment Solution and informs SIMOCRANE Alignment Solution about the lane number.
- 2 SIMOCRANE Alignment Solution detects the container transport vehicle and its direction of travel and position.
- 3 SIMOCRANE Alignment Solution calculates the deviation from the center point of the STS crane in the direction of gantry travel as well as the angle of the container transport vehicle in relation to the lane.
- 4 SIMOCRANE Alignment Solution continuously transmits the position, the angle and the detected entry side to the crane control system as soon as a valid container transport vehicle is detected.
- 5 The crane control system deactivates SIMOCRANE Alignment Solution.



Overview

Collision Prevention

Safety in stacking is a key requirement for reliable operations. The SIMOCRANE Load Collision Prevention System contributes to that safe distances are monitored in real time to avoid collisions and therefore reduce the risk of damage and consequently repair costs. SIMOCRANE LCPS reduces the risk of collisions by offering driver assistance especially regarding blind spots of manually operated cranes and supporting automated moves on automated cranes. The system is an intelligent, laser technology-based measuring system which has been designed to enhance the safety. It contributes for route optimization thus enabling an efficient workflow.

The system can be installed on rail-mounted gantry cranes (RMG) as well as on rubber-tired gantry cranes (RTG).



Example scene for load collision prevention RTG

Benefits

The system will provide an optimal workflow for container handling in the container stack. Furthermore, it provides:

- Elimination of downtime
- Reduce the risk of colliding loads in a stack, reducing damage and repair costs.
- No pre-scan required; operation can continue directly with the next job
- Collision avoidance plus stack profile scan in one system
- Shared hardware with the Final Landing System (FLS)

Application

The task of SIMOCRANE LCPS is to prevent collisions between the spreader/head block/container combination and stacked containers or other objects. SIMOCRANE LCPS basic continuously checks the safety clearances and safety clearance thresholds between the spreader/head block/container and possible collision objects.

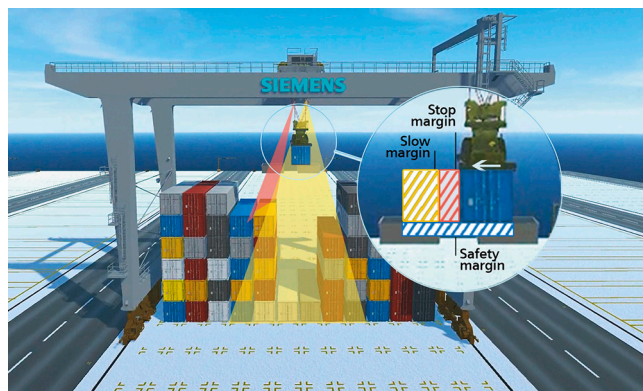
Mode of operation

Principle of operation

The system monitors the position of the spreader and its load. When an obstacle is detected, a virtual speed-dependent safety box dynamically restricts motions according to the defined safety margins. To reduce the risk of colliding towards the stack, the sway prediction is considered.

With this smart pendulum calculation, LCPS considers the residual sway and the stack gradient to define the safety margins around the load. This feature plays a key role in the output supporting the achievement of new standards in efficiency, productivity, and availability of the crane.

Dynamically adjusted safety distances in X, Y and Z direction are monitored and integrated into the drive and control system.



Speed dependent adjustment of the slow and stop margins

SIMOCRANE Solutions

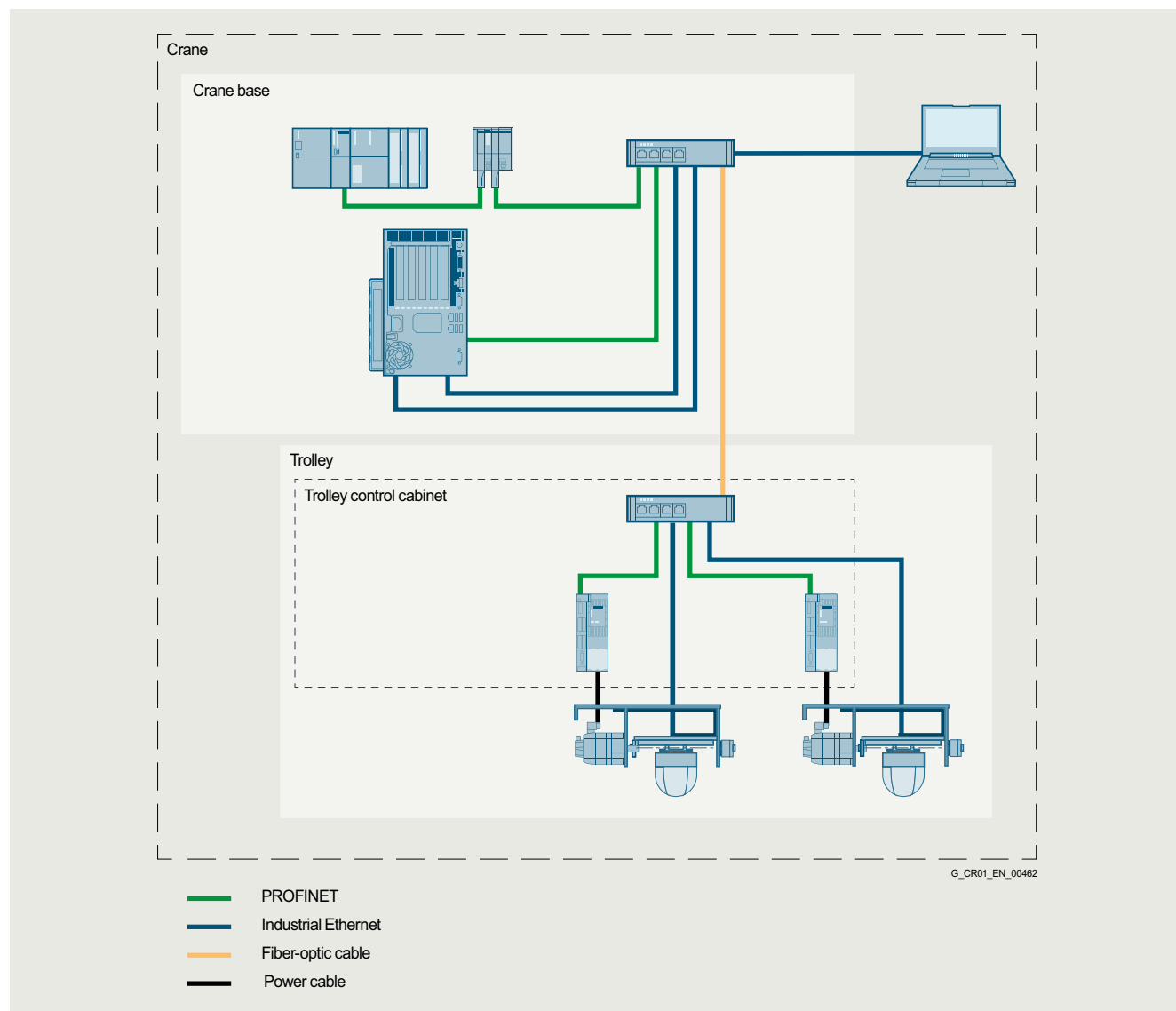
Sensor Modules

Collision Prevention

Design

System design

The following figure shows the components and an example for the design of a Load Collision Prevention System (LCPS).



Example LCPS installed on an RTG



Overview

Final Landing

SIMOCRANE Final Landing system assists remote operator guidance when positioning in auto mode. Using the latest camera or laser technologies together with an innovative assistance via automatic functions, the operator has high control for pick-up and set-down operations.

Final Landing System laser-based

SIMOCRANE final landing system laser based (FLS-L) assists the operator to land the spreader with high precision by means of multiple accurate container recognition functions. For different scenarios, the system contributes for a superior cranes' performance and accurate stacking. Multiple 3D sensors are installed on the crane and measure the offset that must be compensated for an accurate landing.



Example accurate landing procedure

The system can be installed on rail-mounted gantry cranes (RMG) as well as on rubber-tired gantry cranes (RTG).

Benefits

The system will provide an optimal workflow for handling containers in the stack and the transfer zone. Furthermore, it provides:

- Accurate stacking
- Accurate landings
- Enable remote operations.

Mode of operation

FLS-L is continuously triggered by the crane control system during operation and returns status and position data to the crane control system after processing various input data. The input data comprises the following categories:

- Measurement data acquired by FLS-L itself, e.g. laser data.
- Data from third-party systems, e.g. from an SPMS, that are further processed by FLS-L.

The feedback from FLS-L to the crane control system can consist either of absolute or relative position data. For calculation of the relative position data (distance between the spreader and the target position), the use of an SPMS is essential. To determine the position of the spreader (including load, where appropriate), the following 4 degrees of freedom are necessary:

- Gantry position
- Trolley position
- Hoist position
- Skew

The FLS-L subsystem can share hardware (e.g. the 3D sensors) with other subsystems (e.g. LCPS).

SIMOCRANE Solutions

Sensor Modules

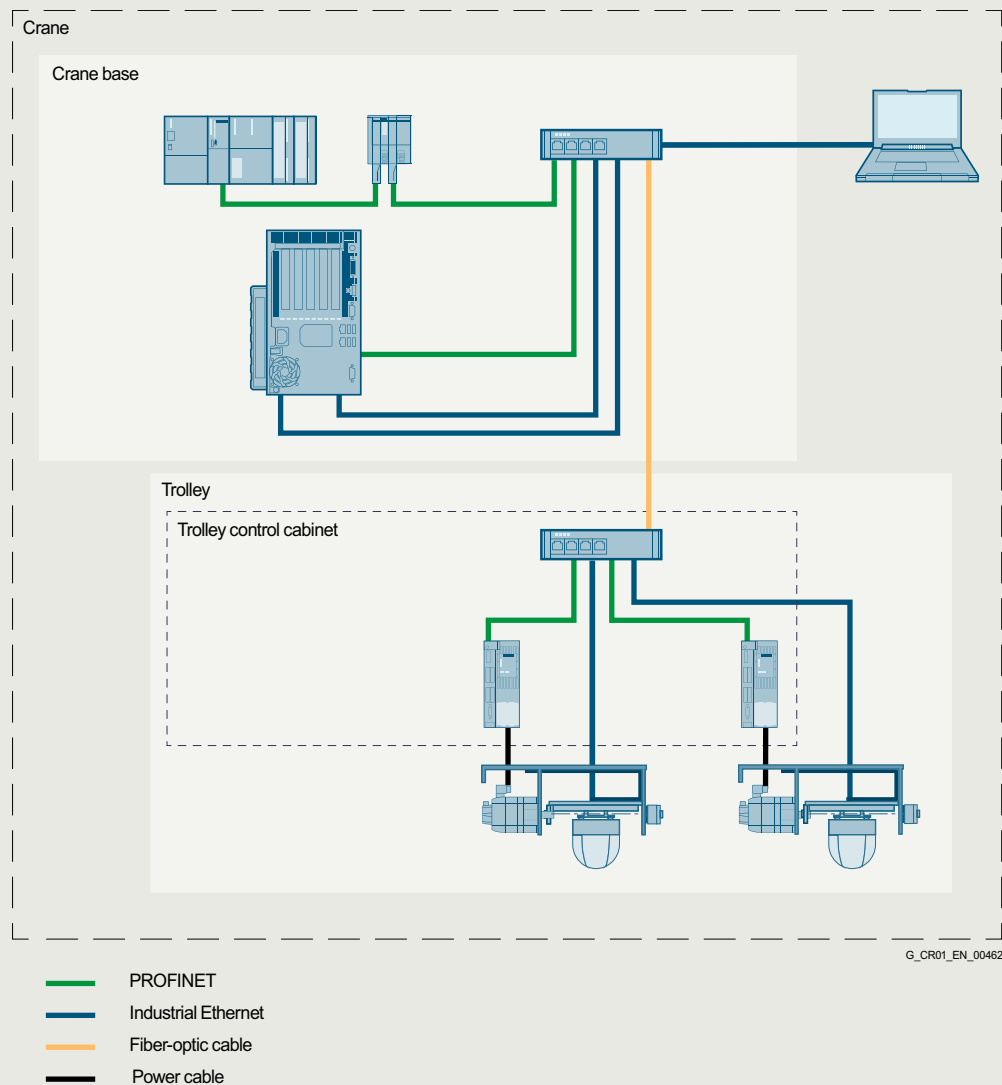
Final Landing > Final Landing System laser-based

Design

System design

The system is equipped with at least 2 laser scanners. The laser scanner is installed under the trolley, so that the system can scan the scene from the top. It has interfaces with the crane control

system and the 3D sensors. The following overview shows an example configuration of the system installed on an STS crane with two 3D sensors.



Example components of SIMOCRANE Sensor Modules FLS for RTG/RMG crane



Overview

Final Landing System camera-based

The SIMOCRANE Final Landing software is a camera-based solution for detecting and handling containers in crane loading terminals. SIMOCRANE FLS-C comprises three modules:

- Pick a container, e.g., from the ground, from a container stack or from a transport vehicle (with markers)
- Place a container onto another container
- Place a container on the ground using markers on the ground

Benefits

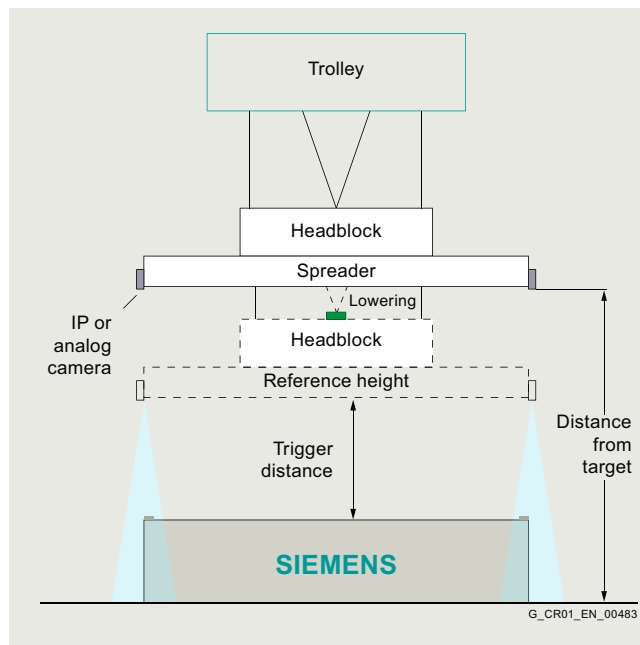
More precise pick and placements of containers can be used for variety of tasks like:

- The system detects the position of the load and target destination with high accuracy
- Increase the level of production by performing fast, accurate landing, hour after hour
- Accurate landing with an innovative assistance via automatic functions
- Cost-saving by using existing cameras on cranes i.e. via RCOS
- Measuring the vertical distance to the target
- Positioning when placing a container

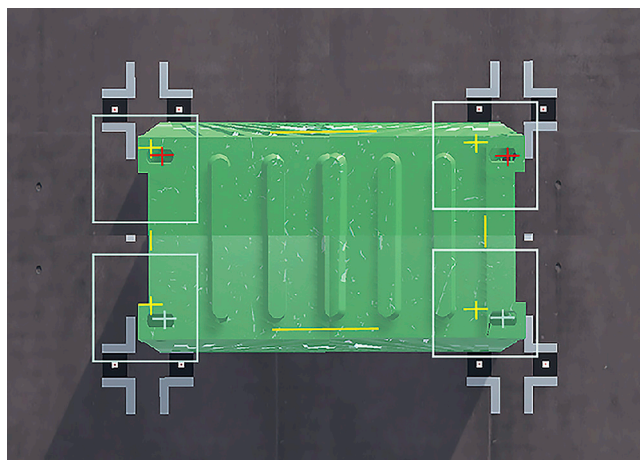
Application

Pick container

SIMOCRANE FLS-C determines the positions of the corner castings of the container for automatically placing the empty spreader on a container. To do this, the corner castings of the target container must be in the detection area of the cameras.



Lower spreader of the container



Target container after corner cast detection

SIMOCRANE Solutions

Sensor Modules

Final Landing > Final Landing System camera-based

Application

Place container on ground

To automatically place a container which has been picked up on the ground in the stacking area, SIMOCRANE FLS-C determines the positions of the ground markers in the stacking area. To do this, the ground markers must be located in the detection area of the cameras and must be completely identifiable.

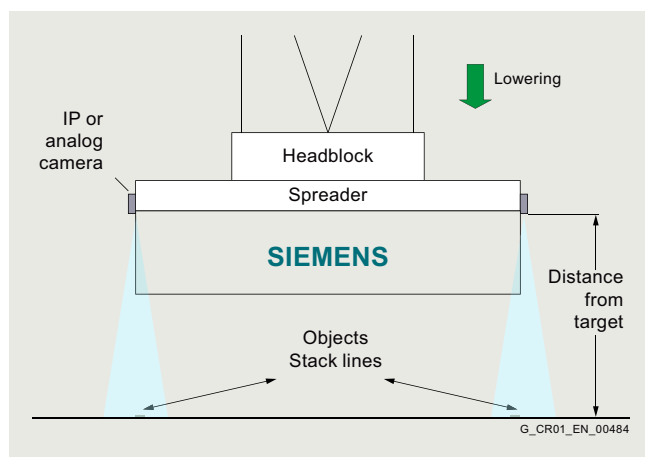
This means:

- With the human eye
- On the camera image

SIMOCRANE FLS-C calculates the following based on the determined marker positions and the position of the spreader:

- The offset of the spreader to the reference position in the X and Y directions
- The skew of the spreader in relation to the reference position

SIMOCRANE FLS-C makes the calculated values available to the crane control system for repositioning of the spreader and correct placement on the ground.



Place container on ground

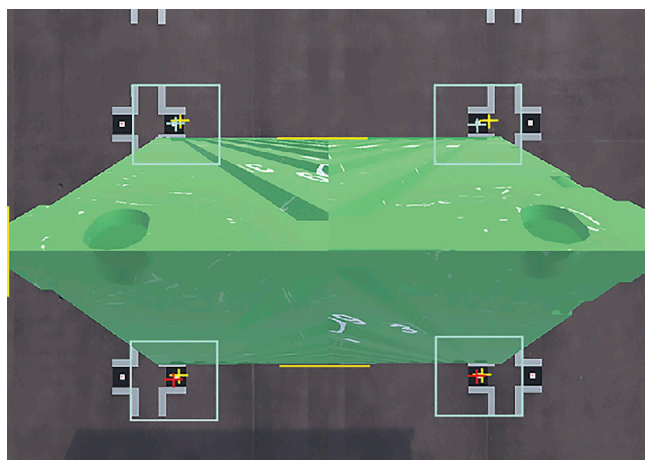


Image on ground after detection of stack lines

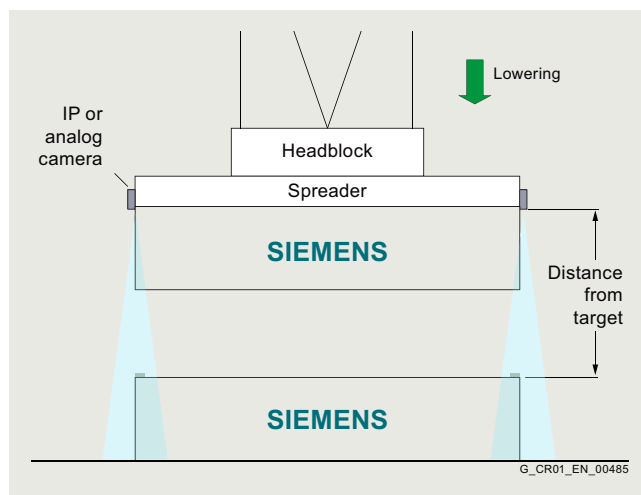
Ground markers, e.g., stack lines, which mark the container location in the field of view are required on the ground for the operating mode "Place container on ground". These ground markers must be visible under all weather conditions. They must be positioned such that the container is not placed on top of them.



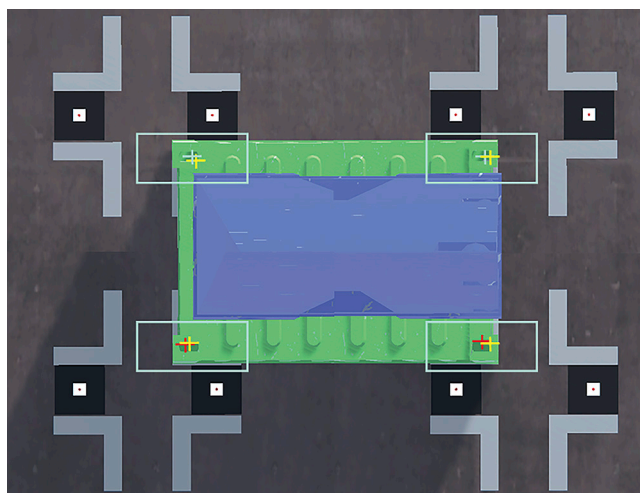
Examples of possible ground markers

Stacking container

Stacking Container enables automatic stacking of containers. When a container has already been picked up, the positions of the corner castings of the container located below it are detected. The automatic setting down procedure occurs following successful localization.



Stack operation



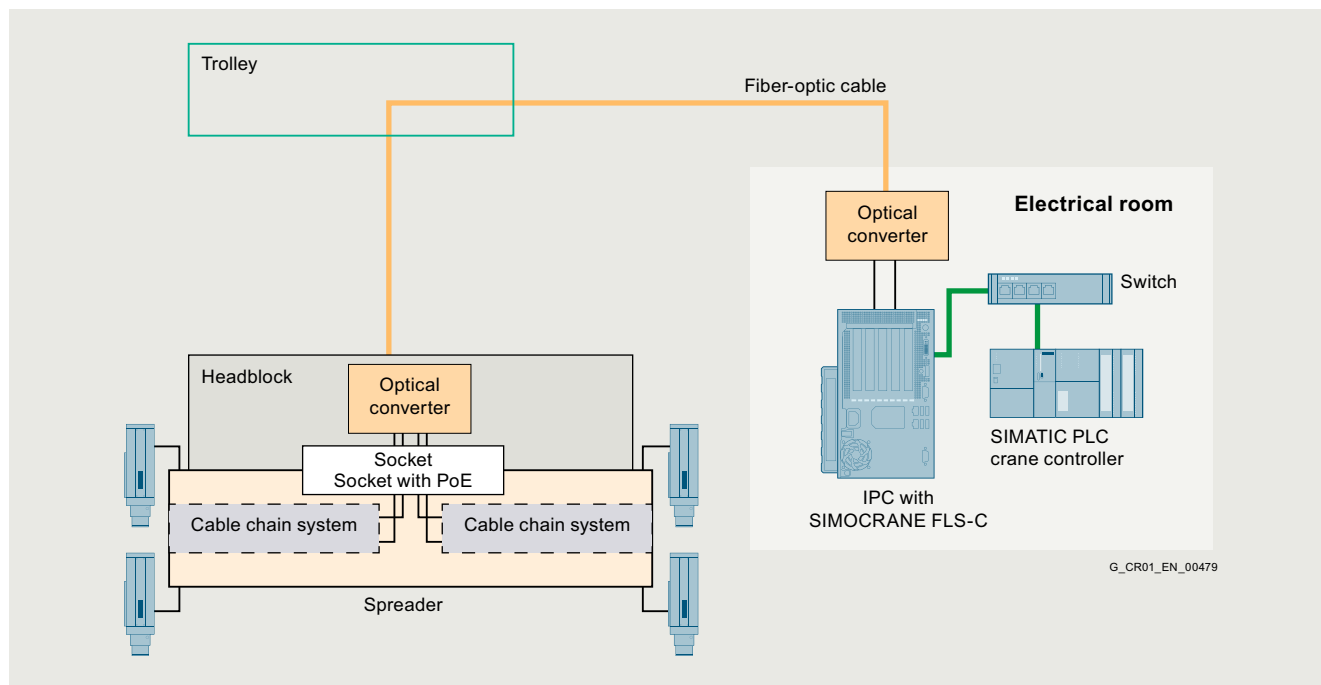
Stack operation

Design

System design

SIMOCRANE Alignment Solution requires the following hardware:

- Computer with the Microsoft Windows operating system, e.g., SIMATIC Industrial PC, as camera controller.
The necessary performance and the type of computer depend on the customer requirements.
- 4 IP cameras. The cameras are mounted on the spreader of the crane.



SIMOCRANE FLS-C hardware components with IP cameras

To make it easier to replace the spreader, the camera cables between the spreader and the head block are fitted with plug connectors (sockets).

SIMOCRANE Solutions

Sensor Modules

Final Landing > Final Landing System camera-based

Mode of operation

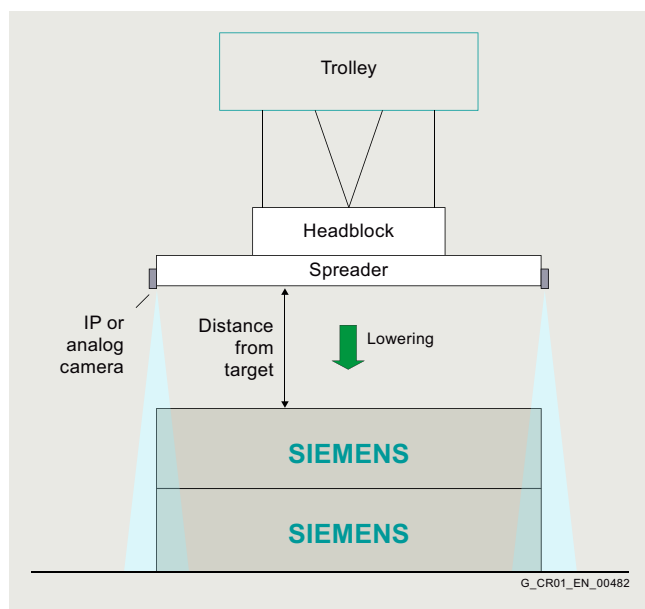
4 cameras are mounted on the spreader for SIMOCRANE FLS-C.

The crane control system triggers SIMOCRANE FLS-C for a variety of detection tasks, e.g. measuring containers and ground markers, measuring the vertical distance to the target position when placing a container.

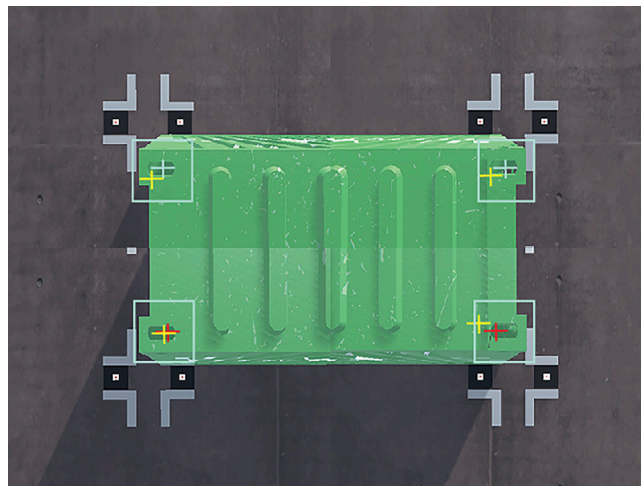
The detection tasks are performed:

- When the spreader is being placed at the defined position.
- When the cameras are at a defined distance (trigger distance) from the target object.

The trigger distance depends on the type and size of the target object and the local conditions, e.g., camera mounting position and detection sub-tasks of SIMOCRANE FLS-C.



SIMOCRANE FLS-C takes a snapshot, processes the image content, and sends the positions of the detected objects, e.g., the corner castings, to the crane control system.



Detection of corner castings in the images from the 4 cameras

The figure above shows:

- The corner castings of a container
- The detected positions in the form of red and green crosses
- The reference positions in the form of yellow crosses

SIMOCRANE FLS-C searches for the corner castings inside the evaluation area. You can adjust the sizes and positions of the evaluation areas. A smaller evaluation area reduces the processing time. A green rectangle marks the evaluation area.

SIMOCRANE FLS-C uses a plausibility check to select the 2 positions out of the 4 detected positions with the smallest deviations from the reference positions. These 2 positions are marked with green crosses. The remaining positions are marked with red crosses. They are not used for further processing. If fewer than 2 plausible positions are detected, the complete detection procedure is discarded.

SIMOCRANE FLS-C calculates average values for the X and Y directions based on the deviations of the detected positions from the reference positions. SIMOCRANE FLS-C sends the calculated average values to the crane control system. The crane control system can correct the position of the spreader based on these deviations. Also, the images from the 4 cameras are stored in an archive for diagnostic purposes.



Overview

Detection

Detection stands for all kind of task where objects needs to be detected being part of a manual and automated process. This could objects be from vehicles, containers, twist-lock in a container until obstacles which could lead to collisions. The SIMOCRANE Sensor Modules supplies a complete portfolio of solutions.

CTDS

The SIMOCRANE Container Twistlock Detection Solution (CTDS) software is a camera-based Solution which supports the automated handling of containers in crane loading terminals, and detects the accidentally not removed twistlocks, or cones. This is achieved by camera equipment and image detection software.

Benefits

- Checking if all twistlocks and cones are removed from the handled containers before you put them into the stack or on horizontal transport
- Ensures that customers can avoid heavy accidents and dangerous scenarios within their process.
- Prevents automatic locking of containers in the stack and thus prevents piggy bag situations.

Application

When containers are handled using gantry cranes, it occasionally happens that not all transport locks, twistlocks or cones are removed. This can result in damage to the mechanical system of the crane or transport vehicles and containers. Containers can also become caught in each other.

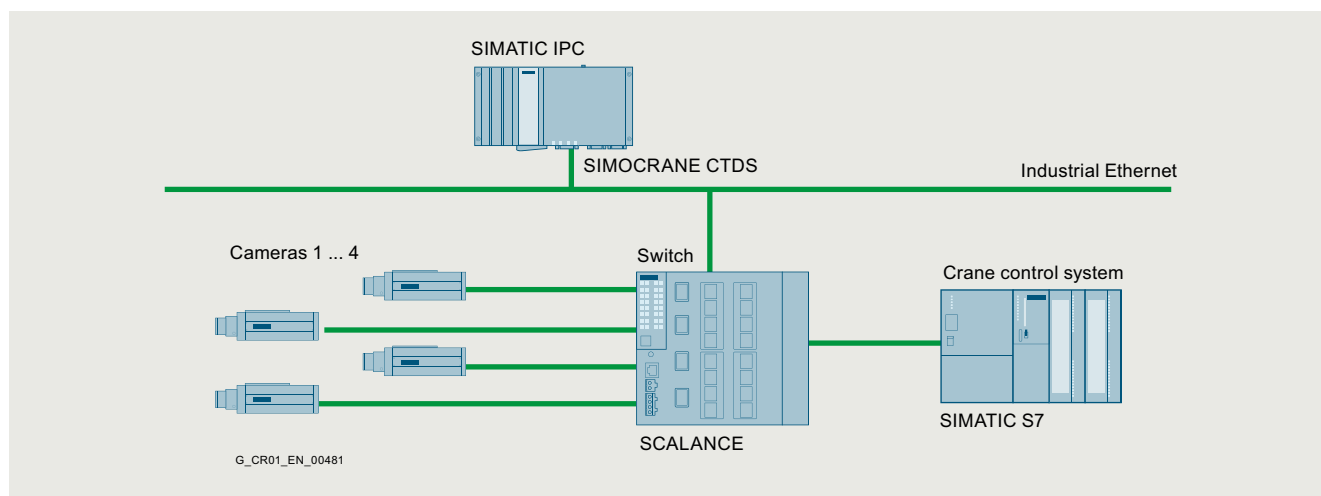
Design

SIMOCRANE CTDS requires the following hardware:

- Computer with the Microsoft Windows operating system

The computer performance depends on the customer requirements.

- At least 2 cameras that are integrated in the network. For example, the cameras can be mounted on:
- The crane legs
- Switch for the connection to the crane control system



SIMOCRANE CTDS, hardware

SIMOCRANE CTDS exchanges data with the crane control system via the Industrial Ethernet.

SIMOCRANE Solutions

Sensor Modules

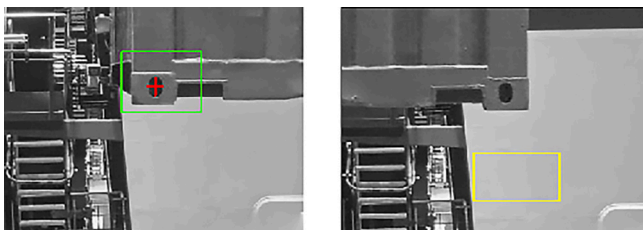
Detection > CTDS

Mode of operation

Twistlocks and cones on the underside of containers can be detected using the "Detect Twistlocks / Cones" operating mode. The containers must be moved past the cameras for this purpose. Detected twistlocks/cones are signaled to the crane control system.

Searching for corner castings

If the corner castings are not detected, because they pass through the camera image at a level that is too high or too low – an error message is issued to the crane control system. For the error scenario, an image with four corner castings quad image is also sent to the control room.



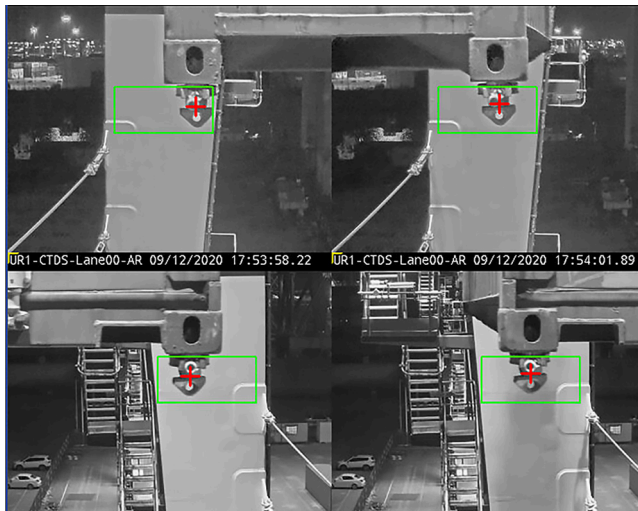
Searching for corner castings

Detecting corner castings

- Image on the left – The corner casting has been detected.
- Image on the right – The corner casting cannot be detected because it is outside the detection area.

Searching for twistlocks/cones

The system searches for twistlocks/cones below the detected corner castings.



Twistlocks detected

Twistlocks/cones have been detected and a corresponding message is sent to the crane control system.



Overview

Identification

Identification stands for all kind of task where objects needs to be identified being part of a manual and automated process. This could be a vehicle ID number and container ID number. The SIMOCRANE Sensor Modules supplies a complete portfolio of solutions for identification.

CNRS

The Container Number Recognition Solution CNRS is used on cranes terminals for supervision purposes, as assistance system for the crane driver and for the remote control of automated stacking cranes (ASC/RMG/RTG). Images taken by the camera are being evaluated by optical character recognition (OCR) software.

Benefits

The advantages of using SIMOCRANE CNRS are as following:

- Increased efficiency of container handling and avoids discrepancies in the container stack area
- Completing the next step towards a fully automated crane or a fully automated terminal
- Prevents containers from being lost or misidentified
- Existing cameras on cranes could be used

Application

SIMOCRANE CNRS is a camera-based solution which supports the automated detection of container numbers in crane loading terminals.

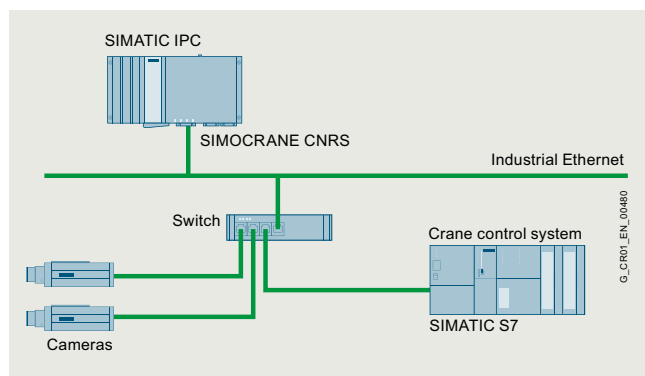
Sometimes it happens that a container is accidentally delivered to the wrong crane. SIMOCRANE CNRS avoids the loss of containers in a manual and automated container terminal.

The SIMOCRANE CNRS can detect the numbers printed on the roof, short, and long sides of the container. The cameras can be installed on typical locations such as the truck lane, lashing platform, or on the spreader.

Design

SIMOCRANE CNRS requires the following hardware:

- A powerful controller for deployment of the software (IPC or virtualized e.g., Hyper-V). It processes the video data and finds the container number.
- One set of cameras. The number of cameras will be optimized for the client's purpose.



SIMOCRANE CTDS, hardware

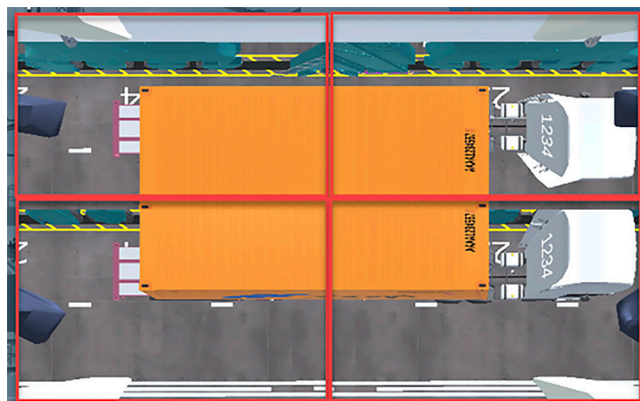
SIMOCRANE CNRS exchanges data with the crane control system via the Industrial Ethernet.

Mode of operation

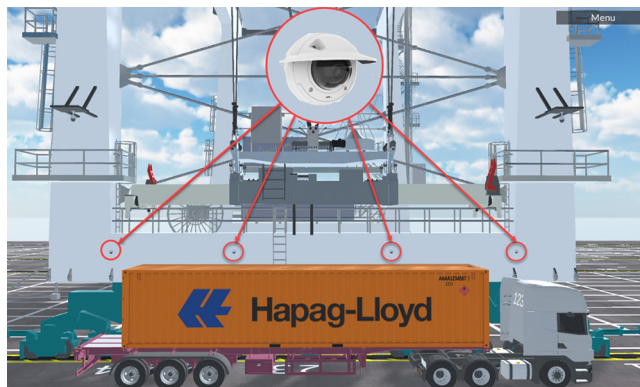
SIMOCRANE CNRS reads in images from cameras and processes these.

SIMOCRANE CNRS evaluates the images from the cameras with different detection algorithms.

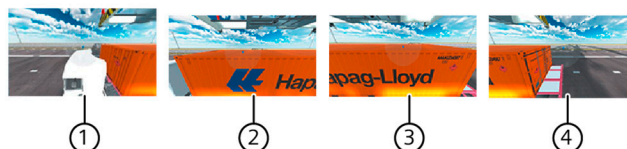
Depending on the operating mode and transmits the results to the crane control system. The results are archived in image sequences in a ring memory, so the images remain available for later investigation and analysis.



Field of view of cameras from above, example



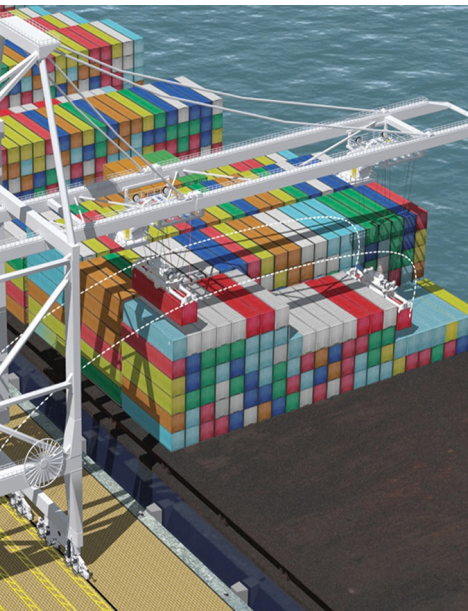
Camera positions on the crane, example



Fields of view of cameras from the sill beam, example

- ① Field of view of the camera on the left, viewed from the crane
- ② Field of view of the camera to the left of center
- ③ Field of view of the camera to the right of center
- ④ Field of view of the camera on the right

SIMOCRANE application examples



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6/3	<u>Rubber tired gantry (RTG) crane</u>
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SIMOCRANE application examples

SIMOCRANE Technology Suite

Overview

SIMOCRANE offers a range of various products that, in different combinations, fulfill a wide range of different requirements for scalable crane automation solutions.

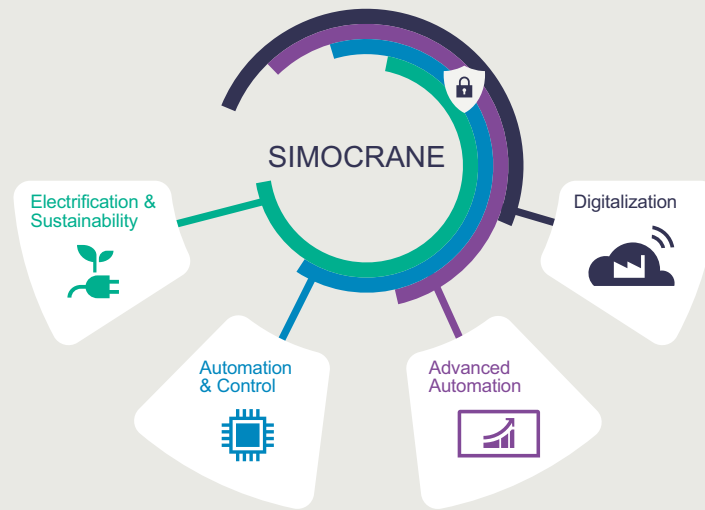
The SIMOCRANE Technology Suite is based on standard Siemens products accomplished by market-specific applications and solutions. Our customers therefore enjoy all the usual advantages regarding reliability of Siemens products combined with innovative crane automation solutions.

This high degree of scalability is a decisive advantage in the implementation of simple manual crane applications through

to semi or fully automated crane applications. The image below illustrates our SIMOCRANE Technology Suite with a wide range of modular solutions for digitalizing crane operation.

The diversity and combination possibilities of SIMOCRANE products for implementing the different requirements will be illustrated here.

The detailed functional scope of the individual products and solutions is described in the corresponding sections. The following application examples, provide an overview about the use of SIMOCRANE products in typical crane applications.



SIMOCRANE Technology Suite

For further application support please contact the Cranes Application Center.

Email: applications.cranes.aud@siemens.com

SIMOCRANE application examples

SIMOCRANE ECO Technology

Rubber tired gantry (RTG) crane

Application

This application example describes an ECO configuration for a rubber tired gantry (RTG) crane.



Application example

The objective is to reduce the fuel consumption by operating the diesel engine/electrically driven RTG crane at speeds dependent on the load using standard industrial products and SIMOCRANE products from Siemens.

Savings generated by an ECO configuration depend on a number of crane-specific factors. Only a few of these factors can be influenced by ECO Technology. Concrete statements cannot therefore be made about the achievable savings for specific configurations. It can be assumed, however, that when SIMOCRANE ECO Technology is used in comparison to cranes with constant speed or 2 speeds, a noticeable saving is achieved.

Comparison tests have demonstrated a savings potential of between 40 and 50%. Test cycles were conducted under identical conditions at a constant speed of 1800 r/min and at speeds controlled by ECO Technology for the purposes of comparison. Siemens offers support with specification of the possible crane construction and use. The final average consumption of the crane will be determined by the actual design and use of the crane.

To achieve savings, the following factors should be taken into account:

- Selection of combustion engine; every combustion engine has typical dynamic behavior and typical consumption.
- Design of the crane (total weight, components in drive train, gears, tires, spreaders, etc.)
- Speed, acceleration times, and design of the hoisting gear, trolley, or crane travelling gear
- Design of the auxiliary power supply (lighting, heating, cooling, etc.); the basic load of the auxiliary power supply should be as low as possible.
- Use of the crane

All cranes differ with regard to their specifications and the relevant design, so it is extremely difficult to quantify the possible savings of one crane over another. Specification of the required maximum fuel consumption per hour is the better approach. The overall design of the hardware (crane and installation) and software can then be developed and optimized on the basis of this specific ECO requirement.

Solution

In this example of an upgrade to SIMOCRANE ECO Technology, a configuration with SIMOCRANE Basic Technology was selected. SIMOCRANE Basic Technology is equipped with tested crane functionality. The Basic Technology package comprises SIMOTION D with a CompactFlash card. The ready-to-use application with integrated ECO Basic Technology interface can be used with minimum configuration and commissioning outlay. Use of SIMOCRANE Basic Technology is not mandatory for operation of SIMOCRANE ECO Technology. For realization of the ECO example, the following SIMOCRANE products have to be selected:

- 1 × SIMOCRANE ECO Technology V1.0 license
Article No. **6GA7230-0AA00-0AA0**
- 1 × SIMOCRANE Basic Technology V3.0
Article No. **6AU1660-4AA20-0AA0**
- 1 × SIMOCRANE CMS V4.4 Lean
Article No. **6GA7214-0AA00-0AA1**
- 1 × SINAMICS S120 Motor Module in chassis format as infeed
- 1 × SINAMICS S120 Active Line Module with Active Interface Module and license "Grid droop control" (**S02**) for auxiliary drive

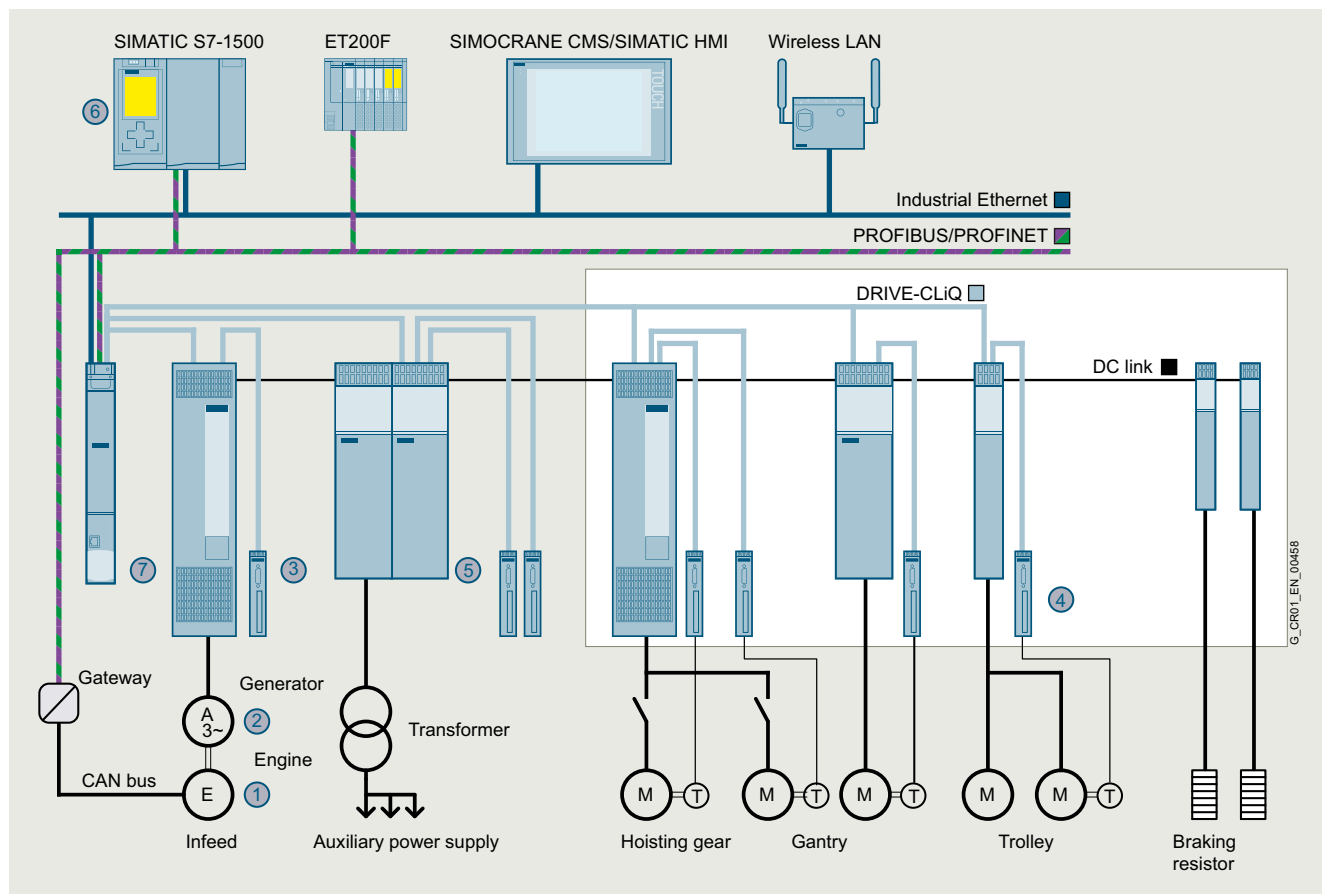
SIMOCRANE application examples

SIMOCRANE ECO Technology

Rubber tired gantry (RTG) crane

Design

A conventional configuration is transformed into an ECO application simply by changing points 3 (infeed), 5 (auxiliary supply) and 7 (ECO Technology) of the graphic "Topology of SIMOCRANE ECO Technology for RTG" (see below).



Topology of SIMOCRANE ECO Technology for RTG

The selection steps for conversion to SIMOCRANE ECO Technology will now be explained. The numbers in the graphic above correspond to the numbers below. The description is limited to the ECO-specific changes.

The crane configuration can, of course, involve selection from all SIMOCRANE products in accordance with requirements.

For details of the individual SIMOCRANE products as well as further configuration options, see Sections:

- SIMOCRANE Standard Technology
- SIMOCRANE Advanced Technology (sway control systems, truck positioning)
- SIMOCRANE CMS (Crane Management System)

Design**Selection steps****1. Diesel engine**

Use of ECO Technology demands that the load-dependent speed of the diesel engine can be controlled in a closed feed-back loop. For fast and flexible communication with the ECO system, use of a CAN bus is recommended. The diesel engine should be operated in a variable speed range.

2. Generator

A permanent-magnet synchronous generator has to be used due to its better properties over the entire performance range. This concerns torque motors that offer relatively high output at low speeds. This is possible thanks to the lower speeds of the diesel engine. A typical RTG selection is a synchronous generator with excitation (voltage controller or automatic voltage regulator (AVR)). This generator type can be used for the infeed only after a check for voltage interruptions. It may be necessary to install a reactor between the infeed and the generator. Please contact the supplier or Siemens Application Support for more information.

3. Infeed

For ECO, the infeed must be equipped with a SINAMICS S120 Motor Module. In combination with ECO Technology, the Motor Module generates a stable DC link, even when the generator voltage constantly fluctuates. Only SINAMICS S120 Motor Modules in chassis format have been tested and approved for this mode of operation. A Motor Module is selected for the infeed based on the same criteria as for the Basic Line Module (BLM), i.e. based on the total output and the current that is required for supplying the DC link loads.

4. Traction drives, hoists, trolleys, gantries and braking modules

When upgrading to ECO Technology, no criteria influence this motion package and the selection of the braking module.

5. Auxiliary supply

The auxiliary power supply is realized with Active Line Module, Active Interface Module and Voltage Sense Modules. All the auxiliary loads must be connected after transformer for 2-phase (L+N) components.

Selection of the Active Line Modules and Active Interface Module must take into account the constant (average) power/current consumption and the maximum power/current consumption of the connected loads for the purpose of handling the inrush current.

6. Controller, such as PLC, HMI with SIMOCRANE CMS installed and preparation for RCMS

When upgrading to ECO Technology, no criteria influence this selection.

7. SIMOCRANE ECO Technology

SIMOTION D4x5-2 is used with SINAMICS Integrated V4.3 SP1 or higher, SINAMICS V4.5 or higher and the two licenses for Basic Technology and ECO Technology.

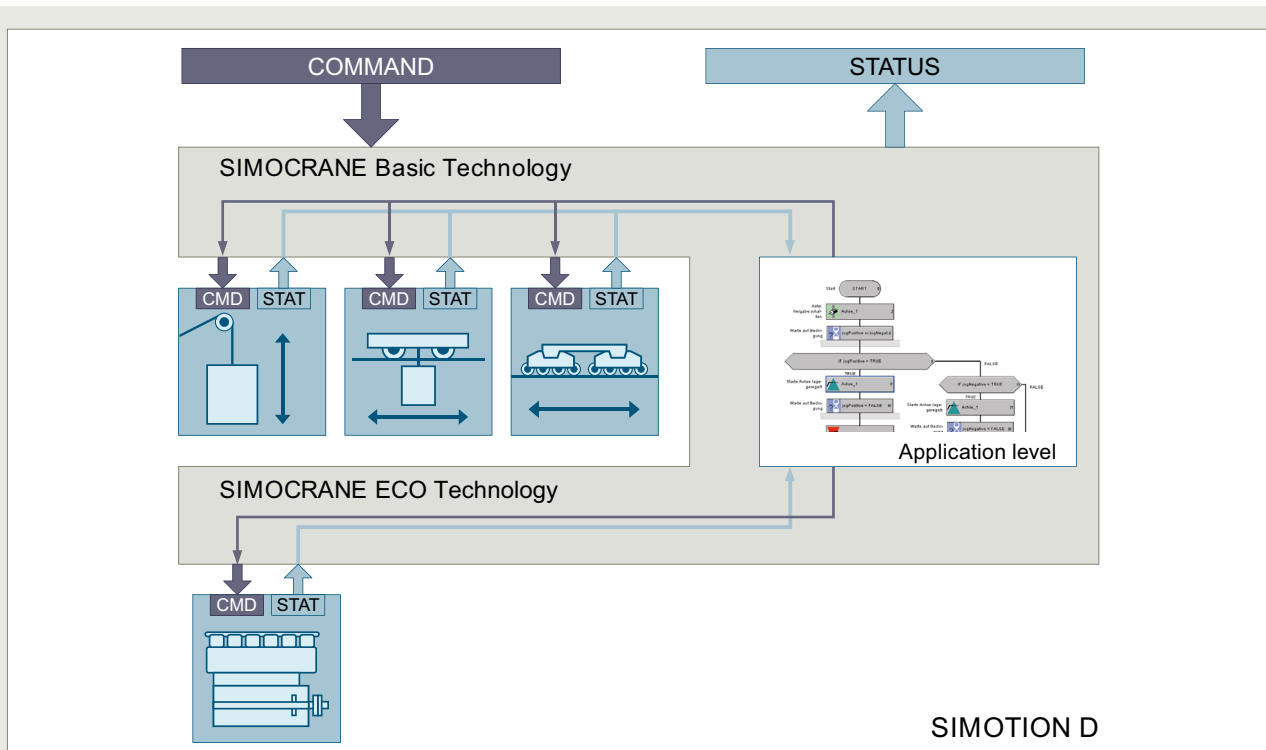
SIMOCRANE application examples

SIMOCRANE ECO Technology

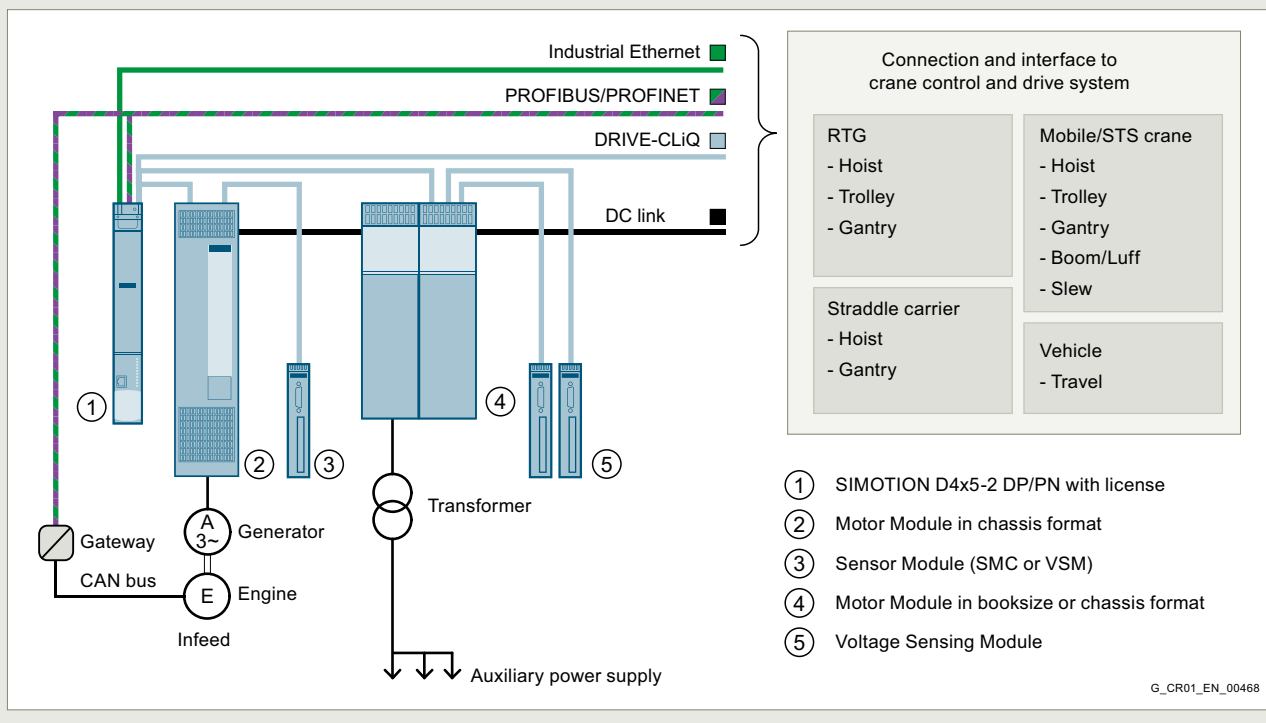
Rubber tired gantry (RTG) crane

Design

The basic components required for an ECO package are shown in the overview diagram below:



6



SIMOCRANE ECO Technology configuration for RTG

Note:

Integration of an energy storage unit for the purpose of implementing a hybrid control strategy, i.e. storage and reuse of regenerative energy, is possible as an application. Please address any inquiries in this regard to our Application Support in the Cranes Department in Germany.

SIMOCRANE application examples

SIMOCRANE ECO Technology

Rubber tired gantry (RTG) crane

Selection and ordering data

SIMOCRANE components required for ECO RTG configuration

Description	Article No.
SIMOCRANE ECO Technology V1.0 for SIMOTION D4x5-2 consisting of 1 item each • ECO Technology V1.0 license • DVD with - ECO Technology DCC blocks - Standard application - Documentation	6GA7230-0AA00-0AA0
SIMOCRANE Basic Technology V3.0 for SIMOTION D435-2	6AU1660-4AA20-0AA0
SIMOCRANE CMS V4.4 Lean	6GA7214-0AA00-0AA1

Suggestion for additionally required components, e.g.:

Description	Article No.
SIMOTION SCOUT V5.3 SP1	6AU1810-1BA53-1XA0
Optional package	
Drive Control Chart (DCC) V3.2 SP1 for SIMOTION/SINAMICS	6AU1810-1JA32-1XA0

Further information on selection and ordering of supplementary components can be found in the following catalogs:

- D 21.4 – SINAMICS S120, SINAMICS S220 and SIMOTICS
 - SINAMICS S120 drive system
 - Permanent-magnet synchronous motor with encoder
- PM 21 – SIMOTION Equipment for Production Machines
 - SIMOTION CX32-2 Controller Extension

SIMOCRANE application examples

STS crane with landside automation

Application

This application example describes a solution for automated STS crane with autolandings at landside on terminal vehicles using the SIMOCRANE technologies for an unloading from ship.

Application example

A sensor system (e.g., SIMOCRANE TPS) assists the truck driver when parking with the aid of simple guidance via a traffic light or display. The guidance equipment is placed in such a way that the driver can see it under all circumstances. The Terminal Operation System (TOS) specifies the lanes for container hand-over and the travel direction of the truck. The transfer area under the crane is divided into multiple lanes. In the selected lanes, a measurement system detects and tracks the truck and guides the truck driver to the ideal container hand-over position. After the truck is positioned, a measurement system shall provide target landing position to the crane controller, so that it can perform an automatic container hand-over.

After positioning the truck, the crane system will start the hand-over procedure. The crane control will calculate the optimal path from the container start position to its destination. To guarantee a smooth container hand-over, container movements including its sway are controlled by the crane control system.

Manual intervention must be possible at any time in case the crane automation reports a problem. A crane management system (e.g., SIMOCRANE CMS and RCMS) will supply information about the reported problem. A remote operator connects a Remote-Control Operating System (e.g., SIMOCRANE RCOS) to the crane which requests support. After solving the problem, the crane will be back to automatic operation.

Solution

The application example formulated above can be implemented using SIMOCRANE products and solutions in combination with external systems like ship profile scanning system. For this application example, the products and solutions and their functions described below are applied.

SIMOCRANE Basic Technology forms the basis for this application and controls the standard motion control functions of hoist and trolley as well as gantry.

SIMOCRANE Sway Control, as advanced technology, carries out safe, reliable and performant crane operation.

Crane Management System – SIMOCRANE CMS
SIMOCRANE CMS records faults and operating data and allows parameters to be set for crane operation.

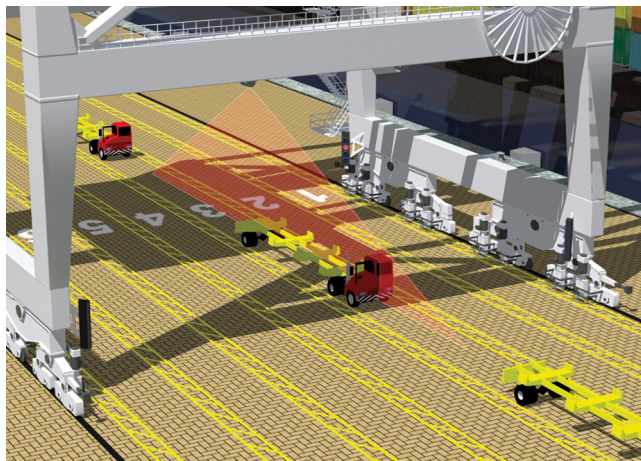
SIMOCRANE TPS guides the truck to the position in the specified lane.

SIMOCRANE RCOS makes it possible for crane operators to supervise, monitoring crane movement and manual intervention, if required.

Procedure

1. Controlled parking of a truck

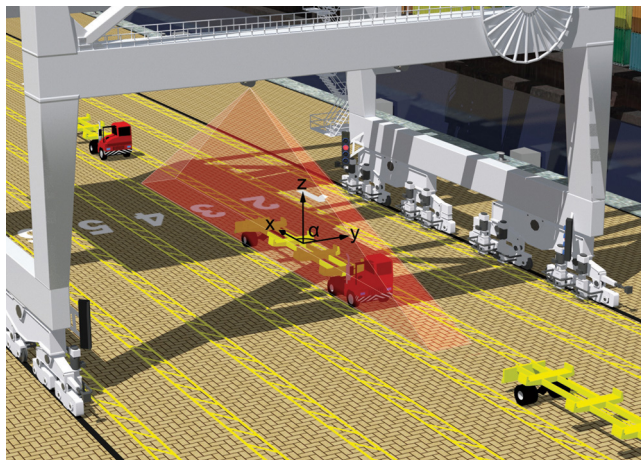
SIMOCRANE TPS is used to detect and track an approaching truck and to determine its exact target position. The driver is guided to the target position using a signaling system (e.g. traffic light).



TPS – Parking procedure

2. Precise target position measurement for the parking truck

Parking is still done manually by a truck driver. For this reason, after parking, precise measurement of the truck is necessary. This is also performed by SIMOCRANE TPS. The precise target coordinates determined (X, Y, Z and angle of rotation) are transferred to the crane controller.



TPS – Position determination / target measurement

Note:

The determined coordinates must be converted to a crane coordinate system on the application side in the crane controller!

SIMOCRANE application examples

STS crane with landside automation

Application

3. Automatical travel from the ship to landside

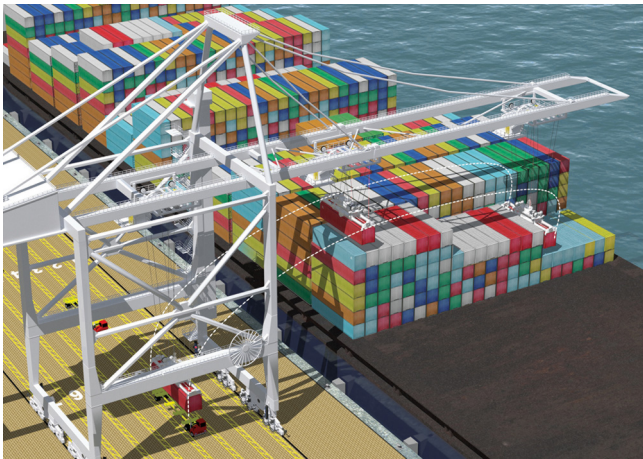
This procedure can be performed in parallel with step 1 and step 2.

The SIMOCRANE Sway Control System provides the following functions here:

- Travel along a time-optimized trajectory considering obstacles, which are provided by an external ship profile scanning system.
- Joint movement with coordinated motion control of the trolley and the hoisting gear.
- Closed-loop control of load swaying.
- Closed-loop control of the angle of rotation of the load (skew oscillation) via cylinders or electrical system.
- The TLS-control enables spreader in suitable trim-list-skew position by sending the setpoints for the trim, list and skew cylinders to the crane controller.

Note:

For automated STS crane, a ship profile scanning system with load collision prevention function is precondition for safe, performant and reliable operation.

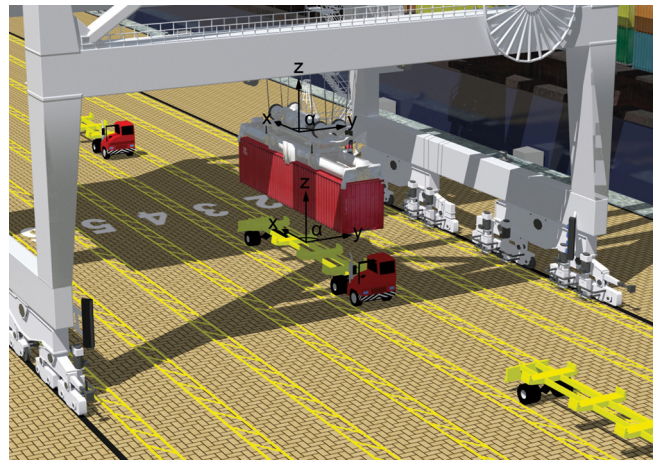


TPS – Scenario on-board ship

4. Autolanding a container on the truck

The decisive factor in this step is accurate interplay of the SIMOCRANE components used.

- The load position is determined by the SIMOCRANE CenSOR camera measuring system and it allows closed-loop sway control and load position control.
- The target position and skew angle are determined by SIMOCRANE TPS and it is output at the interface for the crane controller.
- Based on the load and the target position data, SIMOCRANE Sway Control carries out the positioning operation completely for the relevant axes.
- Additionally, skew control is enabled in landing procedure.



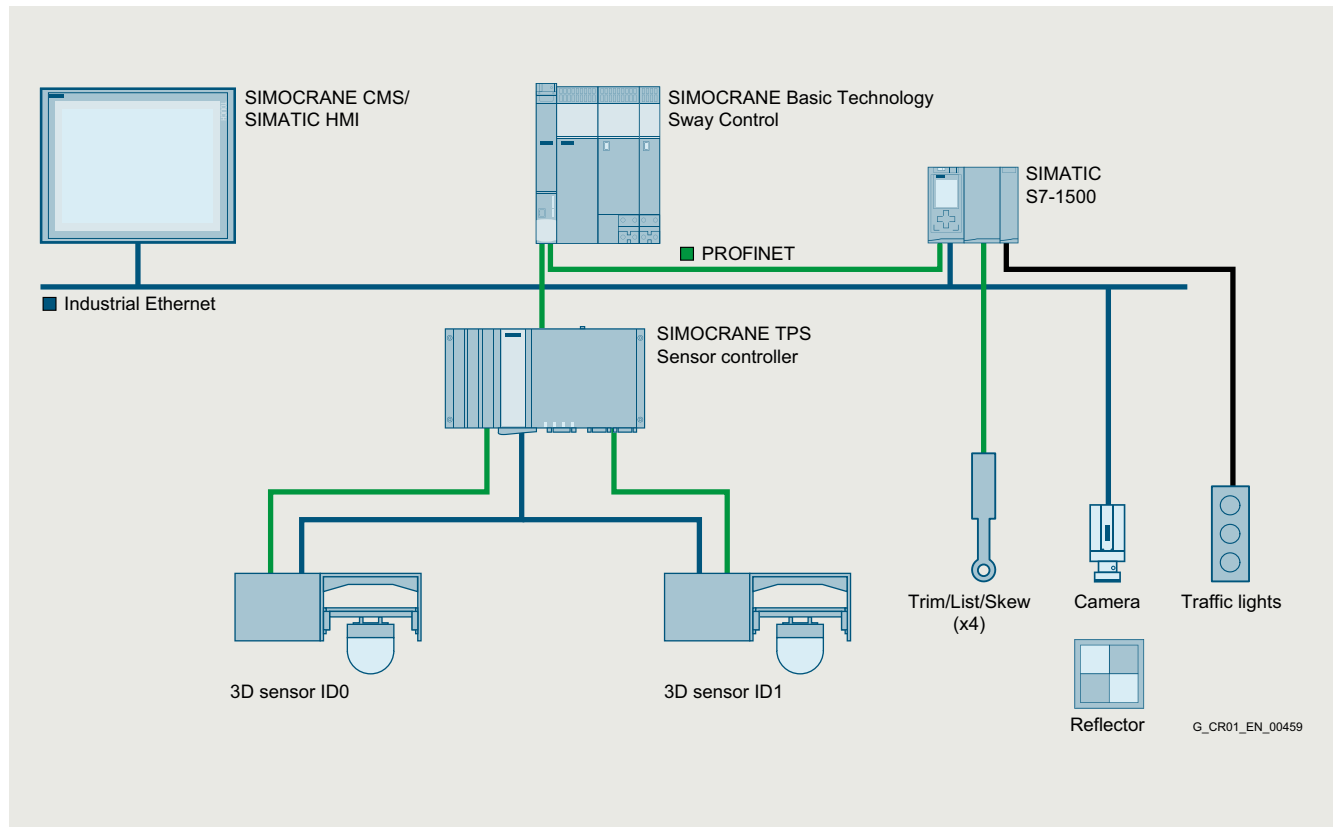
TPS – Setting down a container

SIMOCRANE application examples

STS crane with landside automation

Design

System structure



Topology of semi-automatic STS crane

Details of the individual SIMOCRANE products as well as further configuration options can be found in the Chapters:

- SIMOCRANE Standard Technology
- SIMOCRANE Advanced Technology
- SIMOCRANE CMS (Crane Management System)
- SIMOCRANE Solutions

G CR01 EN 00474



A crane operator starts hoist with Manual Mode (MAN) until the safe height – yellow position A – at waterside, then switches over to Semi-Automatic Mode (SAM) on the fly. SAM proceeds with either autolanding at lashing platform for twist-lock handling, if required, or moves directly to the target position at land-side. With the CenSOR (camera and reflector), the autolanding on trucks or AGVs can be either guided by higher level controller with additional safety related monitoring or achieved directly by using SAM. With direct connection to the Terminal Operation System (TOS) and optimized terminal logistic, productivity can be greatly increased by Dual Cycling Operation.

SIMOCRANE application examples

STS crane with landside automation

Selection and ordering data

The list shows all the relevant SIMOCRANE components for this configuration:

Description	Article No.
SIMOCRANE Basic Technology V3.0 incl. SIMOTION D435-2 (1 item)	6AU1660-4AA20-0AA0
SIMOCRANE Truck Positioning System (TPS)	Please refer to Chapter SIMOCRANE Solutions.
SIMOCRANE Sway Control System consisting of	
• SIMOCRANE SC integrated V3.0 HF1 software type – STS/GSU	6GA7200-0AA01-1AA0
• SIMOCRANE CenSOR V3.0 HF1 Camera for sway angle measurement with 35 mm lens	6GA7202-2AA10-1BF1
• Retroreflector 300 × 300 mm, lifting height up to 50 m	6GA7201-1AA01-0AA0
• Retroreflector 500 × 500 mm, lifting height up to 70 m	6GA7201-1AA02-0AA0
SIMOCRANE CMS (HMI) • SIMOCRANE CMS 4.4 Advanced	6GA7214-1AB00-0AA1

SIMOCRANE application examples

Mid-performance OHBC crane

Application

This application example describes a simple configuration for an overhead bridge crane (OHBC) which applies the SIMOCRANE products for mid-performance market.



Application example

The objective is to equip an overhead bridge crane with necessary crane-specific technology such as start-pulse function for hoist to prevent load sag, pushbutton controller with fixed or variable setpoint and positioning function as well as smart function like inching function for all axes. Furthermore, a sway damping is required for manual operation and even for automatic positioning of trolley and gantry. In this way, it can relieve a crane operator and increases the crane productivity and automation degree.

The following example describes the challenges of a multi-axis configuration used in mid-performance crane applications. It involves an overhead bridge crane (OHBC), controlled by PLC via PROFINET communication. The SIMOCRANE Basic Technology V5.0 (Basic License) provides crane-specific functions as mentioned above and more.

Furthermore, the SIMOCRANE Drive-Based Sway Control can damp sway in manual operation and positioning for trolley and gantry and approaches the target positions with high accuracy and efficiency. In combination of both products, Siemens can even provide dynamic pre-limit switch and support collision prevention assistance. With both products, Siemens meets the challenge of most applications in mid-performance market.

Solution

In order to fulfill the requirement, the following SIMOCRANE products are required:

- 1× SIMOCRANE Basic Technology V5.0 (Basic License)
Article No. **6GA7260-6AA30-1BA0**
- 1× SIMOCRANE Drive-Based Sway Control V1.0 SP2 –
solution for multi-axis (Basic Control)
Article No. **6SL3077-6AA00-3AB0**

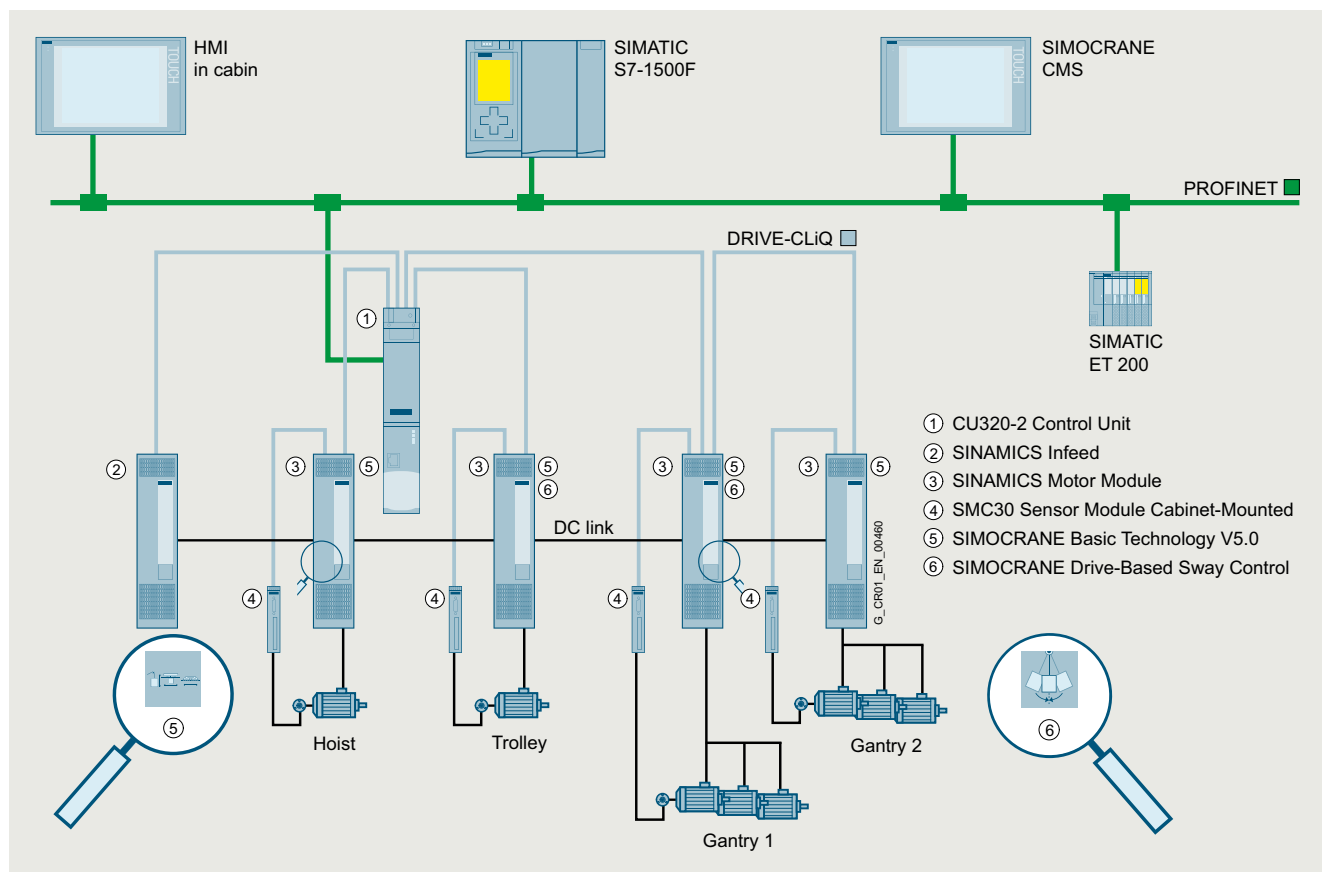
SIMOCRANE application examples

Mid-performance OHBC crane

Design

The graphic below shows a crane topology with a multi-axis drives configuration. With PROFINET/PROFIsafe (telegram) communication the PLC can enable the SINAMICS Safety Integrated function as well. In hoist applications, an encoder is equipped at the hoist for safety reasons and for providing pendulum length to cross travel (trolley) and long travel (gantry).

For positioning, encoders for trolley and gantry are required. In this application SIMOCRANE Drive-Based Sway Control reaches the best performance with a positioning accuracy up to 1 mm.



Topology of a mid-performance OHBC crane with multi-axis configuration

Selection and ordering data

SIMOCRANE components required for this configuration:

Description	Article No.
SIMOCRANE Basic Technology V5.0 comprises CompactFlash Card with Basic and Performance license 1 item	6GA7260-6AA30-1BA0
SIMOCRANE Drive-Based Sway Control V1.0 SP2 for multi-axis applications (Basic Control) 1 item	6SL3077-6AA00-3AB0

Suggestion for additionally required components, e.g.:

Description	Article No.
Drive Control Chart (DCC) for V3.4 SP2 and higher 1 item	6AU1810-1HA34-0XB0
STARTER for V5.4 SP2 and higher	6SL3072-0AA00-0AG0
SINAMICS S120 CU320-2 PN Control Unit without CompactFlash Card	6SL3040-1MA01-0AA0

SIMOCRANE application examples

SIMOCRANE CMS Crane Management System

Application

For multi-distributed systems, with a large number of cranes the system architecture using SIMOCRANE CMS and RCMS can be used in order to interconnect all stations together and make use of the long term archiving system of WinCC. With the connection of all CMS systems to the RCMS server all data can be archived in a central database.

Application example

On a terminal with 4 STS cranes and 16 RTG cranes SIMOCRANE CMS provides a standard crane-specific signals monitoring, failure analysis, playback of all crane movements and data using replay as well as reporting and maintenance instructions.

With the RCMS server installed in the terminal, the cranes can be monitored easily. Every crane connected to the RCMS server sends its configured operational data and alarm messages to the central database of the RCMS server. The data is used to calculate KPIs of the terminal like moves, MMBF and counter values. Furthermore, the RCMS shows the operating status of each crane on the terminal and provides the possibility to respond immediately to any occurring event.

Solution

In order to fulfill the requirements the following SIMOCRANE products have to be ordered:

- 4 × SIMOCRANE CMS V4.4 Advanced (STS cranes)
Article No. **6GA7214-1AB00-0AA1**
- 16 × SIMOCRANE CMS V4.4 Lean (RTG cranes)
Article No. **6GA7214-0AA00-0AA1**
- 1 × SIMOCRANE RCMS V4.4 standard package (single-server) 1 × WebClient
Article No. **6GA7215-0AA00-0AA1**

For the communication between the server and all clients a sufficient bandwidth in form of TCP/IP must be available. Additionally to the SIMOCRANE CMS products hardware with the following minimum requirements is needed.

- 20 × CMS stations: The minimum requirements are as follows:
 - Processor: Intel Core i3 or higher
 - Main memory: minimum of 8 GB
 - Hard disk: minimum 160 GB (preferably more)
 - Drives: DVD-ROM drive
 - Operating system: Windows 10 or Windows 11 (64 bit, enterprise/professional), MUI (Multilingual User Interface), system language English (US)

We recommend using a SIMATIC IPC477 for every CMS station on the terminal.

- 1 × RCMS station: The minimum requirements are:
 - Processor: Intel Quad Core i7 or higher
 - Main memory: minimum of 16 GB
 - Hard disk: minimum 2 × 1 TB
 - Drives: DVD-ROM drive
 - Graphics: 2 × VGA or DVI or at least one must support a Resolution of 1920 × 1200
 - Operating system: Windows Server 2019, MUI (Multilingual User Interface), system language English (US)

For the RCMS server we recommend using a SIMATIC IPC847 or SIMATIC IPC647.

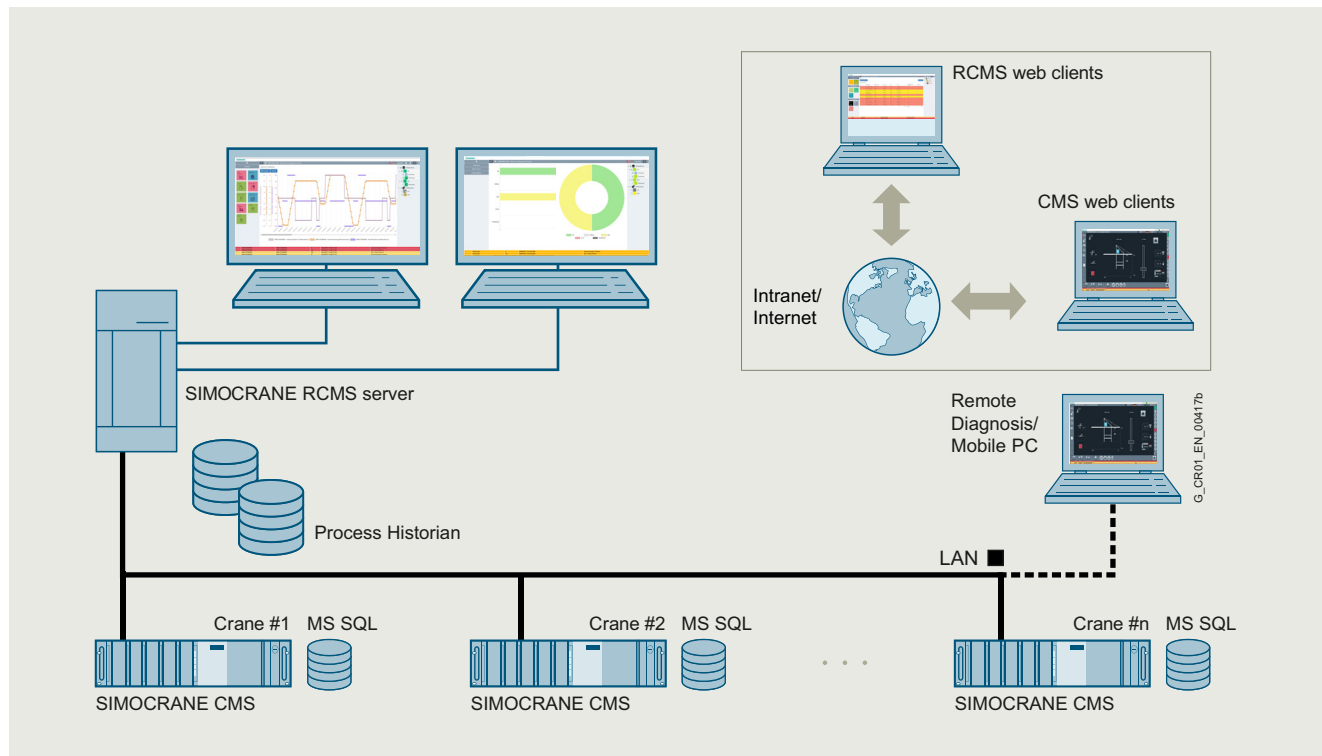
SIMOCRANE application examples

SIMOCRANE CMS Crane Management System

Design

On each crane SIMOCRANE CMS is installed on a Panel PC with a direct connection to the crane PLC. Furthermore, each crane is connected to the RCMS server (Rack PC) via TCP/IP commu-

nication provided by the SIMOCRANE CMS product. The configuration of SIMOCRANE CMS and RCMS can be adjusted to customer needs by the application engineer.



Possible setup of SIMOCRANE CMS products

Selection and ordering data

SIMOCRANE components required for this configuration:

Description	Article No.
SIMOCRANE CMS V4.4 Advanced 4 items	6GA7214-1AB00-0AA1
SIMOCRANE CMS V4.4 Lean 16 items	6GA7214-0AA00-0AA1
SIMOCRANE CMS V4.3 RCMS Single station 1 item	6GA7215-0AA00-0AA1

Equipment Logistics System ELS



7/2	Equipment Logistics System ELS
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7/3	Overview
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7/4	ELS INTERMODAL
7/4	Overview

Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit

www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under

www.siemens.com/cert.



Equipment Logistics System ELS

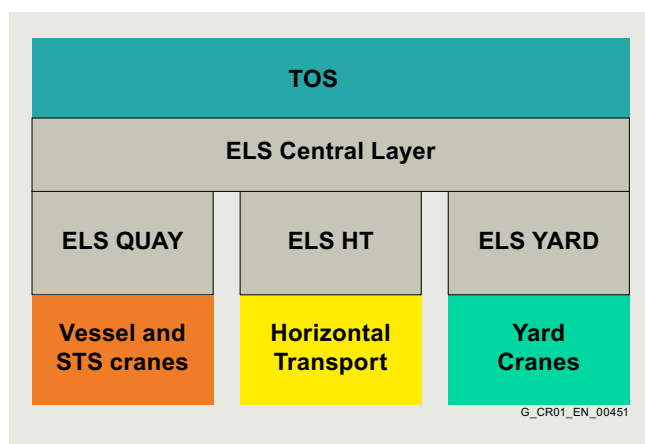
Overview

The Equipment Logistics System (ELS) is an enterprise-based platform to optimize the operation and throughput in a terminal. The ELS system is typically placed between the terminal operating system and the equipment control systems for hoisting and transport equipment. ELS has various modules for maritime and intermodal terminals.

These modules cover:

- ELS QUAY for ship to shore cranes (STS)
- ELS HT for horizontal transport (terminal tractors, straddle carriers, AGVs, reach stackers, ...)
- ELS YARD for yard cranes (ARMGs, ARTGs and straddle carriers)
- ELS INTERMODAL for intermodal cranes (railcar handling, stack, gate functionality, manual areas, handling of dangerous goods)

Each module has its own data model and an independent persistent data layer (Microsoft SQL database). All modules are controlled by a central layer managing the flows between the modules.



Design

ELS is an intelligent middleware to decouple host systems (i.e. TOS) and the equipment. Besides the data layer it provides a lot of operational functions, such as planning, scheduling and dispatching of container movements in a terminal. A powerful GUI including a real time 3D-visualization ensures transparency and interaction at any time.

Furthermore, exceptional handling such as bypassing obstacle areas, chimney prevention, etc. is part of the standard scope. The advanced strategy for location finding covers operational requirements and container properties, such as dangerous goods. ELS will do the routing to its destination using the most economical and efficient path.

The software solution follows the idea of an open platform. Normally equipment control systems (ECS) allow parameterization only, but ELS offers APIs to connect foreign systems directly to ELS kernel.

APIs from ELS can be used to:

- Connect foreign PLC brands to ELS
- Create custom GUIs
- Connect mobile devices to ELS
- Transfer data to existing data hubs for data analytics
- Connect 3rd party ECS to ELS

Also, API can be used to overwrite strategies inside ELS. This means, customers can create their own functionality inside ELS by writing own software code.

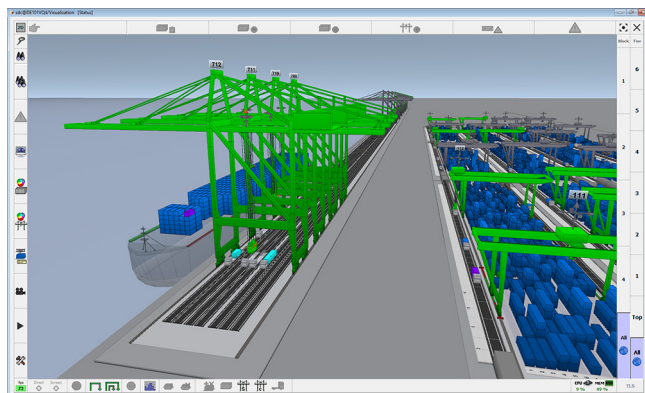
Following this approach, ELS can also be integrated into existing brownfield areas to improve the productivity.

Besides the operational functionality, a data hub and a data warehouse can be provided to collect all data for analysis and further improvements.



Overview

ELS QUAY



Example of a 3D-visualization screen with waterside STS cranes

The ELS QUAY module is focused on the operation of an STS crane. It receives the work instructions from a TOS, schedules the orders and does the dispatching to spreader/PLCs. It supports single or double trolley (with platform handover), with single, twin and/or tandem spreader.

Using the online connection to the PLC, transport commands are sent directly to the crane to ensure no waiting times in case of normal operation.

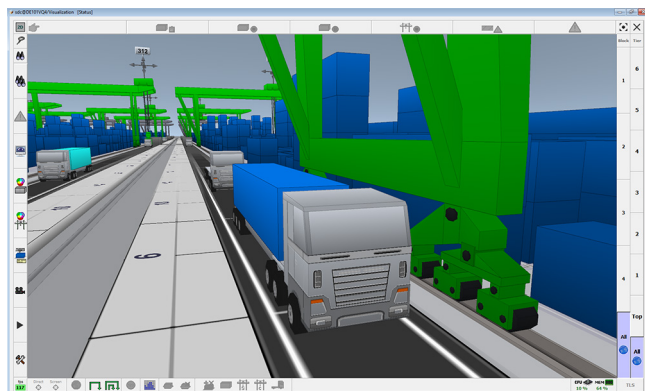
Containers are picked and placed under the STS on different lanes, either on the ground for straddle carrier operation or onto AGVs/terminal tractors. Management of the individual lanes is part of the ELS QUAY module.

Data from PLCs are tracked and in case of no-read of the OCR-system, container ID can be updated manually.

All movements can be monitored in the 3D visualization in real time.

Overview

ELS HT



Example of a customized screen for horizontal transport equipment

ELS HT is a module designed for horizontal transport in all variations. It supports various vehicles for horizontal transport, such as straddle carriers, AGVs, terminal tractors and others and can guide these vehicles by technical interface or by dialog terminal for the vehicle operators.

ELS HT offers different levels of operation. Transport instructions can be transferred to a fleet manager or being processed by the ELS HT internal fleet manager.

The ELS internal fleet manager is a generic fleet manager assigning the planned movements to vehicles, gives move instructions to the individual vehicles, determines the routing paths for each transport and supervises the execution. Also, it monitors the technical status of each vehicle if information is transferred.

ELS HT can also connect to an existing fleet manager.



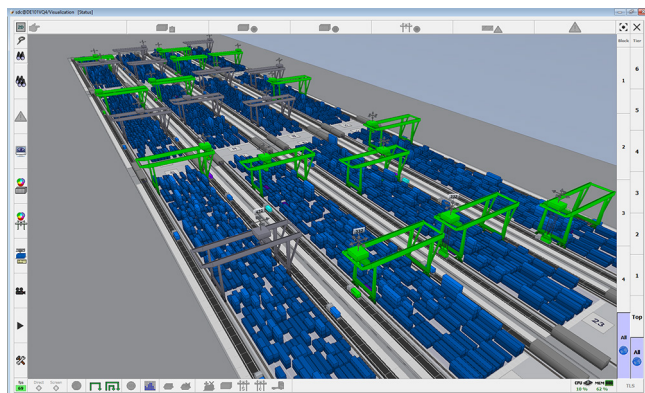
Equipment Logistics System ELS

ELS YARD – ELS INTERMODAL

ELS YARD

Overview

ELS YARD



SIEMOCRANE ELS Equipment Logistics System, ELS YARD

The ELS YARD module is the central module for managing the yard operation. It can be operated with ARMGs, ARTGs or straddle carrier, as end-loading or as side-loading module.

Side-loading module: Transfer area is the loading lane for trucks, the truck position is directly beside the bay of the actual container position/destination location.

End-loading module: Transfer area is located at the end of the block. Containers will be picked for storing from this area or delivered from stack to this area.

ELS YARD takes over container in the transfer area and stores it at the requested destination location. If no location is given, ELS determines its own location.

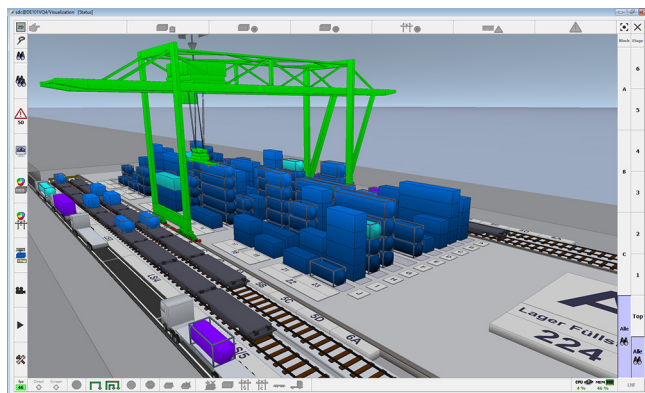
For retrieval, dedicated container will be selected and placed in the transfer area (on a dedicated location/vehicle or location calculated by ELS).

Movement orders will be scheduled and dispatched, if more than one order per crane is available. If no crane is assigned to a movement, ELS will automatically select the best crane. Based on scheduling, reefer unplug support can be provided.

ELS INTERMODAL

Overview

ELS INTERMODAL



Example of a 3D-visualization screen of an intermodal terminal

The ELS INTERMODAL is a combination of the maritime modules and connects the required aspects in one application. It is designed to operate one or more intermodal cranes with overlapping work areas managing for example:

- The stacking areas
- Wagons/railcars on the rails
- Loading lane for trucks
- Manual operated devices (i.e. reach stacker or fork lift trucks)
- Manual areas (i.e. for empty container stacking)
- Gate or interface to the gate systems

ELS INTERMODAL not only retrieves data from the railway companies, but it also allows operators to plan the trains themselves. Inbound and outbound trains are managed according to timetables. The software supports different railcar types, including their dimensions and/or twistlock positions and assists operators in arranging the setup that is required for loading.

Before unloading, inbound trains are verified either through a mobile device or through the crane's camera scans. ELS INTERMODAL oversees all timelines and ensures that all trains are loaded and unloaded while adhering strictly to the designated departure times.

An efficient stack management ensures that ELS INTERMODAL always finds the best location for a container in a stack, based on the given information such as planned exit time/exit medium, weight, container type, stacking rules etc.

Also, if dangerous goods should be handled, it ensures, that all defined rules (e.g. distance to other DGR containers or time constraints) will not be violated.

The scheduling is done automatically based on deadlines for trains and time windows for truck arrival (if available). Based on scheduling, reefer unplug support can be provided.

Dispatching can be done by ELS itself or by a crane operator using ELS dialog functions.

Trucks will be handled on the loading lane for loading and unloading. At gate entry, a truck will be directed by ELS either directly to the position on the loading lane or to a parking area. From the parking area, trucks will be called to the loading lane by technical support, i.e. via a big display or via app on the truck drivers mobile phone.

All actions executed in ELS can be transferred to a billing system to charge the terminal customers.

Design

ELS is designed as a client server application. The server is running on Microsoft Windows Server or Linux. The database is SQL-based, such as Oracle or Microsoft SQL.

It is recommended to run the server in a virtual environment.

High-availability solutions can be provided according to customers' requirements.

The client is running on standard Windows PC or mobile devices.

Drive systems



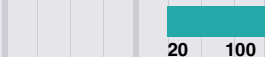
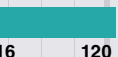
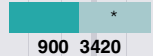
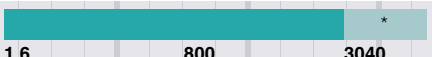
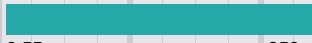
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Drive systems

Overview

Type overview and rating data

Overview

Converter type and description	Type of format	Degree of protection	Rated power P_N in kW for 380 ... 480 V 3 AC line voltage				Selection and ordering data Catalog or Page
			1	10	100	1000	
Drive system for multi-axis applications							
Basic Line Module Infeed (AC/DC module) Uncontrolled DC link No energy recovery	Booksize format	IP20					D 21.4
	Chassis format	IP00					D 21.3
Smart Line Module Infeed (AC/DC module) Uncontrolled DC link Energy recovery	Booksize format	IP20					D 21.4
	Chassis format	IP00					D 21.3
Active Line Module Infeed (AC/DC module) Controlled DC link Energy recovery	Booksize format	IP20					D 21.4
	Chassis format	IP20, IP00					D 21.3
	Cabinet	IP20 ... IP23					8/6 ... 8/22 ...
Motor Module DC/AC module	Booksize format	IP20					D 21.4
	Chassis format	IP20, IP00					D 21.3
	Cabinet	IP20 ... IP23					8/23 ... 8/33 ...
Control Module CU320-2 Control Unit	Booksize format	IP20	Control Unit for infeed module and Motor Module.				D 21.4
Drive system for single-axis applications							
Chassis Power Module Power Module (AC/AC) Uncontrolled DC link No energy recovery	Chassis format	IP20					D 21.3
PM240-2 Power Module Power Module (AC/AC) Uncontrolled DC link No energy recovery	Blocksize format	IP20					D 21.4
Control Module CU310-2 Control Unit	Blocksize format	IP20	Control Unit for single-axis drives.				D 21.4

* parallel connection

Overview



Flexibility for successful crane concepts

As part of the SINAMICS converter family, the SINAMICS S120 drive is a modular system for high-performance applications in crane construction. SINAMICS S120 offers high-performance single-axis and multi-axis drives for a very broad range of crane applications. By virtue of its scalability and flexibility, SINAMICS S120 is the ideal system for satisfying the ever increasing demand for more axes and better performance. SINAMICS S120 supports flexible crane concepts and speedy implementation of customized drive solutions.

The response to ever increasing demands

Modern cranes must be built at ever lower cost, but deliver ever greater productivity. The SINAMICS S120 drive concept meets both these challenges! It is easy to configure and thus helps to reduce project completion times. Its excellent dynamic response and accuracy permit higher cycle rates for maximum productivity.

Application areas in crane construction

SINAMICS S120 enhances the performance of cranes, in both industrial and harbor crane systems:

- Container cranes
- Grab cranes
- Stacking cranes
- Ladle cranes
- Bridge cranes
- Goliath cranes

Modularity for crane construction

SINAMICS S120 is designed to allow free combination of power and control performance. Multi-axis drives with higher-level motion control can be implemented with the SINAMICS S120 modular system as easily as single-drive solutions.

Greater flexibility with central control intelligence

On the SINAMICS S120, the drive intelligence is combined with closed-loop control functions into Control Units.

These units are capable of controlling drives in Vector, Servo and V/f modes. They also perform the speed and torque control functions plus other intelligent drive functions for all axes on the drive. Vector control is used in crane applications.

SINAMICS S120 – functions for better efficiency

- Basic functions: Speed control, torque control, positioning functions
- Intelligent starting functions for independent restart after power supply interruption
- BICO technology with interconnection of drive-related I/Os for easy adaptation of the drive system to its operating environment
- Integrated safety functions for rational implementation of safety concepts
- Regulated infeed/regenerative feedback functions for preventing undesirable reactions on the supply, allowing recovery of braking energy and ensuring greater stability against line fluctuations.

DRIVE-CLiQ – the digital interface between all components

All SINAMICS S120 components, including the motors and encoders, are interconnected by a shared serial interface called DRIVE-CLiQ. The standardized cables and connectors reduce the variety of different parts and cut storage costs. Converter boards (Sensor Modules) for converting standard encoder signals to DRIVE-CLiQ are available for third-party motors or retrofit applications.

Swift and automatic: The electronic rating plate

An important digital linkage element of the SINAMICS S120 drive system are the electronic rating plates integrated in every component. They allow all drive components to be detected automatically via a DRIVE-CLiQ link. As a result, data do not need to be entered manually during commissioning or component replacement – helping to ensure that drives are commissioned successfully! The electronic rating plates of the motors contain, for example, the parameters of the electrical equivalent circuit diagram and the characteristic data of the built-in motor encoder in addition to information such as order and identification numbers.

Modular design ensures flexibility and scalability

DC/AC units (Motor Modules) – available in booksize compact, booksize and chassis formats – are characterized by their modular design. All the drive intelligence is organized into Control Units. The Control Units perform all the closed-loop control functions for the drive line-up. They also handle all other drive functions such as the interconnection of drive-related I/Os, positioning functions, and feature PROFIBUS DP or PROFINET as the central interface for linking to higher-level automation systems.

Line Modules function as the central energy supply to the voltage-source DC link. Line Modules are optionally available with regulated infeed/regenerative feedback to provide a constant DC link voltage and high level of supply compatibility. Motor Modules supply the motors with energy from the DC link.

Configurable control cabinets based on Motor Modules and Line Modules in chassis format can be ordered in Cabinet Module format.

On AC/AC units, the infeed and motor power supply functions are combined in one device, the Power Module – available in blocksize and chassis formats. For single-axis applications, drive control functions are performed by a special Control Unit (CU310-2) mounted on the Power Module and for multi-axis applications, by a Control Unit (e.g. CU320-2) connected by a DRIVE-CLiQ link. In this case, a Control Unit Adapter is mounted on the Power Module in place of the Control Unit.

Drive systems

System overview for crane concepts

Overview

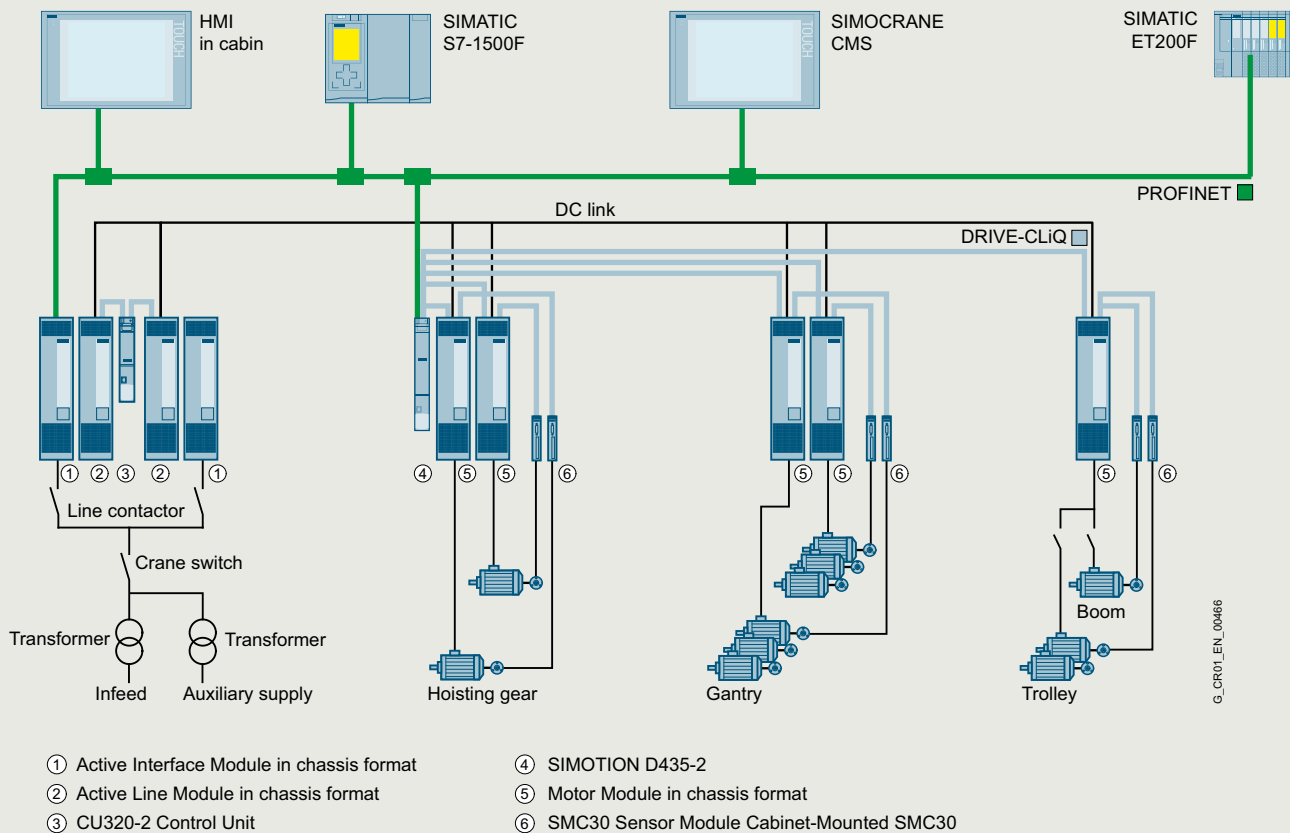


SINAMICS S120 blocksize, booksize compact, booksize, chassis and Cabinet Module formats

All formats can be combined as required

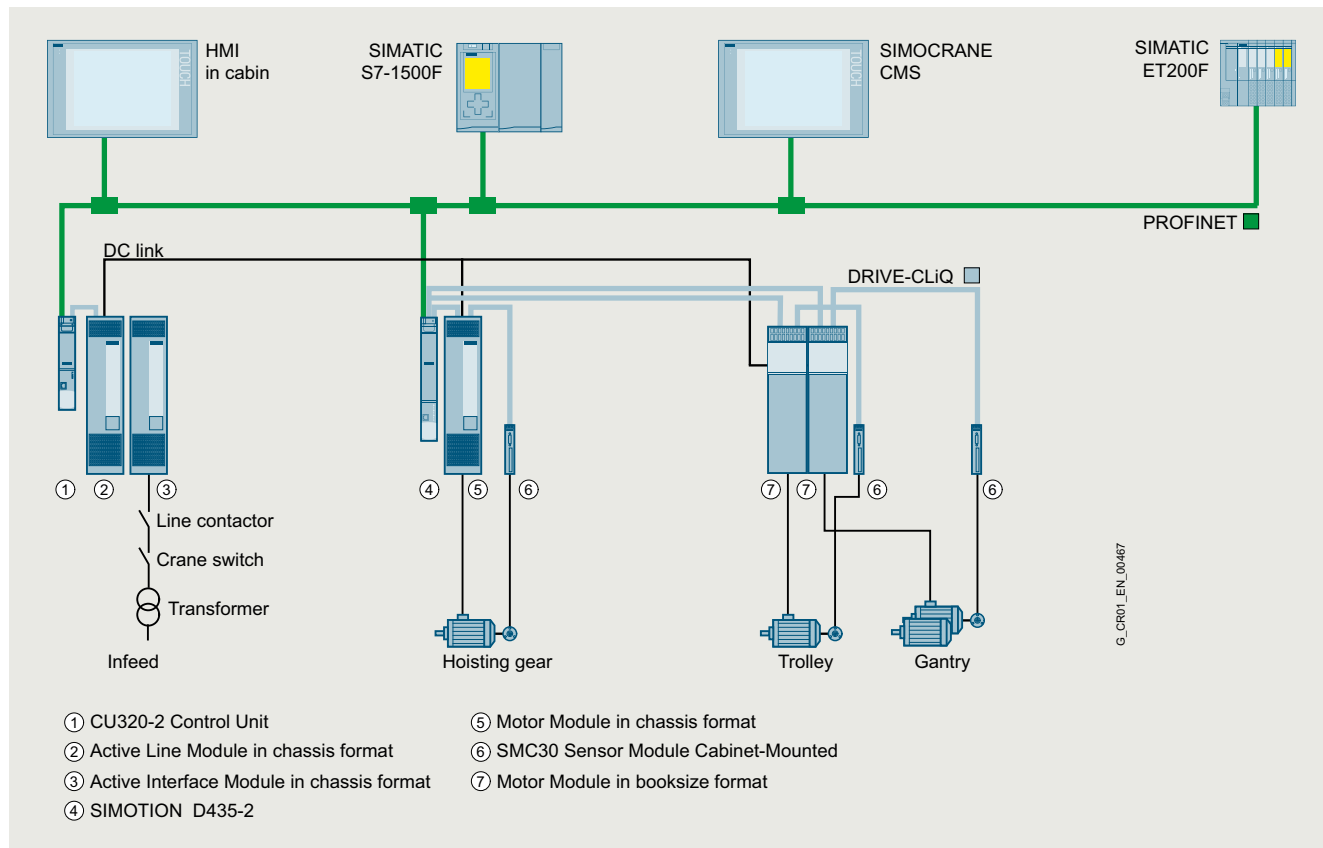
The different SINAMICS S120 formats can be combined freely thanks to their DRIVE-CLiQ interfaces, e.g. Line Modules in

chassis format can be freely combined with Motor Modules in booksize format for multi-axis applications with high total output.

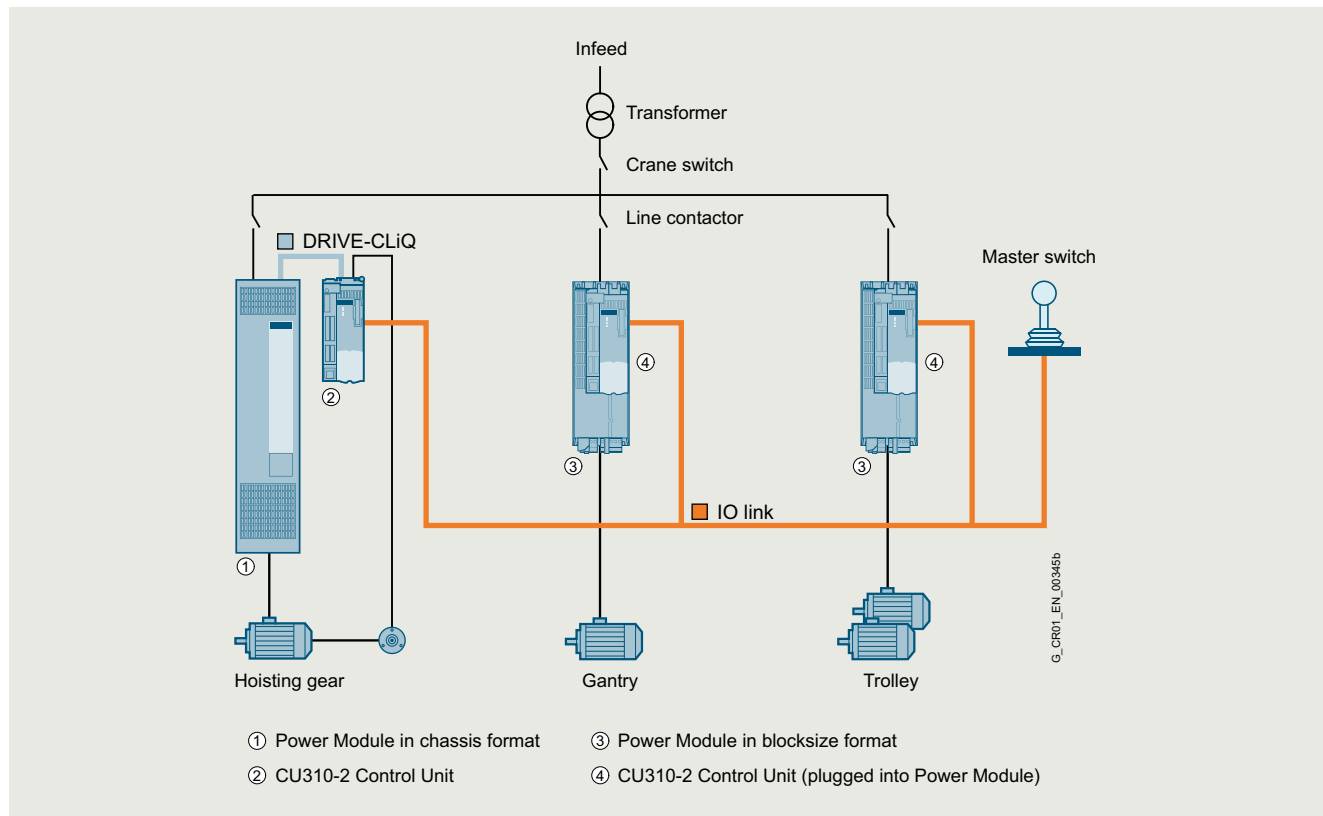


Container crane topology with chassis format

Overview



Bridge crane topology with chassis and booksize formats



Bridge crane topology with Power Modules in chassis and blocksize formats

Drive systems

SINAMICS S120 Cabinet Modules

Overview



In the SINAMICS S120 Cabinet Modules, the built-in units of the SINAMICS S120 chassis format are integrated to provide a modular cabinet system for multi-motor drives with a central line infeed and a common DC link busbar for crane systems. As standard, they are installed side by side in a row.

The main components of the system in crane applications are as follows:

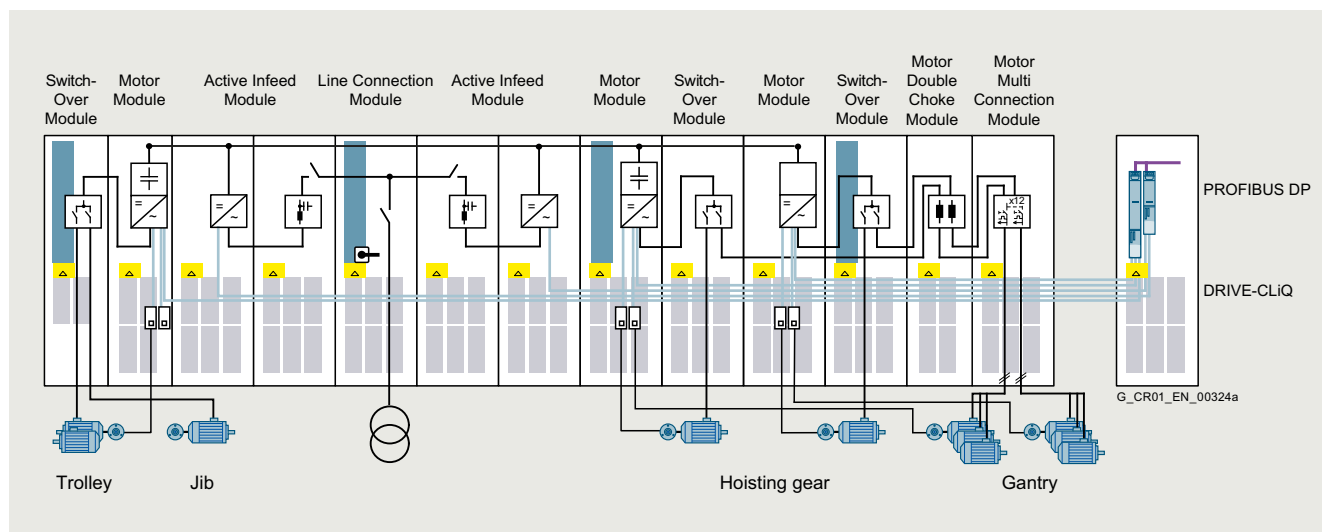
- Line Connection Modules with line-side components such as contactors, fuses and circuit breakers
- Line Modules for infeed in the Active Line Module version for four-quadrant mode with negligible line harmonic distortion and integrated line contactors
- Motor Modules in chassis format for controlling motors
- Switch-Over Modules for both economic and redundant combinations of motors and Motor Modules
- Motor Multi Connection Modules for parallel connection of motors for gantry drives in particular
- Motor Double Choke Modules for connecting a reactor between Motor Modules and motors when long cables are used, as is the case in gantry drives

The industry-specific version Cranes ordering option **B70** is based on the requirements of the IEC 60204-32 standard and implements the measures required for the cabinet units.

Specification in contrast to the available standard cabinet design:

- All auxiliary power supplies are routed to terminals for wiring in star topology
- Vibrational load in operation
 - Deflection 1.0 mm at 2 to 13.2 Hz
 - Acceleration 6.8 m/s² at 13.2 to 100 Hz
- The colors of the cores are in accordance with IEC 60204-32 except in the case of built-in Chassis Modules
- The complete documentation is supplied for the cabinets for the ordered configuration
- Internal wiring of the transport units
- Prepared wiring for easy assembly

Component overview based on the example of a container crane with Cabinet Modules



When used in cranes, the industry-specific option **B70** must be specified separately on ordering for all cabinets.



Characteristic curves

Derating data for the chassis format

SINAMICS S120 Cabinet Modules and the associated system components are rated for an ambient temperature of 40 °C and installation altitudes up to 2000 m above sea level.

At ambient temperatures of > 40 °C, the output current must be reduced. Ambient temperatures above 50 °C are not permissible.

At installation altitudes > 2000 m above sea level, it must be taken into account that the air pressure, and therefore air density, decreases as the height increases. As a consequence, the cooling efficiency and the insulation capacity of the air also decrease.

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and, on the other, to lower heat loss in the Cabinet Module by reducing the output current, whereby ambient temperatures lower than 40 °C may be offset to compensate.

The following table specifies the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection (the permissible compensation between installation altitude and the ambient temperatures < 40 °C – air intake temperature at the entry to the Cabinet Module – has been taken into account in the specified values).

The values apply under the precondition that it is ensured that the cooling air, as specified in the technical specifications, flows through the units as a result of the cabinet arrangement.

As additional measure for installation altitudes from 2000 to 5000 m, an isolating transformer is required in order to reduce transient overvoltages according to EN 60664-1.

[For additional information about this, please refer to the SINAMICS Low Voltage Engineering Manual.](#)

Degree of protection	Installation altitude above sea level m	Current derating factor (as a % of the rated current) for an ambient/air intake temperature of						
		20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C
IP20, IP21, IP23	0 ... 2000	100 %	100 %	100 %	100 %	100 %	93.3 %	86.7 %
	2001 ... 2500	100 %	100 %	100 %	100 %	96.3 %		
	2501 ... 3000	100 %	100 %	100 %	98.7 %			
	3001 ... 3500	100 %	100 %	100 %				
	3501 ... 4000	100 %	100 %	96.3 %				
	4001 ... 4500	100 %	97.5 %					
	4501 ... 5000	98.2 %						

Current derating factors for Cabinet Modules as a function of the ambient/air intake temperature, the installation altitude and the degree of protection

Current derating for SINAMICS S120 Motors Modules, chassis format as a function of the pulse frequency

To reduce motor noise or to increase output frequency, the pulse frequency can be increased relative to the factory setting. When the pulse frequency is increased, the derating factor of the output current must be taken into account.

This derating factor must be applied to the currents specified in the technical specifications.

[For additional information about this, please refer to the SINAMICS Low Voltage Engineering Manual.](#)

Motor Module in chassis format	Type rating at 400 V	Output current at 2 kHz	Derating factor at pulse frequency				
			2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
6SL3720-...	kW	A	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
380 ... 480 V 3 AC							
1TE32-1AA3	110	210	95 %	82 %	74 %	54 %	50 %
1TE32-6AA3	132	260	95 %	83 %	74 %	54 %	50 %
1TE33-1AA3	160	310	97 %	88 %	78 %	54 %	50 %
1TE33-8AA3	200	380	96 %	87 %	77 %	54 %	50 %
1TE35-0AA3	250	490	94 %	78 %	71 %	53 %	50 %

Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Motor Module in chassis format	Type rating at 400 V or 690 V	Output current at 1.25 kHz	Derating factor at pulse frequency				
			2.0 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz
6SL3720-...	kW	A					
380 ... 480 V 3 AC							
1TE36-1AA3	315	605	83 %	72 %	64 %	60 %	40 %
1TE37-5AA3	400	745	83 %	72 %	64 %	60 %	40 %
1TE38-4AA3	450	840	87 %	79 %	64 %	55 %	40 %
1TE41-0AA3	560	985	92 %	87 %	70 %	60 %	50 %
1TE41-2AA3	710	1260	92 %	87 %	70 %	60 %	50 %
1TE41-4AA3	800	1405	97 %	95 %	74 %	64 %	50 %

Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Drive systems

SINAMICS S120 Cabinet Modules

Characteristic curves

The following table lists the maximum achievable output frequency as a function of the pulse frequency:

Current controller clock cycle	Adjustable pulse frequency	Max. achievable output frequency f_A		
T_I	f_p	V/f mode	Vector mode	Servo mode
250 $\mu\text{s}^{1)}$	2 kHz	166 Hz	166 Hz	333 Hz
	4 kHz	333 Hz	333 Hz	550 Hz ³⁾
	8 kHz	550 Hz ³⁾	480 Hz	550 Hz ³⁾
400 $\mu\text{s}^{2)}$	1.25 kHz	104 Hz	104 Hz	–
	2.5 kHz	208 Hz	208 Hz	–
	5.0 kHz	416 Hz	300 Hz	–
	7.5 kHz	550 Hz ³⁾	300 Hz	–

Overload capability

SINAMICS S120 Cabinet Modules have an overload reserve, e.g. to handle breakaway torques. If larger surge loads occur, this must be taken into account when configuring. In drives with overload requirements, the appropriate base-load current must, therefore, be used as a basis for the required load.

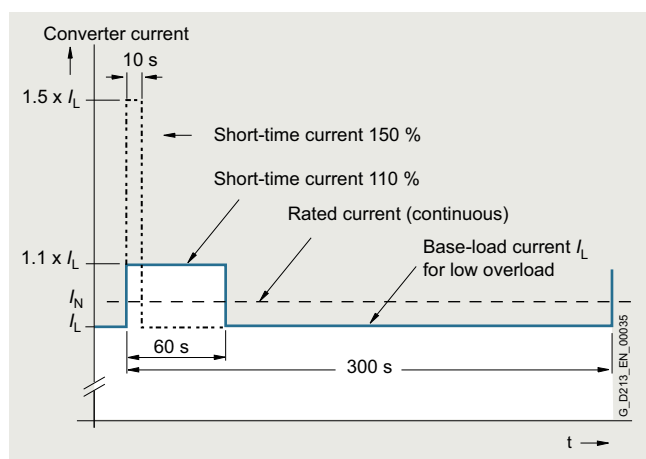
Permissible overload assumes that the drive converter is operated at its base-load current before and after the overload occurs, based on a duty cycle duration of 300 s.

For temporary, periodic duty cycles with high variations of load within the duty cycle, the relevant sections of the SINAMICS Low Voltage Engineering Manual must be observed.

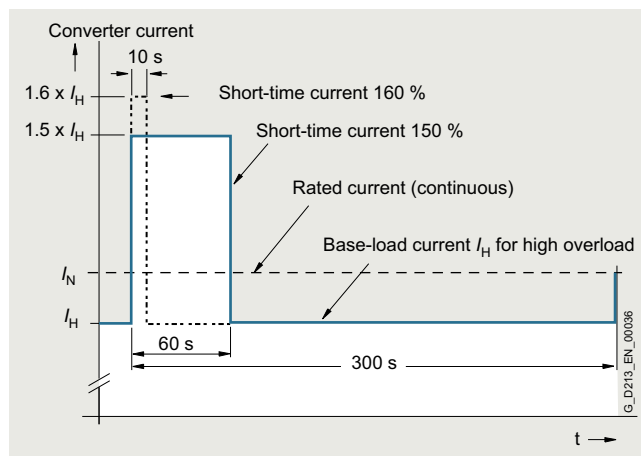
Motor Modules in chassis format

Motor Modules with power units in chassis format can be configured on the basis of different base-load currents.

The base-load current for a low overload I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s.

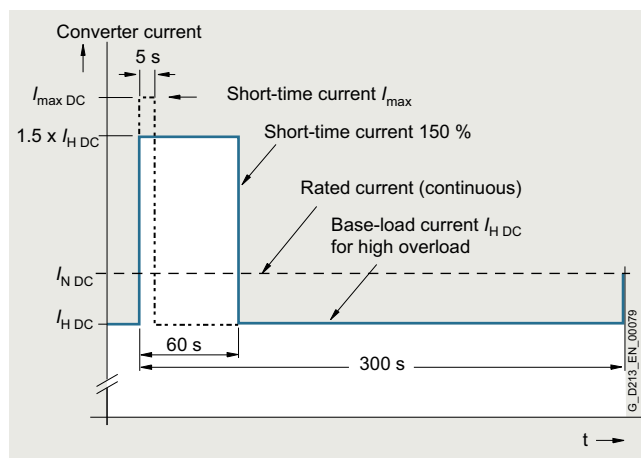


The base-load current for a high overload I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s.



Line Modules in chassis format

The base-load current for a high overload I_{HDC} is based on a duty cycle of 150 % for 60 s or I_{maxDC} for 5 s.



¹⁾ As factory setting, the following Motor Modules in chassis format have a current controller clock cycle of 250 μs and a pulse frequency of 2 kHz:
- 510 ... 720 V DC: $\leq 250 \text{ kW} / 490 \text{ A}$

²⁾ As factory setting, the following Motor Modules in chassis format have a current controller clock cycle of 400 μs and a pulse frequency of 1.25 kHz:
- 510 ... 720 V DC: $\geq 315 \text{ kW} / 605 \text{ A}$

³⁾ With the "High output frequencies" license, which can be ordered as option **J01** on the CompactFlash card for SINAMICS S120, the maximum output frequency is increased up to 650 Hz. For more information, see <https://support.industry.siemens.com/cs/document/104020669>



Overview

Degrees of protection

The EN 60529 standard covers the protection of electrical equipment by means of housings, covers or equivalent, and includes:

- Protection of persons against accidental contact with live or moving parts within the housing and protection of the equipment against the ingress of solid foreign matter (touch protection and protection against ingress of solid foreign matter)
- Protection of the equipment against the ingress of water (water protection)
- Abbreviations for the internationally agreed degrees of protection

The degrees of protection are specified by abbreviations comprising the code letters IP and two digits.

Degree of protection	First digit (touch protection and protection against ingress of solid foreign matter)	Second digit (protection of the equipment against the ingress of water)
IP20 (Standard)	Protected against solid foreign matter diameter ≥ 12.5 mm	No water protection
IP21 (Option M21)	Protected against solid foreign matter diameter ≥ 12.5 mm	Protected against drip water Vertically falling water drops shall not have a harmful effect.
IP23 (Option M23)	Protected against solid foreign matter diameter ≥ 12.5 mm	Protected against spray water Water sprayed on both sides of the vertical at an angle of up to 60° shall not have a harmful effect.

Cabinet Modules fulfill the criteria for degree of protection IP20 as standard. The other degrees of protection outlined here are available as an option.

Drive systems

SINAMICS S120 Cabinet Modules

General technical specifications

Technical specifications

Unless specified otherwise, the following technical specifications are valid for all the following components of the SINAMICS S120 Cabinet Modules.

Electrical data			
Line voltages	380 ... 480 V 3 AC, $\pm 10\%$ (-15 % < 1 min)		
Line system configurations	Isolated systems (IT systems)		
Line frequency	47 ... 63 Hz		
Output frequency	0 ... 550 Hz (> 100/160 Hz, observe the derating)		
Line power factor Fundamental	Adjustable (factory-set to $\cos\varphi = 1$)		
• Active Line Module			
Efficiency	> 97.0 %		
Control method	Vector/servo control with and without encoder or V/f control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, parameterizable (in the default setting, 3 fixed setpoints plus 1 minimum speed are selectable using terminal block/PROFIBUS/PROFINET)		
Skipped speed ranges	4, programmable		
Braking operation	With regenerative feedback, or the use of an optional brake chopper and braking resistors		
Mechanical data			
Degree of protection	IP20 (higher degrees of protection up to IP23 optional)		
Protection class	I acc. to EN 61800-5-1		
Touch protection	EN 50274/DGUV regulation 3 when used as intended		
Cabinet system	Rittal TS 8, doors with double-barb lock, three-section base plates for cable entry		
Paint finish	RAL 7035 (indoor requirements)		
Cooling method	Forced air cooling AF to EN 60146		
Ambient conditions	Storage ¹⁾	Transport ¹⁾	Operation
Ambient temperature	-25 ... +55 °C	-25 ... +70 °C above <u>-40 °C²⁾</u> for 24 hours	0 ... +40 °C to +50 °C see derating data
Relative humidity (condensation not permissible)	5 ... 95 % ²⁾ Class 1K4 acc. to IEC 60721-3-1:1997	5 ... 95 % at 40 °C Class 2K3 acc. to IEC 60721-3-2:1997	5 ... 95 % ²⁾ Class 3K3 acc. to IEC 60721-3-3:2002
Environmental class/harmful chemical substances	Class 1C2 acc. to EN 60721-3-1:1997	Class 2C2 acc. to EN 60721-3-2:1997	Class 3C2 acc. to EN 60721-3-3:2002
Organic/biological influences	Class 1B1 acc. to EN 60721-3-1:1997	Class 2B1 acc. to EN 60721-3-2:1997	Class 3B1 acc. to EN 60721-3-3:2002
Degree of pollution	2 acc. to IEC/EN 61800-5-1		
Installation altitude	Cabinet Modules, chassis format: up to 2000 m above sea level, without derating, > 2000 m, see characteristic curves/derating data		
Mechanical stability	Storage ¹⁾	Transport ¹⁾	Operation
Vibratory load	Class 1M1 acc. to EN 60721-3-1:1997 1.5 mm at <u>5 ... 9 Hz</u> –	Class 2M1 acc. to EN 60721-3-2:1997 3.1 mm at <u>5 ... 9 Hz</u> –	–
• Deflection - With option B70	–	–	0.075 mm at 10 ... 58 Hz 1.0 mm at 2 ... 13.2 Hz
• Acceleration - With option B70	5 m/s ² at > 9 ... 200 Hz –	10 m/s ² at > 9 ... 200 Hz –	9.8 m/s ² at > 58 ... 200 Hz 6.8 m/s ² at > 13.2 ... 100 Hz
Shock load	Class 1M1 acc. to EN 60721-3-1:1997 40 m/s ² at 22 ms	Class 2M1 acc. to EN 60721-3-2:1997 100 m/s ² at 11 ms	Class 3M1 acc. to EN 60721-3-3:2002 Test values acc. to EN 60068-2-27 Test Ea: 5 g, 30 ms, 3 shocks
• Acceleration	–	–	–
Compliance with standards			
Conformances/approvals, according to	CE (EMC Directive 2014/30/EU, Low Voltage Directive 2014/35/EU, and Machinery Directive 2006/42/EC for functional safety)		
Radio interference suppression	SINAMICS drive converter systems are not designed for connection to the public grid (first environment). Radio interference suppression is compliant with the EMC product standard for variable-speed drives EN 61800-3, "Second environment" (industrial line supplies). The equipment can cause electromagnetic interference when it is connected to the public network. However, if supplementary measures are taken (e.g. → line filter), it can also be operated in the "first environment".		

¹⁾ In transport packaging.

²⁾ Deviations with respect to the specified class are underlined.



Technical specifications

The most important directives and standards are listed below. These are used as basis for the SINAMICS S120 Cabinet Modules and they must be carefully observed to achieve an EMC-compliant configuration that is safe both functionally and in operation.

European directives

2014/35/EU	Low-voltage Directive: Directive of the European Parliament and Council of February 26, 2014 on the harmonization of the laws of the member states relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast)
2014/30/EU	EMC Directive: Directive of the European Parliament and Council of February 26, 2014 on the harmonization of the laws of the member states relating to electromagnetic compatibility (recast)
2006/42/EC	Machinery Directive: Directive of the European Parliament and Council of May 17, 2006, on machinery and amending Directive 95/16/EC (recast)
2011/65/EU	RoHS II Directive: Directive of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast)

European standards

EN ISO 3744	Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane
EN ISO 13849-1	Safety of machinery – safety-related parts of control systems Part 1: General design principles (EN ISO 13849-1: 2006)
EN 60146-1-1	Semiconductor converters – General requirements and line-commutated converters Part 1-1: Specification of basic requirements
EN 60204-1	Safety of machinery – Electrical equipment of machines Part 1: General requirements
EN 60529	Degrees of protection provided by enclosures (IP code)
IEC 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
IEC 61508-2	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC 61508-3	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 3: Software requirements
EN 61800-2	Adjustable speed electrical power drive systems Part 2: General requirements – Rating specifications for low-voltage adjustable frequency AC power drive systems
EN 61800-3	Adjustable speed electrical power drive systems Part 3: EMC requirements including specific test methods
EN 61800-5-1	Adjustable speed electrical power drive systems Part 5: Safety requirements Main section 1: Electrical and thermal requirements
EN 61800-5-2	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional safety (IEC 61800-5-2: 2007)

Drive systems**SINAMICS S120 Cabinet Modules****Line Connection Modules****Overview**

Line Connection Modules (LCM) contain the line-side infeed with main circuit breaker and fuse switch disconnect or circuit breaker and provide the connection between the plant power system and the Line Modules.

Line Connection Modules are available for the following voltages and currents:

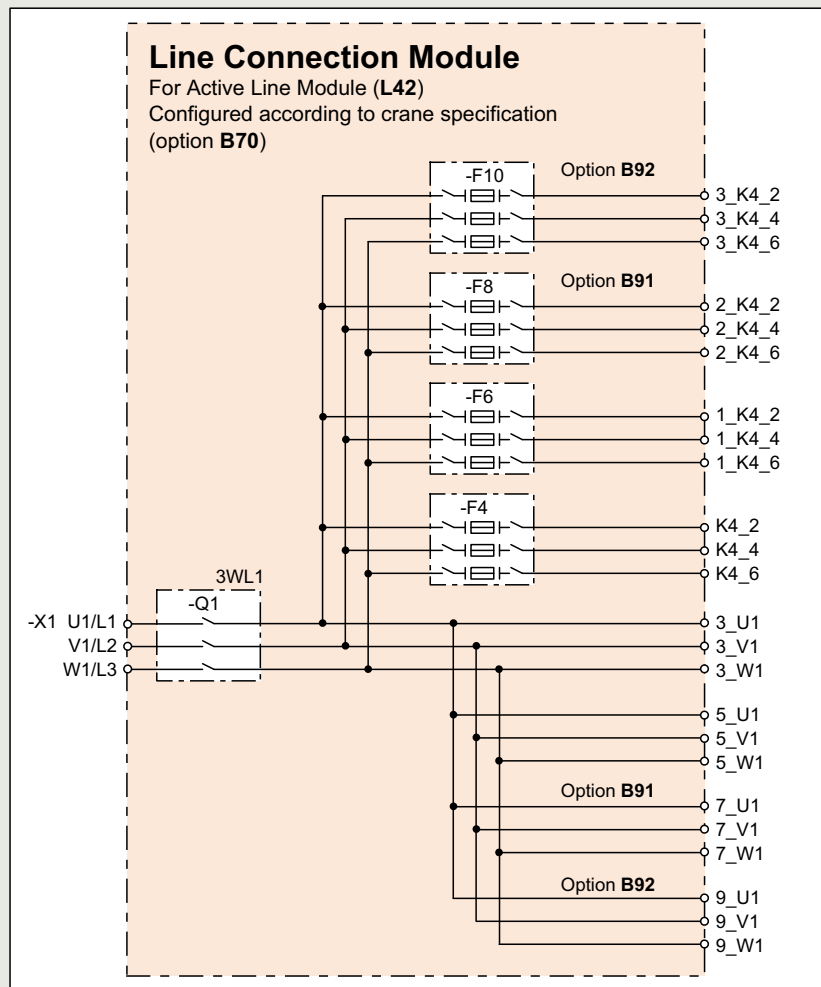
Line voltage	Rated infeed/regenerative feedback current
380 ... 480 V 3 AC	1250 ... 6300 A

Design

Units with an input current > 800 A include a fixed-mounted circuit breaker (a withdrawable circuit breaker is optionally possible).

Integration

Cabinet Module


 Connection example of a Line Connection Module ≥ 2000 A for connection to Active Line Modules in parallel connection

Drive systems

SINAMICS S120 Cabinet Modules

Line Connection Modules

Technical specifications

Line voltage 380 ... 480 V 3 AC		Line Connection Module					
		Type					
		6SL3700-0LE41-3AA3	6SL3700-0LE41-6AA3	6SL3700-0LE42-0BA3	6SL3700-0LE43-2BA3	6SL3700-0NE44-0BA3	6SL3700-0NE46-3BA3
		Prepared for connection to Line Modules connected in parallel					
Infeed/regenerative feedback current							
• Rated current I_{NE}	A	1250	1600	2000	3200	4000	6300
Power requirement							
• 24 V DC aux. power supply	A	–	–	–	–	–	–
• 230 V 2 AC	A	1.07	1.07	2.14	2.14	4	4
Power loss, max. ¹⁾							
• at 50 Hz 400 V							
- Option L42	kW	0.29	0.41	0.6	0.95	1.8	1.8
• at 60 Hz 460 V							
- Option L42	kW	0.29	0.41	0.6	0.95	1.8	1.8
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	68/70	68/70	70/72	70/72	72/74	72/74
Line supply connection L1, L2, L3							
• Conductor cross-section, max. (IEC)	mm ²	5/M12 + 4/M16 10 × 240	5/M12 + 4/M16 10 × 240	5/M12 + 4/M16 10 × 240	5/M12 + 4/M16 10 × 240	64/M12 64 × 240	64/M12 64 × 240
PE/GND connection							
• Busbar cross-section	mm ²	PE bar 600	PE bar 600	PE bar 600	PE bar 600	PE bar 600	PE bar 600
• Conductor cross-section, max. (IEC)	mm ²	240	240	240	240	240	240
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width with option B70	mm	1000	1000	1000	1000	1200	1200
• Height ²⁾	mm	2200	2200	2200	2200	2200	2200
• Depth	mm	600	600	600	600	600	600
Weight, approx.							
• Option L42	kg	470	490	620	720	1100	1100
Frame size		JL	JL	KL	LL	–	–

¹⁾ The specified power loss represents the maximum value at 100 % utilization. The value is lower under normal operating conditions.

²⁾ The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23 degree of protection.



Selection and ordering data

Line Connection Modules		Active Line Modules			
Current ¹⁾	Article No. with order code B70 for Cranes industry version and order code L42 for operation on Active Line Modules. ²⁾	Number of Active Line Modules connected in parallel	Total rated current	Total rated output	Type
A			A	kW	
Line voltage 380 ... 480 V 3 AC					
1250	6SL3700-0LE41-3AA3-Z B70+L42	2	931	570	2 × 6SL3730-7TE35-0BA3
		1	985	570	6SL3730-7TE41-0BA3
1600	6SL3700-0LE41-6AA3-Z B70+L42	1	1405	900	6SL3730-7TE41-4BA3
		2	1596	950	1 × 6SL3730-7TE38-4BA3 1 × 6SL3730-7TE38-4BA3- Z B94
2000	6SL3700-0LE42-0BA3-Z B70+L42	2	1871	1197	1 × 6SL3730-7TE41-0BA3 1 × 6SL3730-7TE41-0BC3
3200	6SL3700-0LE43-2BA3-Z B70+L42	2	2669	1710	1 × 6SL3730-7TE41-4BA3 1 × 6SL3730-7TE41-4BC3
		3	2807	1795	2 × 6SL3730-7TE41-0BA3 1 × 6SL3730-7TE41-0BC3
					or
					1 × 6SL3730-7TE41-0BA3 2 × 6SL3730-7TE41-0BC3
4000	6SL3700-0NE44-0BA3-Z B70+L42	4	3740	2394	2 × 6SL3730-7TE41-0BA3 2 × 6SL3730-7TE41-0BC3
		3	4000	2565	2 × 6SL3730-7TE41-4BA3 1 × 6SL3730-7TE41-4BC3
					or
					1 × 6SL3730-7TE41-4BA3 2 × 6SL3730-7TE41-4BC3
6300	6SL3700-0NE46-3BA3-Z B70+L42	4	5340	3420	2 × 6SL3730-7TE41-4BA3 2 × 6SL3730-7TE41-4BC3

¹⁾ The current values listed are based on an ambient temperature (air intake temperature) of 40 °C.

²⁾ For further special versions with order codes, see "Options".

Drive systems

SINAMICS S120 Cabinet Modules

Line Connection Modules

Options

The table below lists the options available for Line Connection Modules (for details, refer to the section "Description of the options"):

Brief description of options	Additional identification code -Z with order code and plain text if required
Cranes industry version	B70
Measuring instrument for measuring line voltage and line current	B81
Transformer fuse for 350 kVA transformer output	B82
Surge arrester 600 V	B83
Busbar set for 2nd Active Line Module on right	B91
Busbar set for 2nd Active Line Module on left	B92
Withdrawable circuit breaker in place of a fixed-mounted circuit breaker	L25
Line Connection Modules for Active Line Modules	L42
EMERGENCY OFF pushbutton in cabinet door	L45
Cabinet anti-condensation heating	L55
Insulation monitoring	L87
Base 100 mm high, RAL 7022	M06
Cable compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection (includes M60)	M23
Side panel (left)	M27
Additional touch protection (included in M23)	M60
EMC shield bus	M70
DC busbar system ($I_d = 1170$ A, $1 \times 60 \times 10$ mm)	M80
DC busbar system ($I_d = 1500$ A, $1 \times 80 \times 10$ mm)	M81
DC busbar system ($I_d = 1840$ A, $1 \times 100 \times 10$ mm)	M82
DC busbar system ($I_d = 2150$ A, $2 \times 60 \times 10$ mm)	M83
DC busbar system ($I_d = 2730$ A, $2 \times 80 \times 10$ mm)	M84
DC busbar system ($I_d = 3320$ A, $2 \times 100 \times 10$ mm)	M85
DC busbar system ($I_d = 3720$ A, $3 \times 80 \times 10$ mm)	M86
DC busbar system ($I_d = 4480$ A, $3 \times 100 \times 10$ mm)	M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09 • and special color RAL
Assembly into transport units at factory	Y11 • and identification code
Label for plant identification, 1-line, 40×80 mm	Y31 • and identification code
Label for plant identification, 2-line, 40×180 mm	Y32 • and identification code
Label for plant identification, 4-line, 40×180 mm	Y33 • and identification code
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	D02

Certain options may be mutually exclusive.

Inadmissible option combinations:

- **M21** (IP21 degree of protection) and **M23** (IP23 degree of protection)
- **Y31**, **Y32**, **Y33** (1, 2 or 4-line label for plant identification)

Electrical options

DC busbar system mechanical options (busbars between individual Cabinet Modules)

	M80	M81	M82	M83	M84	M85	M86	M87
M80		–	–	✓	–	–	–	–
M81	–		–	–	✓	–	✓	–
M82	–	–		–	–	✓	–	✓
M83	✓	–	–		–	–	–	–
M84	–	✓	–	–		–	✓	–
M85	–	–	✓	–	–		–	✓
M86	–	✓	–	–	✓	–		–
M87	–	–	✓	–	–	✓	–	

✓	Combination possible
–	Combination not possible

Overview



Active Line Modules can supply energy and return regenerative energy to the supply system.

Active Line Modules generate a regulated DC voltage that is kept consistent regardless of fluctuations in the line voltage (the line voltage must range within the permissible tolerances). Active Line Modules draw a virtually sinusoidal current from the supply system and therefore do not cause any harmful current harmonics.

A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure – i.e. if energy cannot be recovered to the supply. [For further information about these components, see Catalog D 21.3.](#)

Up to 4 identical Active Line Modules can be connected in parallel to increase the power and to provide a redundant configuration.

Active Line Modules are available for the following voltages and power ratings:

Line voltage	Rated output
380 ... 480 V 3 AC	300 ... 900 kW (power can be increased to up to 3420 kW through parallel connection)

Design

Active Line Modules are always operated together with an Active Interface Module, which contains the associated Clean Power Filter and pre-charging circuit. The integrated line filter ensures compliance with the EMC requirements for the "second environment".

The Active Line Module and Active Interface Module are supplied as a complete, fully wired unit, i.e., the customer does not need to supply any further cables or carry out any other wiring tasks.

Parallel connection of Active Line Modules to increase power rating

For configuring a drive line-up with higher outputs, Active Line Modules are available, which can be operated in parallel on a common Line Connection Module. Up to 4 identical Active Line Modules can be arranged to the left and right of the Line Connection Module. Up to 2 Active Line Modules each can be arranged on the left and right.

The power connections on the Active Line Module on the left of the Line Connection Module are a mirror image (Article No. with "C" in the next to last position, example: 6SL3730-7T.41.-BC3), which results in a very compact design for the line infeed.

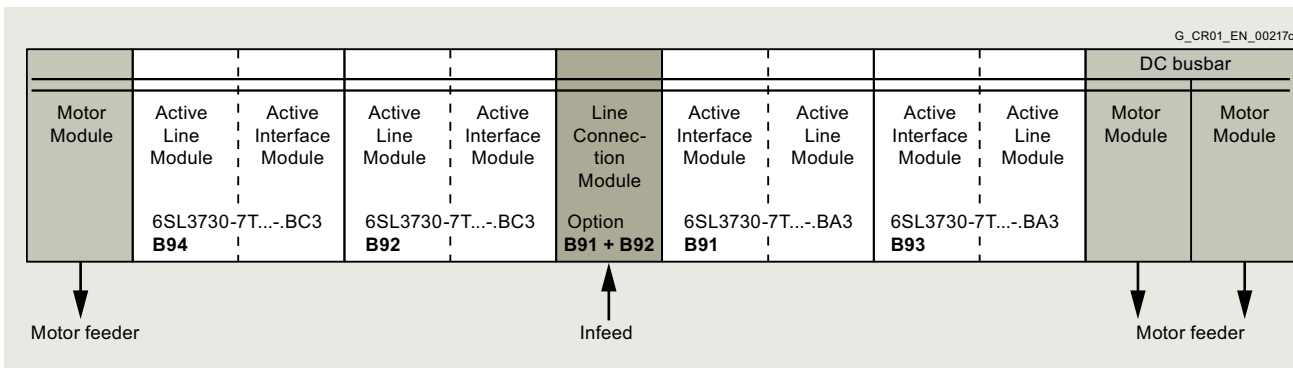
If a second Active Line Module has to be arranged on the right side, the option **B91** must be specified for the Line Connection Module and for the first Active Line Module on the right side. The second Active Line Module on the right side must be also specified with option **B93**. If a second Active Line Module has to be arranged on the left side, the option **B92** must be specified for the Line Connection Module and for the first Active Line Module on the left side. The second Active Line Module on the left side must be also specified with option **B94**.

Please note that only Active Line Modules with exactly the same power rating may be connected in parallel. The potential for imbalances in current distribution means that a current derating of 5 % applies; this must be taken into account when the modules are dimensioned.

When configuring, it must be ensured that the maximum DC link capacitance for the drive line-up that can be charged through the Active Line Modules is not exceeded.

A connection of the Active Line Modules in parallel using DRIVE-CLiQ must be taken into consideration.

[For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.](#)



Drive systems

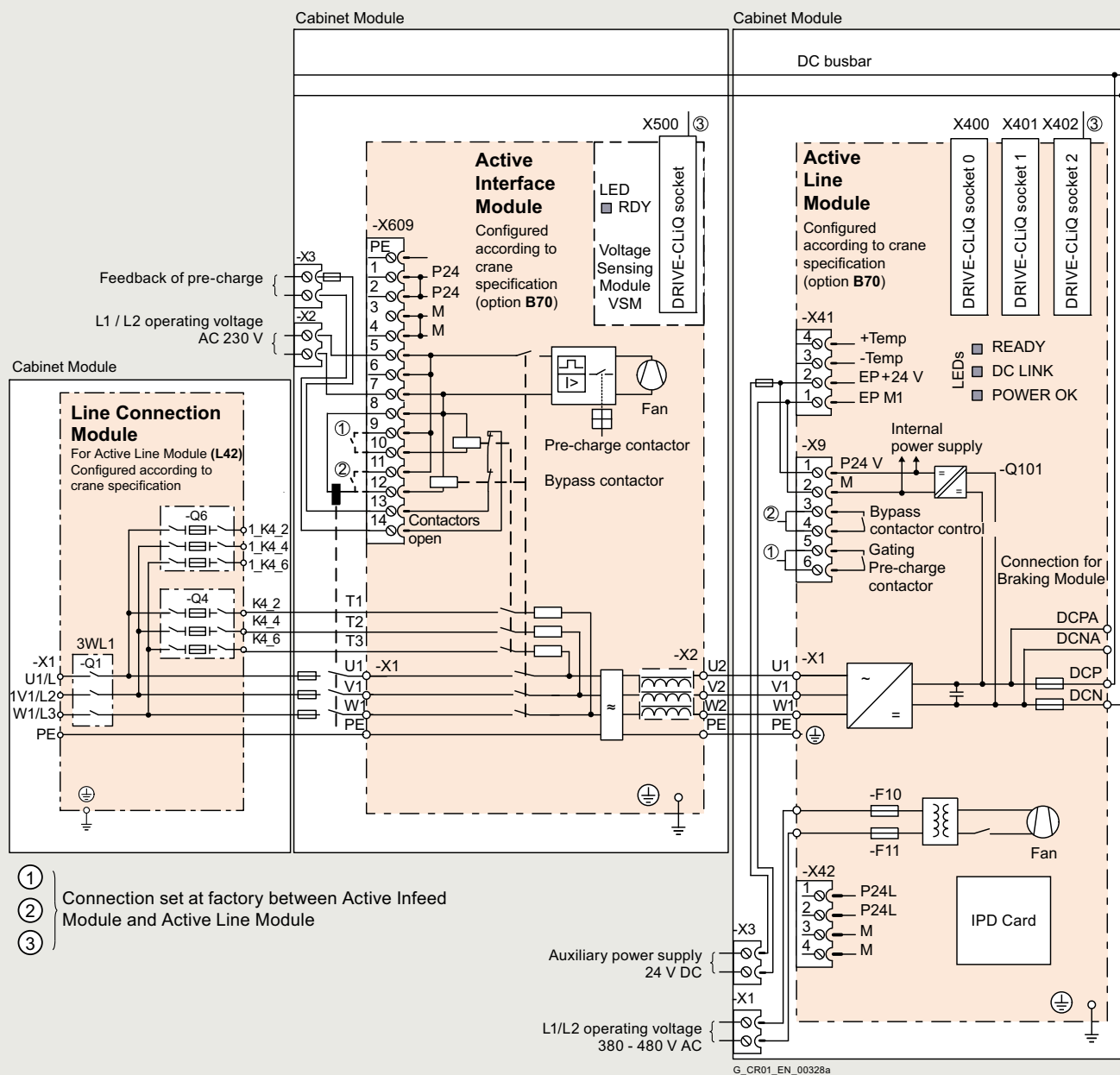
SINAMICS S120 Cabinet Modules

Active Line Modules including Active Interface Modules

Integration

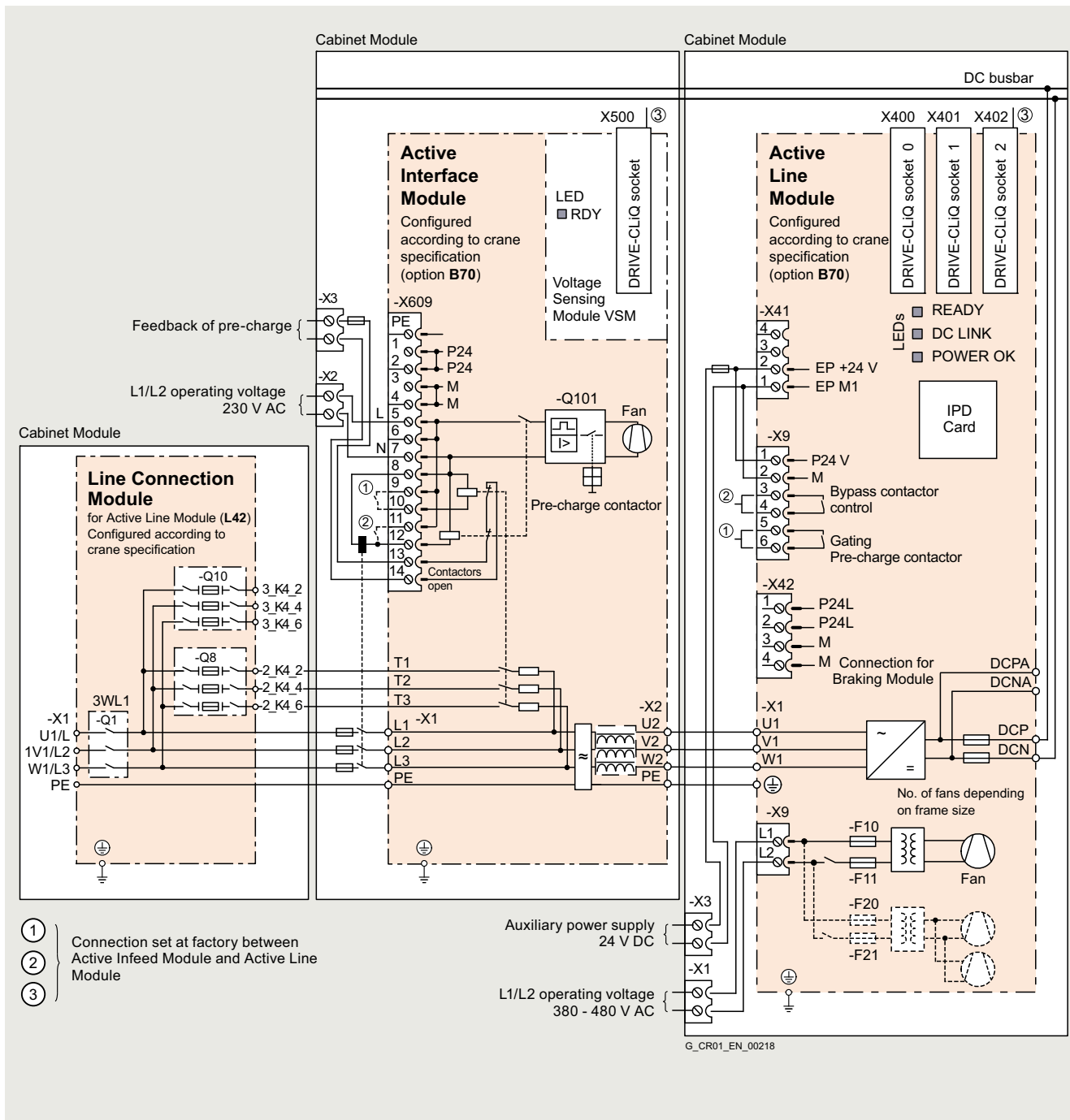
The Active Line Module is controlled by the CU320-2 Control Unit. Data is exchanged between the Control Unit and Module

via the DRIVE-CLiQ connections. The Active Interface Module is included in the scope of delivery for the Active Line Module.



Example of connection of an Active Line Module (frame sizes GI/GX)

Integration



Example of connection of an Active Line Module (frame sizes HI/HX and JI/JX)

Drive systems

SINAMICS S120 Cabinet Modules

Active Line Modules including Active Interface Modules

Technical specifications

Line voltage 380 ... 480 V 3 AC		Active Line Module			
		Type			
		6SL3730-7TE35-0BA3	6SL3730-7TE38-4BA3	6SL3730-7TE41-0BA3	6SL3730-7TE41-4BA3
		For parallel connection, mounted to the left of the Line Connection Module			
				6SL3730-7TE41-0BC3	6SL3730-7TE41-4BC3
Rated output					
• at $I_{N\ DC}$ (50 Hz 400 V)	kW	300	500	630	900
• at $I_{H\ DC}$ (50 Hz 400 V)	kW	270	465	545	780
• at $I_{N\ DC}$ (60 Hz 460 V)	hp	500	700	900	1250
• at $I_{H\ DC}$ (60 Hz 460 V)	hp	400	700	800	1000
DC link current					
• Rated current $I_{N\ DC}$	A	549	940	1103	1574
• Base-load current $I_{H\ DC}^{1)}$	A	489	837	982	1404
• Maximum current $I_{max\ DC}$	A	823	1410	1654	2361
Infeed/regenerative feedback current					
• Rated current $I_{N\ E}$	A	490	840	985	1405
• Maximum current $I_{max\ E}$	A	735	1260	1477	2107
Power requirement					
• 24 V DC aux. power supply	A	1.52	1.57	1.67	1.67
• 400 V AC	A	1.8	3.6	5.4	5.4
DC link capacitance					
• Active Line Module	μF	9600	16800	18900	28800
• Drive line-up, max.	μF	76800	134400	230400	230400
Power loss, max. ²⁾					
• at 50 Hz 400 V	kW	8.7	13.8	17.6	21.8
• at 60 Hz 460 V	kW	9.0	14.3	18.3	22.7
Cooling air requirement	m ³ /s	1.3	1.58	1.88	1.88
Sound pressure level $L_{pA}^{3)}$ (1 m) at 50/60 Hz	dB	72/74	77/79	78/80	78/80
PE/GND connection		PE bar	PE bar	PE bar	PE bar
• Busbar cross-section	mm ²	600	600	600	600
• Conductor cross-section, max. (IEC)	mm ²	240	240	240	240
Cable length, max. ⁴⁾					
• Shielded	m	2700	3900	3900	3900
• Unshielded	m	4050	5850	5850	5850
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width with option B70	mm	1000	1200	1600	1600
• Height ⁵⁾	mm	2200	2200	2200	2200
• Depth	mm	600	600	600	600
Weight, approx.	kg	530	930	1360	1360
Frame size		GX + GI	HX + HI	JX + JI	JX + JI

¹⁾ The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

²⁾ The specified power loss represents the maximum value at 100% utilization. The value is lower under normal operating conditions.

³⁾ Total sound pressure level of Active Interface Module and Active Line Module.

⁴⁾ Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request.

⁵⁾ The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23 degree of protection.

Selection and ordering data

Rated output kW	Active Line Module (incl. Active Interface Module) Article No. with order code B70 for Cranes industry version. ¹⁾	Note for a parallel connection
Line voltage 380 ... 480 V 3 AC (DC link voltage 540 ... 720 V DC)		
300	6SL3730-7TE35-0BA3-Z B70	–
500	6SL3730-7TE38-4BA3-Z B70	–
630	6SL3730-7TE41-0BA3-Z B70	–
	6SL3730-7TE41-0BC3-Z B70	Mounted on the left of the Line Connection Module (mirror-image design)
900	6SL3730-7TE41-4BA3-Z B70	–
	6SL3730-7TE41-4BC3-Z B70	Mounted on the left of the Line Connection Module (mirror-image design)

¹⁾ For further special versions with order codes, see "Options".

Drive systems

SINAMICS S120 Cabinet Modules

Active Line Modules including Active Interface Modules

Options

The table below lists the options available for Active Line Modules (for details, refer to the section "Description of the options"):

Brief description of options	Additional identification code -Z with order code and plain text if required
Cranes industry version	B70
Busbar set for 2nd Active Line Module on right	B91
Busbar set for 2nd Active Line Module on left	B92
2nd Active Line Module on right	B93
2nd Active Line Module on left	B94
Cabinet anti-condensation heating	L55
Base 100 mm high, RAL 7022	M06
Cable compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection (includes M60)	M23
Side panel (right)	M26
Side panel (left)	M27
Additional touch protection (included in M23)	M60
DC busbar system ($I_d = 1170$ A, $1 \times 60 \times 10$ mm)	M80
DC busbar system ($I_d = 1500$ A, $1 \times 80 \times 10$ mm)	M81
DC busbar system ($I_d = 1840$ A, $1 \times 100 \times 10$ mm)	M82
DC busbar system ($I_d = 2150$ A, $2 \times 60 \times 10$ mm)	M83
DC busbar system ($I_d = 2730$ A, $2 \times 80 \times 10$ mm)	M84
DC busbar system ($I_d = 3320$ A, $2 \times 100 \times 10$ mm)	M85
DC busbar system ($I_d = 3720$ A, $3 \times 80 \times 10$ mm)	M86
DC busbar system ($I_d = 4480$ A, $3 \times 100 \times 10$ mm)	M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09 • and special color RAL
Assembly into transport units at factory	Y11 • and identification code
Label for plant identification, 1-line, 40×80 mm	Y31 • and identification code
Label for plant identification, 2-line, 40×180 mm	Y32 • and identification code
Label for plant identification, 4-line, 40×180 mm	Y33 • and identification code
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	D02

Certain options may be mutually exclusive.

Inadmissible option combinations:

- **M21** (IP21 degree of protection) and **M23** (IP23 degree of protection)
- **Y31**, **Y32**, **Y33** (1, 2 or 4-line label for plant identification)

DC busbar system mechanical options (busbars between individual Cabinet Modules)

	M80	M81	M82	M83	M84	M85	M86	M87
M80		–	–	✓	–	–	–	–
M81	–		–	–	✓	–	✓	–
M82	–	–		–	–	✓	–	✓
M83	✓	–	–		–	–	–	–
M84	–	✓	–	–		–	✓	–
M85	–	–	✓	–	–		–	✓
M86	–	✓	–	–	✓	–		–
M87	–	–	✓	–	–	✓	–	
✓	Combination possible							
–	Combination not possible							

Overview



Motor Modules in chassis format are available in the output range from 110 kW to 800 kW.

Line voltage	DC link voltage	Type rating
380 ... 480 V 3 AC	510 ... 720 V DC	110 ... 800 kW

Design

Motor Modules in chassis format contain the following components as standard:

- Retaining device for the DC busbar, including the connection to the DC connections of the Motor Module
- Nickel-plated connection busbars for motor cables for Motor Modules, frame sizes FX and GX; connection is made directly on the unit for Motor Modules, frame sizes HX and JX.
- Cable clamping bar for the power cables
- DRIVE-CLiQ interface (3 DRIVE-CLiQ sockets), without Control Unit
- Customer interface -X55
- Nickel-plated PE busbar (60 × 10 mm), including jumper for looping through to the next Cabinet Module
- EMC-compliant design thanks to additional shielding measures and appropriate cable routing

SINAMICS S120 Cabinet Modules

Integration

The Control Units and the DRIVE-CLiQ cable are not included in the scope of supply and must be configured by the customer.



Connection example of a Motor Module



Technical specifications

Line voltage 380 ... 480 V 3 AC DC link voltage 510 ... 720 V DC		Motor Module in chassis format					
		Type					
		6SL3720-1TE32-1AA3	6SL3720-1TE32-6AA3	6SL3720-1TE33-1AA3	6SL3720-1TE33-8AA3	6SL3720-1TE35-0AA3	6SL3720-1TE36-1AA3
Type rating							
• at I_L (50 Hz 400 V) ¹⁾	kW	110	132	160	200	250	315
• at I_H (50 Hz 400 V) ¹⁾	kW	90	110	132	160	200	250
• at I_L (60 Hz 460 V) ²⁾	hp	150	200	250	300	400	500
• at I_H (60 Hz 460 V) ²⁾	hp	150	200	200	250	350	350
Output current							
• Rated current I_N A	A	210	260	310	380	490	605
• Base-load current I_L ³⁾	A	205	250	302	370	477	590
• Base-load current I_H ⁴⁾	A	178	233	277	340	438	460
• Maximum current I_{max} A	A	307	375	453	555	715	885
DC link current							
• Rated current I_N DC when supplied from - Active Line Module	A	227	281	335	411	529	653
• Base-load current I_L DC ³⁾ when supplied from - Active Line Module	A	221	273	326	400	515	636
• Base-load current I_H DC ⁴⁾ when supplied from - Active Line Module	A	202	250	298	365	470	581
Power requirement							
• 24 V DC aux. power supply	A	0.8	0.8	0.9	0.9	0.9	1.0
• 400 V AC	A	0.63	1.13	1.8	1.8	1.8	3.6
DC link capacitance		μF	4200	5200	6300	7800	9600
Pulse frequency ⁵⁾							
• Rated frequency	kHz	2	2	2	2	2	1.25
• Pulse frequency, max. - without current derating	Hz	2	2	2	2	2	1.25
- with current derating	Hz	8	8	8	8	8	8
Power loss, max. ⁶⁾							
• at 50 Hz 400 V	kW	1.86	2.5	2.96	3.67	4.28	5.84
• at 60 Hz 460 V	kW	1.94	2.6	3.1	3.8	4.5	6.3
Cooling air requirement		m³/s	0.17	0.23	0.36	0.36	0.78
Sound pressure level L_{pA} (1 m) at 50/60 Hz		dB	67	69	69	69	72
Motor connection U2, V2, W2 with option B70 • Conductor cross-section, max. (IEC)		mm²	2 × M12 screws 2 × 185	2 × M12 screws 2 × 185	3 × M12 screws 2 × 240	3 × M12 screws 2 × 240	6 × M12 screws 4 × 240
Cable length, max. ⁷⁾							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
PE/GND connection • Busbar cross-section • Conductor cross-section, max. (IEC)		mm² mm²	PE bar 600 240	PE bar 600 240	PE bar 600 240	PE bar 600 240	PE bar 600 240
Degree of protection			IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm	400	400	400	400	400	600
• Height ⁸⁾	mm	2200	2200	2200	2200	2200	2200
• Depth	mm	600	600	600	600	600	600
Weight, approx.		kg	145	145	286	286	490
Frame size			FX	FX	GX	GX	HX

¹⁾ Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 400 V 3 AC 50 Hz.

²⁾ Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 460 V 3 AC 60 Hz.

³⁾ The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

⁴⁾ The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

⁵⁾ Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

⁶⁾ The specified power loss represents the maximum value at 100 % capacity utilization. The value is lower under normal operating conditions.

⁷⁾ Total of all motor cables. Longer cable lengths for specific configurations are available on request. See also SINAMICS Low Voltage Engineering Manual.

⁸⁾ The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23 degree of protection.

Drive systems

SINAMICS S120 Cabinet Modules

Motor Modules in chassis format

Technical specifications

Line voltage 380 ... 480 V 3 AC DC link voltage 510 ... 720 V DC		Motor Modules in chassis format				
		Type				
		6SL3720-1TE37-5AA3	6SL3720-1TE38-4AA3	6SL3720-1TE41-0AA3	6SL3720-1TE41-2AA3	6SL3720-1TE41-4AA3
Type rating						
• at I_L (50 Hz 400 V) ¹⁾	kW	400	450	560	710	800
• at I_H (50 Hz 400 V) ¹⁾	kW	315	400	450	560	710
• at I_L (60 Hz 460 V) ²⁾	hp	600	700	800	1000	1150
• at I_H (60 Hz 460 V) ²⁾	hp	450	600	700	900	1000
Output current						
• Rated current I_{NA}	A	745	840	985	1260	1405
• Base-load current $I_{LDC}^{3)}$	A	725	820	960	1230	1370
• Base-load current $I_{HDC}^{4)}$	A	570	700	860	1127	1257
• Maximum current I_{maxA}	A	1087	1230	1440	1845	2055
DC link current						
• Rated current I_{NDC} when supplied from - Active Line Module	A	805	907	1064	1361	1517
• Base-load current $I_{LDC}^{3)}$ when supplied from - Active Line Module	A	784	884	1037	1326	1479
• Base-load current $I_{HDC}^{4)}$ when supplied from - Active Line Module	A	716	807	946	1211	1350
Power requirement						
• 24 V DC aux. power supply	A	1.0	1.0	1.25	1.4	1.4
• 400 V AC	A	3.6	3.6	5.4	5.4	5.4
DC link capacitance		μF	15600	16800	18900	26100
Pulse frequency ⁵⁾						
• Rated frequency	kHz	1.25	1.25	1.25	1.25	1.25
• Pulse frequency, max. - without current derating	kHz	1.25	1.25	1.25	1.25	1.25
- with current derating	kHz	8	8	8	8	8
Power loss, max. ⁶⁾						
• at 50 Hz 400 V	kW	6.68	7.15	9.5	11.1	12
• at 60 Hz 460 V	kW	7.3	7.8	10.2	12.0	13
Cooling air requirement		m ³ /s	0.78	0.78	1.1	1.1
Sound pressure level L_{pA} (1 m) at 50/60 Hz		dB	72	72	72	72
Motor connection			6 × M12 screws	6 × M12 screws	8 × M12 screws	8 × M12 screws
U2, V2, W2 with option B70						
• Conductor cross-section, max. (IEC)	mm ²	4 × 240	4 × 240	6 × 240	6 × 240	6 × 240
Cable length, max. ⁷⁾						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
PE/GND connection			PE bar	PE bar	PE bar	PE bar
• Busbar cross-section	mm ²	600	600	600	600	600
• Conductor cross-section, max. (IEC)	mm ²	240	240	240	240	240
Degree of protection			IP20	IP20	IP20	IP20
Dimensions						
• Width	mm	600	600	800	800	800
• Height ⁸⁾	mm	2200	2200	2200	2200	2200
• Depth	mm	600	600	600	600	600
Weight, approx.		kg	490	490	700	700
Frame size			HX	HX	JX	JX

¹⁾ Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 400 V 3 AC 50 Hz.

²⁾ Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 460 V 3 AC 60 Hz.

³⁾ The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

⁴⁾ The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

⁵⁾ Information regarding the correlation between the pulse frequency and max. output current/output frequency is provided in the SINAMICS Low Voltage Engineering Manual.

⁶⁾ The specified power loss represents the maximum value at 100 % capacity utilization. The value is lower under normal operating conditions.

⁷⁾ Total of all motor cables. Longer cable lengths for specific configurations are available on request. See also SINAMICS Low Voltage Engineering Manual.

⁸⁾ The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23 degree of protection.



Selection and ordering data

Type rating	Rated output current I_N	Motor Modules in chassis format
kW	A	Article No. with order code B70 for Cranes industry version. ¹⁾
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)		
110	210	6SL3720-1TE32-1AA3-Z B70
132	260	6SL3720-1TE32-6AA3-Z B70
160	310	6SL3720-1TE33-1AA3-Z B70
200	380	6SL3720-1TE33-8AA3-Z B70
250	490	6SL3720-1TE35-0AA3-Z B70
315	605	6SL3720-1TE36-1AA3-Z B70
400	745	6SL3720-1TE37-5AA3-Z B70
450	840	6SL3720-1TE38-4AA3-Z B70
560	985	6SL3720-1TE41-0AA3-Z B70
710	1260	6SL3720-1TE41-2AA3-Z B70
800	1405	6SL3720-1TE41-4AA3-Z B70

¹⁾ For further special versions with order codes, see "Options".

Drive systems

SINAMICS S120 Cabinet Modules

Motor Modules in chassis format

Options

The table below lists the options available for Motor Modules (for details, refer to the section "Description of the options"):

Brief description of options	Additional identification code -Z with order code and plain text if required
Cranes industry version	B70
SMC10 Sensor Module Cabinet-Mounted	K46
SMC20 Sensor Module Cabinet-Mounted	K48
SMC30 Sensor Module Cabinet-Mounted	K50
VSM10 Voltage Sensing Module Cabinet-Mounted	K51
Terminal Module for controlling the Safe Torque Off and Safe Stop 1 safety functions	K82
Motor reactor	L08
DC interface incl. pre-charging circuit of the relevant DC link capacitance	L37
Cabinet anti-condensation heating	L55
Base 100 mm high, RAL 7022	M06
Cable compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection (includes M60)	M23
Side panel (right)	M26
Side panel (left)	M27
Additional touch protection (included in M23)	M60
EMC shield bus	M70
DC busbar system ($I_d = 1170$ A, $1 \times 60 \times 10$ mm)	M80
DC busbar system ($I_d = 1500$ A, $1 \times 80 \times 10$ mm)	M81
DC busbar system ($I_d = 1840$ A, $1 \times 100 \times 10$ mm)	M82
DC busbar system ($I_d = 2150$ A, $2 \times 60 \times 10$ mm)	M83
DC busbar system ($I_d = 2730$ A, $2 \times 80 \times 10$ mm)	M84
DC busbar system ($I_d = 3320$ A, $2 \times 100 \times 10$ mm)	M85
DC busbar system ($I_d = 3720$ A, $3 \times 80 \times 10$ mm)	M86
DC busbar system ($I_d = 4480$ A, $3 \times 100 \times 10$ mm)	M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09 • and special color RAL
Assembly into transport units at factory	Y11 • and identification code
Label for plant identification, 1-line, 40×80 mm	Y31 • and identification code
Label for plant identification, 2-line, 40×180 mm	Y32 • and identification code
Label for plant identification, 4-line, 40×180 mm	Y33 • and identification code
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	D02

Certain options may be mutually exclusive.

Inadmissible option combinations:

- **M21** (IP21 degree of protection) and **M23** (IP23 degree of protection)
- **Y31**, **Y32**, **Y33** (1, 2 or 4-line label for plant identification)

DC busbar system mechanical options (busbars between individual Cabinet Modules)

	M80	M81	M82	M83	M84	M85	M86	M87
M80		–	–	✓	–	–	–	–
M81	–		–	–	✓	–	✓	–
M82	–	–		–	–	✓	–	✓
M83	✓	–	–		–	–	–	–
M84	–	✓	–	–		–	✓	–
M85	–	–	✓	–	–		–	✓
M86	–	✓	–	–	✓	–		–
M87	–	–	✓	–	–	✓	–	

✓	Combination possible
–	Combination not possible



Overview



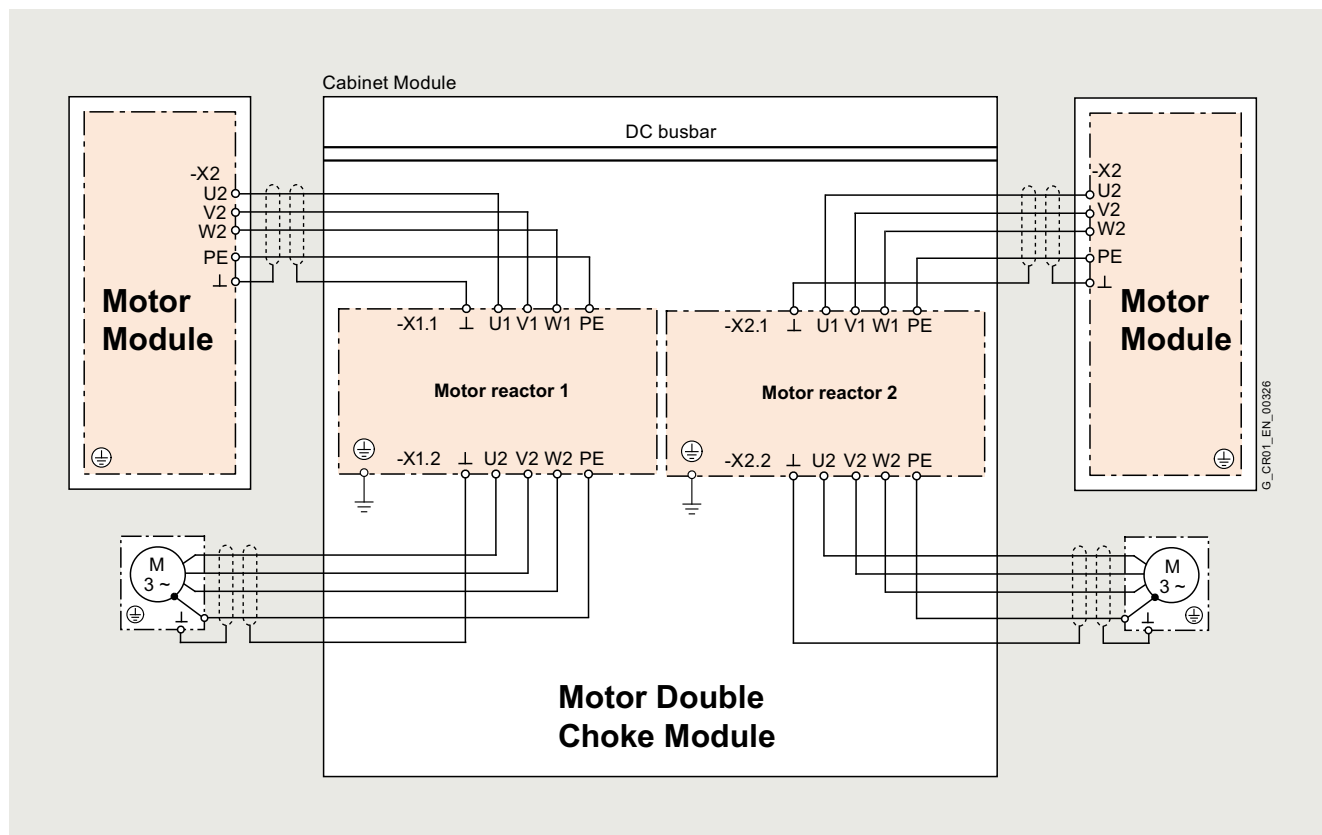
Motor reactors reduce the voltage stress on the motor windings by reducing the voltage gradients at the motor terminals that occur when motors are fed from drive converters. At the same time, the capacitive charge/discharge currents that occur at the converter output when long motor cables are used are reduced. Suitably dimensioned motor reactors therefore enable large capacitances and thus longer motor cables to be connected. Their use is generally recommended in the case of multi-motor drives. With option **L08** for Motor Modules, a motor reactor is integrated into the Motor Module up to cabinet size GX (outputs of less than 315 kW). Due to space constraints, a separate cabinet must be planned for the output range 315 to 450 kW (cabinet size HX).

Design

The Motor Double Choke Modules are equipped as standard with 2 identical motor reactors. Two Motor Modules can be connected to one Motor Double Choke Module, depending on the type selected.

Drive systems**SINAMICS S120 Cabinet Modules****Motor Double Choke Modules****Integration**

The Motor Modules connected to the Motor Double Choke Module must be arranged immediately to the left and right of the Motor Double Choke Module.



Connection example of a Motor Double Choke Module


Technical specifications

Line voltage 380 ... 480 V 3 AC		Motor Double Choke Module	
		Type	
		6SL3700-2AE36-1BA3	6SL3700-2AE38-4BA3
Type rating	kW	315	450
Number of reactors		2	2
Rated current I_{NE}	A	605	840
Power loss	kW	< 2	< 2
Cooling air requirement		Convection	Convection
Sound pressure level L_{pA}	dB	–	–
Line supply/load connection		2 × M12	2 × M12
Cable length, max.			
• Shielded	m	300	300
• Unshielded	m	450	450
PE connection		PE bar 600 8 × M12	PE bar 600 8 × M12
Degree of protection		IP20	IP20
Dimensions			
• Width	mm	600	600
• Height	mm	220	220
• Depth	mm	600	600
Weight, approx.	kg	420	450
Matching Motor Modules		6SL3720-1TE36-1AA3	6SL3720-1TE37-5AA3 6SL3720-1TE38-4AA3

Selection and ordering data

Type rating	Motor Double Choke Module	Motor Module in chassis format
kW	Article No. with order code B70 for Cranes industry version. ¹⁾	Type
315	6SL3700-2AE36-1BA3-Z B70	6SL3720-1TE36-1AA3
400	6SL3700-2AE38-4BA3-Z B70	6SL3720-1TE37-5AA3
450	6SL3700-2AE38-4BA3-Z B70	6SL3720-1TE38-4AA3

¹⁾ For further special versions with order codes, see "Options".

Drive systems

SINAMICS S120 Cabinet Modules

Motor Double Choke Modules

Options

The table below lists the options available for Motor Double Choke Modules (for details, refer to the section "Description of the options"):

Brief description of options	Additional identification code -Z with order code and plain text if required
Cranes industry version	B70
Cabinet anti-condensation heating	L55
Base 100 mm high, RAL 7022	M06
Cable compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection (includes M60)	M23
Side panel (right)	M26
Side panel (left)	M27
Additional touch protection (included in M23)	M60
EMC shield bus	M70
DC busbar system ($I_d = 1170$ A, 1 × 60 × 10 mm)	M80
DC busbar system ($I_d = 1500$ A, 1 × 80 × 10 mm)	M81
DC busbar system ($I_d = 1840$ A, 1 × 100 × 10 mm)	M82
DC busbar system ($I_d = 2150$ A, 2 × 60 × 10 mm)	M83
DC busbar system ($I_d = 2730$ A, 2 × 80 × 10 mm)	M84
DC busbar system ($I_d = 3320$ A, 2 × 100 × 10 mm)	M85
DC busbar system ($I_d = 3720$ A, 3 × 80 × 10 mm)	M86
DC busbar system ($I_d = 4480$ A, 3 × 100 × 10 mm)	M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09 • and special color RAL
Assembly into transport units at factory	Y11 • and identification code
Label for plant identification, 1-line, 40 × 80 mm	Y31 • and identification code
Label for plant identification, 2-line, 40 × 180 mm	Y32 • and identification code
Label for plant identification, 4-line, 40 × 180 mm	Y33 • and identification code
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	D02

Certain options may be mutually exclusive.

Inadmissible option combinations:

- **M21** (IP21 degree of protection) and **M23** (IP23 degree of protection)
- **Y31**, **Y32**, **Y33** (1, 2 or 4-line label for plant identification)

DC busbar system mechanical options (busbars between individual Cabinet Modules)

	M80	M81	M82	M83	M84	M85	M86	M87
M80		-	-	✓	-	-	-	-
M81	-		-	-	✓	-	✓	-
M82	-	-		-	-	✓	-	✓
M83	✓	-	-		-	-	-	-
M84	-	✓	-	-		-	✓	-
M85	-	-	✓	-	-		-	✓
M86	-	✓	-	-	✓	-		-
M87	-	-	✓	-	-	✓	-	
✓	Combination possible							
-	Combination not possible							

Overview



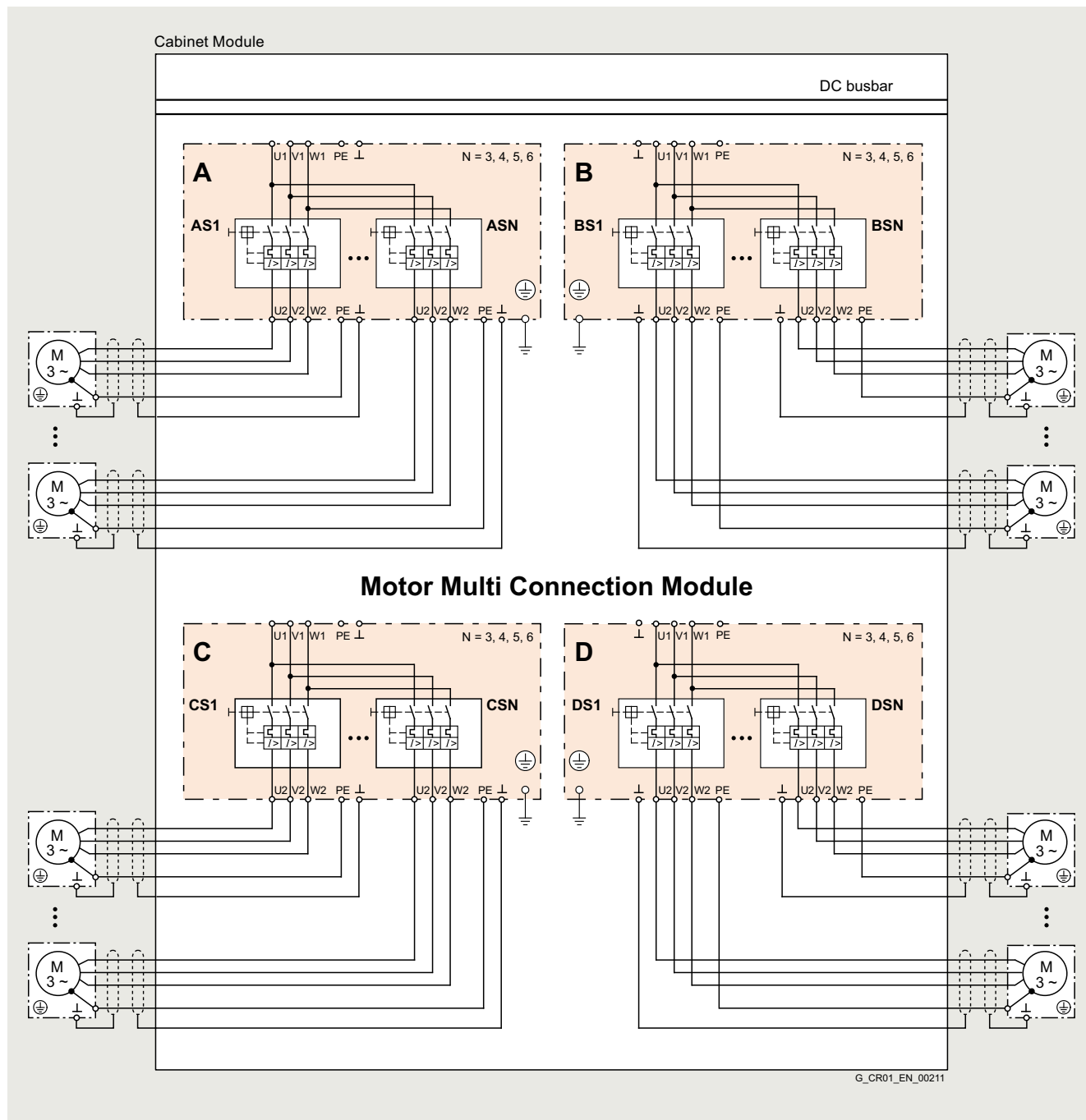
If the drive output of a gantry with drive motors is distributed over multiple axes to achieve a more compact design and enhanced motion, these motors can be operated cost-optimized in parallel with a converter with an appropriate total power rating. The Motor Multi Connection Modules are used to protect the individual motors from the total power of the converter. Motor Multi Connection Modules contain the motor circuit breakers. Each motor circuit breaker protects one motor. Several motor circuit breakers are connected in parallel on the input side into a section for connection to a Motor Module. The Motor Multi Connection Modules can be equipped with optional analog measuring instruments built into the cabinet door for indicating the current motor currents and current output voltage of the Motor Modules.

Design

In total, 4 control cabinet versions are available for connecting 12, 16, 20 or 24 motors with an appropriate number of motor circuit breakers. The motor circuit breakers are designed for a rated current of 45 A to 63 A. The motor circuit breakers are always connected at the input side into 4 groups of 3, 4, 5 or 6 motor circuit breakers for connection to Motor Modules. Up to 2 Motor Modules can be connected to one Motor Multi Connection Module for operating up to 2 sections of motors connected in parallel. As an option, depending on the control cabinet version, 12, 16, 20 or 24 ammeters for indicating the motor currents as well as 2 voltmeters for indicating the output voltages of the Motor Modules can be integrated in the cabinet door of the Motor Multi Connection Module.

Drive systems**SINAMICS S120 Cabinet Modules****Motor Multi Connection Modules****Integration**

The motors and Motor Modules are connected to the Motor Multi Connection Module in accordance with the grouping.



Connection example of a Motor Multi Connection Module



Technical specifications

Line voltage 380 ... 480 V 3 AC		Motor Multi Connection Module			
		Type			
		6SL3700-2EE34-0AA3-Z B70	6SL3700-2EE34-0BA3-Z B70	6SL3700-2EE34-0CA3-Z B70	6SL3700-2EE34-0DA3-Z B70
Number of motor circuit breakers		12	16	20	24
Rated current per group	A	400	400	400	400
Power loss	kW	< 1	< 1	< 1	< 1
Cooling air requirement		Convection	Convection	Convection	Convection
Sound pressure level L_{pA}	dB	–	–	–	–
Line supply/load connection		Screw-type terminal 16 mm ²	Screw-type terminal 16 mm ²	Screw-type terminal 16 mm ²	Screw-type terminal 16 mm ²
Cable length, max.					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
PE connection		PE bar 600 8 × M12	PE bar 600 10 × M12	PE bar 600 10 × M12	PE bar 600 10 × M12
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm	600	600	800	800
• Height	mm	2200	2200	2200	2200
• Depth	mm	600	600	600	600
Weight, approx.	kg	240	280	290	300

Selection and ordering data

Number of motor circuit breakers	Number of connectable motors	Motor Multi Connection Module		Additional identification code -Z with order code
		Article No. with order code B70 for Cranes industry version. ¹⁾	Option "Measuring instruments in control cabinet door"	
12	12	6SL3700-2EE34-0AA3-Z B70	• 12 ammeters Analog measuring instruments of moving-iron type, 90° scale, 0 ... 60/120 A, direct measuring • 2 voltmeters Analog measuring instrument of moving-coil type, 90° scale, 0 ... 520 V, 4 ... 20 mA	B80
16	16	6SL3700-2EE34-0BA3-Z B70	• 16 ammeters Analog measuring instruments of moving-iron type, 90° scale, 0 ... 60/120 A, direct measuring • 2 voltmeters Analog measuring instrument of moving-coil type, 90° scale, 0 ... 520 V, 4 ... 20 mA	B80
20	20	6SL3700-2EE34-0CA3-Z B70	• 20 ammeters Analog measuring instruments of moving-iron type, 90° scale, 0 ... 60/120 A, direct measuring • 2 voltmeters Analog measuring instrument of moving-coil type, 90° scale, 0 ... 520 V, 4 ... 20 mA	B80
24	24	6SL3700-2EE34-0DA3-Z B70	• 24 ammeters Analog measuring instruments of moving-iron type, 90° scale, 0 ... 60/120 A, direct measuring • 2 voltmeters Analog measuring instrument of moving-coil type, 90° scale, 0 ... 520 V, 4 ... 20 mA	B80

Ordering example 1

A gantry with 12 motors is to be operated in two sections with 6 motors connected in parallel to one Motor Multi Connection Module.

Selection: Motor Multi Connection Module with 12 motor circuit breakers or 12 connectable motors and the option "Cranes industry version".

Order:
6SL3700-2EE34-0AA3-Z B70

Ordering example 2

A gantry with 24 motors is to be operated in two sections with 12 motors connected in parallel to one Motor Multi Connection Module with the ability to control the output voltage and motor currents.

Selection: Motor Multi Connection Module with 24 motor circuit breakers or 24 connectable motors in the "Cranes industry version" with measuring instruments for indicating motor current and voltage in the cabinet door.

Order:
6SL3700-2EE34-0DA3-Z B70+B80

¹⁾ For further special versions with order codes, see "Options".

Drive systems

SINAMICS S120 Cabinet Modules

Motor Multi Connection Modules

Options

The table below lists the options available for Motor Multi Connection Modules (for details, refer to the section "Description of the options"):

Brief description of options	Additional identification code -Z with order code and plain text if required
Cranes industry version	B70
Measuring instruments in control cabinet door	B80
Cabinet anti-condensation heating	L55
Base 100 mm high, RAL 7022	M06
Cable compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection (includes M60)	M23
Side panel (right)	M26
Side panel (left)	M27
Additional touch protection (included in M23)	M60
EMC shield bus	M70
DC busbar system ($I_d = 1170$ A, $1 \times 60 \times 10$ mm)	M80
DC busbar system ($I_d = 1500$ A, $1 \times 80 \times 10$ mm)	M81
DC busbar system ($I_d = 1840$ A, $1 \times 100 \times 10$ mm)	M82
DC busbar system ($I_d = 2150$ A, $2 \times 60 \times 10$ mm)	M83
DC busbar system ($I_d = 2730$ A, $2 \times 80 \times 10$ mm)	M84
DC busbar system ($I_d = 3320$ A, $2 \times 100 \times 10$ mm)	M85
DC busbar system ($I_d = 3720$ A, $3 \times 80 \times 10$ mm)	M86
DC busbar system ($I_d = 4480$ A, $3 \times 100 \times 10$ mm)	M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09 • and special color RAL
Assembly into transport units at factory	Y11 • and identification code
Label for plant identification, 1-line, 40×80 mm	Y31 • and identification code
Label for plant identification, 2-line, 40×180 mm	Y32 • and identification code
Label for plant identification, 4-line, 40×180 mm	Y33 • and identification code
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	D02

Certain options may be mutually exclusive.

Inadmissible option combinations:

- **M21** (IP21 degree of protection) and **M23** (IP23 degree of protection)
- **Y31**, **Y32**, **Y33** (1, 2 or 4-line label for plant identification)

DC busbar system mechanical options (busbars between individual Cabinet Modules)

	M80	M81	M82	M83	M84	M85	M86	M87
M80		–	–	✓	–	–	–	–
M81	–		–	–	✓	–	✓	–
M82	–	–		–	–	✓	–	✓
M83	✓	–	–		–	–	–	–
M84	–	✓	–	–		–	✓	–
M85	–	–	✓	–	–		–	✓
M86	–	✓	–	–	✓	–		–
M87	–	–	✓	–	–	✓	–	
✓	Combination possible							
–	Combination not possible							

Overview



Switch-Over Modules switch and motors together in accordance with their type. This results in an increase in plant availability due to redundancy and optimum utilization of the available plant components. The Switch-Over Modules can be optionally equipped with analog measuring instruments integrated into the cabinet door for indication of the output voltage of the Motor Modules and for indicating the motor currents.

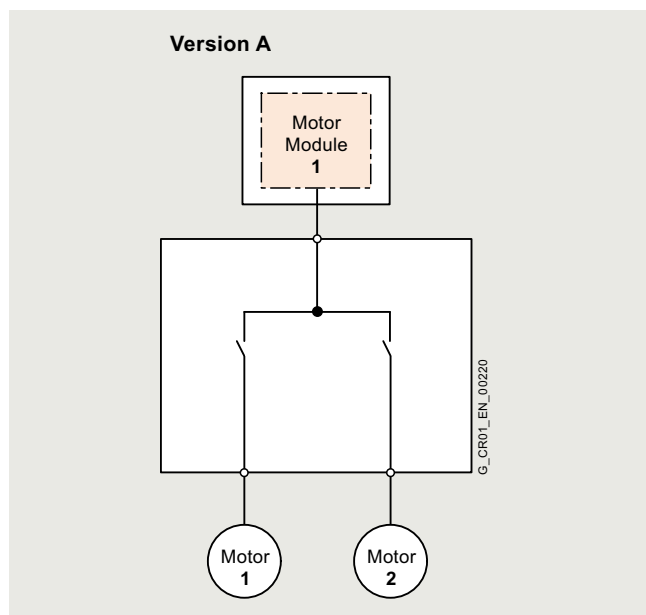
Design

A total of 4 circuit versions are available.

Version A

- A Motor Module operates either Motor 1 or Motor 2

Function diagram for version A

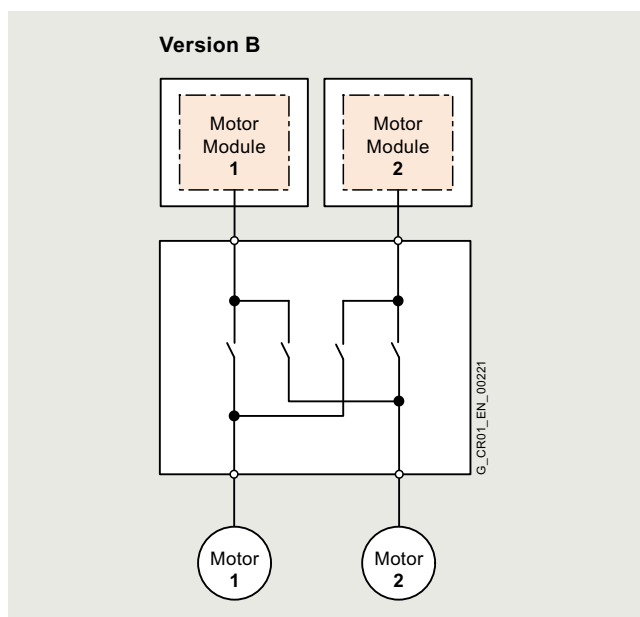


Implementation of version A with option **B80**:
2 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and a voltmeter (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage of the Motor Module.

Version B

- Motor Module 1 operates Motor 1 and Motor Module 2 operates Motor 2 or
- Motor Module 1 operates Motor 2 and Motor Module 2 operates Motor 1

Function diagram for version B



Implementation of version B with option **B80**:
2 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and 2 voltmeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage at the Motor Modules.

Drive systems

SINAMICS S120 Cabinet Modules

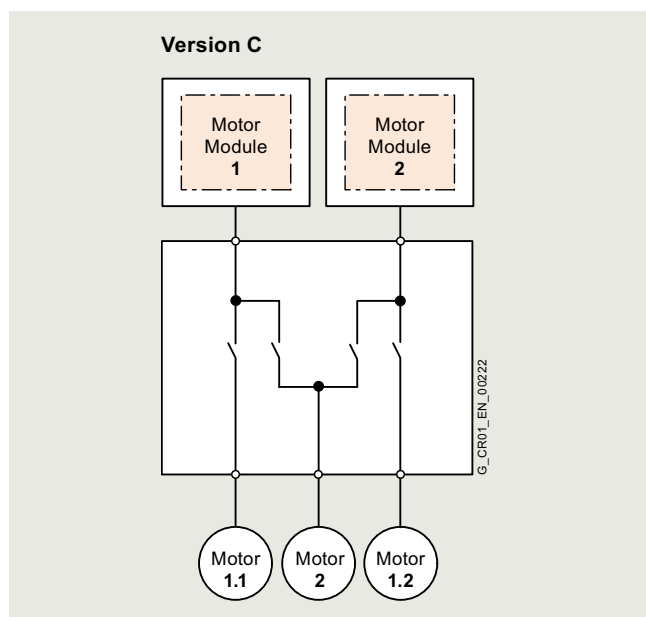
Switch-Over Modules

Design

Version C

- Motor Module 1 operates Motor 1.1 and
- Motor Module 2 operates Motor 1.2 or
- Motor Module 1 operates Motor 2 or
- Motor Module 2 operates Motor 2

Function diagram for version C

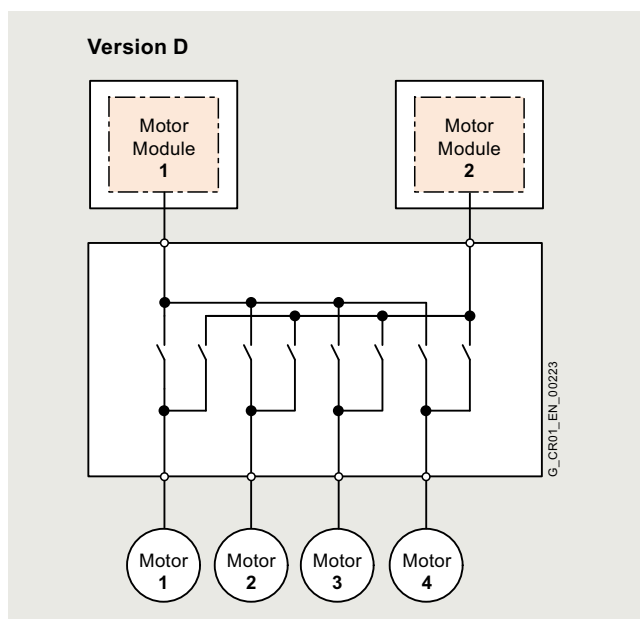


Implementation of version C with option **B80**:
3 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and 2 voltmeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage at the Motor Modules.

Version D

- Motor Module 1 operates Motor 1 or 2 or 3 or 4 and
- Motor Module 2 operates a motor other than Motor Module 1

Function diagram for version D

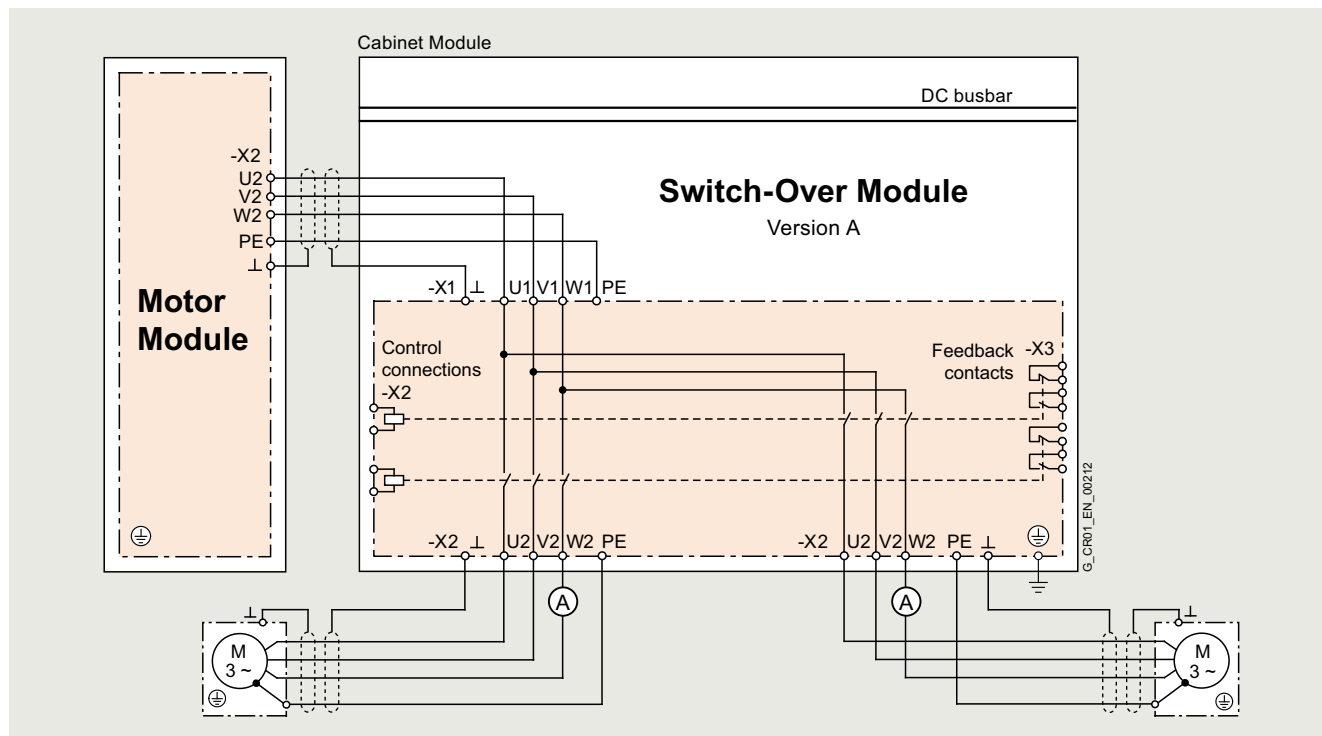


Implementation of version D with option **B80**:
2 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and 2 voltmeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage at the Motor Modules.

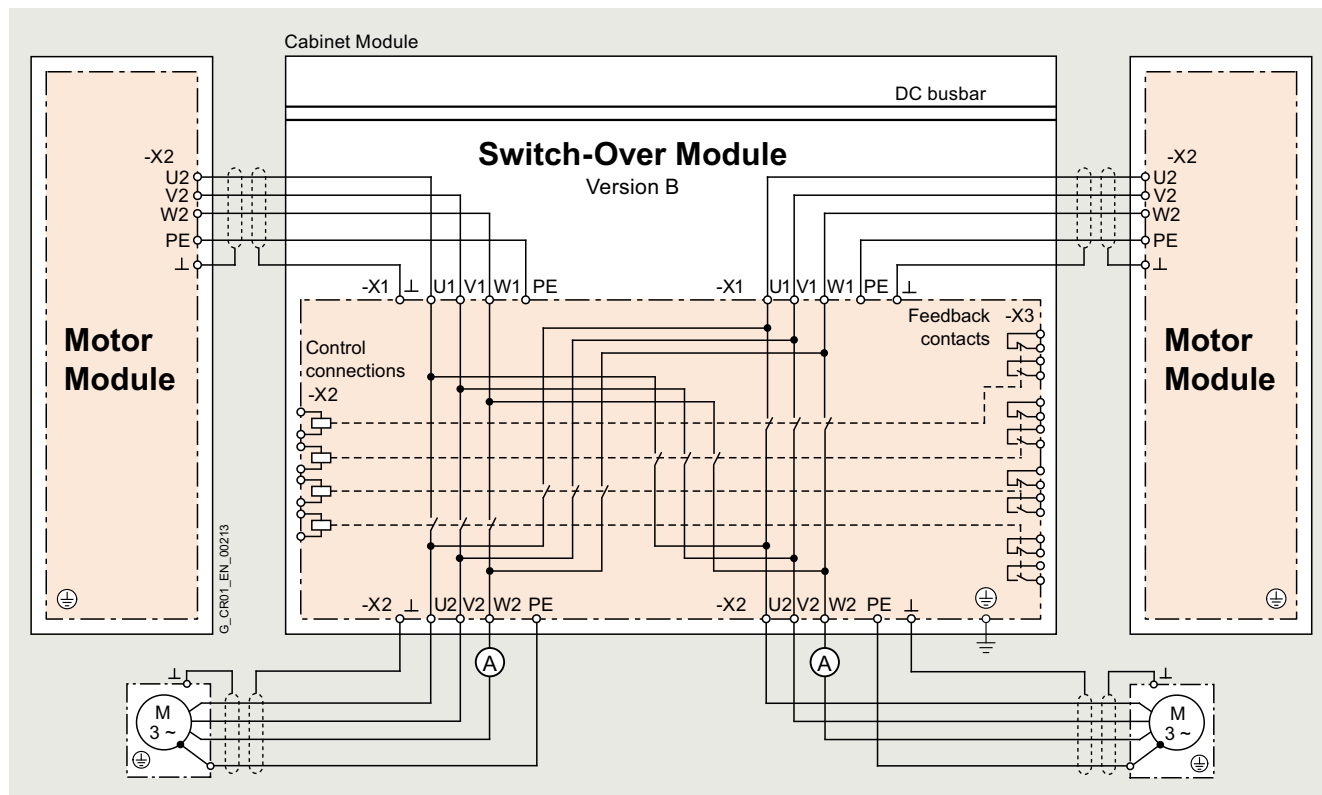
The checkback contacts of the individual contactors are connected to terminals to support plant-specific interlocks.

Integration

The motors and Motor Modules are connected to the Switch-Over Module in accordance with the grouping.

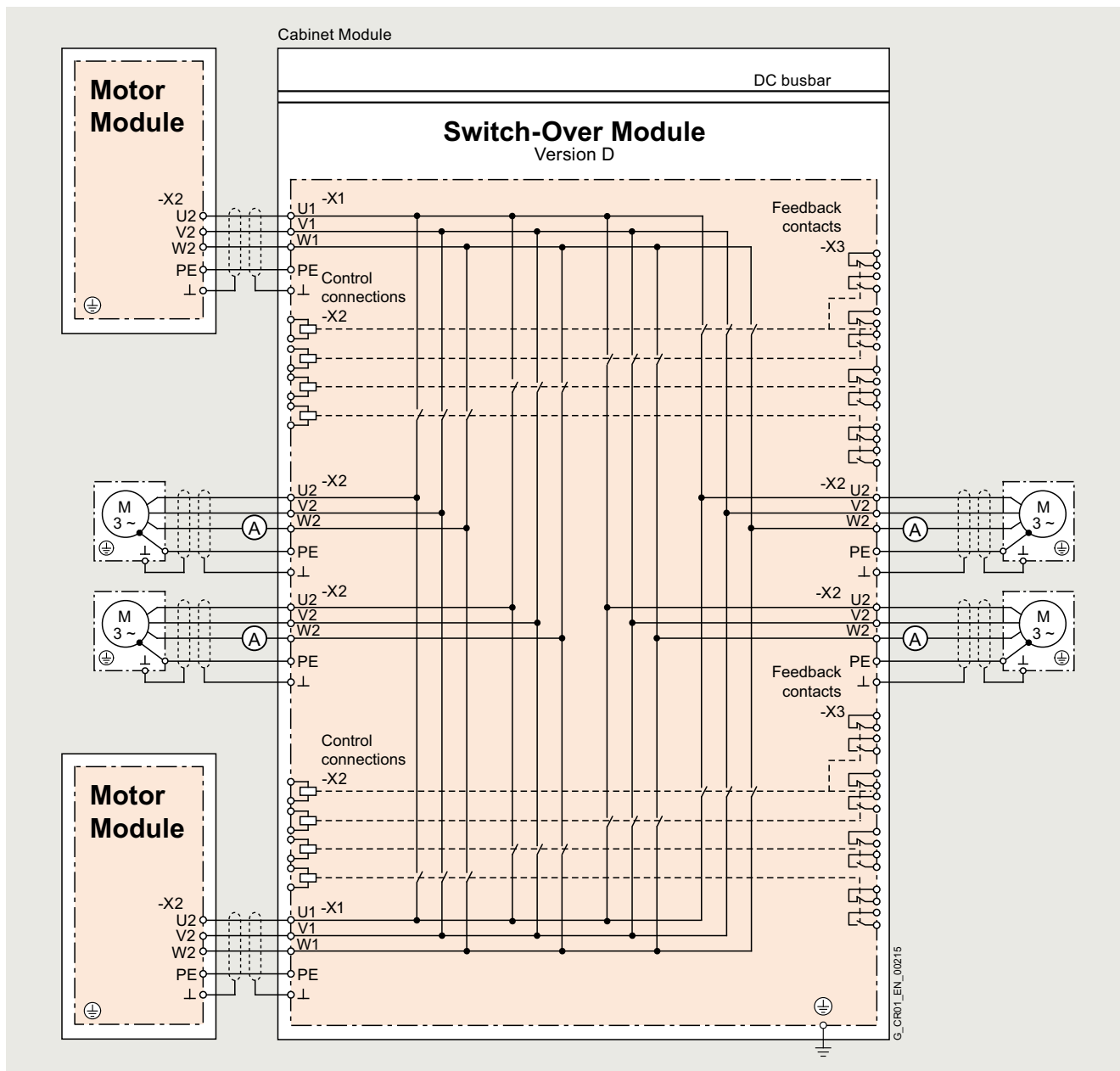
Version A


Connection example of a Switch-Over Module, Version A

Version B


Connection example of a Switch-Over Module, Version B

Version C

Integration
Version D


Connection example of a Switch-Over Module, Version D

Drive systems

SINAMICS S120 Cabinet Modules

Switch-Over Modules

Technical specifications

Line voltage 380 ... 480 V 3 AC		Switch-Over Module			
		Type			
		6SL3700-2FE36-1AA3-Z B70	6SL3700-2FE36-1BA3-Z B70	6SL3700-2FE36-1CA3-Z B70	6SL3700-2FE36-1DA3-Z B70
Version		A	B	C	D
Number of contactors		2	4	4	8
Rated current	A	605	605	605	605
Power loss	kW	< 1	< 1	< 1	< 1
Cooling air requirement		Convection	Convection	Convection	Convection
Sound pressure level L_{pA}	dB	–	–	–	–
Line supply/load connection		6 × M12	6 × M12	6 × M12	6 × M12
Cable length, max.					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
PE connection		PE bar 600 8 × M12	PE bar 600 8 × M12	PE bar 600 8 × M12	PE bar 600 8 × M12
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm	600	600	600	600
• Height	mm	2200	2200	2200	2200
• Depth	mm	600	600	600	600
Weight, approx.	kg	320	360	380	430
Matching Motor Modules		6SL3720-1TE35-0AA3 6SL3720-1TE36-1AA3	6SL3720-1TE35-0AA3 6SL3720-1TE36-1AA3	6SL3720-1TE35-0AA3 6SL3720-1TE36-1AA3	6SL3720-1TE35-0AA3 6SL3720-1TE36-1AA3

Line voltage 380 ... 480 V 3 AC		Switch-Over Module		
		Type		
		6SL3700-2FE39-9AA3-Z B70	6SL3700-2FE39-9BA3-Z B70	6SL3700-2FE39-9CA3-Z B70
Version		A	B	C
Number of contactors		4	8	8
Rated current	A	985	985	985
Power loss	kW	< 1	< 2	< 2
Cooling air requirement		Convection	Convection	Convection
Sound pressure level L_{pA}	dB	–	–	–
Line supply/load connection		10 × M12	10 × M12	10 × M12
Cable length, max.				
• Shielded	m	300	300	300
• Unshielded	m	450	450	450
PE connection		PE bar 600 8 × M12	PE bar 800 10 × M12	PE bar 800 10 × M12
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm	600	800	800
• Height	mm	2200	2200	2200
• Depth	mm	600	600	600
Weight, approx.	kg	400	600	650
Matching Motor Modules		6SL3720-1TE37-5AA3 6SL3720-1TE38-4AA3 6SL3720-1TE41-0AA3	6SL3720-1TE37-5AA3 6SL3720-1TE38-4AA3 6SL3720-1TE41-0AA3	6SL3720-1TE37-5AA3 6SL3720-1TE38-4AA3 6SL3720-1TE41-0AA3


Technical specifications

Line voltage 380 ... 480 V 3 AC		Switch-Over Module		
		Type		
		6SL3700-2FE41-3AA3-Z B70	6SL3700-2FE41-3BA3-Z B70	6SL3700-2FE41-3CA3-Z B70
Version		A	B	C
Number of contactors		6	8	8
Rated current	A	1260	1260	1260
Power loss	kW	< 1.5	< 2	< 2
Cooling air requirement		Convection	Convection	Convection
Sound pressure level L_{pA}	dB	–	–	–
Line supply/load connection		14 × M12	14 × M12	14 × M12
Cable length, max.				
• Shielded	m	300	300	300
• Unshielded	m	450	450	450
PE connection		PE bar 800 10 × M12	PE bar 800 10 × M12	PE bar 800 10 × M12
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm	800	800	800
• Height	mm	2200	2200	2200
• Depth	mm	600	600	600
Weight, approx.	kg	550	650	750
Matching Motor Modules		6SL3720-1TE41-2AA3	6SL3720-1TE41-2AA3	6SL3720-1TE41-2AA3

Line voltage 380 ... 480 V 3 AC		Switch-Over Module		
		Type		
		6SL3700-2FE41-4AA3-Z B70	6SL3700-2FE41-4BA3-Z B70	6SL3700-2FE41-4CA3-Z B70
Version		A	B	C
Number of contactors		6	12	12
Rated current	A	1405	1405	1405
Power loss	kW	< 1.5	< 2.5	< 2.5
Cooling air requirement		Convection	Convection	Convection
Sound pressure level L_{pA}	dB	–	–	–
Line supply/load connection		14 × M12	14 × M12	14 × M12
Cable length, max.				
• Shielded	m	300	300	300
• Unshielded	m	450	450	450
PE connection		PE bar 800 10 × M12	PE bar 1200 10 × M12	PE bar 1200 10 × M12
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm	800	1200	1200
• Height	mm	2200	2200	2200
• Depth	mm	600	600	600
Weight, approx.	kg	550	800	850
Matching Motor Modules		6SL3720-1TE41-4AA3	6SL3720-1TE41-4AA3	6SL3720-4TE41-2AA3

Drive systems

SINAMICS S120 Cabinet Modules

Switch-Over Modules

Selection and ordering

Version	Switch-Over Modules Article No. with order code B70 for Cranes industry version. ¹⁾	Connectable Motor Modules	Type rating
		Type	kW
A	6SL3700-2FE36-1AA3-Z B70	6SL3720-1TE35-0AA3	250
		6SL3720-1TE36-1AA3	315
	6SL3700-2FE39-9AA3-Z B70	6SL3720-1TE37-5AA3	400
		6SL3720-1TE38-4AA3	450
		6SL3720-1TE41-0AA3	560
	6SL3700-2FE41-3AA3-Z B70	6SL3720-1TE41-2AA3	710
B	6SL3700-2FE36-1BA3-Z B70	6SL3720-1TE35-0AA3	250
		6SL3720-1TE36-1AA3	315
	6SL3700-2FE39-9BA3-Z B70	6SL3720-1TE37-5AA3	400
		6SL3720-1TE38-4AA3	450
		6SL3720-1TE41-0AA3	560
	6SL3700-2FE41-3BA3-Z B70	6SL3720-1TE41-2AA3	710
C	6SL3700-2FE36-1CA3-Z B70	6SL3720-1TE35-0AA3	250
		6SL3720-1TE36-1AA3	315
	6SL3700-2FE39-9CA3-Z B70	6SL3720-1TE37-5AA3	400
		6SL3720-1TE38-4AA3	450
		6SL3720-1TE41-0AA3	560
	6SL3700-2FE41-3CA3-Z B70	6SL3720-1TE41-2AA3	710
D	6SL3700-2FE41-4CA3-Z B70	6SL3720-1TE41-4AA3	800
		6SL3720-1TE41-4AA3	800
D	6SL3700-2FE36-1DA3-Z B70	6SL3720-1TE35-0AA3	250
		6SL3720-1TE36-1AA3	315

¹⁾ For further special versions with order codes, see "Options".



Options

The table below lists the options available for Switch-Over Modules (for details, refer to the section "Description of the options"):

Brief description of options	Additional identification code -Z with order code and plain text if required
Cranes industry version	B70
Measuring instruments in control cabinet door	B80
Cabinet anti-condensation heating	L55
Base 100 mm high, RAL 7022	M06
Cable compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection (includes M60)	M23
Side panel (right)	M26
Side panel (left)	M27
Additional touch protection (included in M23)	M60
EMC shield bus	M70
DC busbar system ($I_d = 1170$ A, $1 \times 60 \times 10$ mm)	M80
DC busbar system ($I_d = 1500$ A, $1 \times 80 \times 10$ mm)	M81
DC busbar system ($I_d = 1840$ A, $1 \times 100 \times 10$ mm)	M82
DC busbar system ($I_d = 2150$ A, $2 \times 60 \times 10$ mm)	M83
DC busbar system ($I_d = 2730$ A, $2 \times 80 \times 10$ mm)	M84
DC busbar system ($I_d = 3320$ A, $2 \times 100 \times 10$ mm)	M85
DC busbar system ($I_d = 3720$ A, $3 \times 80 \times 10$ mm)	M86
DC busbar system ($I_d = 4480$ A, $3 \times 100 \times 10$ mm)	M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09 • and special color RAL
Assembly into transport units at factory	Y11 • and identification code
Label for plant identification, 1-line, 40×80 mm	Y31 • and identification code
Label for plant identification, 2-line, 40×180 mm	Y32 • and identification code
Label for plant identification, 4-line, 40×180 mm	Y33 • and identification code
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	D02

Certain options may be mutually exclusive.

Inadmissible option combinations:

- **M21** (IP21 degree of protection) and **M23** (IP23 degree of protection)
- **Y31**, **Y32**, **Y33** (1, 2 or 4-line label for plant identification)

DC busbar system mechanical options (busbars between individual Cabinet Modules)

	M80	M81	M82	M83	M84	M85	M86	M87
M80		—	—	✓	—	—	—	—
M81	—		—	—	✓	—	✓	—
M82	—	—		—	—	✓	—	✓
M83	✓	—	—		—	—	—	—
M84	—	✓	—	—		—	✓	—
M85	—	—	✓	—	—		—	✓
M86	—	✓	—	—	✓	—		—
M87	—	—	✓	—	—	✓	—	

✓	Combination possible
—	Combination not possible

Drive systems

SINAMICS S120 Cabinet Modules

Description of the options

Options

B70

Cranes industry version

The modules are designed for increased mechanical stress. Operation is permitted for the following vibratory load:

- Deflection: ± 1 mm at 2.0 to 13.2 Hz
- Acceleration: 0.7 g at 13.2 to 100 Hz

The core colors of the wiring are in accordance with IEC 60204-32 except in the case of built-in Chassis Modules. The auxiliary voltage terminals are marked and implemented as follows:

- X1: > 230 V AC, spring-loaded terminal
- X2: 230 V AC, spring-loaded terminal
- X3: 24 V DC, spring-loaded terminal
- X21: LCM, spring-loaded terminal
- X10: Pre-charging, screw-type terminal

The scope of supply includes documentation for the control cabinets for the ordered configuration of a crane.

The equipment designations and core end designations are in accordance with EN 61346-2. All auxiliary voltages are routed to terminals and must be externally fed.

B80

Measuring instruments in control cabinet door

Measuring instruments for measuring the output currents and voltages of the Motor Modules are installed in the cabinet door of the Switch-Over Modules and Motor Multi Connection Modules. The number of measuring instruments is dependent on the function version of the Switch-Over Module and Motor Multi Connection Module.

B81

Measuring instrument for measuring line voltage and line current

The Line Connection Module is equipped with an additional measuring instrument for measuring and indicating the line voltage and line current (SICAM P50 7KG7750-0AA01-0AA0).

B82

Circuit breaker for auxiliary power supply

With this option, the LCM is equipped with an additional fuse switch disconnector for a maximum of 500 A which allows a transformer (max. 350 kVA) to be used to supply the auxiliary drives, control circuits and special current circuits.?

B83

Surge arrester

The Line Connection Modules are equipped with a 600 V surge arrester.

B91

Busbar set for 2nd Active Line Module on right

With this ordering option, additional DC busbars are supplied for connecting the 2nd Active Line Module to the right of the Line Connection Module.

B92

Busbar set for 2nd Active Line Module on left

With this ordering option, additional DC busbars are supplied for connecting the 2nd Active Line Module to the left of the Line Connection Module.

B93

2nd Active Line Module on right

With this ordering option the position of the Active Line Module is specified as 2nd Active Line Module on the right side of the Line Connection Module.

B94

2nd Active Line Module on right

With this ordering option the position of the Active Line Module is specified as 2nd Active Line Module on the left side of the Line Connection Module.

D02

Customer documentation in DXF format

Option **D02** can be used to order documents such as circuit diagrams, terminal diagrams, the layout diagram, and the dimensional drawing in DXF format, e.g. for further processing in AutoCAD systems.

K46

SMC10 Sensor Module Cabinet-Mounted for resolvers

The SMC10 Sensor Module can be used to simultaneously record the speed and the rotor position angle. The signals received from the resolver are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes. The following encoders are supported by the SMC10:

- 2-pole resolver
- Multi-pole resolver

The motor temperature can also be measured using KTY84-130, Pt1000 or PTC thermistors.

K48

SMC20 Sensor Module Cabinet-Mounted for sin/cos incremental encoder or EnDat absolute encoder

The SMC20 Sensor Module can be used to simultaneously record the speed and position. The signals received from the incremental encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes. The following encoder signals can be evaluated:

- Incremental encoder sin/cos 1 V_{pp}
- EnDat absolute encoder
- SSI encoder

The motor temperature can also be measured using KTY84-130, Pt1000 or PTC thermistors.

K50

SMC30 Sensor Module Cabinet-Mounted to acquire the actual motor speed

The SMC30 Sensor Module can be used to acquire speed. The signals received from the rotary pulse encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoder signals can be evaluated:

- TTL encoder
- HTL encoder
- SSI encoder

The motor temperature can also be measured using KTY84-130, Pt1000 or PTC thermistors.

K51

VSM10 Voltage Sensing Module

The VSM10 Voltage Sensing Module is used to acquire the voltage characteristic at the motor end.



Options

K82

Terminal Module for controlling the Safe Torque Off and Safe Stop 1 safety functions

The Terminal Module controls the Safety Integrated Basic Functions Safe Torque Off (STO) and Safe Stop 1 (SS1) (time-controlled) for a voltage of 24 V DC/AC (terminology as defined in IEC 61800-5-2). The relays used here are permitted up to an installation altitude of 2000 m. The use of this option for requirements that go beyond this is possible upon request.

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the components (Control Unit and Motor Module), satisfy the requirements of EN 61800-5-2, EN 60204-1, EN ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

With option **K82**, the requirements specified in EN 61800-5-2, EN 60204-1, EN ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

The Safety Integrated functions using option **K82** are only available in conjunction with certified components and software versions.

The Safety Integrated functions of SINAMICS are generally certified by independent institutes. An up-to-date list of certified components is available on request from your local Siemens office.

With the Motor Modules in chassis format, option **K82** cannot be ordered together with option **L55** (cabinet anti-condensation heating).

L08

Motor reactor

Motor reactors reduce the voltage stress on the motor windings by reducing the voltage gradients at the motor terminals that occur when motors are fed from drive converters. At the same time, the capacitive charge/discharge currents that occur at the converter output when long motor cables are used are reduced. Suitably dimensioned motor reactors or series connections of motor reactors therefore offer a solution which allows a higher capacitance and thus also longer motor cables to be connected. It is generally recommended that motor reactors are used in the case of multi-motor drives. With option **L08** for Motor Modules, a motor reactor is integrated, fully wired, into the Motor Module up to cabinet size GX (outputs of less than 315 kW). Due to space constraints, a separate cabinet must be planned for the output range 315 to 450 kW (cabinet size HX; see [Motor Double Choke Module](#)).

L25

Circuit breaker in a withdrawable unit design

Line Connection Modules with an input current of > 800 A are equipped with fixed-mounted circuit breakers as standard. Where the customer requires a visible isolating distance, a withdrawable circuit breaker can be ordered as an option.

L37

DC interface incl. pre-charging circuit of the relevant DC link capacitance

If, for reasons relating to the process or availability, the Motor Module needs to be disconnected from or connected to the common DC link for an entire drive line-up during operation, a manually operated isolating distance can be ordered as an option. With chassis format power units, this takes the form of switch disconnectors. Option **L37** is installed on the busbar between the Motor Module and the main DC busbar. This option also includes a pre-charging switch for the DC link capacitors of the relevant Motor Module so that it can be switched in to the pre-charged DC link. The switching operation is performed externally. The operating levers can be locked using a padlock (padlock not included in scope of delivery). The degree of protection of the cabinets is not affected.

L42

Line Connection Module for Active Line Modules

Option **L42** is specified in the order to indicate that the Line Connection Module will be connected to an Active Line Module. The Line Connection Module is then adapted accordingly (pre-charging circuit, connection busbars, etc.). Also refer to the assignment table in the "Line Connection Modules".

L45

EMERGENCY OFF pushbutton in cabinet door

The EMERGENCY OFF pushbutton with protective collar is installed in the cabinet door of the Line Connection Module and its contacts are connected to a terminal block. From here, the EMERGENCY OFF pushbutton can be integrated into the plant-side EMERGENCY OFF chain.

L55

Cabinet anti-condensation heating

The anti-condensation heating is recommended for low ambient temperatures and high levels of humidity to prevent condensation. Depending on the cabinet width, a 100 W cabinet heater is installed for each Cabinet Module. One heating element for cabinet width up to 600 mm, 2 heating elements for cabinet width over 800 mm. The power supply for the anti-condensation heating (110 to 230 V AC, at terminal block -X240) must be provided externally and fused with max. 16 A. Within the transport units, the heaters are internally connected and must only be fed once. Option **L55** cannot be ordered together with option **K82** (Terminal Module for the control of safety functions).

L87

Insulation monitoring

An insulation monitor must be used if the converter is operated on an isolated supply system. The device monitors the entire galvanically coupled circuit for insulation faults. An alarm is output by the insulation monitor in the event of a fault.

Notice:

Only one insulation monitor can be used within the same electrically connected supply system. As there are different response strategies when a ground fault occurs in an isolated supply system, output relays of the insulation monitor are provided for integration in a line-side control. It is also possible to integrate the outputs into the monitoring system of the Cabinet Modules on the line side.

Drive systems

SINAMICS S120 Cabinet Modules

Description of the options

Options

Terminal A1-A101	Meaning
11	Signaling relay ALARM 1
12	Signaling relay ALARM 1
14	Signaling relay ALARM 1
21	Signaling relay ALARM 2
22	Signaling relay ALARM 2
24	Signaling relay ALARM 2
M+	External kΩ display (0 ... 400 μA)
M-	External kΩ display (0 ... 400 μA)
R1	External reset key (NC contact or wire jumper, otherwise the fault code is not stored)
R2	External reset key (NC contact or wire jumper)
T1	External test button
T2	External test button

M06

Base 100 mm high, RAL 7022

The additional cabinet base allows larger bending radii for cables (cable inlet from below) and enables them to be routed within the cabinet base. The cabinet base is supplied in RAL 7022 in all cases. A special paint finish is not available for the base. It is delivered completely assembled with the cabinet.

M07

Cable compartment 200 mm high, RAL 7035

The cable compartment is made of strong sheet steel and allows cables to be connected more flexibly (entry from below). It also allows routing of cables within the compartment. It is delivered completely assembled with the cabinet.

Notice:

The cable compartment is painted as standard with RAL 7035. If a special color is requested for the cabinet (option **Y09**), the cable compartment is also painted in this color.

M21

IP21 degree of protection

Cabinet version in IP20, but with additional roof or canopy. This increases the cabinet height by 250 mm. For transport reasons, the roofs or canopies are delivered separately and must be fitted on site.

Notice:

The roof or canopies are painted with color RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the roofs or canopies will also be painted in this color.

M23

IP23 degree of protection (includes M60)

Cabinet Modules with IP23 degree of protection are supplied with additional hoods, plastic ventilation grilles, and a filter medium in the air inlet and outlet. This increases the cabinet height by 400 mm. The filter medium must be maintained according to the local environmental conditions. For transport reasons, the hoods are delivered separately and must be fitted on site.

Notice:

The hoods are painted with color RAL 7035 as standard. If a special color is requested for the cabinet (option **Y09**), the hood is also painted in this color. The molded plastic parts (e.g. ventilation grilles) have color RAL 7035 and cannot be painted.

M26

Side panel (right)

For side-by-side installation of Cabinet Modules from left to right, cabinets can be ordered ready-prepared at the factory for assembly on-site. If option **M26** is ordered, the Cabinet Module is shipped with a side panel fitted on the right. This side panel is essential for ensuring compliance with IP20 and higher degrees of protection.

M27

Side panel (left)

For side-by-side installation of Cabinet Modules from right to left, cabinets can be ordered ready-prepared at the factory for assembly on-site. If option **M27** is ordered, the Cabinet Module is shipped with a side panel fitted on the left. This side panel is essential for ensuring compliance with IP20 and higher degrees of protection.

M60

Additional touch protection (included in M23)

The Cabinet Modules are designed in accordance with DGUV regulation 3 as standard. With option **M60**, additional covers (out of reach) at accessible operator control and switching elements, are provided in the area of the AC and DC busbars and in front of the power unit.

M70

EMC shield bus

The EMC shield bus is used for the connection of line and motor shielded power cables. The supplied EMC shield clamps provide a large surface area for the connection.

M80 to M87

DC busbar system

The correct DC busbar for the Cabinet Module must be ordered. This is fitted in the upper section of the Cabinet Modules and connects the Line Modules to the Motor Modules. The busbar is dimensioned according to the load requirements and demand factor associated with operation of the individual drives, and according to the specific Cabinet Module layout. For this reason, the DC busbar is not supplied as standard, but must be ordered as an option. When selecting busbars, it is important to ensure that the systems of adjacent Cabinet Modules are compatible with one another (refer to the table below and option selection matrix for the Cabinet Modules in question).

Where Cabinet Modules are ordered as a factory-assembled transport unit with option **Y11**, all busbars in the transport unit must be identical.

Order code	DC busbar system, rated current I_N A	Number	Dimensions mm	Compatible with
M80	1170	1	60 × 10	M83
M81	1500	1	80 × 10	M84 and M86
M82	1840	1	100 × 10	M85 and M87
M83	2150	2	60 × 10	M80
M84	2730	2	80 × 10	M81 and M86
M85	3320	2	100 × 10	M82 and M87
M86	3720	3	80 × 10	M81 and M84
M87	4480	3	100 × 10	M82 and M85

The DC busbars are nickel-plated as standard and are available in different designs for a variety of current-carrying capacities. The scope of delivery also includes the jumpers required to link the busbar systems of individual Cabinet Modules.



Options

M90

Crane transport assembly (top-mounted)

A top-mounted crane transport assembly can be ordered as an option for Cabinet Modules. Depending on the width of the module, it consists of either transport eyebolts (width ≤ 800 mm) or transport rails (width ≥ 800 mm). When Cabinet Modules are ordered as factory-assembled transport units (order code **Y11**), they are shipped with transport rails, i.e. option **M90** is automatically included in the scope of delivery of option **Y11** and does not need to be ordered separately.

Y09

Special paint finish for cabinet

The Cabinet Modules are delivered in RAL 7035 as standard. The special paint finish must be specified in plain text when ordering. All RAL colors that are available as powdered coatings can be selected.

Notice:

If options such as roofs or canopies (option **M21**) or hoods (option **M23**) are desired for the Cabinet Modules, these are also painted in the ordered cabinet color. The molded plastic parts (e.g. ventilation grilles) have color RAL 7035 and cannot be painted.

Y11

Assembly into transport units at factory

With this option, Cabinet Modules can be ordered as factory-assembled transport units with a maximum width of up to 2400 mm. In this case, the relevant modules are shipped as interconnected units (both electrically and mechanically). When DC busbars (options **M80** to **M87**) are selected for these "units", it must be ensured that identical busbars are installed within the transport unit and are compatible with all adjacent Cabinet Modules. In the case of a transport unit order, all the Cabinet Modules to be included in the unit and their installation sequence from left to right must be specified in plain text according to the syntax below:

Plain text required to order:

	TU	1	-	1 ... 6
• Transport Unit	x			
• Serial number of transport unit				
• Position of Cabinet Module within transport unit from left to right				x

Option **Y11** is particularly recommended for units comprising Line Connection Modules and Line Modules because the required pre-charging input circuits and connection busbars, for example, can be incorporated in the transport unit for certain versions. Please refer to the assignment tables in "Line Connection Modules". The transport unit is shipped with a crane transport rail, which means that option **M90** is not required.

Y31

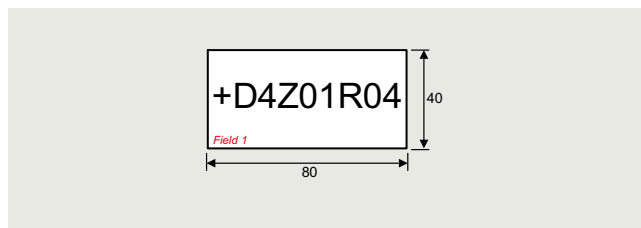
Label for plant identification, 1-line, 40 × 80 mm

Labels made of Formica (white with black engraving) are offered for the identification of the Cabinet Modules. The labels are stuck onto the cabinet door.

Dimensions H × W: 40 × 80 mm

The text must be specified in plain text when ordering.

Field 1: Max. 9 characters, font size 10 mm.



Y32

Label for plant identification, 2-line, 40 × 180 mm

Labels made of Formica (white with black engraving) are offered for the identification of the Cabinet Modules. The labels are stuck onto the cabinet door.

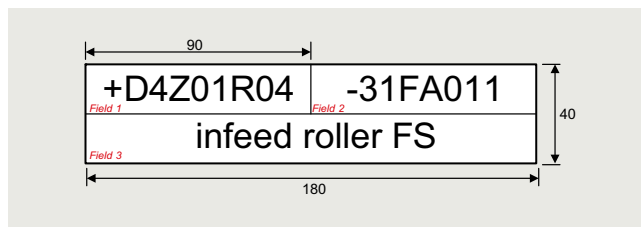
Dimensions H × W: 40 × 180 mm

The text must be specified in plain text when ordering.

Field 1: Max. 9 characters, font size 10 mm

Field 2: Max. 9 characters, font size 10 mm

Field 3: Max. 20 characters, font size 10 mm.



Y33

Label for plant identification, 4-line, 40 × 180 mm

Labels made of Formica (white with black engraving) are offered for the identification of the Cabinet Modules. The labels are stuck onto the cabinet door.

Dimensions H × W: 40 × 180 mm

The text must be specified in plain text when ordering.

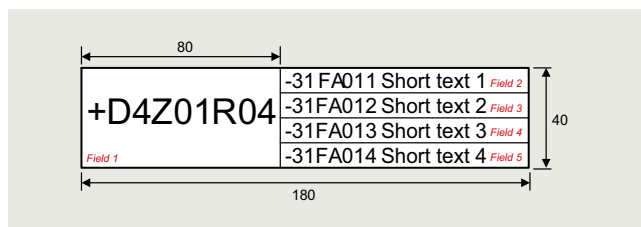
Field 1: Max. 9 characters, font size 10 mm

Field 2: Max. 20 characters, font size 6 mm

Field 3: Max. 20 characters, font size 6 mm

Field 4: Max. 20 characters, font size 6 mm

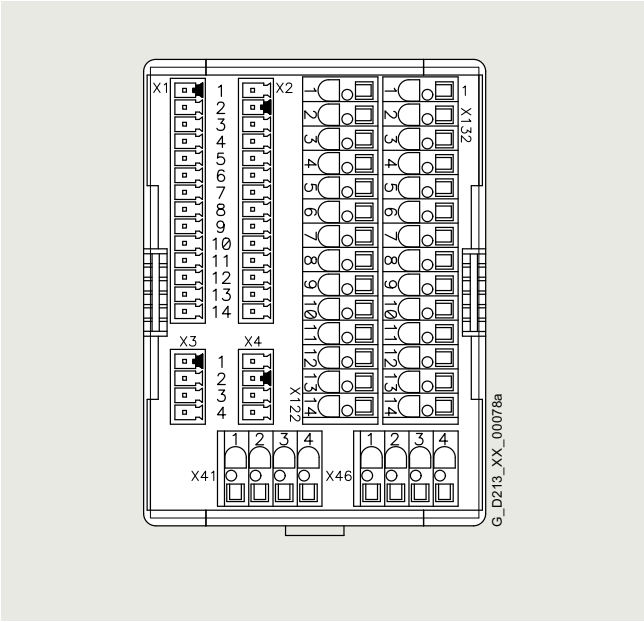
Field 5: Max. 20 characters, font size 6 mm.



Drive systems
SINAMICS S120 Cabinet Modules

Customer terminal strip -X55

Overview



Customer terminal strip -X55 represents the interface to the I/O devices and marshals a range of cabinet-internal signals to a central terminal strip module mounted in the lower part of the cabinet.

It can be used with Motor Modules in chassis format.

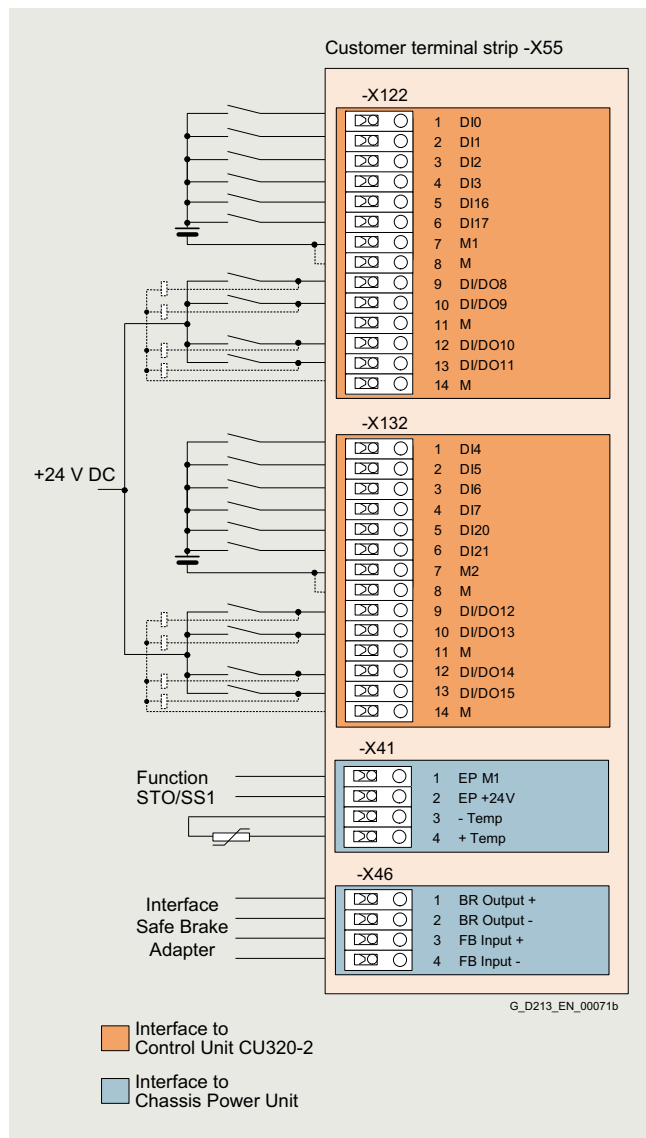
Design

To connect signal cables on the customer side, terminal strip -X55 includes terminals -X122, -X132, -X41 and -X46 (terminals -X1 to -X4 are used inside the cabinet and are not available). As a consequence, depending on the version (with/without option **K90**) the following digital inputs/outputs and/or signals are available:

The customer terminal strip -X55 includes:	Motor Modules in chassis format		Active Line Modules	
	without CU320-2 (K90/K95)	with CU320-2 (K90/K95)	without CU320-2 (K90/K95)	with CU320-2 (K90/K95)
-X122, -X132				
12 digital inputs DI	–	✓	–	✓
8 bidirectional inputs/outputs (DI/DO)	–	✓	–	✓
-X41				
Connection safety function Safe Torque Off/Safe Stop 1	✓	✓	–	–
Connection temperature sensor KTY84/PTC/Pt100/Pt1000	✓	✓	–	–
-X46				
Connection Safe Brake Adapter	✓	✓	–	–

Design

Pin assignment



Terminal assignment of customer terminal strip -X55

Terminal strip -X55-X122 digital inputs/outputs

Terminal	Designation ¹⁾	Technical specifications
1	DI 0	Voltage -30 ... +30 V DC
2	DI 1	Current consumption, typical: 9 mA at 24 V DC
3	DI 2	Electrical isolation: Terminal M1 is the reference potential
4	DI 3	Level (incl. ripple):
5	DI 16	• High signal level: 15 ... 30 V
6	DI 17	• Low signal level: -30 ... +5 V
		Input delay (typ.):
		• For 0 → 1: 50 µs
		• For 1 → 0: 150 µs
7	M1	Reference potential for terminals 1 ... 6
8	M	Ground
9	DI/DO 8	As input:
10	DI/DO 9	Voltage -30 ... +30 V DC
11	M	Current consumption, typical: 9 mA at 24 V DC
12	DI/DO 10	Level (incl. ripple):
13	DI/DO 11	• High signal level: 15 ... 30 V
		• Low signal level: -30 ... +5 V
14	M	Fast inputs: ²⁾
		• DI/DO 8, 9, 10 and 11
		Input delay (typ.):
		• For 0 → 1: 5 µs
		• For 1 → 0: 50 µs
		As output:
		Voltage 24 V DC
		Max. load current for each output: 500 mA
		Continuously short-circuit proof
		Output delay (typ./max.): ³⁾
		• For 0 → 1: 150 µs/400 µs
		• For 1 → 0: 75 µs/100 µs
		Switching frequency:
		• With ohmic load: max. 100 Hz
		• With inductive load: max. 0.5 Hz
		• With lamp load: max. 10 Hz
		• Max. lamp load: 5 W

Max. connectable cross-section: 2.5 mm².

¹⁾ DI: Digital input
DI/DO: Bidirectional digital input/output
M: Electronics ground
M1: Ground reference.

²⁾ Can be used as measuring probe input or input for the external zero mark.

³⁾ Data for: $U_{cc} = 24 \text{ V}$; load 48Ω ; High (1) = 90 % U_{out} ; Low (0) = 10 % U_{out} .

Drive systems

SINAMICS S120 Cabinet Modules

Customer terminal strip -X55

Design

Terminal strip -X55-X132 digital inputs/outputs

Terminal	Designation ¹⁾	Technical specifications
1	DI 4	Voltage -30 ... +30 V DC
2	DI 5	Current consumption, typical: 9 mA at 24 V DC
3	DI 6	Electrical isolation: Terminal M2 is the reference potential
4	DI 7	Level (incl. ripple):
5	DI 20	• High signal level: 15 ... 30 V
6	DI 21	• Low signal level: -30 ... +5 V
		Input delay (typ.):
		• For 0 → 1: 50 µs
		• For 1 → 0: 150 µs
7	M2	Reference potential for terminals 1 ... 6
8	M	Ground
9	DI/DO 12	As input:
10	DI/DO 13	Voltage -30 ... +30 V DC
11	M	Current consumption, typical: 9 mA at 24 V DC
12	DI/DO 14	Level (incl. ripple):
13	DI/DO 15	• High signal level: 15 ... 30 V
		• Low signal level: -30 ... +5 V
		Fast inputs: ²⁾
14	M	• DI/DO 12, 13, 14 and 15
		Input delay (typ.):
		• For 0 → 1: 5 µs
		• For 1 → 0: 50 µs
		As output:
		Voltage 24 V DC
		Max. load current for each output: 500 mA
		Continuously short-circuit proof
		Output delay (typ./max.): ³⁾
		• For 0 → 1: 150 µs/400 µs
		• For 1 → 0: 75 µs/100 µs
		Switching frequency:
		• With ohmic load: max. 100 Hz
		• With inductive load: max. 0.5 Hz
		• With lamp load: max. 10 Hz
		• Max. lamp load: 5 W

Max. connectable cross-section: 2.5 mm².

Terminal strip -X55-X41 temperature sensor connection

Terminal	Function	Technical specifications
1	EP M1 (Enable Pulses)	Supply voltage 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA
2	EP +24 V (Enable Pulses)	Signal propagation times: • L → H: 100 µs • H → L: 1000 µs The pulse inhibit function is only available when Safety Integrated Basic Functions are enabled
3	-Temp	Temperature sensor connection for motor temperature sensing:
4	+Temp	KTY84-1C130, PTC, Pt100, Pt1000

Max. connectable cross-section: 2.5 mm².

Terminal strip -X55-X46 brake control and monitoring

Terminal	Function	Technical specifications
1	BR output +	The interface is used to connect the Safe Brake Adapter
2	BR output -	
3	FB input +	
4	FB input -	

Max. connectable cross-section: 2.5 mm².

¹⁾ DI: Digital input
DI/DO: Bidirectional digital input/output
M: Electronics ground
M1: Ground reference.

²⁾ Can be used as measuring probe input or input for the external zero mark.

³⁾ Data for: $U_{CC} = 24 \text{ V}$; load 48Ω ; High (1) = 90 % U_{out} ; Low (0) = 10 % U_{out} .

Motors for cranes



9/2

9/2

9/2

9/2

Crane motors from Innomotics

Innovative drive technology for crane applications

Overview

More information

Motors for cranes

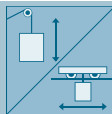
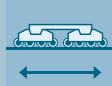
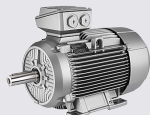
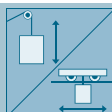
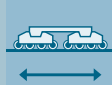
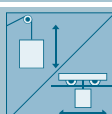
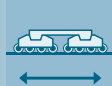
Crane motors from Innomotics

Innovative drive technology for crane applications

Overview

Motors for cranes

Overview of motors from Innomotics for cranes

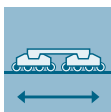
Motor type		Degree of protection	Cooling method	Frame size	Rated power kW	Rated torque Nm	No. of poles	Rated speed r/min	Application
Innomotics DP 	1PC1341	IP55	self	132S ... 280M	5.5 ... 132	50 ... 1066	4	1500	
		IP55	self	132S ... 280M	9 ... 90	41 ... 1089	6	1000	
		IP55	forced	315L	117 ... 214	1425 ... 2605	6	1000	
		IP55	forced	315L	101 ... 179	1657 ... 2923	8	750	
	1PC1361	IP55	non	132S ... 280M	2 ... 47	28 ... 675	4	1500	
		IP55	non	132S ... 280M	1.1 ... 32	24 ... 694	6	1000	
Innomotics SD 	1LE15 1LE16 1LE5	IP55	self	100 ... 450	1.75 ... 1000	15 ... 8100	4, 6, 8	750 ... 1800	 
Innomotics M 	1PH8	IP23, IP55	forced	355	230 ... 1340	3661 ... 12415	6	600 ... 1350	 

Symbol

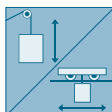
Explanation

Symbol

Explanation



Gantry



Hoisting gear
and trolley

More information

The selection and dimensioning of crane motors can be different and challenging, depending on the application conditions. For the selection of an optimally designed motor for crane applications please contact your local Siemens Cranes sales representative.

The efficient CR-BASICS course provides the necessary knowledge to understand a crane's mechanical and physical inter-relationship.

Theoretical knowledge is deepened with the help of real application calculation examples. The course is supplemented by content about the basics of asynchronous motors and converters, their dimensioning and configuration. The conclusion to the course is a written exam.

You will find further information about the course contents and dates on the internet:

www.siemens.com/simocrane-learning



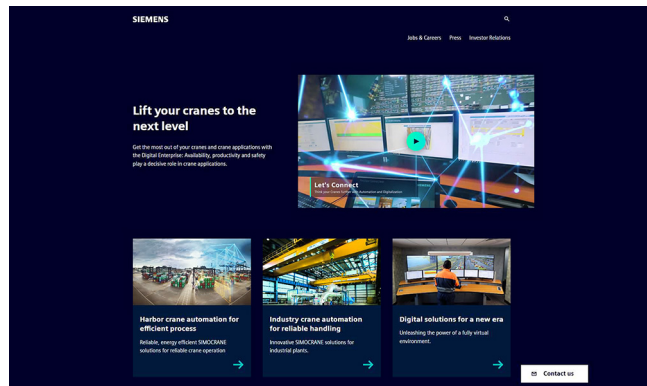
10/2	Contact at Cranes
10/3	Industry Services
10/4	Industry Services – Portfolio overview
10/5	Online Support
10/6	Contact at Siemens
10/7	Applications
10/8	Training
10/8	Training Services
10/10	Crane-specific training – SIMOCRANE course overview
10/11	Spares on Web
10/12	Documentation
10/13	Selection and engineering tools
10/13	Siemens Product Configurator

Services and documentation

Contact at Cranes

Partners at Cranes

Overview



Your personal contact partner and further information on cranes can be found at:

www.siemens.com/cranes

Siemens Internet addresses:

The latest information about SIMOTION products, product support, and FAQs can be found on the Internet at www.siemens.com/simotion

Information on product support can be found on the Internet at <https://support.industry.siemens.com/cs/ww/en>

The latest information about SINAMICS products, product support, and FAQs can be found on the Internet at www.siemens.com/sinamics

The latest information about SIMOCRANE products, product support, and FAQs can be found on the Internet at <https://support.industry.siemens.com/cs/ww/en/ps/20087>

Application Notes:

Available on the Internet at <https://support.industry.siemens.com/cs/ww/en/ps/ae>

Siemens DI Application Support Cranes

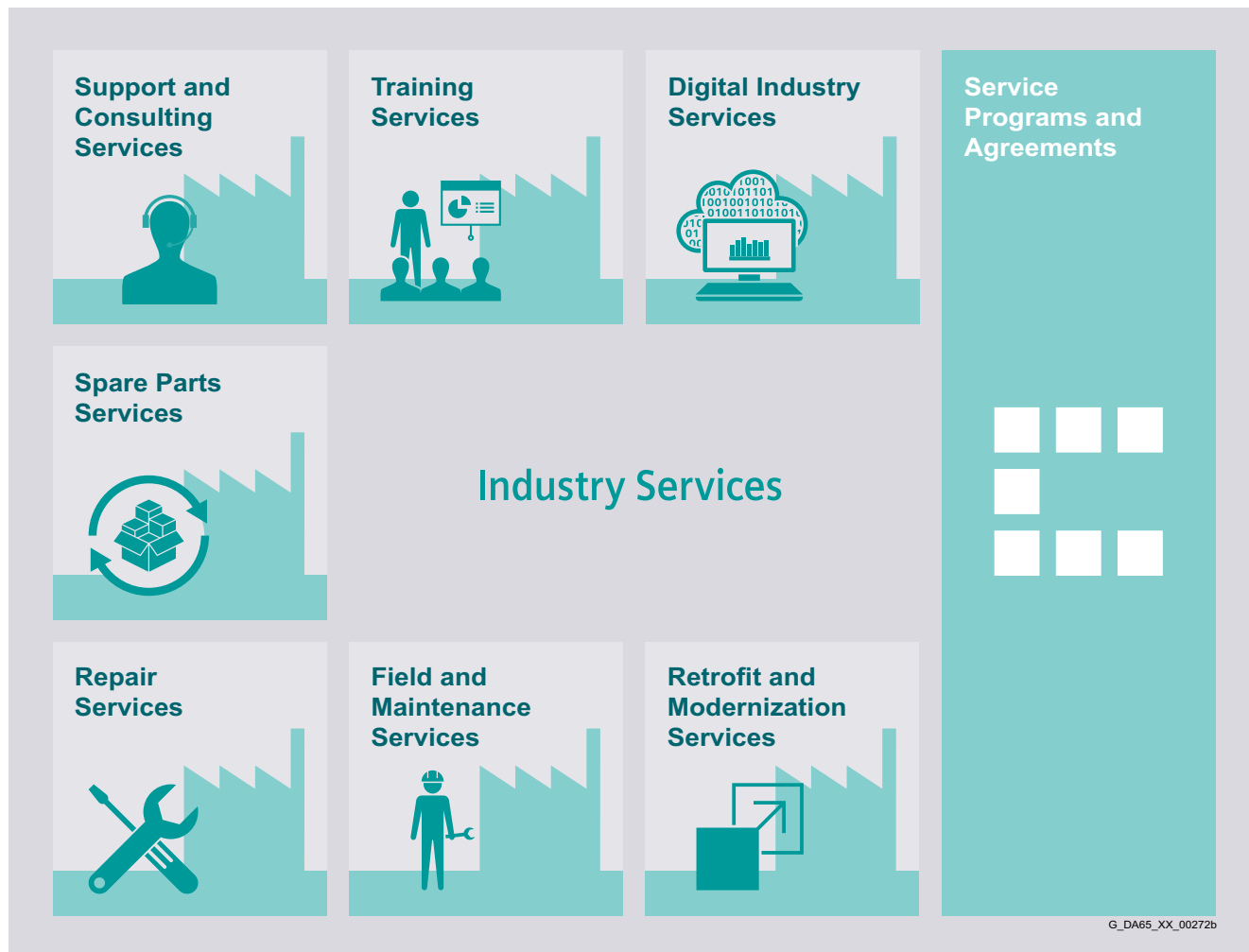
e-mail: applications.cranes.aud@siemens.com
(mailto: applications.cranes.aud@siemens.com)

Training:

Siemens Cranes offers crane-specific training courses:

www.siemens.com/simocrane-learning

If you have any additional questions please contact your local Siemens sales person.

Overview

Keep your business running and shaping your digital future – with Industry Services

Optimizing the productivity of your equipment and operations can be a challenge, especially with constantly changing market conditions. Working with our service experts makes it easier. We understand your industry's unique processes and provide the services needed so that you can better achieve your business goals.

You can count on us to maximize your uptime and minimize your downtime, increasing your operations' productivity and reliability. When your operations have to be changed quickly to meet a new demand or business opportunity, our services give you the flexibility to adapt. Of course, we take care that your production is protected against cyber threats. We assist in keeping your operations as energy and resource efficient as possible and reducing your total cost of ownership. As a trendsetter, we ensure that you can capitalize on the opportunities of digitalization and by applying data analytics to enhance decision making: You can be sure that your plant reaches its full potential and retains this over the longer lifespan.

You can rely on our highly dedicated team of engineers, technicians and specialists to deliver the services you need – safely, professionally and in compliance with all regulations. We are there for you, where you need us, when you need us.

www.siemens.com/digital-enterprise-services

Services and documentation

Industry Services

Industry Services – Portfolio overview

Overview



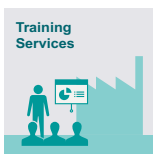
Digital Industry Services

Digital Industry Services make your industrial processes transparent to gain improvements in productivity, asset availability, and energy efficiency.

Production data is generated, filtered and translated with intelligent analytics to enhance decision-making.

This is done whilst taking data security into consideration and with continuous protection against cyber-attack threats.

www.siemens.com/digital-enterprise-services

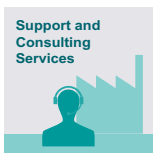


Training Services

From the basics and advanced to specialist skills, SITRAIN courses provide expertise right from the manufacturer – and encompass the entire spectrum of Siemens products and systems for the industry.

Worldwide, SITRAIN courses are available wherever you need a training course in more than 170 locations in over 60 countries.

<https://support.industry.siemens.com/cs/ww/en/sc/2226>



Support and Consulting Services

Industry Online Support site for comprehensive information, application examples, FAQs and support requests.

Technical and Engineering Support for advice and answers for all inquiries about functionality, handling, and fault clearance.

The Service Card as prepaid support for value added services such as Priority Call Back or Extended Support offers the clear advantage of quick and easy purchasing.

Information & Consulting Services, e.g. SIMATIC System Audit; clarity about the state and service capability of your automation system or Lifecycle Information Services; transparency on the lifecycle of the products in your plants.

<https://support.industry.siemens.com/cs/ww/en/sc/2235>



Spare Parts

Spare Parts Services are available worldwide for smooth and fast supply of spare parts – and thus optimal plant availability. Genuine spare parts are available for up to ten years. Logistic experts take care of procurement, transport, custom clearance, storage and order management.

Reliable logistics processes ensure that components reach their destination as needed.

Since not all spare parts can be kept in stock at all times, Siemens offers a preventive measure for spare parts provisioning on the customer's premises with optimized **Spare Parts Packages** for individual products, custom-assembled drive components and entire integrated drive trains – including risk consulting.

Asset Optimization Services help you design a strategy for parts supply where your investment and carrying costs are reduced and the risk of obsolescence is avoided.

<https://support.industry.siemens.com/cs/ww/en/sc/2110>



Repair Services

Repair Services are offered on-site and in regional repair centers for fast restoration of faulty devices' functionality.

Also available are extended repair services, which include additional diagnostic and repair measures, as well as emergency services.

<https://support.industry.siemens.com/cs/ww/en/sc/2154>



Field and Maintenance Services

Siemens specialists are available globally to provide expert field and maintenance services, including commissioning, functional testing, preventive maintenance and fault clearance.

All services can be included in customized service agreements with defined reaction times or fixed maintenance intervals.

<https://support.industry.siemens.com/cs/ww/en/sc/2265>



Retrofit and Modernization Services

Provide a cost-effective solution for the expansion of entire plants, optimization of systems or upgrading existing products to the latest technology and software, e.g. migration services for automation systems.

Service experts support projects from planning through commissioning and, if desired over the entire extended lifespan, e.g. Retrofit for Integrated Drive Systems for an extended lifetime of your machines and plants.

<https://support.industry.siemens.com/cs/ww/en/sc/2286>



Service Programs and Agreements

A technical Service Program or Agreement enables you to easily bundle a wide range of services into a single annual or multi-year agreement.

You pick the services you need to match your unique requirements or fill gaps in your organization's maintenance capabilities.

Programs and agreements can be customized as KPI-based and/or performance-based contracts.

<https://support.industry.siemens.com/cs/ww/en/sc/2275>

Overview

Online Support – fast, intuitive, whenever you want, wherever you need



Web
www.siemens.com/online-support

App
SIEMENS

GET IT ON Google Play | GET IT ON App Store | Herunterladen von Microsoft

Scan the QR code for information on our Online Support app.

FAQ / Application examples
Information about industrial products, programming and configuration as well as application examples

Technical information
Videos, documentation, manuals, updates, product notes, compatibility tool, certificates, planning data such as dimensional drawings, product data, 3D models

Forum
Exchange information and experience with other users and experts

Online Support for Siemens Industry Products

Siemens Industry and Online Support with some 1.7 million visitors per month is one of the most popular web services provided by Siemens. It is the central access point for comprehensive technical know-how about products, systems and services for automation and drives applications as well as for process industries.

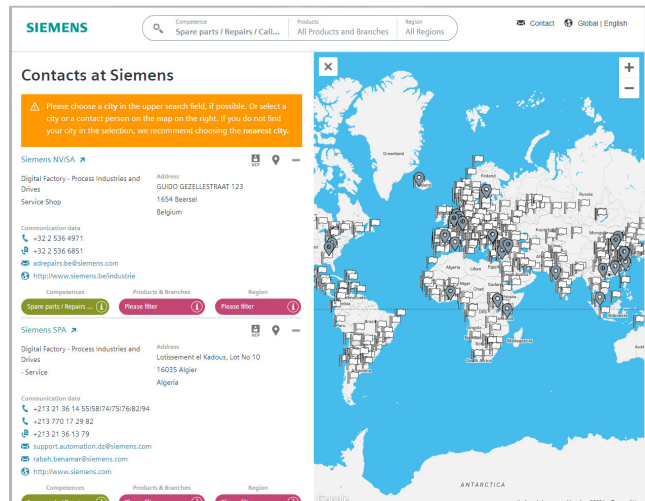
In connection with the challenges and opportunities related to digitalization you can look forward to continued support with innovative offerings.

Services and documentation

Contact at Siemens

Partners

Partners at Siemens



At your service locally, around the globe for consulting, sales, training, service, support, spare parts on the entire portfolio of Siemens.

Your partner can be found in our Personal Contacts Database at:
www.Siemens.com/automation-contact

You start by selecting

- the required competence,
- products and branches,
- a country and a city

or by a

- location search or free text search.

Overview



Our understanding of an application is the customer-specific solution of an automation task based on standard hardware and software components. In this respect, industry knowledge and technological expertise are just as important as expert knowledge about how our products and systems work. We are setting ourselves this challenge with more than 160 application engineers at 20 locations in 13 countries.

Application centers

We currently have application centers in:

- Germany: Head Office Erlangen and 6 German regions, e.g. in Munich, Nuremberg, Stuttgart, Mannheim, Frankfurt, Chemnitz, Cologne, Bielefeld, Bremen, Hanover, Hamburg
- Italy: Bologna, Milan
- USA: Atlanta
- China: Beijing, Shanghai
- France: Paris
- Turkey: Istanbul
- India: Mumbai
- Switzerland: Zurich
- United Kingdom: Manchester
- Brazil: Sao Paulo
- Japan: Tokyo, Osaka
- The Netherlands: The Hague
- Denmark: Ballerup

These application centers specialize in the use of SIMOTION/SINAMICS. You can therefore rely on automation and drive specialists for implementing successful applications. By involving your personnel at an early stage in the process, we can provide a solid basis for rapid knowledge transfer, maintenance and further development of your automation solution.

Advice on applications and implementation

We offer a variety of consultation services to help you find the optimum solution for the SIMOTION/SINAMICS application you want to implement.

The quotation phase includes:

- Clarification of technical questions
- Discussion of machine concepts and customer-specific solutions
- Selection of suitable technology and
- Suggestions for implementation

A technical feasibility study is also performed at the outset. In this way, difficult points of the application can be identified and solved early on. We can also configure and implement your application as a complete solution including control cabinet from a single source.

During the implementation phase a number of proven standards can be applied. This saves engineering costs.

The system can be commissioned by experienced, competent personnel, if required. This saves time and trouble.

If servicing is required, we can support you on site or via tele-service. For further information about servicing, please see "Service & Support".

On-site application training

Training for the implemented applications can also be organized and carried out on site. This training for machine manufacturers and their customers does not deal with individual products, but the entire hardware and software system (for example, automation, drives and visualization).

From an initial concept to successful installation and commissioning: We can provide complete support for SIMOTION/SINAMICS! Contact your Siemens representative.

For additional information, refer to:

<https://support.industry.siemens.com/cs>

→ Applications Examples → Cranes

Services and documentation

Training

Training Services > SITRAIN

Introduction

Lern the way you like it – with SITRAIN

SITRAIN imparts a wide range of technical knowledge for all industries and applications. Our offering is oriented toward the needs of learners and the demands of innovative companies. Get pleasure out of learning - thanks to innovative learning methods, personal support, and knowledge that will help you in your work and further development. For successful, flexible, and continuous learning.

Education and training directly from the manufacturer

SITRAIN provides you with training from the industrial product and solution portfolio from Siemens and benefits from 30 years of expertise in technical training. Take a look at the many options for expanding your knowledge with SITRAIN and find the course that meets your needs! The following training and further education units are available to you for your individual knowledge building:



Industrial Automation Systems SIMATIC

Training available for:
SIMATIC S7-1500, TIA Portal,
SIMATIC S7-300/400,
SIMATIC S7-1200



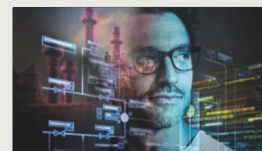
Drive Technology

Training available for:
SINAMICS S120 and
SINAMICS G120 low-voltage
converters,
SINAMICS G130 / G150 /
G180 / S150



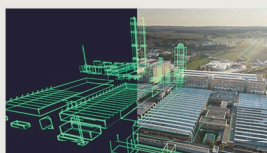
SINUMERIK CNC automation system

Training available for:
SINUMERIK 840D, SINUMERIK
840D sl and SINUMERIK ONE



Process Control Systems

Training available for:
SIMATIC PCS 7,
SIMATIC PCS neo



Digital Enterprise

Training available for:
Openness, SIMIT, OPC UA,
Industrial Edge,
Virtual commissioning



Industrial Communications

Training available for:
PROFINET, SCALANCE,
RUGGEDCOM, Industrial Ethernet,
Fieldbus communication,
Industrial Security,
Remote
communication



Identification and Locating

Training available for:
RFID, RTLS-Systems



Operator Control and Monitoring Systems

Training available for:
SIMATIC WinCC Unified in TIA
Portal, SIMATIC WinCC in TIA
Portal, SIMATIC WinCC V7x



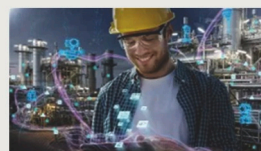
Motion Control System SIMOTION

Training available for:
SIMOTION (Programming,
Commissioning, Diagnostics,
Service)



Smart Infrastructure

Training available for:
SIRIUS, SENTRON, SIVACON,
ALPHA, SIMOCODE,
Circuit breakers



Process Analytics & Instrumentation

Training is available for process
analytics and instrumentation,
explosion protection, process
gas chromatographs



Additional training offer

SIMOVE with Automated
Guided Vehicles (AGV),
SIPLUS CMS, Guidelines and
standards for control cabinets

Introduction***Different learning formats and methods for maximum learning success***

With our SITRAIN training formats, you learn in the way that best suits your preferences and routine. You decide whether you would rather take online training or face-to-face training. It is up to you whether you would like to study on demand or at fixed times.

With a personal learning consultant, in the team, or on your own – you can explore all the possibilities.

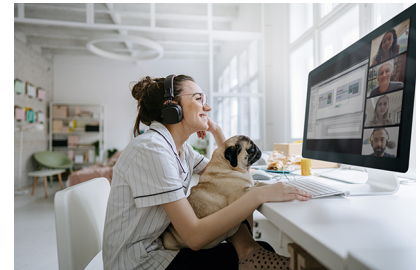
Discover our three learning formats:

**Learning Event**

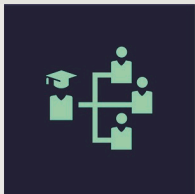
SITRAIN Learning Events are the perfect choice when you want to achieve a defined learning goal in the shortest possible time. You learn in a protected learning environment outside of the daily work routine under the guidance of a learning consultant – virtually, in the training center, or at your company.

**Learning Membership
SITRAIN Access**

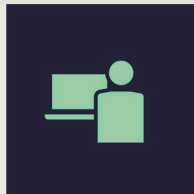
With SITRAIN access, you enter a world of extensive and constantly expanding self-study units on our digital learning platform for industry. With SITRAIN access, you can implement a modern learning culture in your team or company with independent and continuous learning.

**Learning Journey**

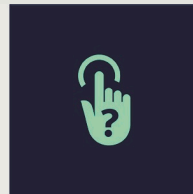
The Learning Journey is the perfect combination of units taken live and self-study units for sustainable learning success. The modular approach enables simple integration into your daily work. This also includes one-year membership for using the SITRAIN access digital learning platform.

**Live**

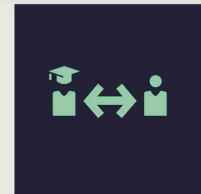
Learn together with others, simultaneously and guided by a learning consultant. Online, in the SITRAIN training center or at your company.

**Self-reliant**

Expand your knowledge self-determined with industry learning and work on your learning units at your own pace and according to your own schedule.

**On demand**

Get the knowledge you need, exactly when you need it. Be it to answer a current question or to work on a special topic.

**Individuell**

Talk directly with the learning consultant, clarify detailed questions and get personal coaching for transferring the learned topics to your own application.

**Training cases catalog**

<https://www.siemens.com/sitrain-catalog-training-cases>

www.siemens.com/sitrain

Find
your local
offer here



Services and documentation

Training

Crane-specific training – SIMOCRANE course overview

Overview

Training courses for SIMOCRANE solutions

Here you will find an overview of the training courses available for the SIMOCRANE solutions.

The courses are modular in design and are intended for a variety of target groups as well as individual customer requirements.

The system overview will acquaint decision-makers and sales personnel with the system very quickly.

The basic and follow-up courses are guaranteed to provide all of the technical knowledge that service personnel will need for commissioning and service.

All courses contain as many practical exercises as possible in order to enable intensive and direct training on the SIMOCRANE solutions and with the tools in small groups.

You will find further information about course contents and dates on the Internet at:

www.siemens.com/simocrane-learning

or let us advise you personally. You can request our latest training catalog from:

Siemens Training NL

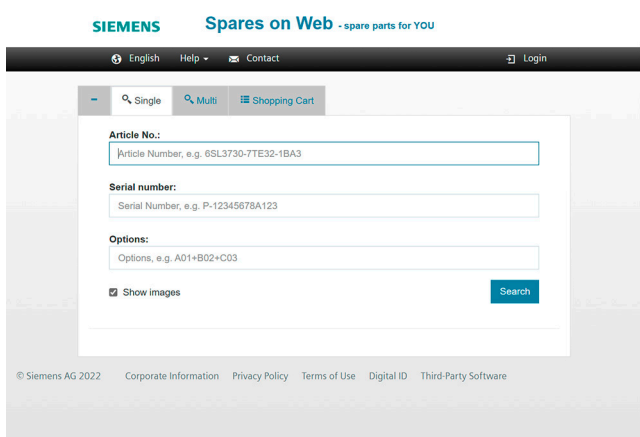
Phone: +31 70 333 390 0

Email: siemens.training.nl@siemens.com

Title (Order code)	Target group	Duration	Language	Course type
Crane physics and drive sizing (CR-BASICS)	• Sales engineers • Business developers • HW/SW engineering personnel	5 days	English	Online training
SIMOCRANE Basic Technology V5.0 (CR-SICR-BT5)	• Crane software engineers • Commissioning engineers • Application engineers	3 days	English	Online training
SIMOCRANE Sway Control V3.0 (CR-SICR-SC)	• Crane software engineers • Commissioning engineers • Application engineers	3 days	English	Online training
SIMOCRANE CMS engineering (CR-SICR-CMS)	• Cranes programmers • Cranes commissioning engineers • Cranes configuring engineers • Cranes service personnel	5 days	English	Online training
SIMOCRANE Remote CMS engineering (CR-SICR-RCMS)	• Cranes programmers • Cranes commissioning engineers • Cranes configuring engineers	3 days	English	Online training
SIMOCRANE Remote Control Operation System RCOS engineering (CR-RCOS_E)	• Cranes programmers • Cranes commissioning engineers • Cranes configuring engineers	4 days	English	Face-to-face training
Maintenance SIMOCRANE, SIMOTION/SINAMICS (CR-MAINT)	• Maintenance supervisors, maintenance technicians of container terminals, ports, steel mills • Technical personnel from crane builders and service companies involved in crane control system service and maintenance	5 days	English	Face-to-face training

Overview

Spares on Web – online identification of spare parts



The screenshot displays the Siemens Spares on Web interface. At the top, the Siemens logo is followed by the text "Spares on Web - spare parts for YOU". Below this is a navigation bar with links for "English", "Help", "Contact", and "Login". A search bar is present with tabs for "Single", "Multi", and "Shopping Cart". The main search area contains three input fields: "Article No." with a placeholder "Article Number, e.g. 6SL3730-7TE32-1BA3", "Serial number" with a placeholder "Serial Number, e.g. P-12345678A123", and "Options" with a placeholder "Options, e.g. A01+B02+C03". There is a checkbox labeled "Show images" and a "Search" button. At the bottom, a footer contains the text "© Siemens AG 2022" and links for "Corporate Information", "Privacy Policy", "Terms of Use", "Digital ID", and "Third-Party Software".

Spares on Web is a web-based tool for identifying spare parts. After you have entered the Article No. and serial number, the spare parts available for the relevant unit are displayed.

www.siemens.com/sow

Services and documentation

Documentation

Overview

A high-quality programmable control or drive system can be used to maximum effect only if the user is aware of the performance of the products used as a result of intensive training and good technical documentation.

This is becoming more important due to the shorter innovation cycles of modern automation products and the convergence of electronics and mechanical engineering.

A comprehensive range of documentation is available which includes a Getting Started guide, operating instructions, installation manuals and a list manual.

The documents are available as a PDF file for downloading from the internet.

Information and documentation relating to SINUMERIK, SINAMICS, and SIMOTION are available on the internet at <https://support.industry.siemens.com/cs/document/109476679>

Information and documentation relating to SIMOCRANE are available on the internet at <https://support.industry.siemens.com/cs/ww/en/ps/14505/man>

Application

Explanations for the manuals:

- **Operating Instructions**
contain all the information needed to install the device and make electrical connections, information about commissioning and a description of the converter functions.
Phases of use: Control cabinet construction, commissioning, operation, maintenance and servicing.
- **Hardware Installation Manual**
contains all relevant information about the intended use of the components of a system (technical specifications, interfaces, dimensional drawings, characteristics, or possible applications), information about installation and electrical connections and information about maintenance and servicing.
Phases of use: Control cabinet configuration/construction, maintenance and servicing.
- **Operating and Installation Instructions**
(for converter and accessories) contain all relevant information about the intended use of the components, such as technical specifications, interfaces, dimensional drawings, characteristics, or possible applications.
Phases of use: Control cabinet configuration/construction.
- **Configuration Manual**
contains all necessary information about the intended use of the components of a system, e.g. technical specifications, interfaces, dimensional drawings, characteristics, or possible applications.
Phases of use: Cabinet configuration/setup, circuit diagram configuration/drawing.
- **Commissioning Manual**
contains all information relevant to commissioning after installation and wiring. It also contains all safety and warning notices relevant to commissioning in addition to overview drawings.
Phases of use: Commissioning of components that have already been connected, configuration of system functions.
- **Engineering Manual**
contains all the information needed for the EMC-compliant installation and for the configuration of control cabinets and drive systems.
Phases of use: Control cabinet configuration/construction.
- **List Manual**
contains all parameters, function diagrams, and faults/alarms for the product/system as well as their meanings and setting options. It contains parameter data and fault/alarm descriptions with functional correlations.
Phases of use: Commissioning of components that have already been connected, configuration of system functions, fault cause/diagnosis
- **Getting Started**
provides information about getting started for the first-time user as well as references to additional information. It contains information about the basic steps to be taken during commissioning. The information in the other documentation should be carefully observed for all of the other work required.
Phases of use: Commissioning of components that have already been connected.
- **Function Manual Drive Functions**
contains all the relevant information about individual drive functions: Description, commissioning and integration in the drive system.
Phases of use: Commissioning of components that have already been connected, configuration of system functions.

Overview

The Siemens Product Configurator helps you to configure the optimum drive technology products for a number of applications. The product portfolio comprises the full drive technology range of gearbox, motor, converter and connection system as well as corresponding controller with suitable software license. The intuitive user interface in conjunction with product-specific preliminary selectors makes it simple, fast and efficient to configure products. The result is a bill of materials with extensive documentation consisting of technical data sheets, motor characteristic curves, 2D dimensional drawings / 3D CAD models, EPLAN macros and much more. You can order the products directly by transferring the bill of materials to the shopping cart of SiePortal.



Siemens Product Configurator at a glance

- Quick and easy configuration of drive products and associated components – gearboxes, motors, converters, controllers, connection systems
- Extensive documentation for all products and components, such as
 - Data sheets in up to 12 languages
 - Motor characteristic curves
 - 2D dimensional drawings / 3D CAD models in different formats
 - Terminal box drawing and terminal connection diagram
 - Certificates
 - EPLAN macros
- Ability to order products directly through SiePortal

Access to the Siemens Product Configurator

The Siemens Product Configurator can be accessed without the need for registration or logging in:

www.siemens.com/spc

Services and documentation

Notes

Appendix



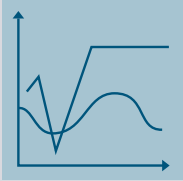
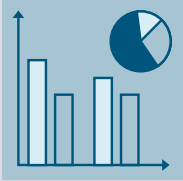
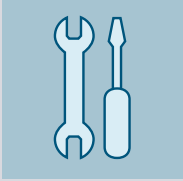
11/2	SIMOCRANE symbols
11/2	Functions of the Crane Management System
11/3	User groups
11/4	Installation locations
11/5	Crane drives and drive axis
11/6	Extended technological functions and products
11/9	Crane types
11/10	Subsystems and components
11/11	Certificate of suitability (approvals)
11/13	Software Licenses
11/15	Conversion tables
11/17	Conditions of sale and delivery

Appendix

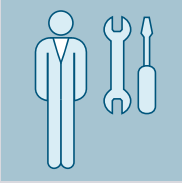
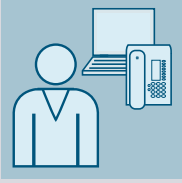
SIMOCRANE symbols

Functions of the Crane Management System

Overview

Function	Symbol	Description of functions
Status display		- Graphical visualization of crane, components and subsystems - Settings of operating parameters for crane operation
Condition monitoring		- Recording of highly dynamic operating variables - Monitoring of limit values
Error diagnostics		- Alarm/event reporting with archiving - Calling up contextual information - Error analysis functions
Measured value acquisition		- Long-term recording of operating values - Graphical or tabular representation and evaluation
Operating data acquisition and reporting		- Acquisition of operating data, operating hours and counter values - Reporting
Reference information		Fast access to plant-related sources of information
Maintenance functions		Maintenance messages and instructions

Overview

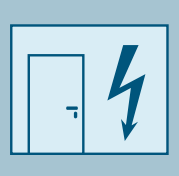
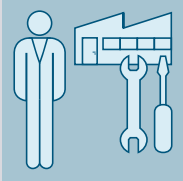
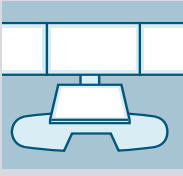
Function	Symbol	Description of functions
Crane driver		- Crane driver directly on the crane - Restricted operator authorizations in crane management system
Crane driver (remote)		- Crane driver at remote control desk - Restricted operator authorizations in crane management system
Maintenance technician		- Maintenance or service technician for crane systems - Extended operator authorizations in crane management system (detailed diagnostics)
Administrator		- System administrator (IT) - Unrestricted operator authorizations in crane management system
Operator		- Plant operators - Restricted operator authorizations in crane management system - Creation of evaluations and reports
RCOS operator		- Remote operator - System specialist with remote access
Remote service		- Maintenance or service technician for crane systems with remote-access - System specialist with remote-access

Appendix

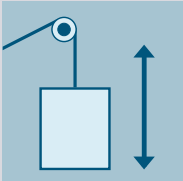
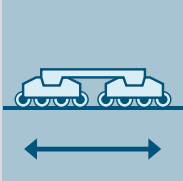
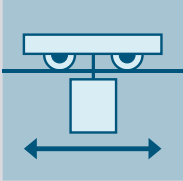
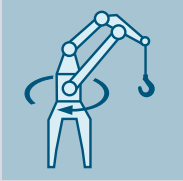
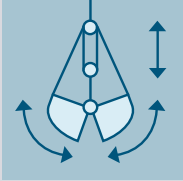
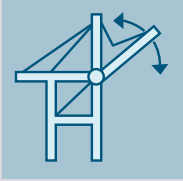
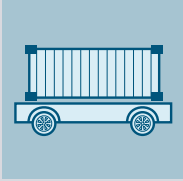
SIMOCRANE symbols

Installation locations

Overview

Function	Symbol	Description of functions
Electrical room		• Installation location for the complete drive and control technology on a crane
Crane driver cabin		• Moveable or permanently installed crane driver cabin
Maintenance building		• Building/location of service and maintenance technician at a terminal
Administration center		• Terminal administration • Central control room with logistics systems • Central server landscape and IT administration
RCOS desk		• Remote Control Operation System

Overview

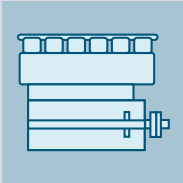
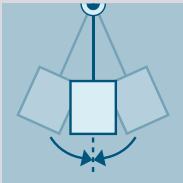
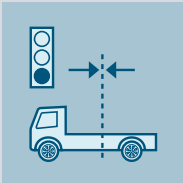
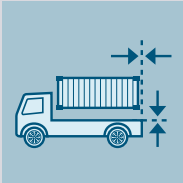
Function	Symbol	Description of functions
Hoist		• Hoisting axis for container cranes
Gantry		• Gantry axis for cranes of different types
Trolley		• Traversing axis for the trolley of cranes of different types
Slewing gear		• Slewing gear axis for slewing luffing cranes and similar types
Grab		• Holding and closing gear for grab cranes
Boom		• Drive axis for the crane boom-hoist for STS or ship unloading cranes
AGV		• Automatic guided vehicle

Appendix

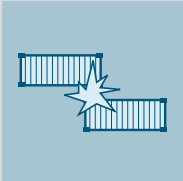
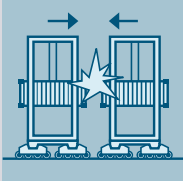
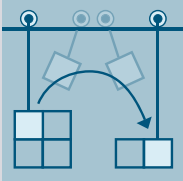
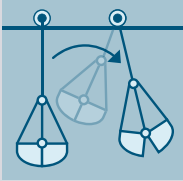
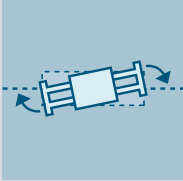
SIMOCRANE symbols

Extended technological functions and products

Overview

Function	Symbol	Description of functions
SIMOCRANE ESSM		Energy system management software for storing the braking energy from the drive system
SIMOCRANE ECO Technology		Fuel saving power management software for combustion engine and alternator power machinery
SIMOCRANE Sway Control Systems		Automatic sway control for cranes of different types
SIMOCRANE Truck Positioning System		Positioning system for trucks hitched to trailers in container terminals
SIMOCRANE CMS		- Crane management system - Status display - Diagnostics - Information
Position control		- Automatic picking up of a load (container) from a truck - Automatic lowering of a load (container) onto a truck - Application-specific function with the use of the products SIMOCRANE Truck Positioning System and the SIMOCRANE Sway Control System

Extended technological functions and products
Overview

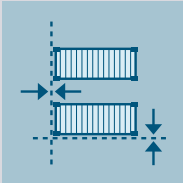
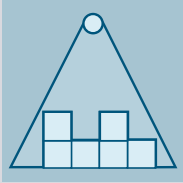
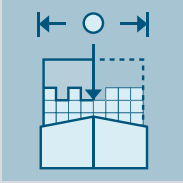
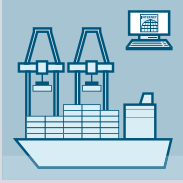
Function	Symbol	Description of functions
Collision Detection Stack		Collision protection in the stacking area of container terminals
Collision Detection ASC		Collision protection for automatic stacking cranes at container terminals
Collision Detection STS		- Collision protection crane – ship with STS cranes - Avoidance of damage to crane or ship
Automatic travel		- Automatic or semi-automatic loading and unloading for container cranes - This function is derived from a function of "SIMOCRANE Sway Control Systems"
On-the-fly unloading		On-the-fly unloading of bulk material to grab cranes
Skew control		- Automatic control of the load angle on a ship-to-shore crane (STS) - The presence of the corresponding mechanical components is a prerequisite for this function - This function is derived from a function of "SIMOCRANE Sway Control Systems"

Appendix

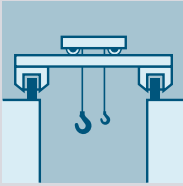
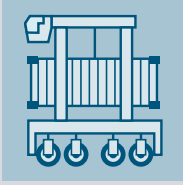
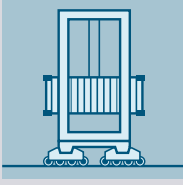
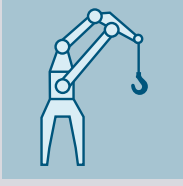
SIMOCRANE symbols

Extended technological functions and products

Overview

Function	Symbol	Description of functions
Position control (stack)		Automatic positioning
Profile scanning		- Automatic detection of the height profile of a container stack in the "stack" - Prerequisite for fully automatic crane operation in the stacking area and for avoiding collisions
Bay scanning		- Automatic acquisition of the height profile of a container stack on the ship - Prerequisite for automatic mode in conjunction with SIMOCRANE Sway Control Systems
Remote access or remote control of stacking		- Remote access of information of the stacking cranes from any PC in the terminal - Remote access web based - Remote control of the crane from control room
Remote access to ship-to-shore cranes		- Remote access of information of the STS cranes from any PC in the terminal - Remote access web-based

Overview

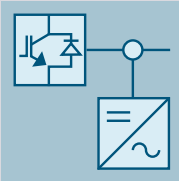
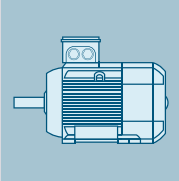
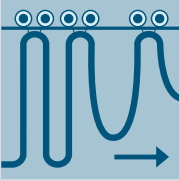
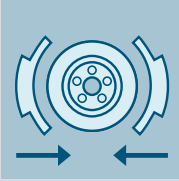
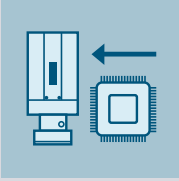
Function	Symbol	Description of functions
Ladle crane		Ladle crane in steelworks
Straddle carrier		Mobile transport crane in container terminals
RTG (ECO RTG)		- Rubber Tired Gantry - Mobile, rubber-tired stacking crane - ECO RTG - Energy-efficient and diesel-powered RTG with hybrid drive system and reload function
GSU		- Grab Ship Unloader - Grab ship unloading crane for handling bulk material in the harbor area
STS		- Ship-To-Shore crane - Container handling in the harbor area - Cargo handling between ship and terminal
RMG		- Rail Mounted Gantry - Rail-mounted stacking crane in the container terminal - This type of crane is frequently used as an automated stacking crane (ASC)
SLC		Slewing luffing crane

Appendix

SIMOCRANE symbols

Subsystems and components

Overview

Function	Symbol	Description of functions
Converter		Frequency converter for three-phase motors
Motor		Motor for the hoisting gear, gantry, trolley, slewing gear etc.
Master switch		Control instrument at crane driver's seat
Cable trailing		- Trailing cable system for moving crane components - Example: Container crane trolley
Cable drum		Cable drum for the main supply cable of electrically supplied cranes
Brake		Brakes for the different drive axes of a crane
Refurbishment		Service for the modernization and conversion of older crane systems
CenSOR		Controller-supported Sway Control System

Appendix

Certificates of suitability (approvals)

Overview

Many of the products in this Catalog fulfill requirements, e.g. for UL, CSA or FM and are labeled with the corresponding approval designation.

All of the certificates of suitability, approvals, certificates, declarations of conformity, test certificates, e.g. CE, UL, Safety Integrated etc. have been performed with the associated system components as they are described in the Catalogs and Configuration Manuals.

The certificates are only valid if the products are used with the described system components, are installed according to the Installation Guidelines and used for their intended purpose.

In other cases, the vendor of these products is responsible for arranging for the issue of new certificates.

Test code	Tested by	Device series/ Component	Test standard	Product category/ File-No.
UL: Underwriters Laboratories Independent public testing body in North America				
     	UL according to UL standard	SINUMERIK	Standard UL 508, CSA C22.2 No. 142	NRAQ/7.E164110 NRAQ/7.E217227
	UL according to CSA standard	SIMOTION	Standard UL 508, CSA C22.2 No. 142	NRAQ/7.E164110
		SINAMICS	Standard UL 508, 508C, 61800-5-1 CSA C22.2 No. 142, 274	NRAQ/7.E164110, NMMS/2/7/8.E192450, NMMS/2/7/8.E203250, NMMS/7.E214113, NMMS/7.E253831 NMMS/2/7/8.E121068 NMMS/7.E355661 NMMS/7.E323473
		SIMODRIVE	Standard UL 508C, CSA C22.2 No. 274	NMMS/2/7/8.E192450 NMMS/7.E214113
		SIMOTICS	Standard UL 1004-1, 1004-6, 1004-8, CSA C22.2 No. 100	PRGY2/8.E227215 PRHZ2/8.E93429 PRHJ2/8.E342747 PRGY2/8.E253922 PRHZ2/8.E342746
	UL according to UL and CSA standards	Line/motor reactors	Standard UL 508, 506, 5085-1, 5085-2, 1561, CSA C22.2 No. 14, 47, 66.1-06, 66.2-06	XQNX2/8.E257859 NMTR2/8.E219022 NMMS2/8.E333628 XPTQ2/8.E257852 XPTQ2/8.E103521 NMMS2/8.E224872 XPTQ2/8.E354316 XPTQ2/8.E198309 XQNX2/8.E475972
	UL according to UL standard	Line filters, dv/dt filters, sine-wave filters	UL 1283, CSA C22.2 No. 8	FOKY2/8.E70122
	UL according to CSA standard	Resistors	UL 508, 508C, CSA C22.2 No. 14, 274	NMTR2/8.E224314 NMMS2/8.E192450 NMTR2/8.E221095 NMTR2/8.E226619
	UL according to UL and CSA standards			
TUV: TÜV Rheinland of North America Inc. Independent public testing body in North America, Nationally Recognized Testing Laboratory (NRTL)				
TÜV: TÜV SÜD Product Service Independent public testing body in Germany, Nationally Recognized Testing Laboratory (NRTL) for North America				
	TUV according to UL and CSA standards	SINAMICS	NRTL listing according to standard UL 508C	U7V 12 06 20078 013 U7 11 04 20078 009 U7 11 04 20078 010 U7 11 04 20078 011
		SIMOTION	NRTL listing according to standard UL 508	U7V 13 03 20078 01
		SIMODRIVE	NRTL listing according to standard UL 508C, CSA C22.2. No. 14	CU 72090702
		Motion Control Encoder	NRTL listing according to UL 61010-1 CSA C22.2 No. 61010-1	U8V 10 06 20196 024

Appendix

Certificates of suitability (approvals)

Overview

Test code	Tested by	Device series/ Component	Test standard	Product category/ File-No.
CSA: Canadian Standards Association Independent public testing body in Canada				
	CSA according to CSA standard	SINUMERIK	Standard CSA C22.2 No. 142	2252-01 : LR 102527
FMRC: Factory Mutual Research Corporation Independent public testing body in North America				
	FM according to FM standard	SINUMERIK	Standard FMRC 3600, FMRC 3611, FMRC 3810, ANSI/ISA S82.02.1	–
EAC: Ivanovo-Certificate Independent public testing body in the Russian Federation				
	EAC in accordance with the EAC Directive	SINAMICS SINUMERIK SIMOTION	Standard IEC 61800-5-1/-2, IEC 61800-3	–
RCM: Australian Communications and Media Authority Independent public testing body in Australia				
	RCM according to EMC standard	SINAMICS SINUMERIK SIMOTION	Standard IEC AS 61800-3, EN 61800-3	–
KC: National Radio Research Agency Independent public testing body in South Korea				
	KC according to EMC standard	SINAMICS SINUMERIK SIMOTION	Standard KN 11	–
BIA Federal Institute for Occupational Safety				
–	Functional safety	SINAMICS SINUMERIK SIMOTION	Standard EN 61800-5-2	–
TÜV SÜD Rail				
–	Functional safety	SINAMICS SINUMERIK SIMOTION	Standard EN 61800-5-2	–

More information about certificates can be found online at:
<https://support.industry.siemens.com/cs/ww/en/ps/cert>

Overview

Software types

Software requiring a license is categorized into types. The following software types have been defined:

- Engineering software
- Runtime software

Engineering software

This includes all software products for creating (engineering) user software, e.g. for configuring, programming, parameterizing, testing, commissioning or servicing.

Data generated with engineering software and executable programs can be duplicated for your own use or for use by third-parties free-of-charge.

Runtime software

This includes all software products required for plant/machine operation, e.g. operating system, basic system, system expansions, drivers, etc.

The duplication of the runtime software and executable programs created with the runtime software for your own use or for use by third-parties is subject to a charge.

You can find information about license fees according to use in the ordering data (e.g. in the catalog). Examples of categories of use include per CPU, per installation, per channel, per instance, per axis, per control loop, per variable, etc.

Information about extended rights of use for parameterization/configuration tools supplied as integral components of the scope of supply can be found in the readme file supplied with the relevant product(s).

License types

Siemens Digital Industries and Smart Infrastructure offers various types of software license:

- Floating license
- Single license
- Rental license
- Rental floating license
- Trial license
- Demo license
- Demo floating license

Floating license

The software may be installed for internal use on any number of devices by the licensee. Only the concurrent user is licensed. The concurrent user is the person using the program. Use begins when the software is started. A license is required for each concurrent user.

Single license

Unlike the floating license, a single license permits only one installation of the software per license.

The type of use licensed is specified in the ordering data and in the Certificate of License (CoL). Types of use include for example per instance, per axis, per channel, etc.

One single license is required for each type of use defined.

Rental license

A rental license supports the "sporadic use" of engineering software. Once the license key has been installed, the software can be used for a specific period of time (the operating hours do not have to be consecutive).

One license is required for each installation of the software.

Rental floating license

The rental floating license corresponds to the rental license, except that a license is not required for each installation of the software. Rather, one license is required per object (for example, user or device).

Trial license

A trial license supports "short-term use" of the software in a non-productive context, e.g. for testing and evaluation purposes. It can be transferred to another license.

Demo license

The demo license support the "sporadic use" of engineering software in a non-productive context, for example, use for testing and evaluation purposes. It can be transferred to another license. After the installation of the license key, the software can be operated for a specific period of time, whereby usage can be interrupted as often as required.

One license is required per installation of the software.

Demo floating license

The demo floating license corresponds to the demo license, except that a license is not required for each installation of the software. Rather, one license is required per object (for example, user or device).

Certificate of License (CoL)

The CoL is the licensee's proof that the use of the software has been licensed by Siemens. A CoL is required for every type of use and must be kept in a safe place.

Downgrading

The licensee is permitted to use the software or an earlier version/release of the software, provided that the licensee owns such a version/release and its use is technically feasible.

Delivery versions

Software is constantly being updated.

The following delivery versions

- PowerPack
- Upgrade

can be used to access updates.

Existing bug fixes are supplied with the ServicePack version.

PowerPack

PowerPacks can be used to upgrade to more powerful software. The licensee receives a new license agreement and CoL (Certificate of License) with the PowerPack. This CoL, together with the CoL for the original product, proves that the new software is licensed.

A separate PowerPack must be purchased for each original license of the software to be replaced.

Upgrade

An upgrade permits the use of a new version of the software on the condition that a license for a previous version of the product is already held.

The licensee receives a new license agreement and CoL with the upgrade. This CoL, together with the CoL for the previous product, proves that the new version is licensed.

A separate upgrade must be purchased for each original license of the software to be upgraded.

Appendix

Software licenses

Overview

ServicePack

ServicePacks are used to debug existing products. ServicePacks may be duplicated for use as prescribed according to the number of existing original licenses.

License key

Siemens Digital Industries and Smart Infrastructure supplies software products with and without license keys.

The license key serves as an electronic license stamp and is also the "switch" for activating the software (floating license, rental license, etc.).

The complete installation of software products requiring license keys includes the program to be licensed (the software) and the license key (which represents the license).

Software Update Service (SUS)

As part of the SUS contract, all software updates for the respective product are made available to you free of charge for a period of one year from the invoice date. The contract will automatically be extended for one year if it is not canceled three months before it expires.

The possession of the current version of the respective software is a basic condition for entering into an SUS contract.

You can download explanations concerning license conditions from https://mall.industry.siemens.com/legal/ww/en/terms_of_trade_en.pdf

Rotary inertia (to convert from A to B, multiply by entry in table)

A \ B	lb-in ²	lb-ft ²	lb-in-s ²	lb-ft-s ² slug-ft ²	kg-cm ²	kg-cm-s ²	gm-cm ²	gm-cm-s ²	oz-in ²	oz-in-s ²
lb-in ²	1	6.94×10^{-3}	2.59×10^{-3}	2.15×10^{-4}	2.926	2.98×10^{-3}	2.92×10^3	2.984	16	4.14×10^{-2}
lb-ft ²	144	1	0.3729	3.10×10^{-2}	421.40	0.4297	4.21×10^5	429.71	2304	5.967
lb-in-s ²	386.08	2.681	1	8.33×10^{-2}	1.129×10^3	1.152	1.129×10^6	1.152×10^3	6.177×10^3	16
lb-ft-s ² slug-ft ²	4.63×10^3	32.17	12	1	1.35×10^4	13.825	1.355×10^7	1.38×10^4	7.41×10^4	192
kg-cm ²	0.3417	2.37×10^{-3}	8.85×10^{-4}	7.37×10^{-5}	1	1.019×10^{-3}	1000	1.019	5.46	1.41×10^{-2}
kg-cm-s ²	335.1	2.327	0.8679	7.23×10^{-2}	980.66	1	9.8×10^5	1000	5.36×10^3	13.887
gm-cm ²	3.417×10^{-4}	2.37×10^{-6}	8.85×10^{-7}	7.37×10^{-8}	1×10^{-3}	1.01×10^{-6}	1	1.01×10^{-3}	5.46×10^{-3}	1.41×10^{-5}
gm-cm-s ²	0.335	2.32×10^{-3}	8.67×10^{-4}	7.23×10^{-5}	0.9806	1×10^{-3}	980.6	1	5.36	1.38×10^{-2}
oz-in ²	0.0625	4.34×10^{-4}	1.61×10^{-4}	1.34×10^{-5}	0.182	1.86×10^{-4}	182.9	0.186	1	2.59×10^{-3}
oz-in-s ²	24.13	0.1675	6.25×10^{-2}	5.20×10^{-3}	70.615	7.20×10^{-2}	7.09×10^4	72.0	386.08	1

Torque (to convert from A to B, multiply by entry in table)

A \ B	lb-in	lb-ft	oz-in	N-m	kg-cm	kg-m	gm-cm	dyne-cm
lb-in	1	8.333×10^{-2}	16	0.113	1.152	1.152×10^{-2}	1.152×10^3	1.129×10^6
lb-ft	12	1	192	1.355	13.825	0.138	1.382×10^4	1.355×10^7
oz-in	6.25×10^{-2}	5.208×10^{-3}	1	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.007	7.061×10^4
N-m	8.850	0.737	141.612	1	10.197	0.102	1.019×10^4	1×10^7
kg-cm	0.8679	7.233×10^{-2}	13.877	9.806×10^{-2}	1	10^{-2}	1000	9.806×10^5
kg-m	86.796	7.233	1.388×10^3	9.806	100	1	1×10^5	9.806×10^7
gm-cm	8.679×10^{-4}	7.233×10^{-5}	1.388×10^{-2}	9.806×10^{-5}	1×10^{-3}	1×10^{-5}	1	980.665
dyne-cm	8.850×10^{-7}	7.375×10^{-8}	1.416×10^{-5}	10^{-7}	1.0197×10^{-6}	1.019×10^{-8}	1.019×10^{-3}	1

Length (to convert from A to B, multiply by entry in table)

A \ B	inches	feet	cm	yd	mm	m
inches	1	0.0833	2.54	0.028	25.4	0.0254
feet	12	1	30.48	0.333	304.8	0.3048
cm	0.3937	0.03281	1	1.09×10^{-2}	10	0.01
yd	36	3	91.44	1	914.4	0.914
mm	0.03937	0.00328	0.1	1.09×10^{-3}	1	0.001
m	39.37	3.281	100	1.09	1000	1

Power (to convert from A to B, multiply by entry in table)

A \ B	hp	Watts
hp (English)	1	745.7
(lb-in) (deg./s)	2.645×10^{-6}	1.972×10^{-3}
(lb-in) (r/min)	1.587×10^{-5}	1.183×10^{-2}
(lb-ft) (deg./s)	3.173×10^{-5}	2.366×10^{-2}
(lb-ft) (r/min)	1.904×10^{-4}	0.1420
Watts	1.341×10^{-3}	1

Force (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	dyne	N
lb	1	16	453.6	4.448×10^5	4.4482
oz	0.0625	1	28.35	2.780×10^4	0.27801
gm	2.205×10^{-3}	0.03527	1	1.02×10^{-3}	N.A.
dyne	2.248×10^{-6}	3.59×10^{-5}	980.7	1	0.00001
N	0.22481	3.5967	N.A.	100000	1

Mass (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	kg	slug
lb	1	16	453.6	0.4536	0.0311
oz	6.25×10^{-2}	1	28.35	0.02835	1.93×10^{-3}
gm	2.205×10^{-3}	3.527×10^{-2}	1	10^{-3}	6.852×10^{-5}
kg	2.205	35.27	10^3	1	6.852×10^{-2}
slug	32.17	514.8	1.459×10^4	14.59	1

Rotation (to convert from A to B, multiply by entry in table)

A \ B	r/min	rad/s	degrees/s
r/min	1	0.105	6.0
rad/s	9.55	1	57.30
degrees/s	0.167	1.745×10^{-2}	1

Appendix

Conversion tables

Temperature Conversion

°F	°C	°C	°F
0	-17.8	-10	14
32	0	0	32
50	10	10	50
70	21.1	20	68
90	32.2	30	86
98.4	37	37	98.4
212	100	100	212
subtract 32 and multiply by $\frac{5}{9}$		multiply by $\frac{9}{5}$ and add 32	

Mechanism Efficiencies

Acme-screw with brass nut	~0.35–0.65
Acme-screw with plastic nut	~0.50–0.85
Ball-screw	~0.85–0.95
Chain and sprocket	~0.95–0.98
Preloaded ball-screw	~0.75–0.85
Spur or bevel-gears	~0.90
Timing belts	~0.96–0.98
Worm gears	~0.45–0.85
Helical gear (1 reduction)	~0.92

Friction Coefficients

Materials	μ
Steel on steel (greased)	~0.15
Plastic on steel	~0.15–0.25
Copper on steel	~0.30
Brass on steel	~0.35
Aluminum on steel	~0.45
Steel on steel	~0.58
Mechanism	μ
Ball bushings	<0.001
Linear bearings	<0.001
Dove-tail slides	~0.2++
Gibb ways	~0.5++

Material Densities

Material	lb-in ³	gm-cm ³
Aluminum	0.096	2.66
Brass	0.299	8.30
Bronze	0.295	8.17
Copper	0.322	8.91
Hard wood	0.029	0.80
Soft wood	0.018	0.48
Plastic	0.040	1.11
Glass	0.079–0.090	2.2–2.5
Titanium	0.163	4.51
Paper	0.025–0.043	0.7–1.2
Polyvinyl chloride	0.047–0.050	1.3–1.4
Rubber	0.033–0.036	0.92–0.99
Silicone rubber, without filler	0.043	1.2
Cast iron, gray	0.274	7.6
Steel	0.280	7.75

Wire Gauges¹⁾

Cross-section mm ²	Standard Wire Gauge (SWG)	American Wire Gauge (AWG)
0.2	25	24
0.3	23	22
0.5	21	20
0.75	20	19
1.0	19	18
1.5	17	16
2.5	15	13
4	13	11
6	12	9
10	9	7
16	7	6
25	5	3
35	3	2
50	0	1/0
70	000	2/0
95	00000	3/0
120	0000000	4/0
150	–	6/0
185	–	7/0

¹⁾ The table shows approximate SWG/AWG sizes nearest to standard metric sizes; the cross-sections do not match exactly.

1. General Provisions

By using this catalog you can purchase hard- and software products as well as services (together hereinafter referred to as "products") described therein from Siemens Aktiengesellschaft or from Innomotics GmbH subject to the following Terms and Conditions of Sale and Delivery (hereinafter referred to as "T&C"). Note, for products purchased from any Siemens entity or Innomotics entity having a registered office outside of Germany, the respective terms and conditions of sale and delivery of the respective Siemens entity or Innomotics entity apply exclusively. The following T&C apply exclusively for orders placed with Siemens Aktiengesellschaft, Germany or Innomotics GmbH, Germany. In the case of an order placed with Innomotics GmbH, the SiePortal T&C and the other terms and conditions are to be read in such a way that Siemens is to be understood as Innomotics GmbH.

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For customers with a seat or registered office in European Union, the following terms and conditions apply subordinate to T&C:

- for products, which include specific terms and conditions in the text of the product description, these specific terms and conditions shall apply and subordinate thereto,,
- for stand-alone software products and software products forming a part of a product or project, the "General Conditions for Software Products for Infrastructure & Industry Business (German law)"¹⁾ and/or
- for consulting services the "Allgemeine Geschäftsbedingungen für Beratungsleistungen für Infrastructure & Industry Geschäft (Deutsches Recht)"¹⁾ (available only in German) and/or
- for other services, the „Supplementary Terms and Conditions for Services for Infrastructure & Industry Business (German Law) ("BL")"¹⁾ and/or
- for other products the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry"¹⁾.

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For customers with a seat or registered office outside European Union, the following terms and conditions apply subordinate to T&C:

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- for other services the "International Terms & Conditions for Services"¹⁾ supplemented by "Software Licensing Conditions"¹⁾ and/or
- for other products the "International Terms & Conditions for Products"¹⁾ supplemented by "Software Licensing Conditions"¹⁾

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To the extent products offered are covered by an existing master or framework agreement, the terms and conditions of that agreement shall apply instead of T&C.

2. Prices

The prices are in € (Euro) ex point of delivery, exclusive of packaging.

The sales tax (value added tax) is not included in the prices. It shall be charged separately at the respective rate according to the applicable statutory legal regulations.

Prices are subject to change without prior notice. We will charge the prices valid at the time of delivery.

To compensate for variations in the price of raw materials (e.g. silver, copper, aluminum, lead, gold, dysprosium and neodym), surcharges are calculated on a daily basis using the so-called metal factor for products containing these raw materials. A surcharge for the respective raw material is calculated as a supplement to the price of a product if the basic official price of the raw material in question is exceeded.

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https://mall.industry.siemens.com/legal/ww/en/terms_of_trade_en.pdf

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To calculate the surcharge applicable to copper, the official price from two days prior to that on which the order was received or the release order was effected is used.

To calculate the surcharge applicable to dysprosium and neodym ("rare earths"), the corresponding three-month basic average price in the quarter prior to that in which the order was received or the release order was effected is used with a one-month buffer (details on the calculation can be found in the explanation of the metal factor).

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The dimensions are in mm. In Germany, according to the German law on units in measuring technology, data in inches apply only to devices for export.

Illustrations are not binding.

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¹⁾ The text of the Terms and Conditions of Siemens AG can be downloaded at https://mall.industry.siemens.com/legal/ww/en/terms_of_trade_en.pdf

Appendix

Conditions of sale and delivery

4. Export Control and Sanctions Compliance

4.1 General

Customer shall comply with all applicable sanctions, embargoes and (re-)export control laws and regulations, and, in any event, with those of the European Union, the United States of America and any locally applicable jurisdiction (collectively "Export Regulations").

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Prior to any transaction by customer concerning products (including hardware, documentation and technology) delivered by Siemens, or products (including maintenance and technical support) performed by Siemens with a third party, customer shall check and certify by appropriate measures that

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Customer shall not, unless permitted by the Export Regulations or respective governmental licenses or approvals,

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Upon request by Siemens, customer shall promptly provide Siemens with all information pertaining to users, the intended use and the location of use or the final destination (in the case of hardware, documentation and technology) of the products. Customer will notify Siemens prior to customer disclosing any information to Siemens that is defense-related or requires controlled or special data handling pursuant to applicable government regulations, and will use the disclosure tools and methods specified by Siemens.

4.6 Reservation

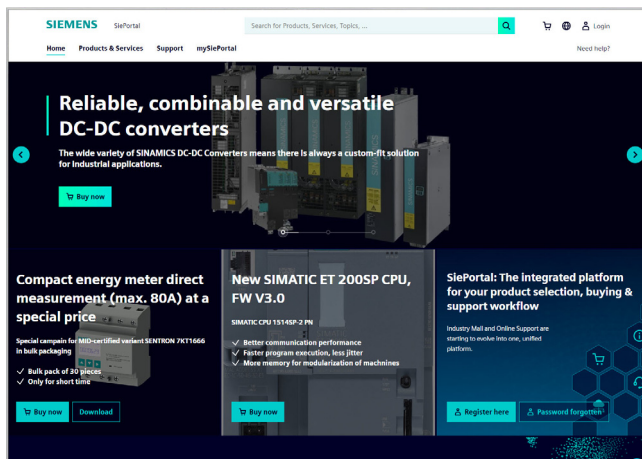
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5. Miscellaneous

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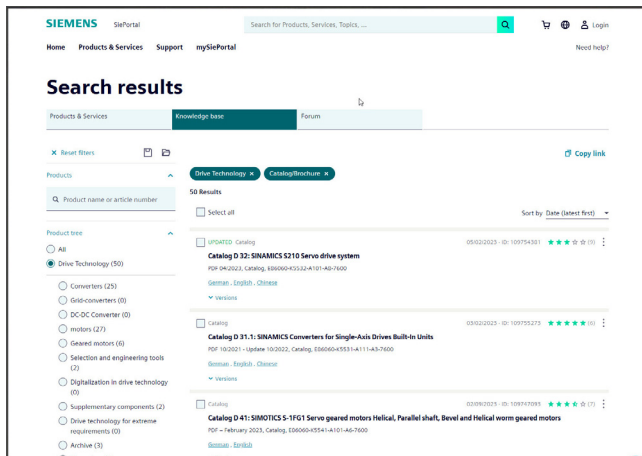
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