SIEMENS

Drive and Control Components for Cranes

Cranes

Catalog CR 1

Edition 2015

Related catalogs

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

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Drive and Control Components for Cranes

Cranes

Catalog CR 1 · 2015

Supersedes:
Catalog CR 1 · 2012
Catalog News CR 1 N · March 2013 chapters 1, 2, 3 and 5

Refer to the Industry Mall for current updates of this catalog:
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The products contained in this catalog can also be found in the Interactive Catalog CA 01.
Article No.: E86060-D4001-A510-D4-7600

Please contact your local Siemens branch.

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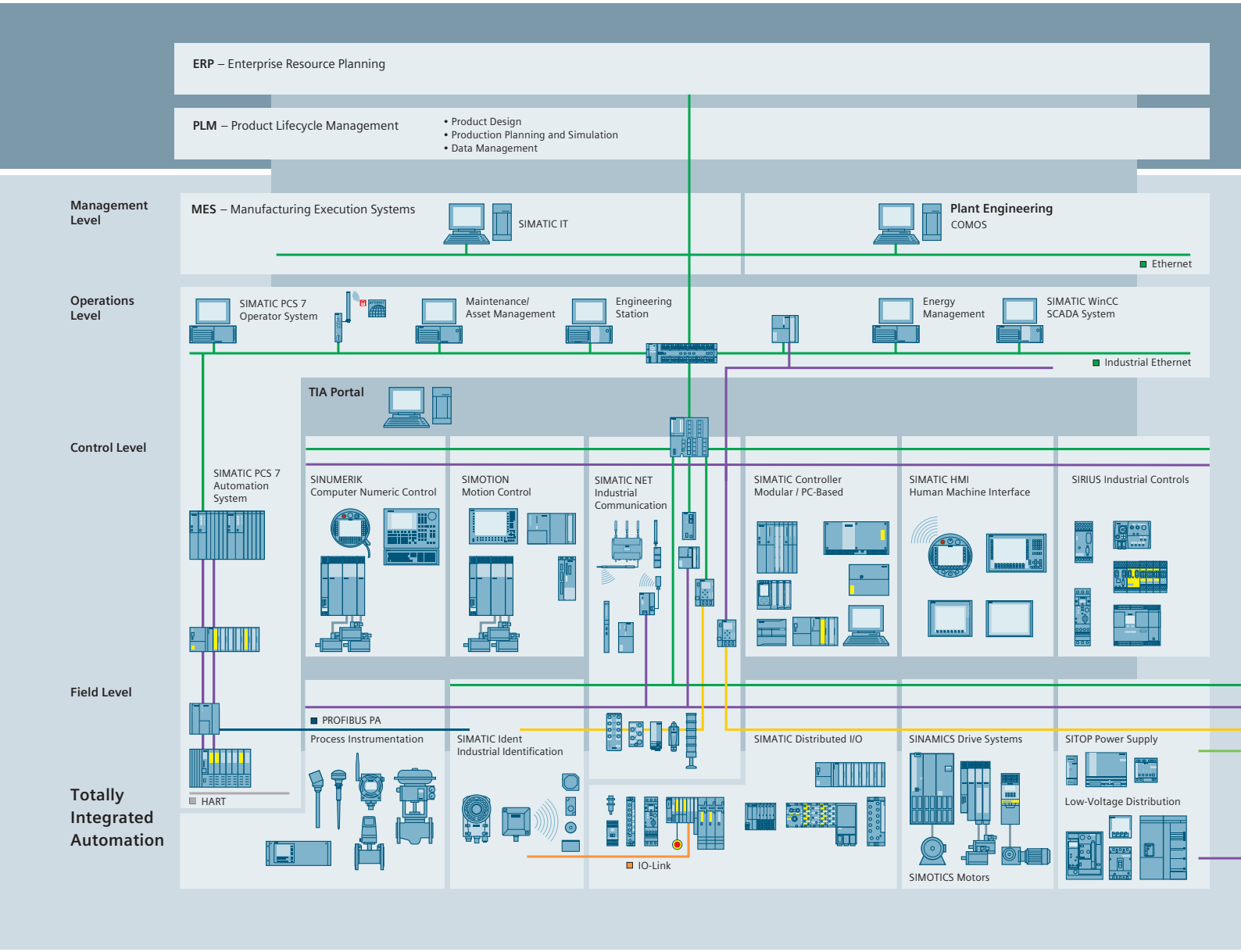
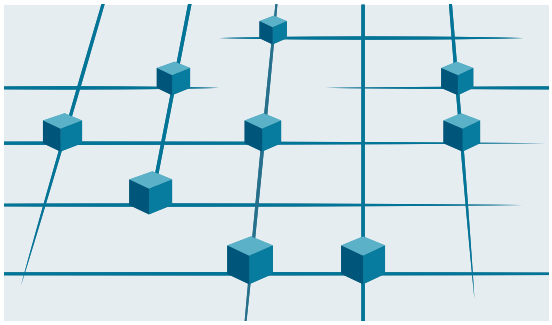


Efficient automation starts with efficient engineering.

Totally Integrated Automation: Efficiency driving productivity.

Efficient engineering is the first step toward better production that is faster, more flexible, and more intelligent. With all components interacting efficiently, Totally Integrated Automation (TIA) delivers enormous time savings right from the engineering phase. The result is lower costs, faster time-to-market, and greater flexibility.



Totally Integrated Automation
Efficient interoperability of all automation components

A unique complete approach for all industries

As one of the world's leading automation suppliers, Siemens provides an integrated, comprehensive portfolio for all requirements in process and manufacturing industries. All components are mutually compatible and system-tested. This ensures that they reliably perform their tasks in industrial use and interact efficiently, and that each automation solution can be implemented with little time and effort based on standard products. The integration of many separate individual engineering tasks into a single engineering environment, for example, provides enormous time and cost savings.

With its comprehensive technology and industry-specific expertise, Siemens is continuously driving progress in manufacturing industries – and Totally Integrated Automation plays a key role.

Totally Integrated Automation creates real value added in all automation tasks, especially for:

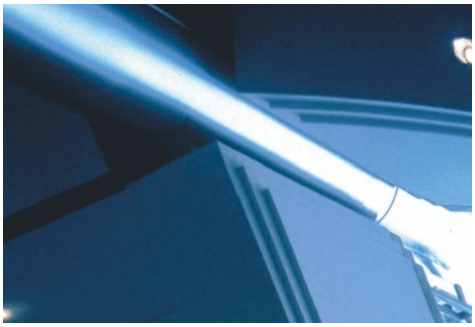
- **Integrated engineering**
  Consistent, comprehensive engineering throughout the entire product development and production process
- **Industrial data management**
  Access to all important data occurring in productive operation – along the entire value chain and across all levels
- **Industrial communication**
  Integrated communication based on international cross-vendor standards that are mutually compatible
- **Industrial security**
  Systematic minimization of the risk of an internal or external attack on plants and networks
- **Safety Integrated**
  Reliable protection of personnel, machinery, and the environment thanks to seamless integration of safety technologies into the standard automation

Making things right with Totally Integrated Automation

Totally Integrated Automation, industrial automation from Siemens, stands for the efficient interoperability of all automation components. The open system architecture covers the entire production process and is based on end-to-end shared characteristics: consistent data management, global standards, and uniform hardware and software interfaces.

Totally Integrated Automation lays the foundation for comprehensive optimization of the production process:

- Time and cost savings due to efficient engineering
- Minimized downtime due to integrated diagnostic functions
- Simplified implementation of automation solutions due to global standards
- Better performance due to interoperability of system-tested components



Answers for industry.

Siemens Industry answers the challenges in the manufacturing and the process industry as well as in the building automation business. Our drive and automation solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) are employed in all kinds of industry. In the manufacturing and the process industry. In industrial as well as in functional buildings.

Siemens offers automation, drive, and low-voltage switching technology as well as industrial software from standard products up to entire industry solutions. The industry software enables our industry customers to optimize the entire value chain – from product design and development through manufacture and sales up to after-sales service. Our electrical and mechanical components offer integrated technologies for the entire drive train – from couplings to gear units, from motors to control and drive solutions for all engineering industries. Our technology platform TIP offers robust solutions for power distribution.

Check out the opportunities our automation and drive solutions provide. And discover how you can sustainably enhance your competitive edge with us.

SIMOCRANE crane technology platform

Overview

Competent and innovative

Crane technology and lifting gear at Siemens have a long tradition. As far back as 1891, Siemens had equipped a 1.5 t slewing crane with regenerative feedback into the line supply.

With our drive technology today we can achieve a lifting capacity of much more than 14000 t and a hoisting gear speed in excess of 180 m/min.

Trends and requirements

We create significant customer benefits through savings in fuel costs and reduction of CO_2 emissions with our rubber tired gantry cranes thanks to our ECO concept. With our automation and safety concepts we implement automatic guided crane operation.

The rapid growth of worldwide container transport with ever shorter cargo handling times places new demands on crane manufacturers, system integrators and operators of harbor cranes. Mastering large dimensions, high speeds and heavy loads despite highly demanding precision and safety requirements and all imaginable climatic environmental conditions is a characteristic challenge for this field of application.

The industrial environment is characterized by a wide variety of crane types and load suspension devices. Precision and safety are paramount here, but throughput of goods and availability are also important factors. Depending on the type of goods to be transported, careful transport and damage prevention can be a decisive factor. Industrial cranes are often part of a process chain (e.g. ladle crane) or are integrated into system landscapes of a logistical type (e.g. warehouse management).

Pre-configured crane control modules for controlling and automating all types of crane

Siemens is setting standards in energy efficiency and energy management

Rising energy costs and reduction of CO_2 emissions are also concerns that demand innovative economical and environmentally sound solutions. Regenerative systems, energy-efficient motors, as well as hybrid drives with intelligent energy management system are today's solutions for the future.

Platform concept

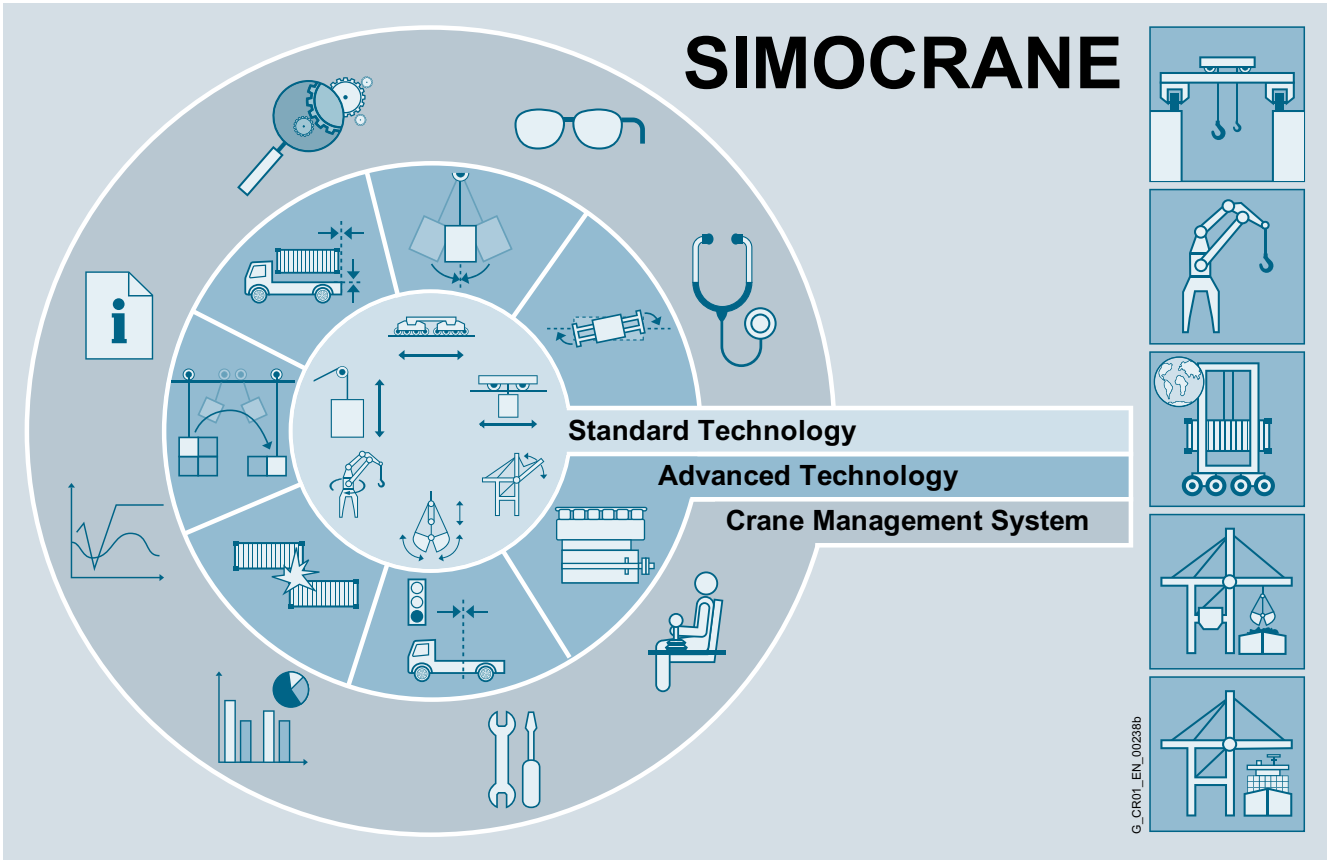
In order to meet these requirements, Siemens has developed the SIMOCRANE crane technology platform. With the solutions developed by Siemens we master the challenge of shorter and shorter handling times for loads combined with reduced energy requirements.

Standardization and specialization

As one of the leading experts in the industry, Siemens offers innovative SINAMICS drive and control systems for this purpose. On this platform, the modular, maintenance-friendly drive and control components of SIMOCRANE form the basis for controlling the motion of a crane.

The portfolio is supplemented with a series of technology options of SIMOCRANE Advanced Technology which, in a suitable combination, optimize operation of a crane and increase the availability.

The concept of a modular technology platform also contributes to the shortening of the configuring and commissioning times.



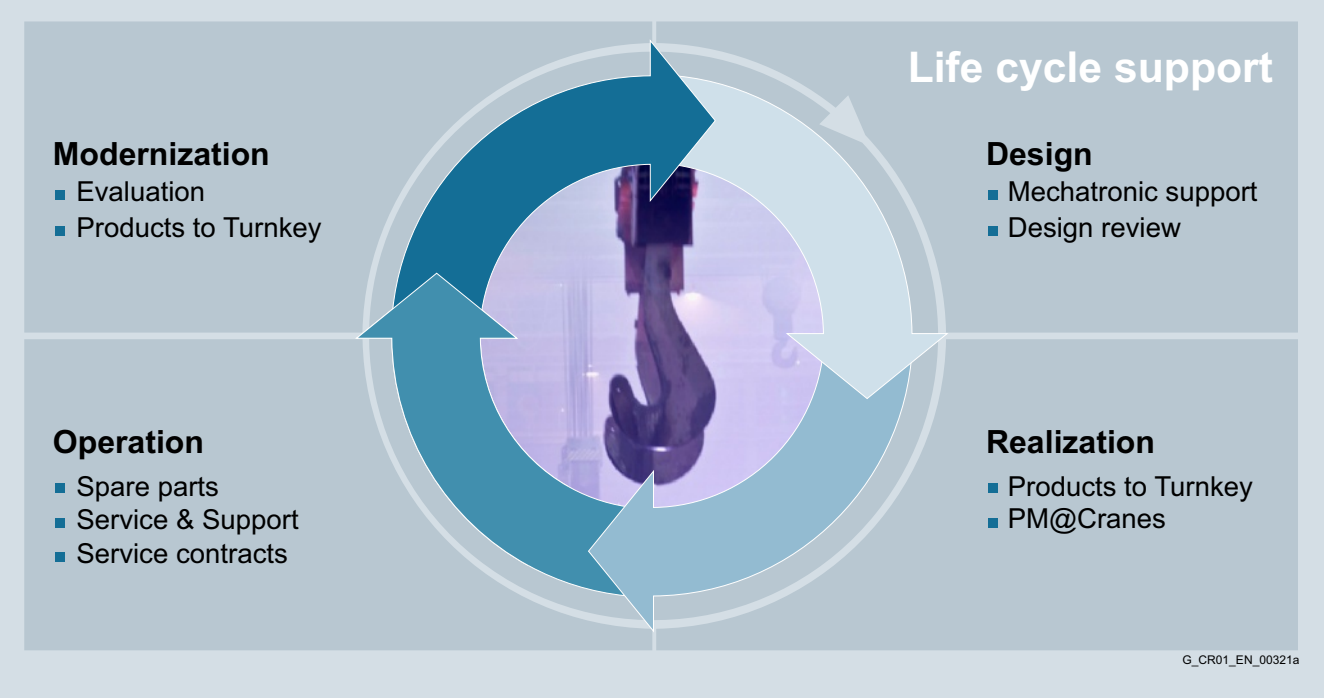
Overview (continued)

Scalable in hardware and software

Our products and solutions cover the requirements of cranes in dockside applications (container loading and unloading, stacking mode and grab mode), as well as in industrial applications in the steel and paper industries (ladle cranes, winding applications), in shipbuilding (Goliath cranes) and in numerous other industrial applications. Due to their scalability they support customers both in the implementation of complex large cranes with high drive outputs of up to several 1000 kW and demanding functional scope (sway control, automation), as well as simpler crane types with lower outputs of just a few kW and a low degree of automation (manual operation).

Continuous consulting

We accompany you over the complete life cycle of your crane. With engineering and mechatronic support for the creation of the optimal solution for your crane. During the implementation, installation and commissioning phases as well as during servicing work this is achieved by provision of spare parts, on-site service (local) and the appropriate maintenance contracts. In the creation of the optimal solution for your crane through to implementation and handover to the plant as well as during servicing work on site or via teleservice. In cooperation with you, we also develop concepts for modernizing and retrofitting old crane systems.



Siemens offers products and solutions for all crane applications

Section "SIMOCRANE application examples" demonstrates what is involved in a complete crane application. It illustrates what is covered by standard products and where the application component is relevant in the application.

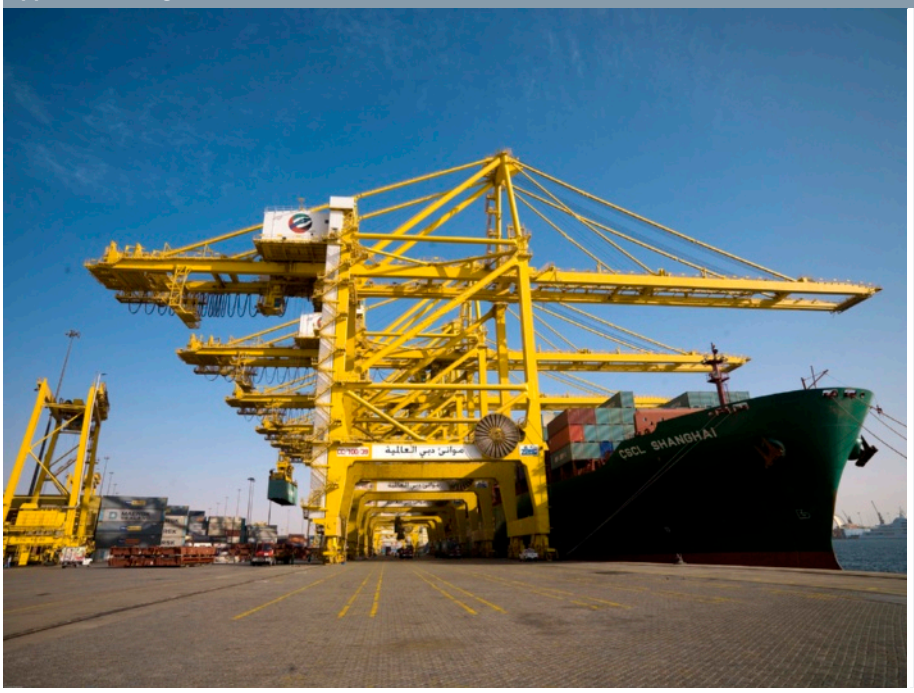
More information

A glossary of terms for SIMOCRANE can be found in Chapter 9 Appendix.

Harbor cranes

Overview

Application range



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

Container cranes

- STS (ship-to-shore) cranes

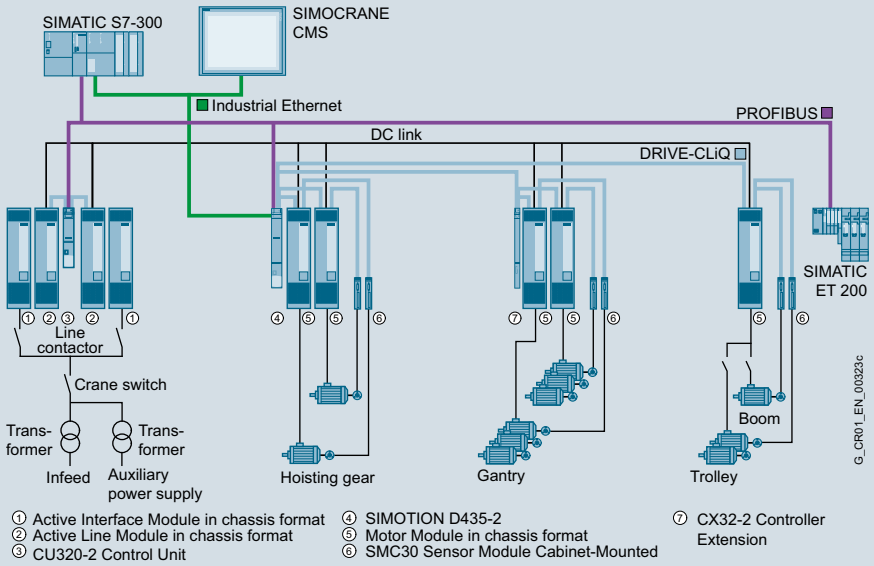
Grab cranes

- GSU (grab ship unloader) cranes

Stacking cranes

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

Crane topology



Drive system:
SINAMICS S120

Controller:
SIMOTION D

SIMATIC S7 I/O:
PROFIBUS/PROFINET

HMI/diagnostics:
SIMOCRANE CMS with SIMATIC WinCC

Overview (continued)

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

SIMOTIC motors

Three-phase induction motors for use with SINAMICS S120

Hoist motors

- SIMOTICS M-1PH8, IP23/IP55, S1, 2.8 to 1340 kW, 13 to 12451 Nm
- SIMOTICS SD 1LE1, IP55, S1, 1.75 to 200 kW, 15 to 1546 Nm
- SIMOTICS SD 1LG4/1LG6, IP55, S1, 1.75 to 332 kW, 15 to 2323 Nm

Gantry motors

- SIMOTICS SD 1LP4/1LP6, with a spring-set brake, IP55, S3-25 %, 3 to 132 kW, 30 to 873 Nm

Industrial cranes

Overview

Application range

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

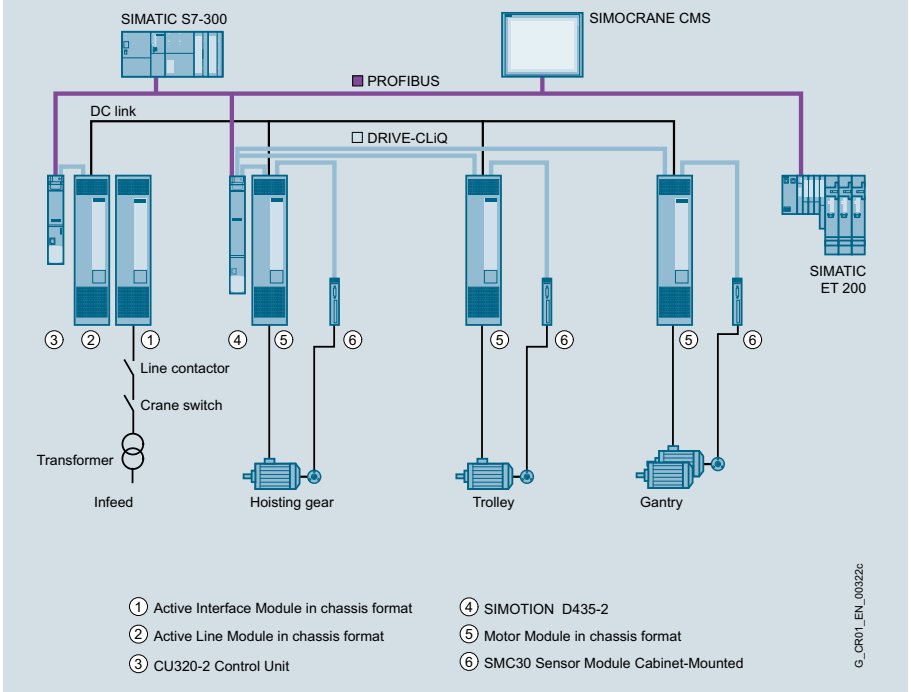
Ladle cranes

Bridge cranes

- OHBC (overhead bridge cranes)

Goliath cranes

Crane topology



Drive system:
SINAMICS S120

Controller:
SIMOTION D
SIMATIC S7

I/O:
PROFIBUS/PROFINET

HMI/diagnostics:
SIMOCRANE CMS with SIMATIC WinCC

Overview (continued)

Drive systems

SINAMICS S120 high-performance multi-axis drive 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

SIMOTIC motors

Three-phase induction motors for use with SINAMICS S120

Hoist motors

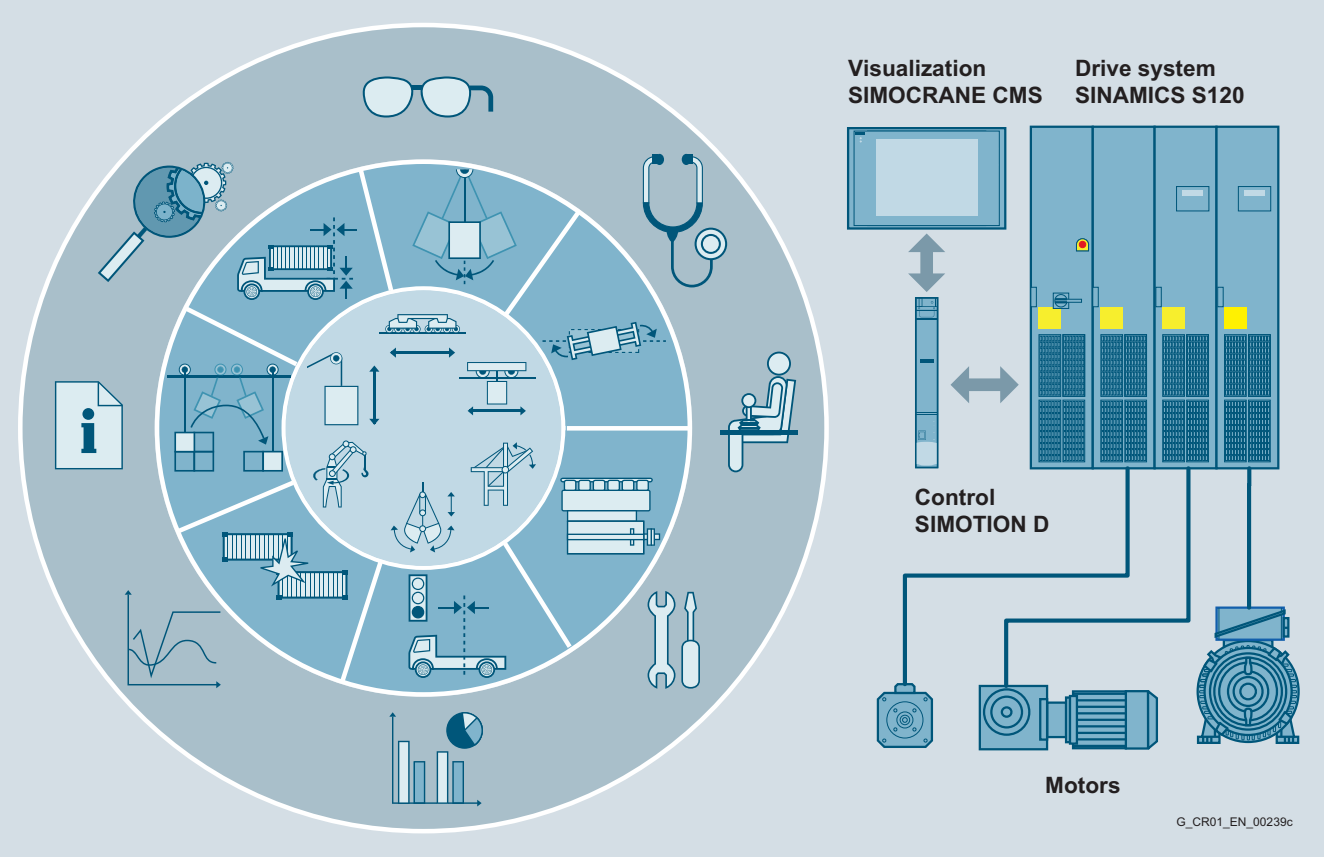
- SIMOTICS M-1PH8, IP23/IP55, S1, 2.8 to 1340 kW, 13 to 12451 Nm
- SIMOTICS SD 1LE15/16, IP55, S1, 1.75 to 200 kW, 15 to 1546 Nm
- SIMOTICS SD 1LG4/1LG6, IP55, S1, 1.75 to 332 kW, 15 to 2323 Nm

Overview

SIMOCRANE Standard Technology

SIMOCRANE Standard Technology supports optimized motion control of different types of crane.

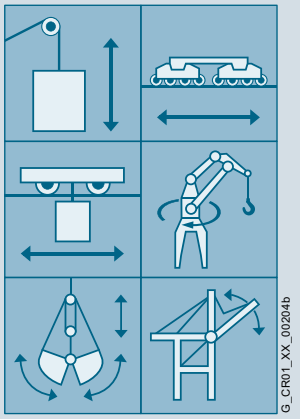
Siemens offers the drive-based mid-performance solution with a compact functional scope SIMOCRANE Drive-Based Technology and the high-performance solution SIMOCRANE Basic Technology, which you can expand using SIMOCRANE Advanced Technology.



Overview (continued)

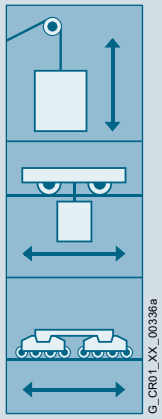
SIMOCRANE Basic Technology

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



SIMOCRANE Drive-Based Technology

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



SIMOCRANE offers scalable technology modules for crane automation to increase productivity. The technology module basis is SIMOCRANE Basic Technology which can be 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 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).

Overview

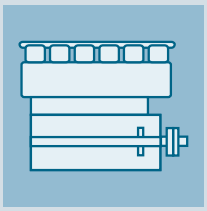
SIMOCRANE Advanced Technology

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 CO_2 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 CO_2 emissions to be reduced.

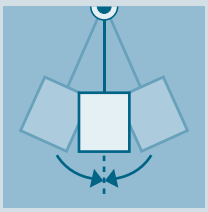
SIMOCRANE ECO Technology



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.

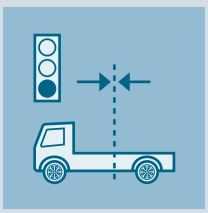
SIMOCRANE offers a high-performance sway control system with different operating modes that ensures a high degree of safety for persons, transport goods and equipment.

Automatic sway control relieves the crane driver and also ensures faster and more accurate positioning of the load.

In the case of automated motion control, a sway control system is essential for avoiding the risk of collisions and accidents. In the case of grab cranes, a completely controlled sway is necessary.

The high-performance solution can be applied for different type of cranes, like STS, GSU and OHBC cranes.
Furthermore, SIMOCRANE meets also the challenge of mid-performance market with its drive-based solution SIMOCRANE Drive-Based Sway Control. Its main function is to damp sway in manual operation, so that it can recieve the crane driver and increase productivity.

SIMOCRANE TPS Truck Positioning System



Positioning of transport vehicles, comprising trucks with container trailers, must be performed smoothly and without delay.

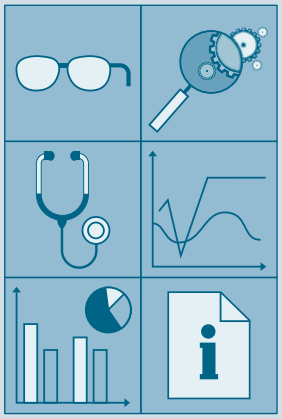
At terminals which use trucks with container trailers for transportation, drivers are instructed manually or must rely on their judgment. This has a detrimental effect on both personnel safety and the duration of positioning tasks.

Overview

SIMOCRANE CMS Crane Management System

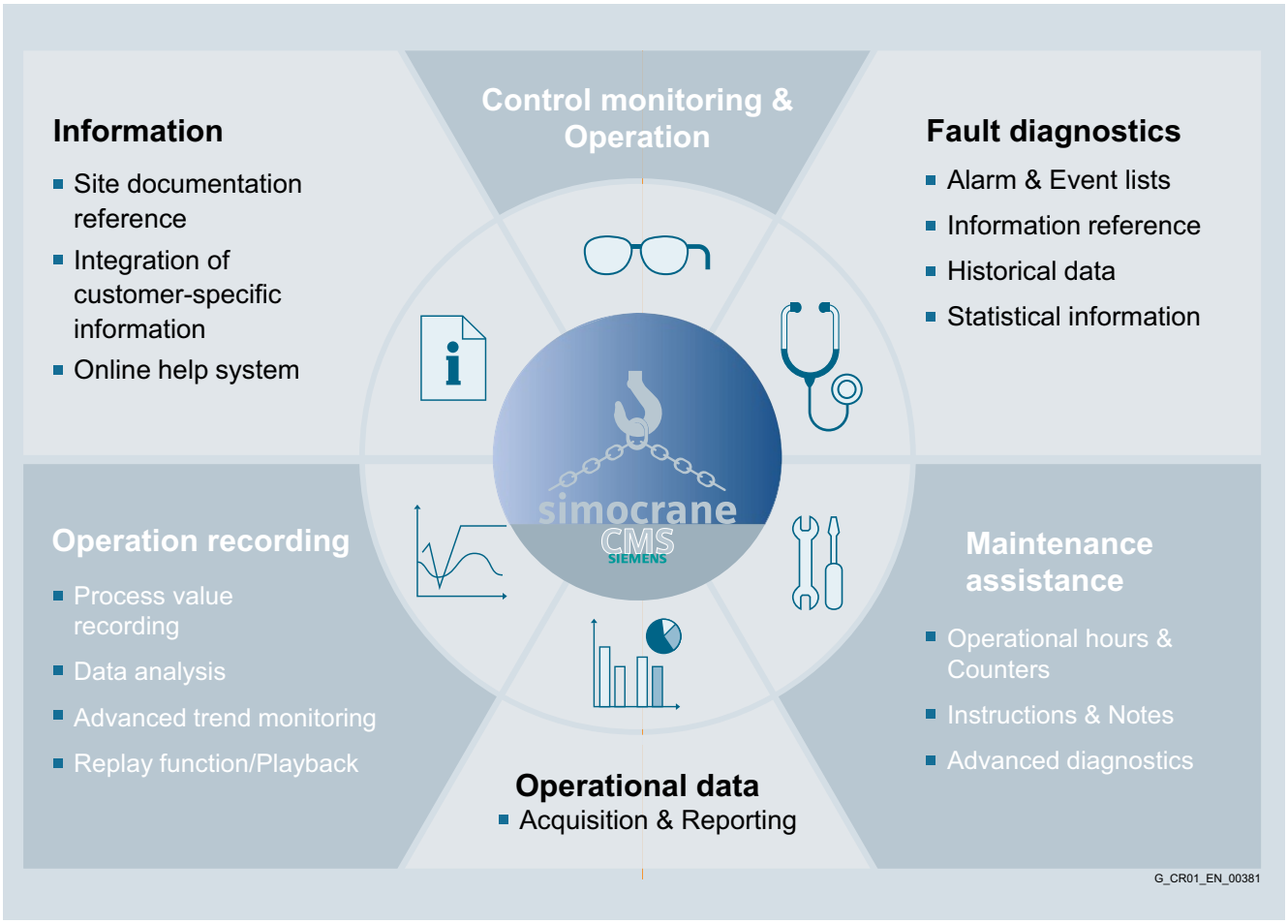
SIMOCRANE CMS

- 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 diagnositics, Replay)
  - CMS options (e.g. multi-terminal operation, advanced reporting)
- Management level
  - RCMS server and client stations for remote operation

Overview

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.

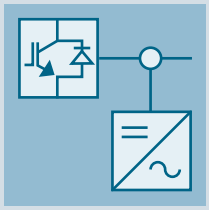
Through the use of Basic Technology and different Advanced Technology functions, different applications can be implemented and various degrees of automation can be achieved.

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

Drive systems

SINAMICS S120 built-in units for crane applications

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.

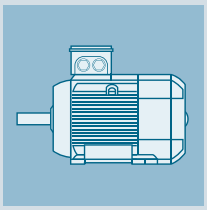
SINAMICS S120 provides the solution for these demanding tasks in combination with the technologies of SIMOCRANE. SINAMICS S120 is characterized by the following properties:

- 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.

SIMOTICS motors

Three-phase induction motors



Siemens offers the ideal SIMOTICS motor for any application.

The challenge in the field of crane drives is to create increasingly compact and dynamic motors in a wide range of outputs and variants. Siemens offers a broad spectrum of hoist and gantry motors to satisfy these demands. A suitable SIMOTICS motor of induction design is available for every Motion Control task – with ratings ranging from 2.2 to 1340 kW.

All SIMOTICS motors for Motion Control applications are optimally designed to operate with the SINAMICS S120 drive system.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit http://www.siemens.com/industrialsecurity.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit http://support.automation.siemens.com.

2

Overview

Crane applications

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

- The SIMOCRANE Basic Technology comprises the following standard functions and covers the motion control of all of the main drives of a crane:
  - Hoist
  - Gantry
  - Trolley
  - Slewing gear
  - Grab
  - Jib (boom hoist) or luffing gear
- All of the functions proven in practice are now implemented on the SIMOTION platform. Furthermore, the latest requirements have been taken into account.
- New 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

Properties of SIMOCRANE Basic Technology V3.0:

- 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 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 costs are reduced
- Standardization is made easier

Application

The SIMOCRANE Basic Technology 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)
  - GSU (grab ship unloader) etc.
- High-performance and mid-performance industrial cranes with crane-specific technology
  - Coil cranes
  - Gantry cranes
  - Waste incineration 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:

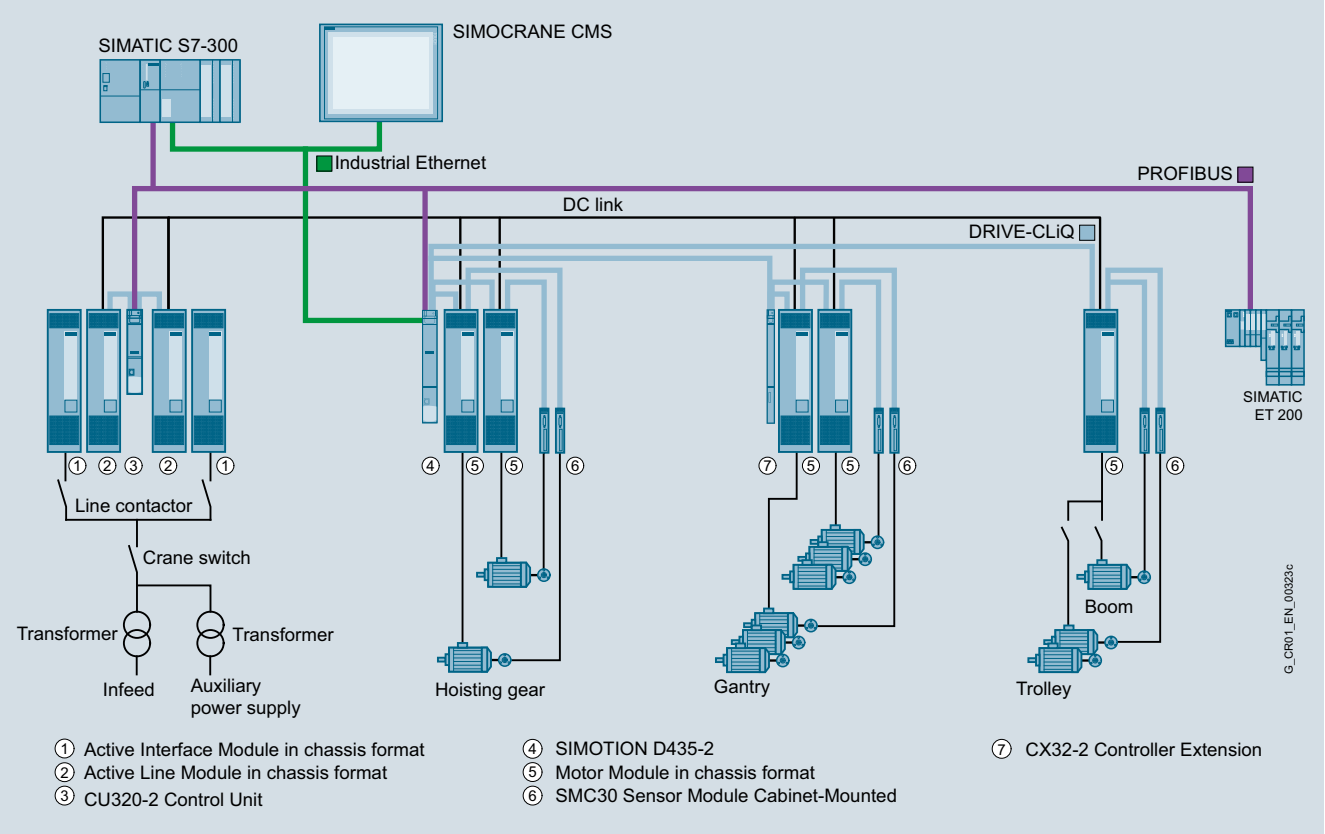
- A SIMOTION D435-2 Control Unit, designed for open and closed-loop control of a multi-axis drive line-up
- One or several SIMOTION CX32-2 Controller Extensions for more than 6 axes (see the application example "Topology of container quay crane" in the "Hardware configuration" section)
- Several SINAMICS 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 several 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, 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 Chapter 3 SIMOCRANE Advanced Technology and Chapter 4 SIMOCRANE CMS Crane Management System.

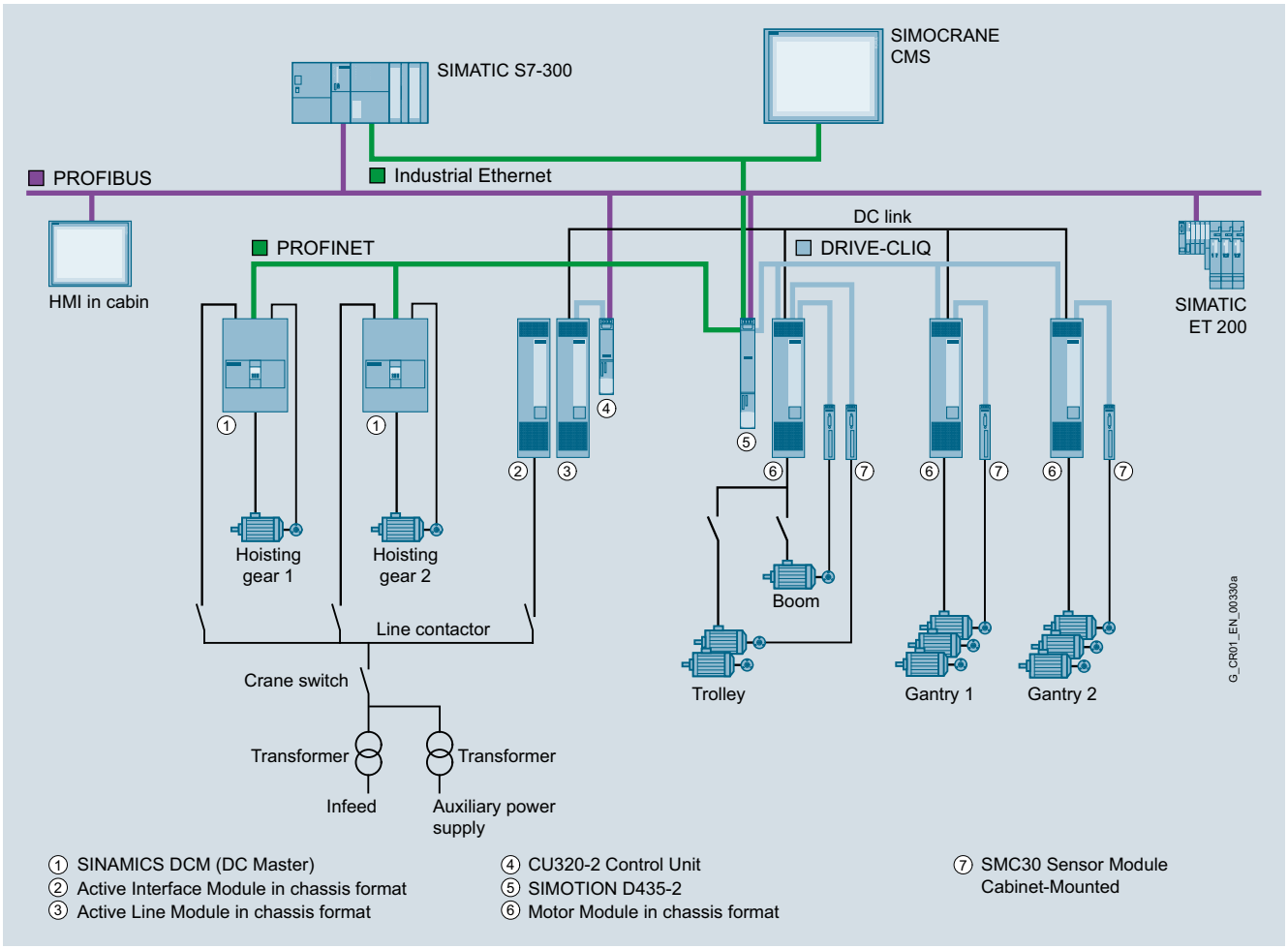


Topology of container quay crane

2

Design (continued)

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 crane").



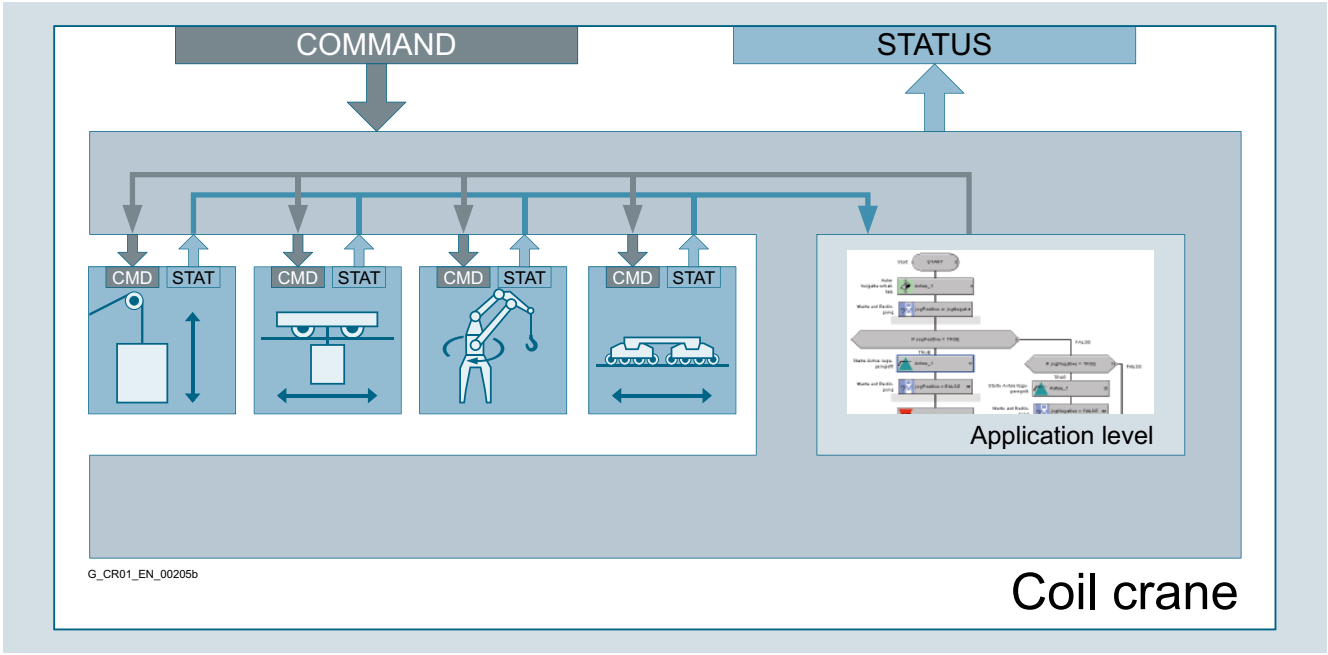
Topology of a container crane with mixed three-phase AC and DC drives (DC/AC)

Design (continued)

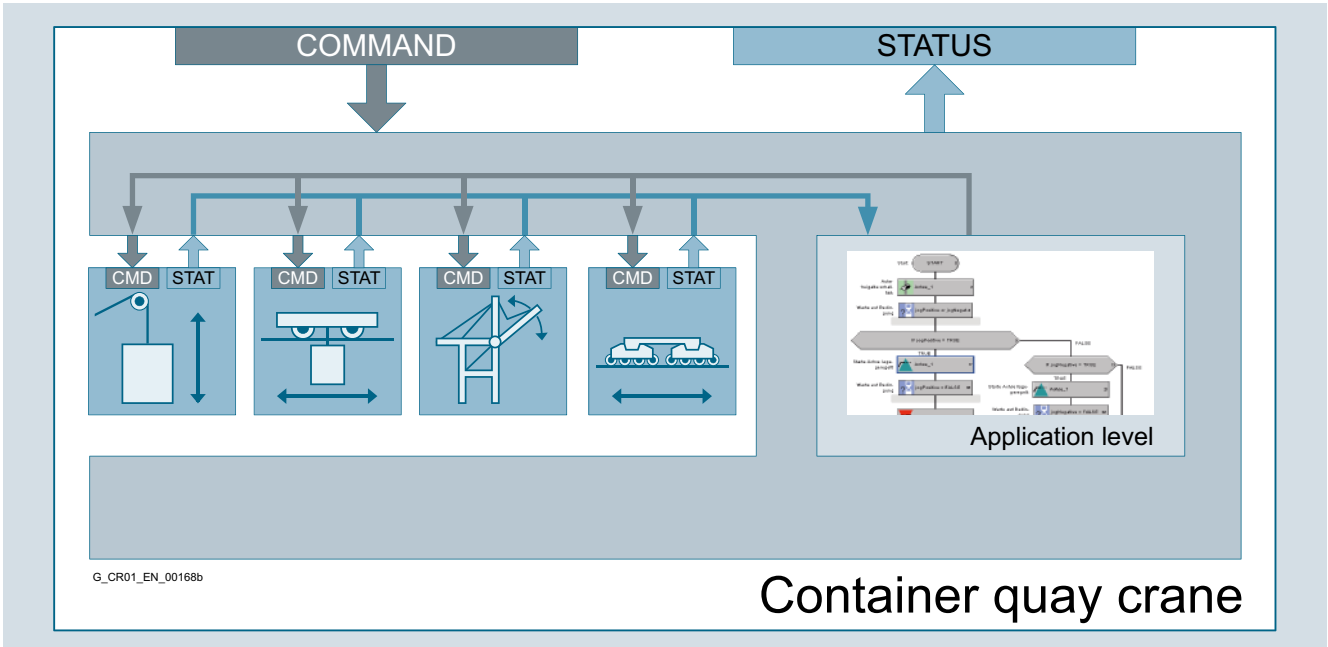
SIMOCRANE Basic Technology software

The SIMOCRANE Basic Technology 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 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.



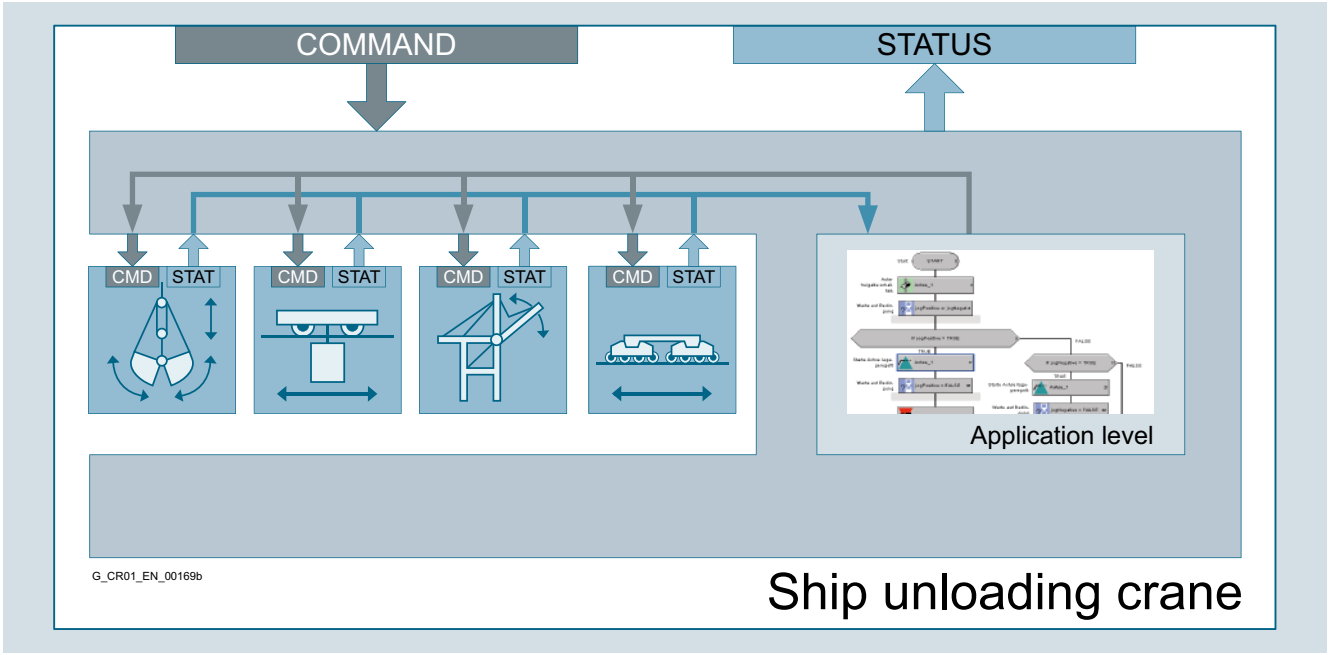
Function blocks for coil crane



Function blocks for container quay crane

2

Design (continued)



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 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 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 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	**6SL3055-0AA00-6AA0**
SINAMICS SMC 30 Sensor Module Cabinet-Mounted	**6SL3055-0AA00-5CA2**
SINAMICS Terminal Module TM31	**6SL3055-0AA00-3AA1**
SIMOTION SCOUT V4.4 HF4	**6AU1810-1BA44-0XA0**
Option package Drive Control Chart (DCC) V2.3	**6AU1810-1JA23-0XA0**

Drive systems SINAMICS S120, motors and connection systems are not included in the package (see Chapter 6 Drive systems). These components must be ordered separately.

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

- PM 21 – SIMOTION, SINAMICS S120 & SIMOTICS
- D 81.1 – SIMOTICS Low-Voltage Motors
- 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/

→ Product Support → (Enter search term) SIMOCRANE

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

https://support.industry.siemens.com/cs/

→ Application Examples → (Enter search term) Crane

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

https://support.industry.siemens.com/cs/

→ Product Support → (Enter search term) SIMOTION

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

https://support.industry.siemens.com/cs/

→ Product Support → (Enter search term) SINAMICS

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 Motion Control Web License Manager.

http://www.siemens.com/automation/license

Training

Siemens Cranes offers crane-specific training

http://www.siemens.nl/training/cranes

Hardware SIMOTION D435-2 Control Unit

Overview

SIMOTION D is the compact, drive-based version of SIMOTION based on the SINAMICS S120 drives 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 onboard
- 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

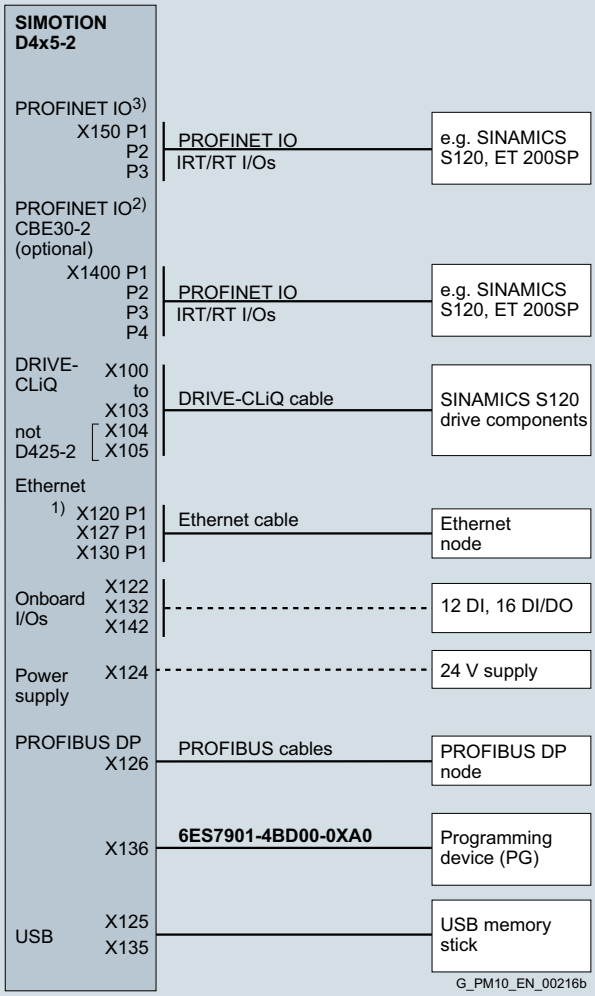
Option modules

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



1) X120 only for D4x5-2 DP.
2) D4x5-2 DP/PN only (CBE30-2 as second PROFINET interface).
3) D4x5-2 DP/PN only.

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.

Technical specifications

		6AU1435-2AD00-0AA0
Product brand name		SIMOTION
Product-type designation		D435-2 DP/PN
Performance class of the motion control system		STANDARD Performance
Version of the motion control system		Multiple-axis system
PLC and motion control performance		
Maximum number of axes		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
Servo/IPO clock cycle, remark		0.5 ms in conjunction with integrated SINAMICS S120 drives (SINAMICS Integrated); 0.25 ms in conjunction with $SERVO_{FAST}$ and IPO_{FAST}
Integrated drive control		
Maximum number of axes for integrated drive control		
• servo		6
• vector		6
• V/f		12
• remark		Alternative control modes; drive control based on SINAMICS S120 CU320-2, firmware version V4.x
Memory		
RAM (work memory)	Mbyte	64
Additional RAM work memory for Java applications	Mbyte	20
RAM disk (load memory)	Mbyte	41
Retentive memory	kbyte	364
Persistent memory (user data on CF)	Mbyte	300
Communication		
DRIVE-CLiQ interfaces		6
USB interfaces		2
Industrial Ethernet interfaces		2
PROFIBUS interfaces		2
• remark		Equidistant and isochronous; can be configured as master or slave
PROFINET interfaces		1
• remark		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 Control and/or device; supports media redundancy (MRP and MRPD)
General technical specifications		
Fan		Double fan/battery module included in scope of delivery
DC supply voltage		
• rated value	V	24
• permissible range	V	20.4 … 28.8
Current consumption, typ.	mA	1 000
• remark		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	-25 … +55
• during transport	°C	-40 … +70
• during operating	°C	± 0 … + 55
- remark		Maximum installation altitude 4000 m above sea level. Above an altitude of 2000 m, the maximum ambient temperature decreases by 7 °C per 1000 m.
Relative humidity without condensation		
• during operating phase	%	5 … 95
Air pressure	hPa	620 … 1 060
Protection class IP		IP20
Height	mm	380
Width	mm	50
Depth	mm	270
• remark		when the spacer is removed 230 mm deep
Net weight	g	3 600

Technical specifications (continued)

		6AU1435-2AD00-0AA0
Product brand name		SIMOTION
Product-type designation		D435-2 DP/PN
Performance class of the 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
• remark		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 inputs/outputs		16
Parameterization possibility of the digital inputs/outputs		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
- remark		Data for V_{cc} = 24 V; load 48 Ohm; "1" = 90 % V_{Out}, "0" = 10 % V_{Out}
Output cam, reproducibility	µs	10
Output cam, resolution	µs	1
Switching frequency of the outputs for		
• ohmic load, max.	Hz	100
• inductive load, max.	Hz	2
• lamp load, max.	Hz	11
Short-circuit protection		Yes
Additional technical specifications		
Backup of non-volatile data		
• Backup of retentive data		unlimited buffer duration
• Buffer time real-time clock		4 days min.
• remark		longer buffer duration of the real-time clock using a battery inserted in the double fan/battery module
Approvals		
• USA		cULus
• Canada		cULus
• Australia		C-Tick
• Korea		KCC

Hardware SIMOTION CX32-2 Controller Extension

Overview

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

		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
• remark		Alternative control modes; drive control based on SINAMICS S120 CU320-2, firmware version V4.x
Communication		
Interfaces DRIVE-CLiQ		4
General technical specifications		
Fan		No fan
DC supply voltage		
• rated value	V	24
• permissible range	V	20.4 … 28.8
Current consumption, typ.	mA	300
• remark		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	-25 … +55
• during transport	°C	-40 … +70
• during operating	°C	± 0 … + 55
- note		Maximum installation altitude 4000 m above sea level. Above an altitude of 2000 m, the maximum ambient temperature decreases by 7 °C per 1000 m.
Relative humidity without condensation		
• during operating phase	%	5 … 95
Air pressure	hPa	620 … 1 060
Protection class IP		IP20
Dimensions height	mm	380
Dimensions width	mm	25
Depth	mm	270
• remark		when the spacer is removed 230 mm deep
Net weight	g	2 600

Technical specifications (continued)

		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
• remark		in groups of 6
Current consumption for "1" signal level, typ.	mA	9
Input delay for		
• signal "0" → "1", typ.	µs	50
• signal "1" → "0", typ.	µs	150
Digital inputs/outputs		
Number of digital inputs/outputs		4
Parameterization possibility of the digital inputs/outputs		parameterizable as DI, as DO, as probe input (max. 4)
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 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
Load voltage minimum	V	20.4
Load voltage maximum	V	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	100
- remark		Data for V_{cc} = 24 V; load 48 Ohm; "1" = 90 % V_{Out}, "0" = 10 % V_{Out}
Switching frequency of the outputs for		
• ohmic load, max.	Hz	100
• inductive load, max.	Hz	2
• lamp load, max.	Hz	11
Short-circuit protection		Yes
Additional technical specifications		
Backup of non-volatile data		
• Backup of retentive data		unlimited buffer duration
Approvals		
• USA		cULus
• Canada		cULus
• Australia		C-Tick
• Korea		KCC

SIMOTION SCOUT Engineering Software

2

Overview

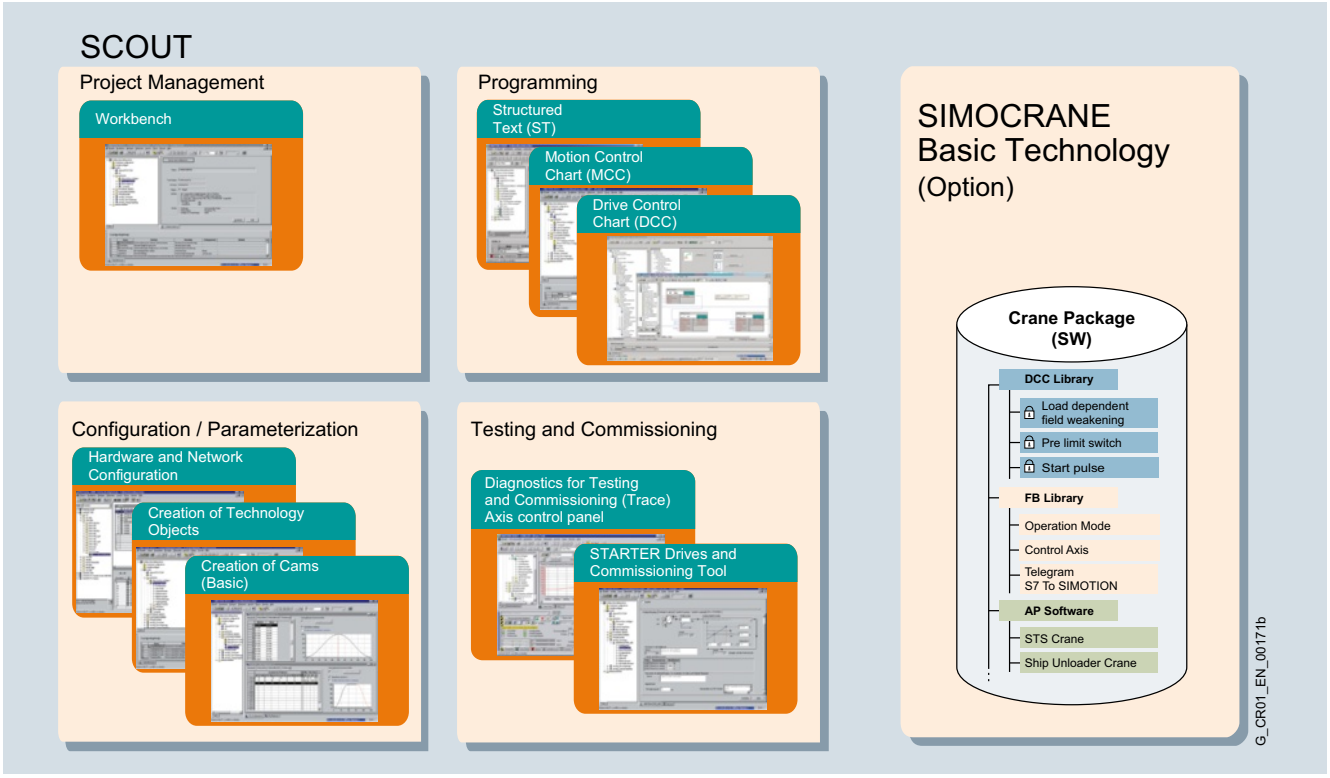
SCOUT is the engineering software for SIMOTION that is integrated in STEP 7. SCOUT contains all the tools required for configuration, parameterization, programming, testing, diagnostics and commissioning of SIMOTION and SINAMICS.

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 (continued)

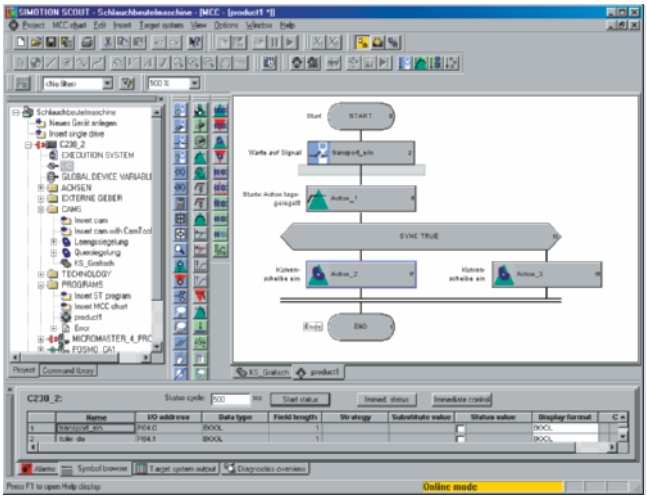
Motion Control Chart (MCC)

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.



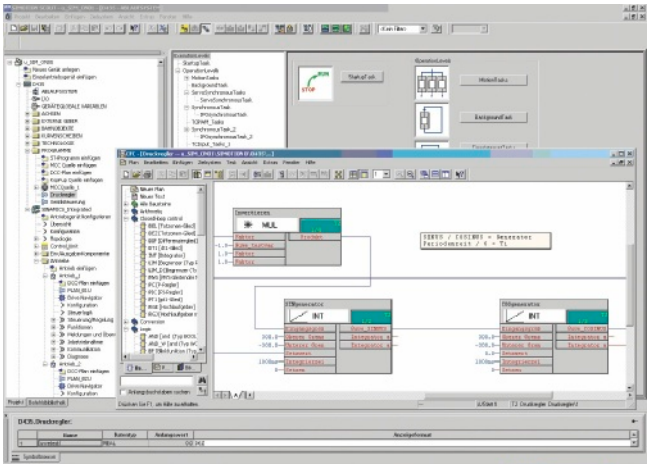
Motion Control Chart (MCC)

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 predefined 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)

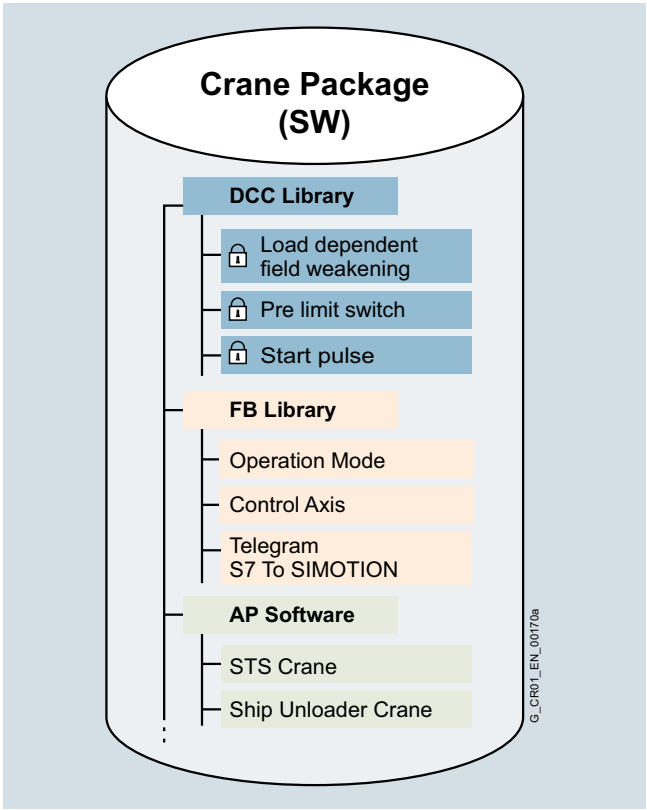
2

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.



SIMOTION technology package

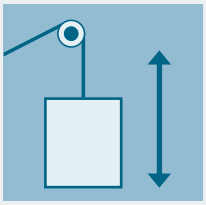
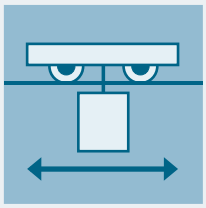
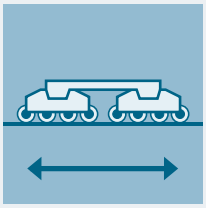
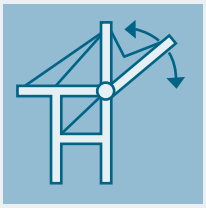
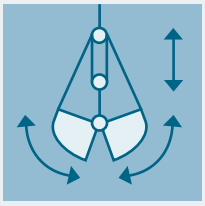
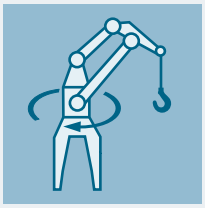
Standard applications

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.

Design (continued)

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 • Master-slave operation • Synchronous operation	• Automatic • Manual • Speed controlled (jogging) • Sway control • Basic positioning
Trolley	**2** 	• Speed controlled • Positioning single axis • Master-slave operation • Synchronous operation	• Automatic • Manual • Speed controlled (jogging) • Encoderless emergency mode • Sway control • Basic positioning
Gantry	**2** 	• Speed controlled • Positioning single axis • Master-slave 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

Design (continued)

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" when starting hoists with a suspended load is prevented.
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 master and slave are monitored. A signal is generated if a specified difference is exceeded.
6	Slack rope controller	This function prevents a slack rope developing in the goods being handled when the grab is closed. The slack rope controller also ensures that the grab can bury itself into the material to be moved and therefore ensuring the maximum filling level.
7	Current equalization control for orange-peel bucket operation	When raising and lowering the closed grab, the tension levels in the holding and closing ropes should be approximately the same. This means that the hoisting power is optimally distributed across the two motors.
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	Master-slave closed-loop torque control	Master-slave operation is used if 2 motors are connected to a common shaft. The master operates either closed-loop position controlled or closed-loop speed controlled depending on the operating mode. The slave only operates closed-loop torque controlled. The master sends the torque as torque setpoint to the slave.
19	Synchronous operation	Synchronous operation control is used if 2 motors are connected to a common load. Depending on the operating mode, the master and slave operate either closed-loop position controlled or closed-loop speed controlled. The slave 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 master-slave 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 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 new 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 to customer-specific requirements - "ready-to-apply" (for adaptation by the user).

The SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 package comprises the following components:

CompactFlash card

- with the crane-specific firmware version for SINAMICS S120 (V4.7)

CD-ROM with

- Cranes DCC blocks
- Standard applications
- Documentation

The features of SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 are as follows:

- Can be operated with SINAMICS PM340 Power Modules/ PM Chassis and PM250 Power Modules
- The extended onboard I/O on the CU310-2 Control Unit permit the control of the standard application
- Additional customer requirements have been taken into account in the application, for instance, digital master switch, combination between start pulse and SINAMICS brake 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 and PM250/PM340/ PM Power Module in the chassis format (can be selected) with SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 and SINAMICS V4.7
- Selectable control via onboard I/O terminals or PROFIBUS; when required, also additionally via the SINAMICS Terminal Module TM31
- We strongly recommend that encoders are used for hoist applications

2

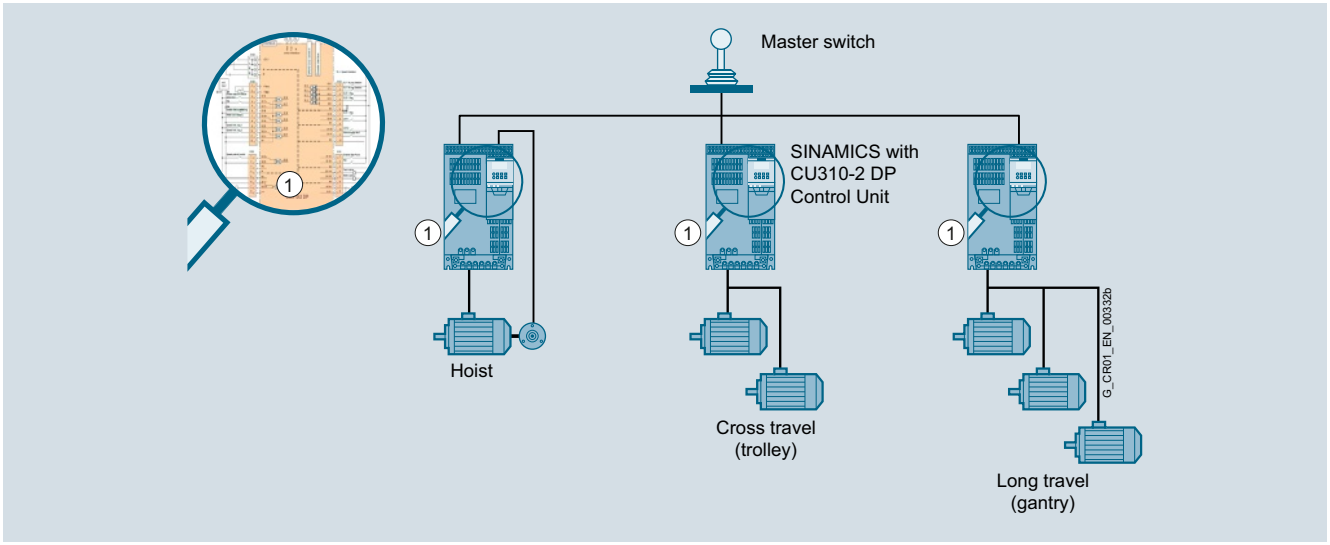
Design (continued)

Hardware configuration

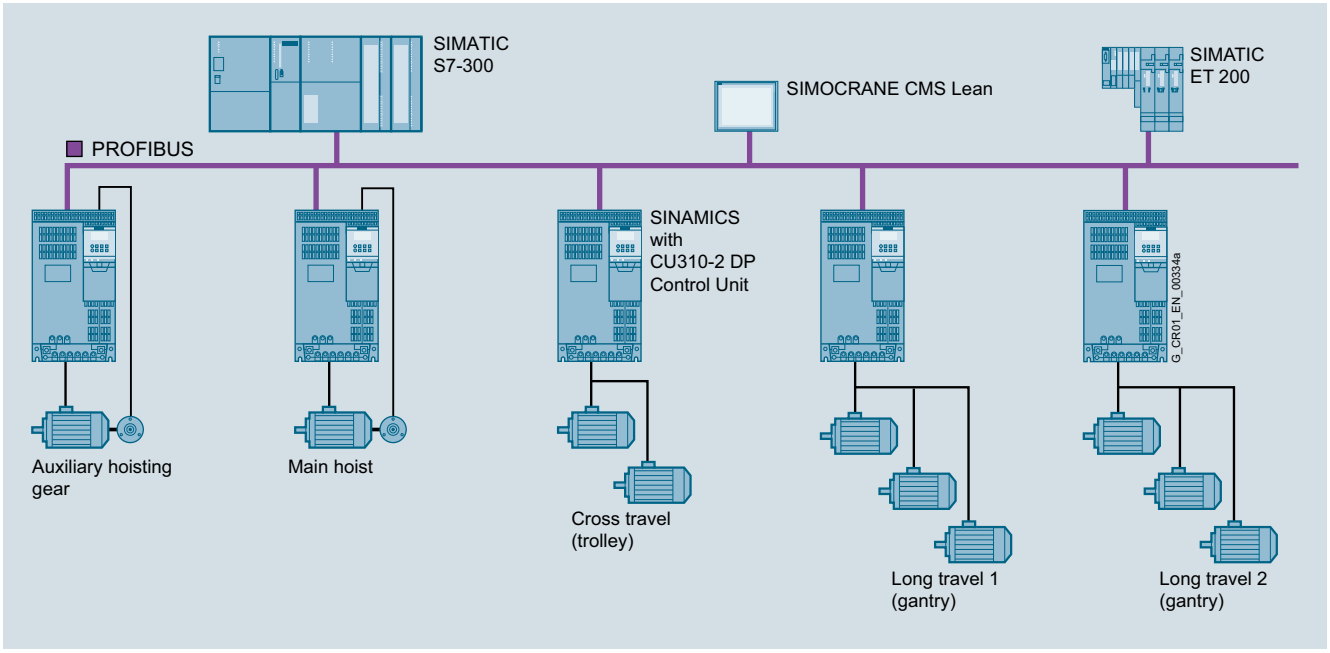
Typical hardware configurations used in mid-performance crane applications are shown in the following examples. It involves an overhead bridge crane (OHBC), controlled using I/O signals or using PROFIBUS DP communication.

It is especially important to note that the crane can be controlled just using the onboard I/O (see "Topology with onboard I/O") with SIMOCRANE Drive-Based Technology V1.0 SP1 HF2.

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



Topology with onboard I/O



Topology with PROFIBUS DP

Software

- Special SINAMICS Firmware V4.7 HF11 for crane applications. The following Power Modules and functions can be operated using this firmware:
  - PM340 Power Module (2-quadrant operation)
  - Power Module in chassis format (2-quadrant operation)
  - PM250 Power Module (4-quadrant operation)
  - Safety Integrated functions
  - Vector control, *V/f* control
  - NO servo control
- Crane technology in DCC blocks, e.g. load-dependent field weakening, start pulse etc.
- Standard applications via PROFIBUS 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.:
  - Master-slave closed-loop torque control
  - Brake control logic
  - Time-optimized positioning
  - Safety Integrated function

Selection and ordering data

Scope of delivery

The SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 package (article number: 6GA7270-1AA11-0AA0) for SINAMICS Control Unit CU310-2 will be supplied.

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

Description	Article No.
SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 for SINAMICS Control Unit CU310-2 each comprising 1 package • CompactFlash card with crane-specific firmware version V4.7 HF11 • CD-ROM with - Cranes DCC blocks - Standard applications - Documentation	**6GA7270-1AA11-0AA0**

Supplementary components

Description	Article No.
SINAMICS S120 Control Unit CU310-2 DP	**6SL3040-1LA00-0AA0**
SINAMICS Terminal Module TM31	**6SL3055-0AA00-3AA1**
SINAMICS STARTER V4.3 SP1 (DVD)	**6SL3072-0AA00-0AG0**
DCC SINAMICS V2.2 SP1	**6AU1810-1HA22-1XA0**

Drive systems, motors and connection systems for SINAMICS S120 are not included in the package (see Chapter 6 Drive systems). These components must be ordered separately.

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

- D 31 – SINAMICS Inverters for Single-Axis Drives and SIMOTICS Motors
- PM 21 – SIMOTION, SINAMICS S120 & SIMOTICS
- D 81.1 – SIMOTICS Low-Voltage Motors
- 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/

→ Product Support → (Enter search term) SIMOCRANE

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

https://support.industry.siemens.com/cs/

→ Application Examples → (Enter search term) Crane

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

https://support.industry.siemens.com/cs/

→ Product Support → (Enter search term) SINAMICS

Training

Siemens Cranes offers crane-specific training courses:

http://www.siemens.nl/training/cranes

2

Overview

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

- Commissioning
- Optimization
- Diagnostics

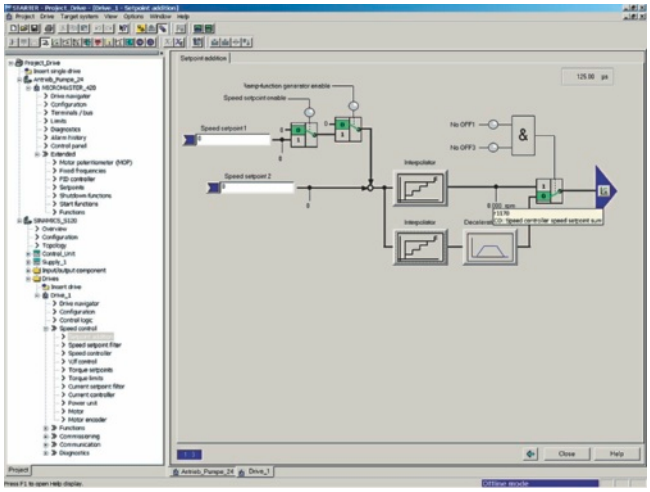
This software can be operated either as a standalone PC application, integrated in SIMATIC STEP 7 with TIA compatibility via Drive ES Basic, as well as integrated in the SIMOTION Engineering Software SCOUT. In both cases, basic functions and handling are identical.

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 "STARTER project navigator"), or as before, using the expert list (see the 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

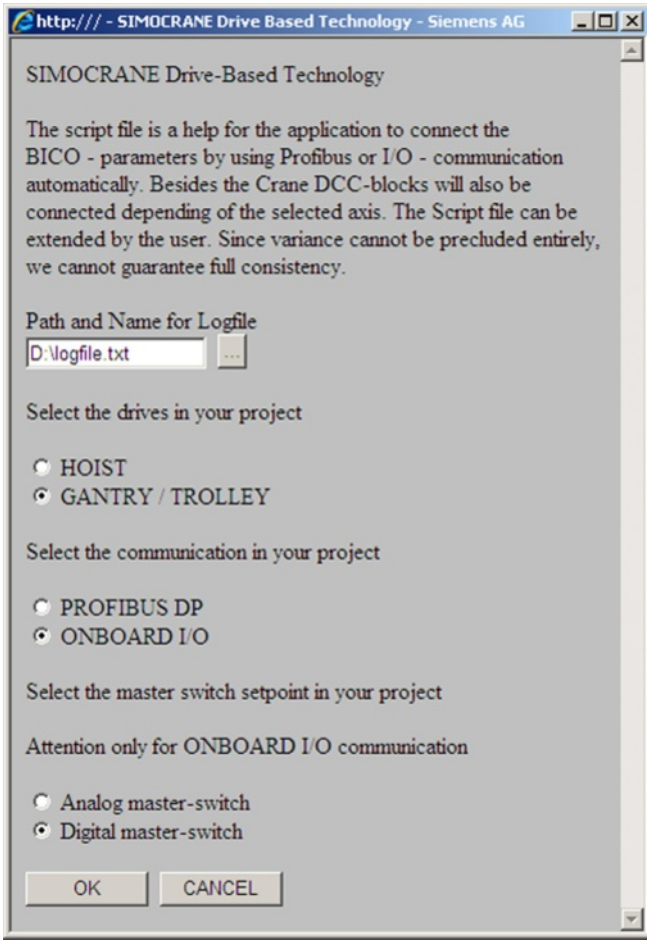
Application

Crane-specific applications

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

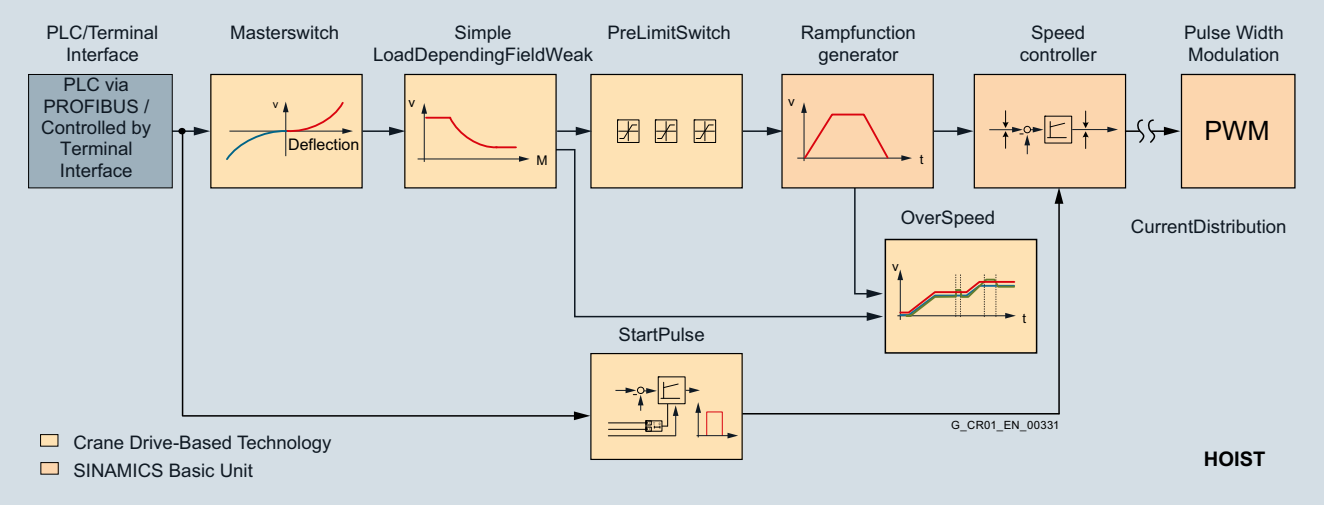
- Single-axis application for the hoist, trolley or gantry with control via PROFIBUS DP, via external I/O terminals or even via just the onboard I/O
- Two-axis application for master-slave closed-loop torque control
- Can be selected using a script screen form (see "Script screen form to configure the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

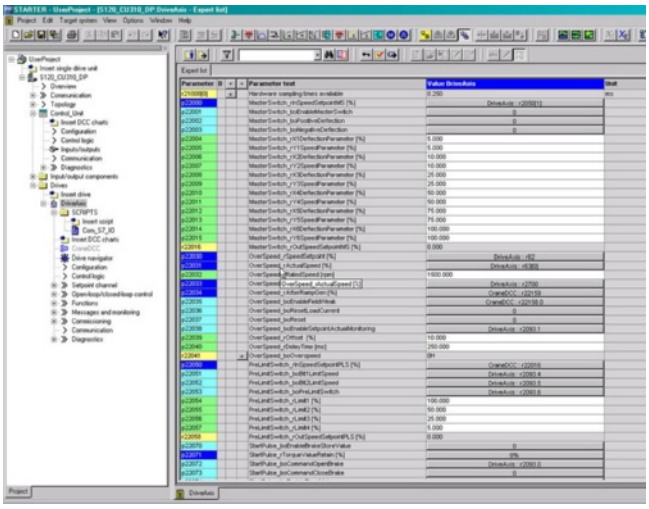


Script screen form to configure the axis, control and type of master switch

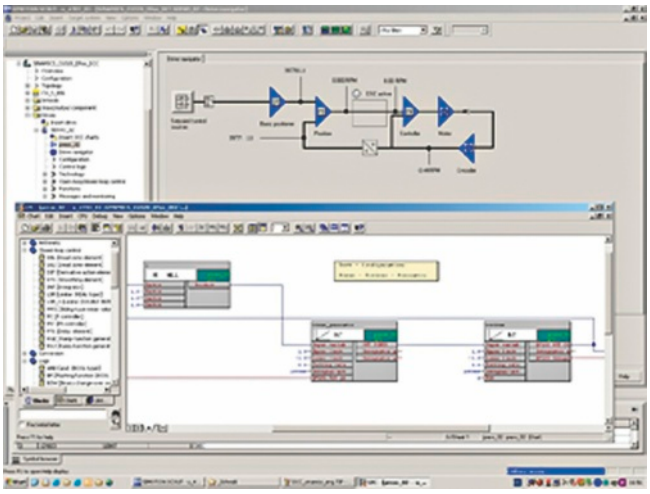
Application (continued)



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



Parameter assignment using the expert list



DCC graphic editor

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.

The crane DCC blocks are preconfigured using the standard SINAMICS DCC Library. Each individual crane-specific technology (e.g. load-dependent field weakening) is optimally pre-configured 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.

2

Design

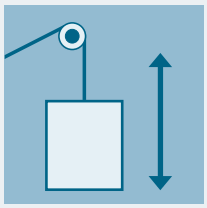
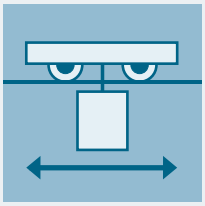
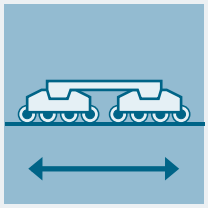
Standard applications

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

- Single-axis application for hoist, trolley or gantry with control via the onboard terminal strip or via PROFIBUS DP
- Two-axis application for master-slave 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 master and slave, 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	Master-slave closed-loop torque control	When 2 motors operate on a common shaft, the master issues the torque setpoint for the slave. The master operates either closed-loop speed controlled or position controlled. The master-slave 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.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit http://www.siemens.com/industrialsecurity.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit http://support.automation.siemens.com.

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 CO_2 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 CO_2 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 new 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.

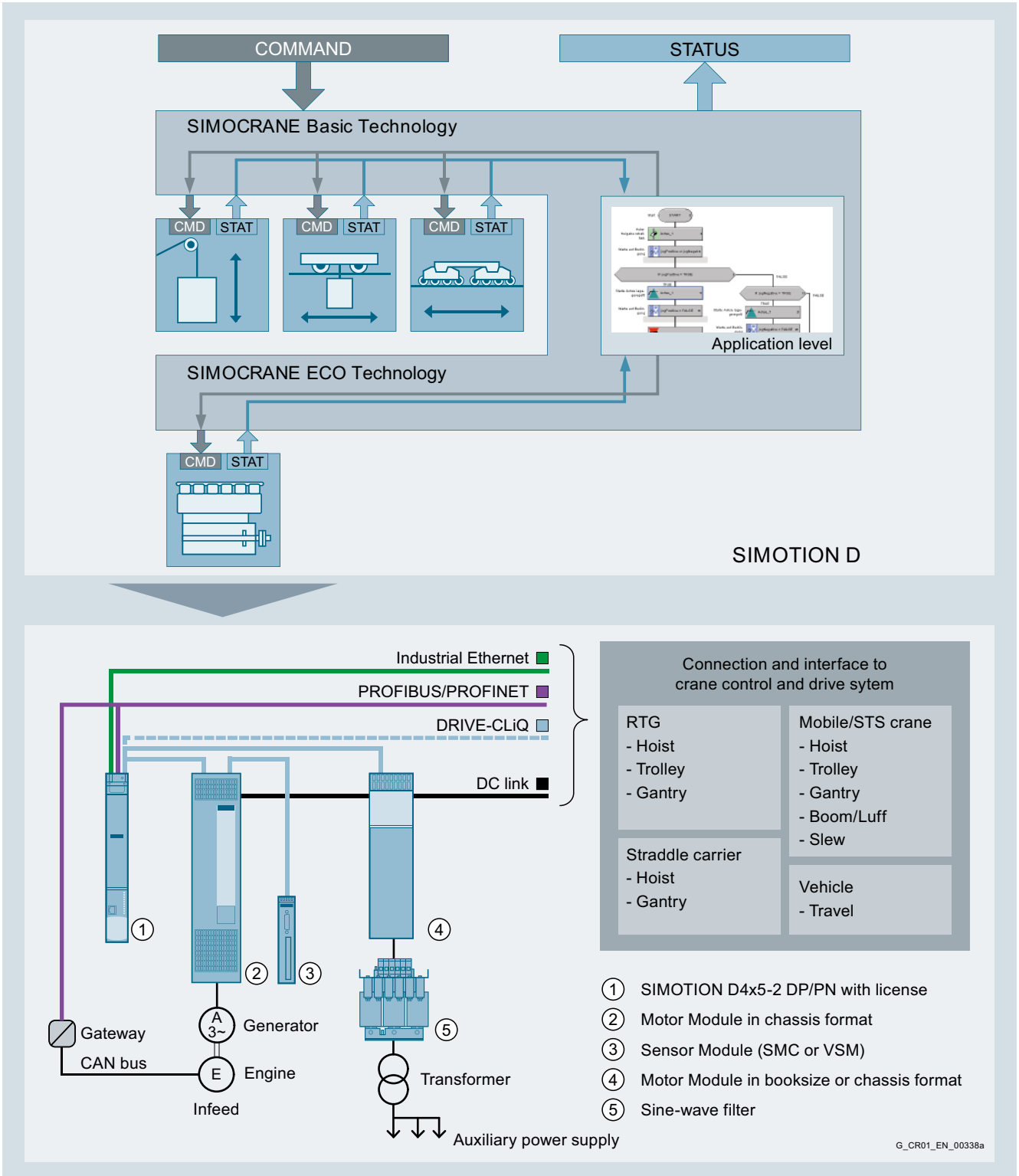
ECO Technology varies the speed of the engine in accordance with the actual energy required for the purpose of optimizing the fuel consumption. As compared with cranes operating with constant speed engines, or cranes with 2 speeds, fuel consumption is reduced in every operating mode.

Design (continued)

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:



SIMOCRANE ECO Technology configuration

Design (continued)

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 Modules. 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 infed voltage.

4. A stable auxiliary supply must be generated by a booksize or chassis converter with sinewave filter due to the variable input voltage and frequency. Selection must take into account the average power/current consumption and the maximum power/current consumption of all components connected to the auxiliary supply. It is important to note that the converter for the auxiliary supply must be operated at a pulse frequency of 4 or 8 kHz to reduce the voltage peaks. These pulse frequencies require derating of the converter output which must be taken into account on selection.

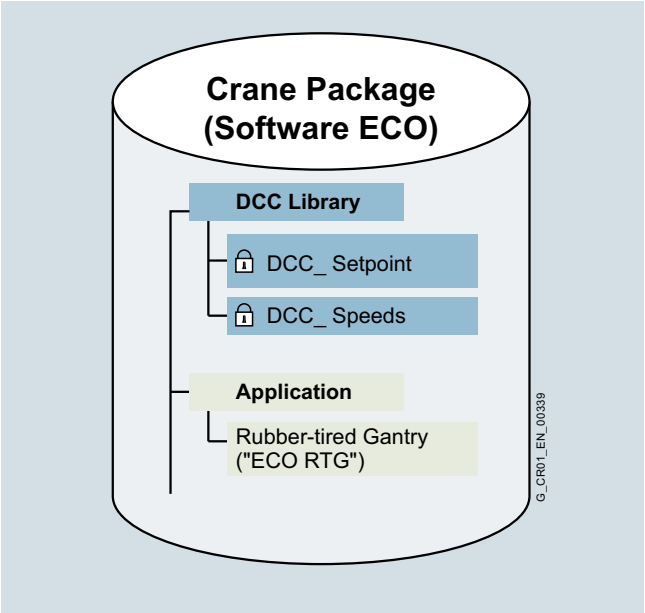
5. A suitable sinewave filter must be selected to ensure that the selected converter produces the cleanest possible auxiliary voltage. The SINAMICS Configuration Manual from Siemens contains extensive information and criteria to aid selection.

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 Comprising 1 package each of: • ECO Technology V1.0 license • DVD with - ECO Technology DCC blocks - Standard application - Documentation	**6GA7230-0AA00-0AA0**

Supplementary components

Description	Article No.
SIMOTION SCOUT V4.3 SP1	**6AU1810-1BA43-1XA0**
Option package	
Drive Control Chart (DCC) V2.2 SP1 for SIMOTION/SINAMICS	**6AU1810-1JA22-1XA0**

Drive systems, motors and connection systems for SINAMICS S120 are not included in the package (see "Chapter 6 Drive systems"). These components must be ordered separately.

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

- PM 21 – SIMOTION, SINAMICS S120 & SIMOTICS
- D 81.1 – SIMOTICS Low-Voltage Motors
- 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/

→ Product Support → (Enter search term) SIMOCRANE

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

https://support.industry.siemens.com/cs/

→ Application Examples → (Enter search term) Crane

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

https://support.industry.siemens.com/cs/

→ Product Support → (Enter search term) SIMOTION

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

https://support.industry.siemens.com/cs/

→ Product Support → (Enter search term) SINAMICS

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 Motion Control Web License Manager that guides the user step-by-step through the installation process.

http://www.siemens.com/automation/license

Training

Siemens Cranes offers crane-specific training courses:

http://www.siemens.nl/training/cranes

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 the SIMOCRANE CeSAR standalone or SIMOCRANE SC integrated system using the SIMOTION D Motion Controller and the SIMOCRANE Basic Technology.

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

Benefits

For the handling and transport tasks of cranes, the trend is toward an ever higher productivity and quality. This is achieved with an increasing number of automatic functions of which electronic sway control systems represent a large 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 drivers regardless of their experience

Application

The sway control system is for new crane controllers, but it can also be retrofitted to legacy crane controllers.

SIMOCRANE CeSAR Sway Control Systems can also be used in cranes in which drive technology from other suppliers is used.

The requirements for the use of SIMOCRANE Sway Control Systems are a crane controller as well as continuously controllable drives. In some cases, position sensors are necessary. In all cranes, sensors are required for the hoisting gear and for the axes to be positioned if automatic positioning is used.

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
- Slewing cranes (on request)

Design

Four different SIMOCRANE Sway Control Systems with varying functionality are available to meet the requirements of different applications. These systems can be expanded by a camera measuring system. The camera measuring system comprises a camera and a reflector. A 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**
Crane type	STS, GSU	STS, GSU	OHBC, Gantry Crane	OHBC, Gantry Crane
Operating modes				
• Manual mode (**MAN**)	✓	✓	✓	✓
• Positioning (**POS**)	✓	✓	✓	✓
• 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 either hoist or slewing gear	Trolley/gantry and either hoist or slewing gear
Hardware platform	SIMOTION D [1]	SIMOTION C	SIMOTION D [1]	SIMOTION C
Camera measuring system				
• Camera	SIMOCRANE CenSOR [2]	SIMOCRANE CenSOR [2]	SIMOCRANE CenSOR [2]	SIMOCRANE CenSOR [2]
• Reflector type [2]	Retroreflector	Retroreflector	Retroreflector	Retroreflector

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, overhead bridge 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 landscape. The system is currently available with the following functional scopes:

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

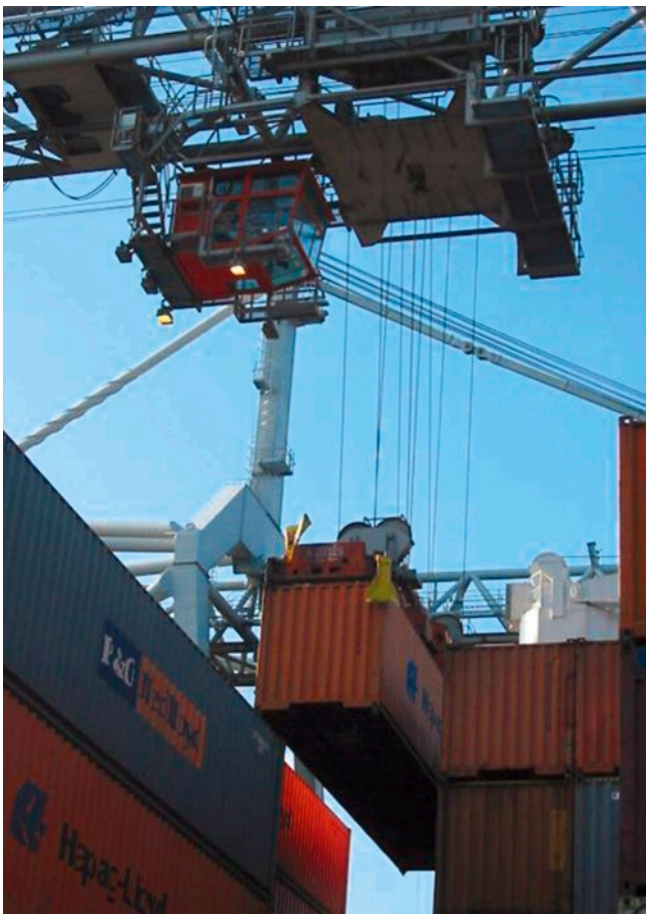
SIMOCRANE CenSOR camera measuring system

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

[1] Hardware not included in scope of supply, see Chapter 2 "SIMOCRANE Basic Technology".

[2] Separately available accessories.

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, swing angle and rotation 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 model are used.

Damping of the load is performed by influencing the traversing speed for each axis individually. When using the position control the defined 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 swaying resulting from the travel motion is largely eliminated. If a camera is also used, swaying 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 application areas:

- Manual mode (**MAN**)
- Positioning (**POS**)
- Sway neutralization
  - Load position (**SNL**[1])
  - Trolley position (**SND**[2])
- Trim, list and skew control (**TLS**)
- Skew damping
- Semi-automatic mode (**SAM**)

The mode is selected (depending on the functional scope) by the PLC by setting the appropriate operation mode 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 a halt.

Positioning (POS)

In the positioning mode, the higher-level controller or the internal setpoint 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.

Trim, list and skew control (TLS control)

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

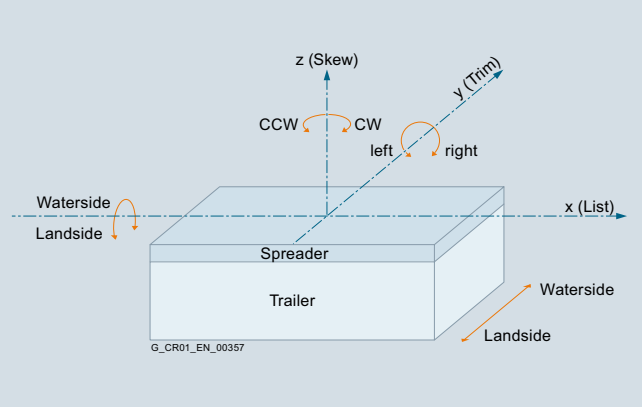
The TLS control function assumes that

- the length or
- the pivot points

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

[1] SNL: Sway neutralization load position
[2] SND: Sway neutralization position

Function (continued)



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 counterclockwise direction (skew). All of these TLS movements can be carried out simultaneously. The current positions of all 4 cylinders can be saved as zero positions and approached again. For TLS positioning, either the last TLS setting or the TL setting 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
  - TLS inching
- TLS Advanced modes
  - Cylinder inching
  - Approach zero position
  - TLS inching (also skew drive)
  - TLS positioning
  - 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 drive. The skewing motions are recorded by the camera. 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 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 a "path curve". The path curve 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 accurately. This operating mode can be used for ship to shore cranes (STS) and ship unloaders (GSU).

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 travel path is generated from the data about the blocked regions. Both axes (trolley and hoist) must be operated in the internal semi-automatic mode.

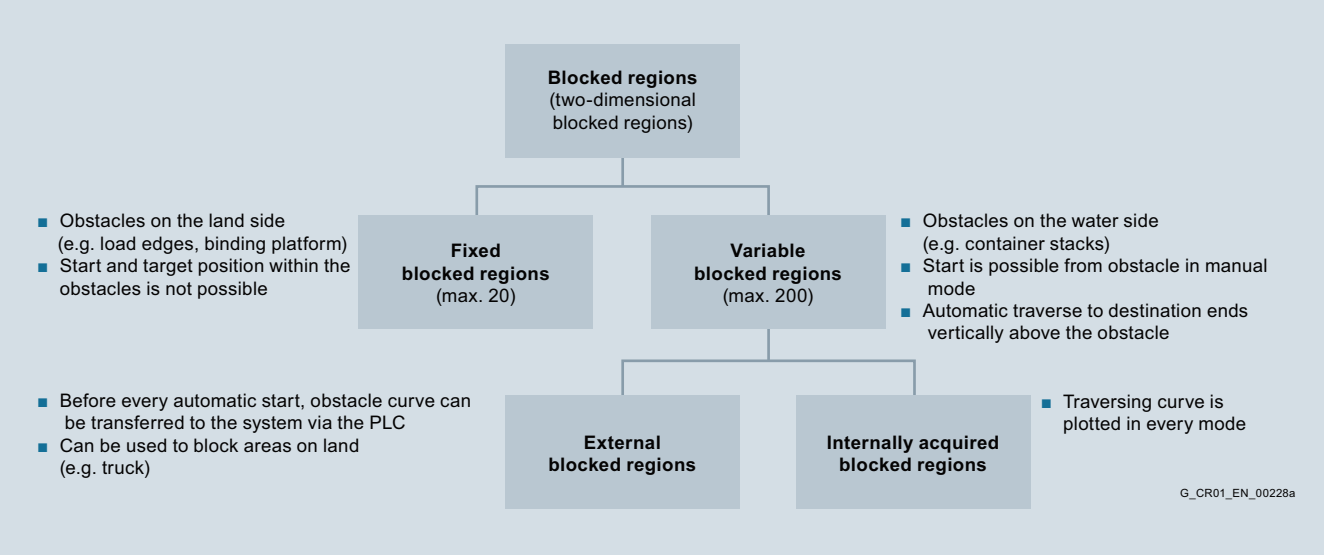
The container stack can be specified externally by the crane controller or acquired internally (taught).

The path curve 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.

Function (continued)

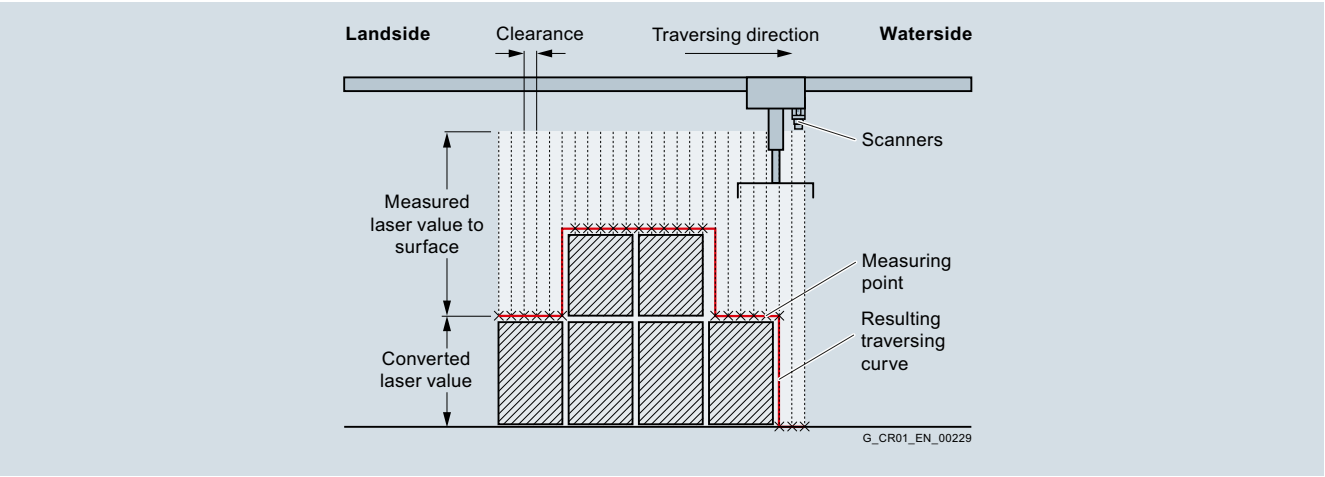
The types of blocked regions and their purposes are shown in the following graphic.



Layout of blocked regions

If a bay scanner is also 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 floor = NULL 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 measurement sensor

Function (continued)

Additional functions in the grab crane application area

Position control with on-the-fly unloading

In the grab crane application (GSU) on-the-fly unloading utilizes the swinging of a grab when unloading bulk goods in order to reduce turnover time. The trolley is stopped before the target position while the grab swings to the target (e.g. funnel). The speed characteristic is calculated so that the grab is above the target position exactly when the trolley stops. The swinging movement is then at its turning point. If the trolley stops now, the grab swings back in the opposite direction.

Grab crane (GSU)

Additional functions for application OHBC, Gantry crane

This application includes overhead bridge cranes (OHBC) and gantry cranes, as well as RTGs and RMGs with two axes in the plane (trolley, gantry) and an additional axis (either slewing gear or 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, e.g. from manual mode to positioning mode and vice versa, while the axis is moving.

Each axis moves independently from the other axes.

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/

→ Product Support → (Enter search term) SIMOCRANE

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

https://support.industry.siemens.com/cs/

→ Application Examples → (Enter search term) Crane

Training

Siemens Cranes offers crane-specific training courses:

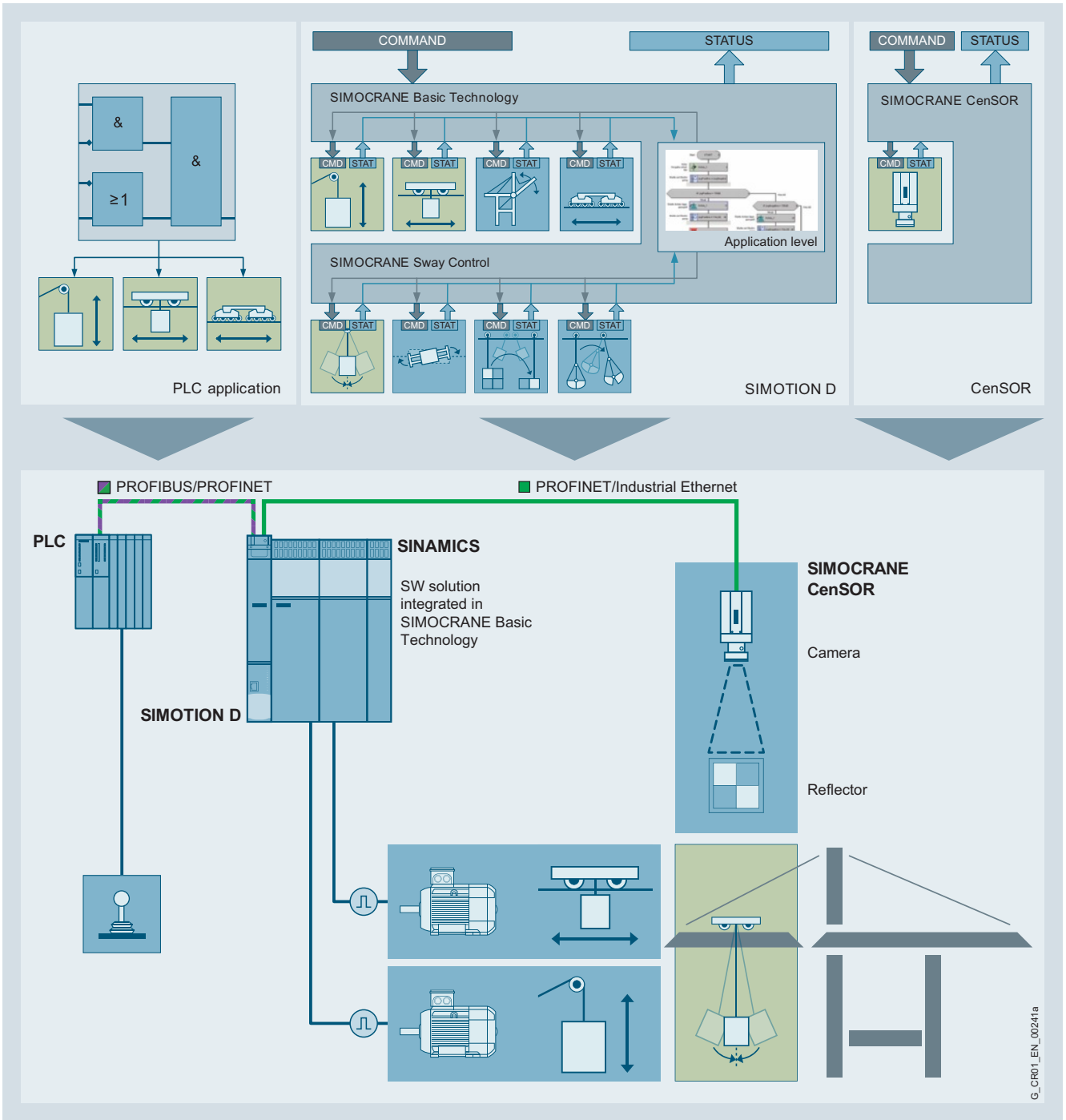
http://www.siemens.nl/training/cranes

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 Control Unit SIMOTION D435-2 DP/PN. Special sway-control blocks are combined with Basic Technology 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 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 supplied SIMOCRANE CeCOMM diagnostics program.



Configuration of SIMOCRANE SC integrated for an STS application

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 • CD-ROM with - Software - Documentation - S7 project example - Configuration examples	• Advanced Control with operating modes: Basic Control, SAM, TLS Advanced • CD-ROM with - Software - Documentation - S7 project example - Configuration 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 • CD-ROM with software, documentation, S7 project example and configuration examples	**6GA7200-0AA01-0AA0**
Advanced Control for SIMOCRANE SC integrated STS, GSU consisting of • License with operating modes: Basic Control, SAM, TLS Advanced • CD-ROM with software, documentation, S7 project example and configuration examples	**6GA7200-0AA01-1AA0**

For the description of the operating modes, see Page 3/8.

SIMOCRANE CeSAR standalone STS, GSU Sway Control System

Design

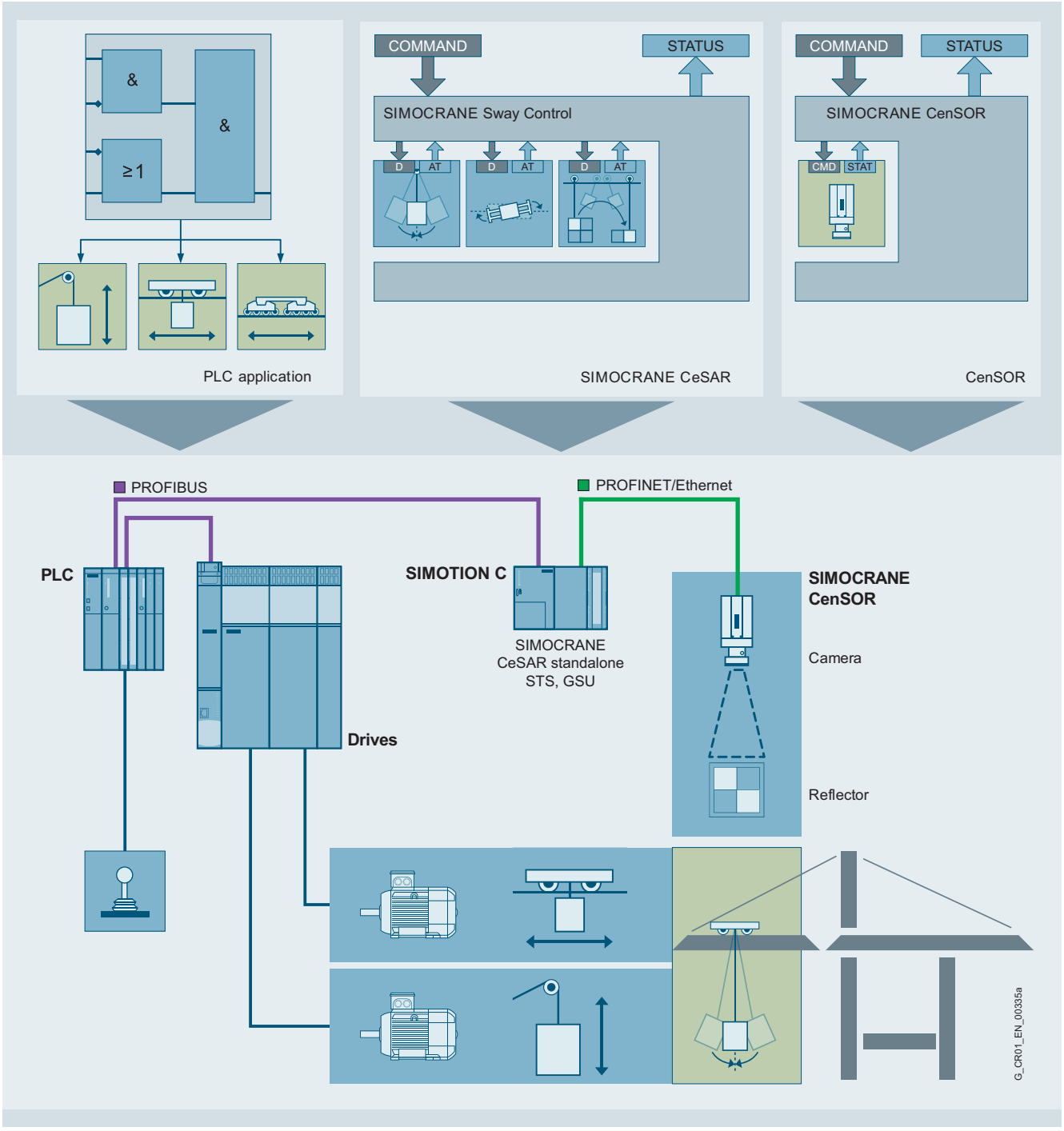
This is a standalone solution. The SIMOCRANE CeSAR standalone STS, GSU communicates with the crane controller (PLC) tasked with providing motion control functionality via the PROFIBUS-DP interface.

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

- SIMOTION C240 PN with integrated PROFIBUS 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

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) • 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) • Standard mounting rail • License certificate • CD-ROM with documentation and S7 project example	**6GA7200-1AA01-1AA0**

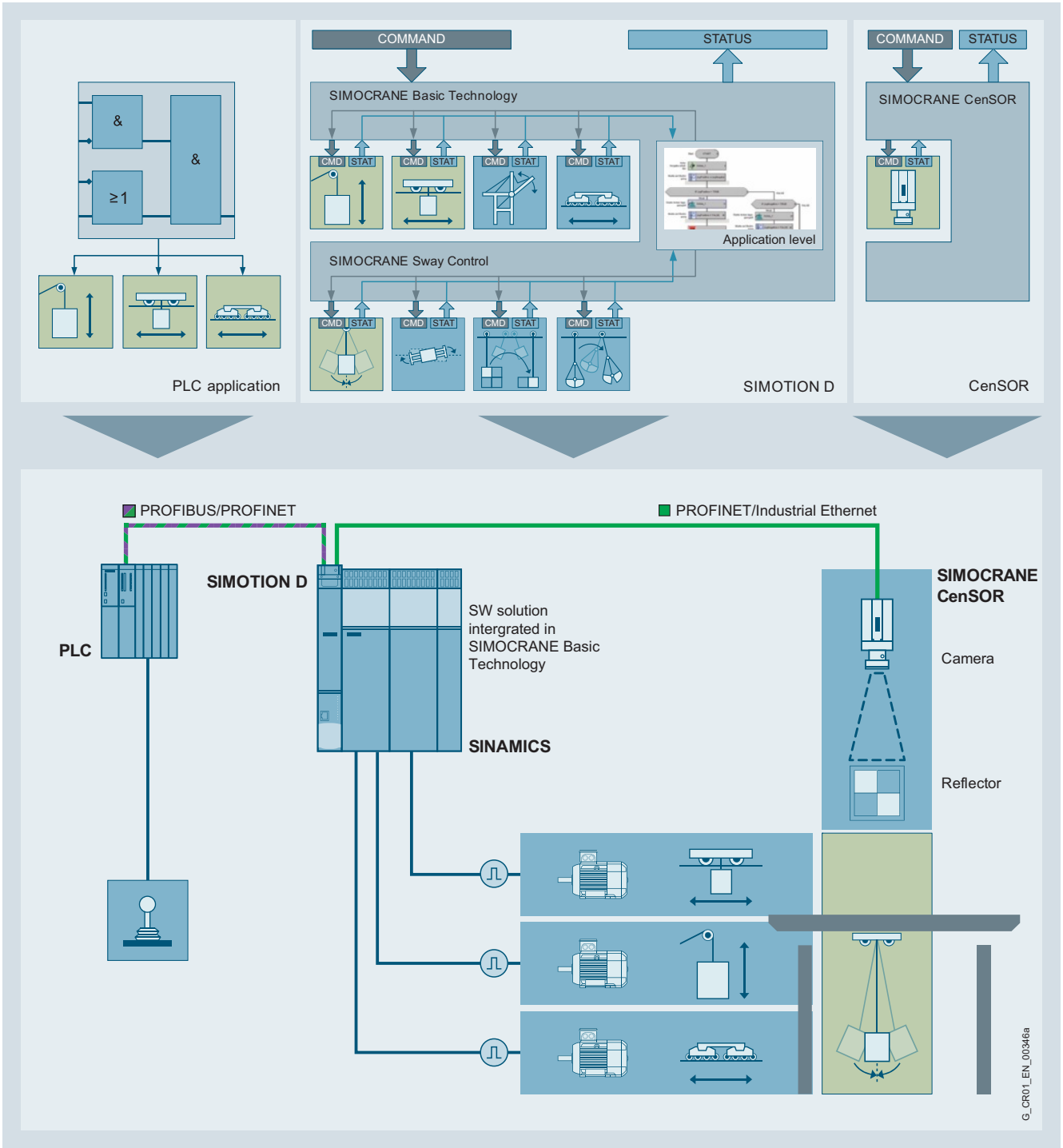
For the description of the operating modes, see Page 3/8.

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 Control Unit SIMOTION D435-2 DP/PN. Special sway-control blocks are combined with Basic Technology 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 supplied SIMOCRANE CeCOMM diagnostics program.



Configuration of SIMOCRANE SC integrated for a bridge crane application

Design (continued)

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.

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 - Configuration example	• Manual license with operating modes: MAN • CD-ROM with - Software - Documentation - S7 project example - Configuration 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, configuration 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, configuration example	**6GA7200-0AA00-2AA0**

For the description of the operating modes, see Page 3/8.

SIMOCRANE CeSAR standalone OHBC, gantry crane Sway Control System

Design

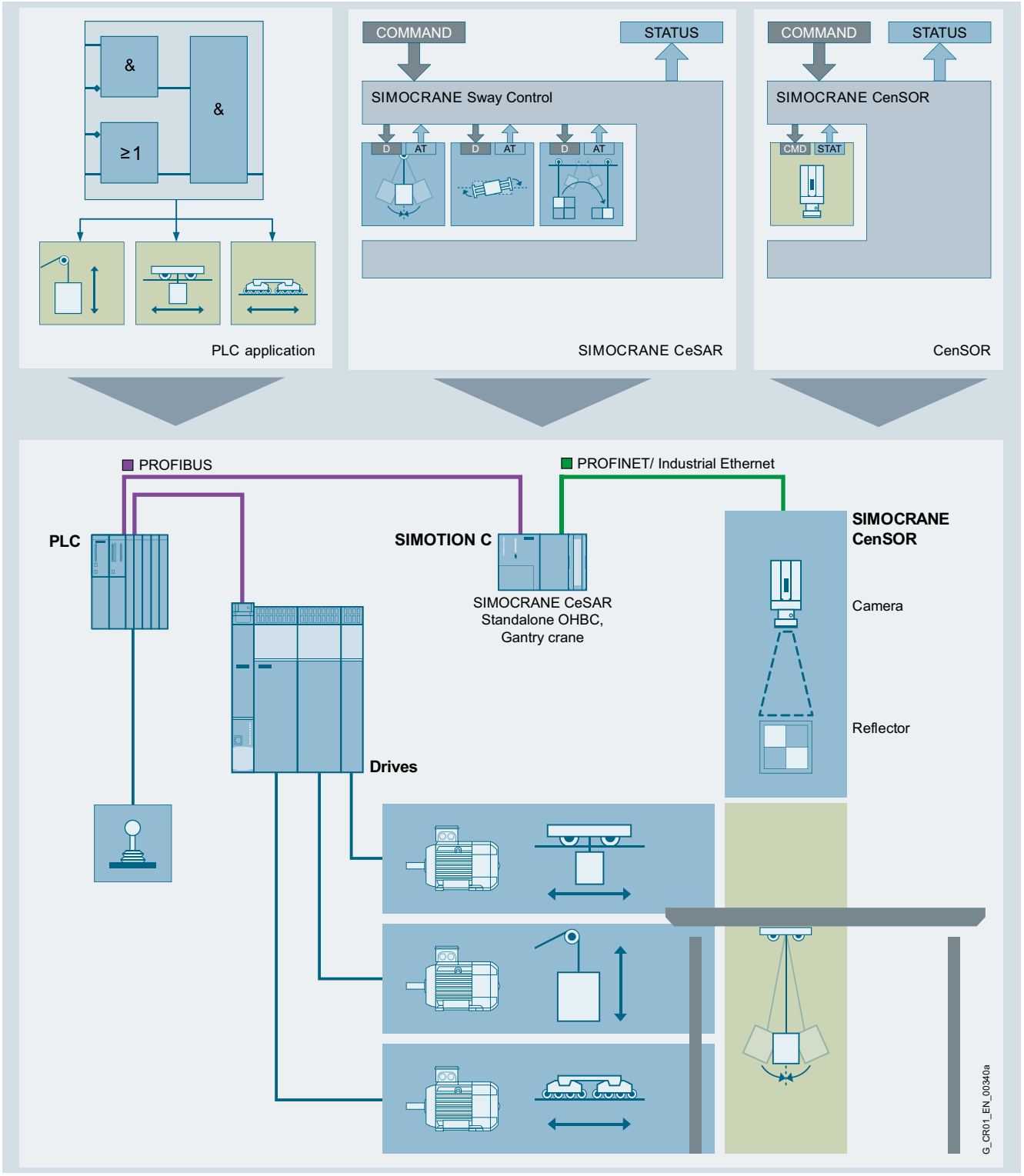
The sway control system is a standalone solution. The SIMOCRANE CeSAR standalone OHBC, gantry crane communicates with the crane controller (PLC) tasked with providing motion control functionality via the PROFIBUS-DP interface.

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

- SIMOTION C240 PN with integrated PROFIBUS 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 SIMOCRANE CeCOMM diagnostics program.



Configuration SIMOCRANE CeSAR standalone OHBC, gantry crane

Design (continued)

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.

Technical specifications

Product designation	**SIMOCRANE CeSAR standalone OHBC, gantry crane Sway Control System**	
Type	6GA7200-1AA00-0AA0	6GA7200-1AA00-2AA0
Scope of delivery	• SIMOTION C240 PN • MMC card (SW + license for operating modes: MAN, POS, SNL/SND) • Standard mounting rail • License certificate • CD-ROM with - Documentation - S7 project example	• SIMOTION C240 PN • MMC card (SW + license for operating mode: MAN) • Standard mounting rail • License certificate • CD-ROM with - Documentation - S7 project example

Selection and ordering data

Description	Article No.
Basic license for SIMOCRANE CeSAR standalone OHBC, gantry crane consisting of • SIMOTION C240 PN • MMC card (SW + license for operating modes: MAN, POS, SNL/SND) • Standard mounting rail • License certificate • CD-ROM with software, documentation and S7 project example	**6GA7200-1AA00-0AA0**
Manual license for SIMOCRANE CeSAR standalone OHBC, gantry crane consisting of • SIMOTION C240 PN • MMC card (SW + license for operating mode: MAN) • Standard mounting rail • License certificate • CD-ROM with documentation and S7 project example	**6GA7200-1AA00-2AA0**

For the description of the operating modes, see Page 3/8.

3

Design

SIMOCRANE CenSOR camera measuring system

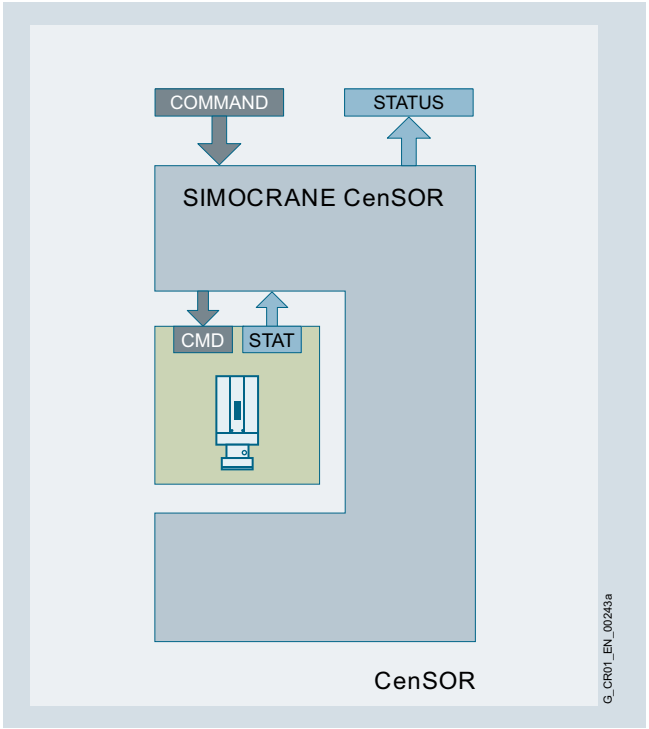
Depending on the task to be performed and the environmental conditions, sway control systems can be implemented with or without camera measuring systems. If a camera is used, it has the task of observer for detecting deviations in the ideal sway response for the situation.

SIMOCRANE CenSOR is a camera measuring system which is typically deployed for cranes in order to determine the position of a marker at distances ranging from 1 to 55 m.

The standard model of the SIMOCRANE CenSOR camera measuring system consists of a camera with integrated processing unit, an integrated infrared flash (in different versions) and a retroreflecting reflector whose size is determined by the maximum distance between reflector and camera.

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

- Outdoor variant: The camera is installed in a stainless-steel housing. This variant is suitable for outdoor applications.
- Indoor variant: The camera is supplied without an enclosure and is ideally suited to applications inside buildings. This variant is only available for the 16 mm lens with a 10 m cable.



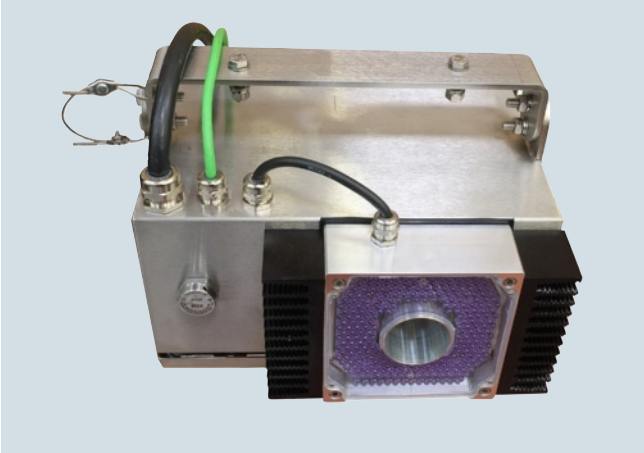
SIMOCRANE CenSOR camera measuring system

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

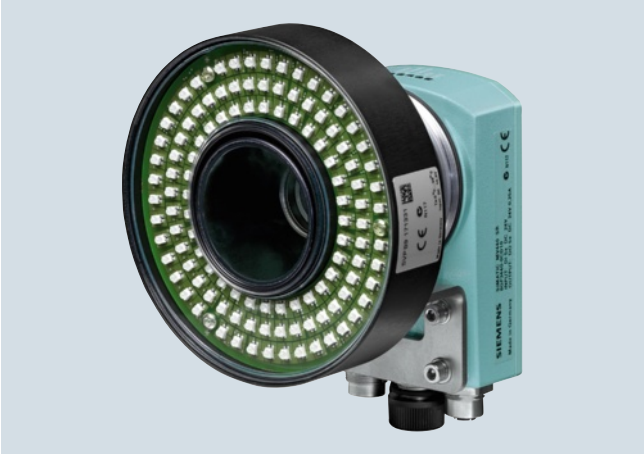
The dimensions of the reflector are dependent on the maximum distance to be measured by the camera. The camera measuring system determines the offset of the reflector in a plane perpendicular to the camera axis and the rotation of the reflector.

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

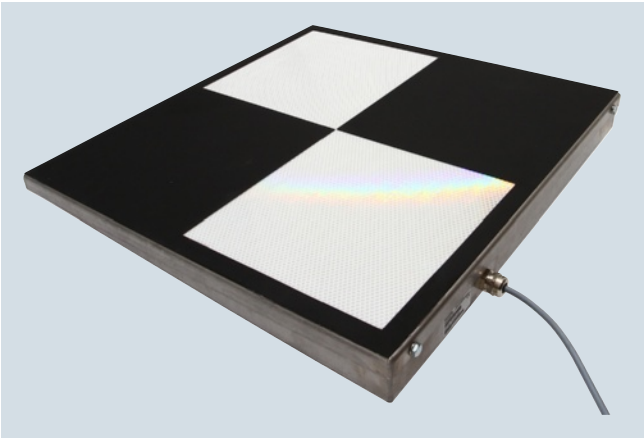
The reflectors are equipped with a heating system to melt snow.



SIMOCRANE CenSOR camera measuring system for outdoor use



SIMOCRANE CenSOR Indoor camera measuring system for indoor use



Retroreflecting reflector with heater

Technical specifications

SIMOCRANE CenSOR camera measuring system

Product designation		**SIMOCRANE CenSOR V2.0**		
Type		6GA7202-1AA10-0..1	6GA7202-1AA10-1..1	6GA7202-1AA22-0BA1
		Camera measuring system for SIMOCRANE Sway Control System	Camera measuring system for SIMOCRANE Sway Control System	Camera measuring system for SIMOCRANE Sway Control System
Version		Outdoor	Outdoor	Indoor
Image capture • Lens	 mm	 16 CCD chip 1/3", 640 × 480, square pixels, full frame shutter	 25 CCD chip 1/3", 1024 × 768, square pixels, full frame shutter	 16 CCD chip 1/3", 640 × 480, square pixels, full frame shutter
Image data transfer		Triggered image capture	Triggered image capture	Triggered image capture
Input voltage range	V	DC 24 +20 … -15 %	DC 24 +20 … -15 %	DC 24 +20 … -15 %
Max. current consumption (at 24 V DC)	mA	270 (without I/O signals)	270 (without I/O signals)	270 (without I/O signals)
Switch-on current I_1		Max. 2 A, < 1 ms	Max. 2 A, < 1 ms	Max. 2 A, < 1 ms
Mains buffering time (at 24 V DC)	ms	10	10	10
Digital output signals				
Load current, max. (floating and short-circuit-proof)	mA	50	50	50
Short-circuit current, max.	mA	240	240	240
Delay times during switch ON and switch OFF	ms	0 … 2	0 … 2	0 … 2
Camera enclosure • Supply voltage		Yes, stainless-steel enclosure 24 V DC/10 A pulse-resistant	Yes, stainless-steel enclosure 24 V DC/10 A pulse-resistant	–
Permissible ambient temperature • Ambient temperature • Storage	 °C °C	 -25 … +50 -30 … +70	 -25 … +50 -30 … +70	 ±0 … +50 -30 … +70
Dimensions • Width • Height • Depth	 mm mm mm	 300 215 250	 300 215 250	 120 150 100
Degree of protection		IP54	IP54	IP67
Weight, approx.	kg	17.2 (without connection cable)	17.2 (without connection cable)	1 (without connection cable)

Reflector

Product designation		**SIMOCRANE CenSOR retroreflector**	
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 • Operation	 °C °C	 -30 … +70 -25 … +70	 -30 … +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 • Height • Depth	 mm mm mm	 312 312 72	 504 504 78
Weight, approx.	kg	4.6	10.7
Integration in the crane controller		See Operating Manual	See Operating Manual
Scope of delivery		Reflector	Reflector

3

Technical specifications (continued)

Reflectors and lenses for SIMOCRANE CenSOR camera measuring systems

The lenses and reflector used depend on the hoisting height of the crane. For higher accuracy requirements, a lens with a larger focal length can be used. This, however, reduces the measuring range because of the smaller aperture angle.

Focal length of the lens	**16 mm (standard)**	**25 mm**
Resolution (relative to the distance)	0.12 mm/m	0.08 mm/m
Image length in the X direction (trolley)	17°	11°
Image length in the Y direction (hoist)	13°	8°
Measuring range in the X direction (relative to the distance)	292 mm/m	187 mm/m
Measuring range in the Y direction (relative to the distance)	216 mm/m	138 mm/m
Maximum hoisting height		
Retroreflectors		
Retroreflector 300 × 300	Up to 23 m	Up to 37 m
Retroreflector 500 × 500	Up to 35 m	Up to 55 m

Selection and ordering data

Description	Article No.
SIMOCRANE CenSOR V2.0 camera measuring system	
Outdoor camera for sway angle measurement in stainless-steel housing	
• with 16 mm lens (standard) and 5 m supply cable for the camera	**6GA7202-1AA10-0AF1**
• with 16 mm lens and 15 m supply cable for the camera	**6GA7202-1AA10-0BF1**
• with 16 mm lens and 25 m supply cable for the camera	**6GA7202-1AA10-0CF1**
• with 25 mm lens and 5 m supply cable for the camera	**6GA7202-1AA10-1AF1**
• with 25 mm lens and 15 m supply cable for the camera	**6GA7202-1AA10-1BF1**
• with 25 mm lens and 25 m supply cable for the camera	**6GA7202-1AA10-1CF1**
SIMOCRANE CenSOR V2.0 camera measuring system	**6GA7202-1AA22-0BA1**
Indoor camera for sway angle measurement, without housing, and with 16 mm lens and 10 m cable	
SIMOCRANE CenSOR retroreflector	
• 300 × 300 mm, with heating	**6GA7201-1AA01-0AA0**
• 500 × 500 mm, with heating	**6GA7201-1AA02-0AA0**

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
- Focus on the single axis solution with AC/AC drive and corresponding SINAMCIS Power Module PM340, Power Module in chassis format and Power Module PM250
- Pre-configured standard applications for trolley or gantry with control via PROFIBUS DP or 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)

SIMOCRANE Drive-Based Sway Control can be applied with or without 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
- Fast commissioning
- Use of standard applications
- Low cost

Application

SIMOCRANE Drive-Based Technology meets the challenges of mid-performance cranes in harbor 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 trolley and gantry

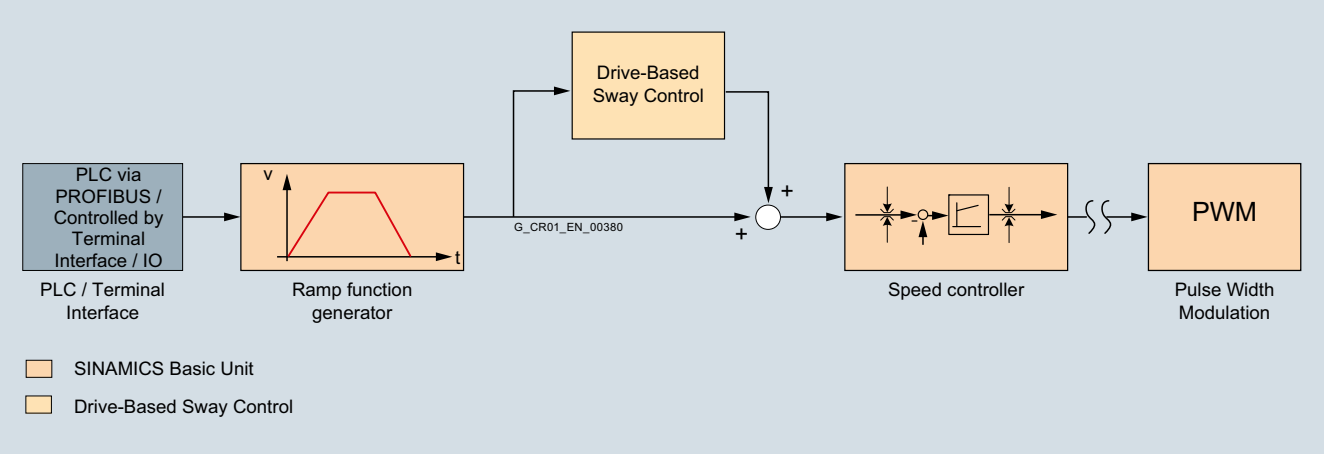
- AC/AC drive comprises SINAMICS CU310-2 Control Unit and PM250/PM340/PM Power Module in chassis format with SINAMICS V4.7 Cranes
- Selectable control via onboard I/O terminals or PROFIBUS
- An encoder for Hoist is request for providing pendulum length of trolley and gantry
- Encoders for trolley and gantry are recommend to insure the Sway Control performance

3

Design (continued)

Application configuration

The SIMOCRANE Drive-Based Sway Control is directly embedded in SINAMICS S120 by using CU310-2 DP Cranes. The following figure shows schematically the software structure after the integration of drive-based Sway Control into the SINAMICS setpoint channel.



Technical specifications

Product designation	**SIMOCRANE Drive-Based Sway Control**
Type	6GA7280-1AA10-0AB0
Scope of delivery	• CompactFlash card (CF card) with crane-specific firmware version for SINAMICS S120 (V4.7 HF11 Cranes) • DVD with: - STARTER installation file for Drive-Based Sway Control - Product documentation - License certificate - Readme files - Application examples and description

Selection and ordering data

Description	Article No.
SIMOCRANE Drive-Based Sway Control includes • CompactFlash card (CF card) with the crane-specific firmware version for SINAMICS S120 (V4.7 HF11 Cranes) • DVD with - STARTER installation file for Drive-Based Sway Control - Product documentation - License certificate - Readme files - Application examples and description	**6GA7280-1AA10-0AB0**

Supplementary components

Description	Article No.
SINAMICS S120 Control Unit CU310-2 DP	**6SL3040-1LA00-0AA0**
SINAMICS Terminal Module TM31	**6SL3055-0AA00-3AA1**
SINAMICS STARTER V4.4 HF3 (DVD)	**6SL3072-0AA00-0AG0**
DCC SINAMICS V2.3 (Full lizenz)	**6AU1810-1HA23-0XA0**

Drive systems, motors and connection systems for SINAMICS S120 are not included in the package (see Chapter 6 Drive systems). These components must be ordered separately.

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

- D 31 – SINAMICS and Motors for Single-axis Drives
- PM 21 – SIMOTION, SINAMICS and Motors for Production Machines
- D 81.1 – Low-voltage motors, IEC squirrel-cage motors
- IK PI – Industrial communication, distributed I/O, PROFIBUS

More information

Siemens product support

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

https://support.industry.siemens.com/cs/

→ Product Support → (Enter search term) SINAMICS

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/de/ps/20087

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 Motion Control Web License Manager.

http://www.siemens.com/automation/license

Training

Siemens Cranes offers crane-specific training courses:

http://www.siemens.nl/training/cranes

Overview

Harbor crane system with trucks

Vehicles, e.g. trucks when handling containers, must be loaded and unloaded without problems and without delays. This requires fast and accurate positioning of the truck below the crane.

Many terminal operators resolve this problem with personnel who guide the truck drivers using hand signals. Or they assign the responsibility to the truck drivers, and must rely on their judgment. This method has a detrimental effect on the positioning tasks, especially on personnel safety and on the duration of positioning tasks.

With SIMOCRANE TPS (truck positioning system), the positioning tasks can be performed accurately and without any delays. The trucks are scanned and measured on arrival at the crane. The data for the remaining distance to the target position is transferred to the crane controller and routed from there to a signal unit, e. g. a traffic light system. The truck drivers are safely and accurately guided to the target position by the signal unit.

Benefits

The use of SIMOCRANE TPS provides the following advantages:

- Reduced risk to personnel and machines. Checkers are no longer necessary
- Time is saved when parking the transport vehicles
- The target position is accurately determined depending on the mode of operation, load and target vehicle
- The degree of automation of a crane is increased when SIMOCRANE TPS is combined with other technology functions (e.g. SIMOCRANE Sway Control Systems)
- Two-lanes mode: The sensor controller can work with two 3D sensors simultaneously. Two trucks can be processed simultaneously (tandem mode)
- Flexible implementation: The trucks are detected from both sides regardless of the direction of travel
- Simple operation for crane drivers and truck drivers
- Maximum time for parking available due to optimum installation position of the 3D sensor; mounting position under the gantry ensures optimal view of the working area.

Application

SIMOCRANE TPS is implemented in applications in which terminal trucks and/or ISO containers have to be positioned with a high degree of accuracy below a container quay crane.

Design

Hardware

SIMOCRANE TPS consists of the following hardware components:

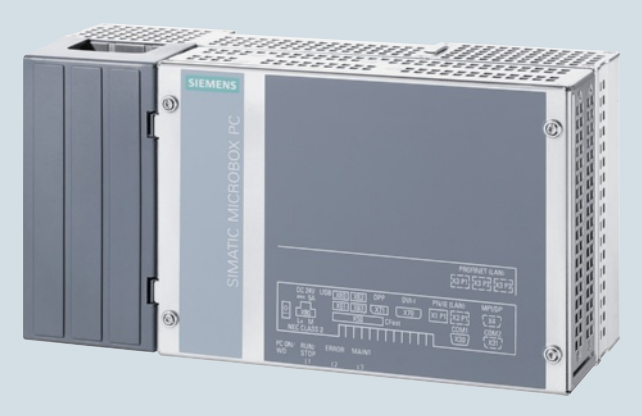
- Sensor controller
- 3D sensor

The sensor controller is based on a SIMATIC Industrial PC. The sensor controller is connected to the 3D sensor via two interfaces:

- RS422 interface for the 2D laser measurement sensor
- CAN interface for the servo motor

You can connect up to two 3D sensors to a sensor controller.

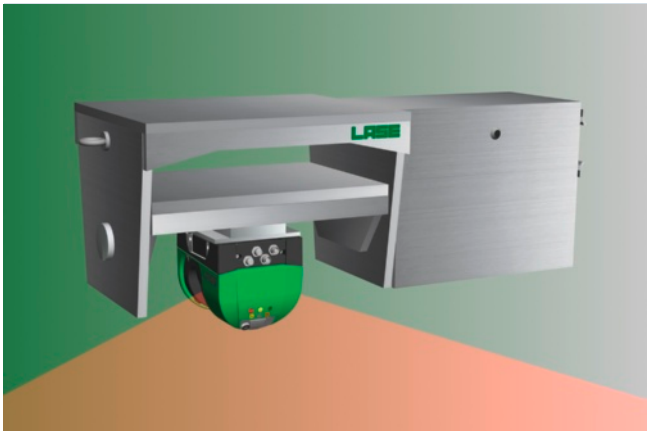
The sensor controller is connected to the crane controller via Ethernet. The sensor controller is installed in a control cabinet for instance in the electrical room of the crane. It is advisable to install the sensor controller as close as possible to the 3D sensors to minimize the length of supply cables.



SIMOCRANE TPS sensor controller

The 3D sensor comprises a 2D laser measurement sensor and a mechanical swiveling platform. The swiveling platform is moved by a high-precision servo motor. The data is exchanged over an RS422 connection for every 2D laser measurement sensor and over a CAN Bus connection for the servo motors.

An external RS422 interface [1] is required for the communication between the SIMOCRANE TPS 3D sensor and the SIMOCRANE TPS sensor controller. The driver of this interface adapter is already installed on the SIMOCRANE TPS V1.2 sensor controller.

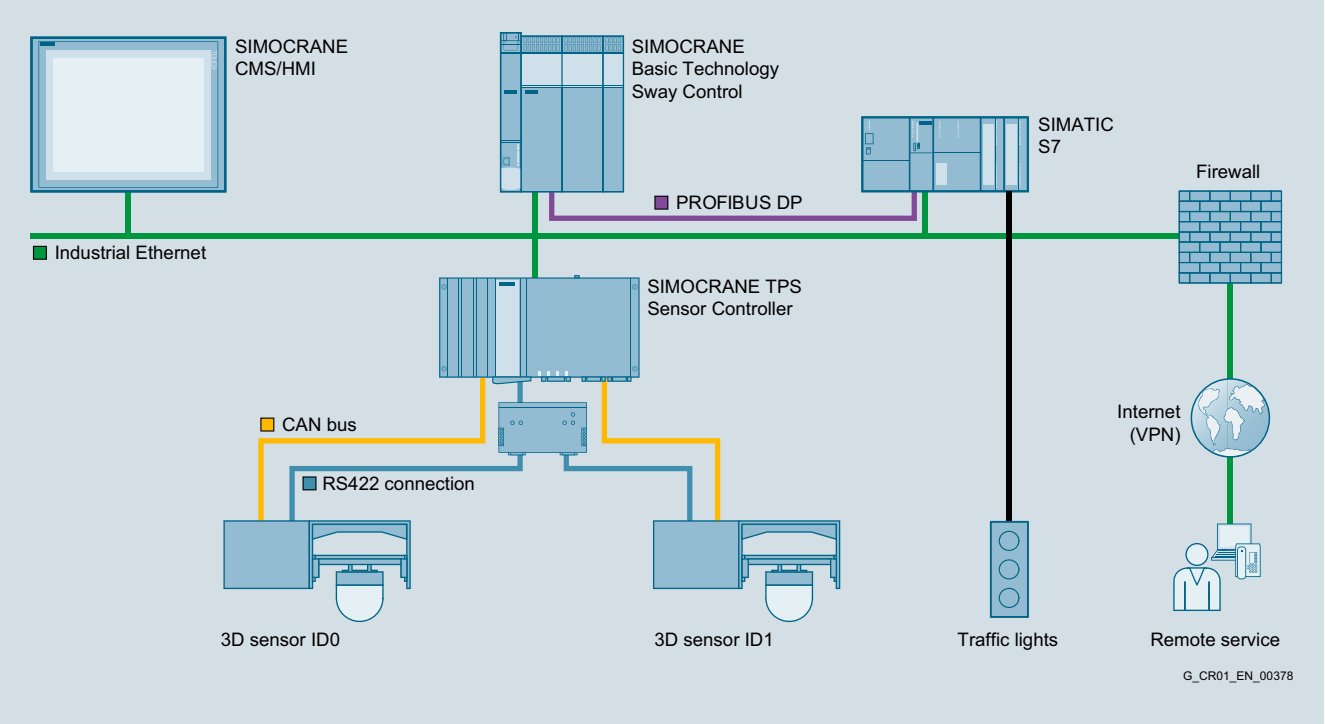


3D sensor

[1] The interface adapter USB-2COMi SI-M is not contained in the scope of supply of SIMOCRANE TPS V1.2 sensor controller. Further Information about this adapter can be found in the SIMOCRANE TPS V1.2 operator's manual and the data sheet of the VSCOM interfaces.

Design (continued)

The following overview graphic shows an example configuration of SIMOCRANE TPS with sensor controller and two 3D sensors:



SIMOCRANE TPS topology – crane system

Design (continued)

Software

The SIMOCRANE TPS software consists of the following two software components:

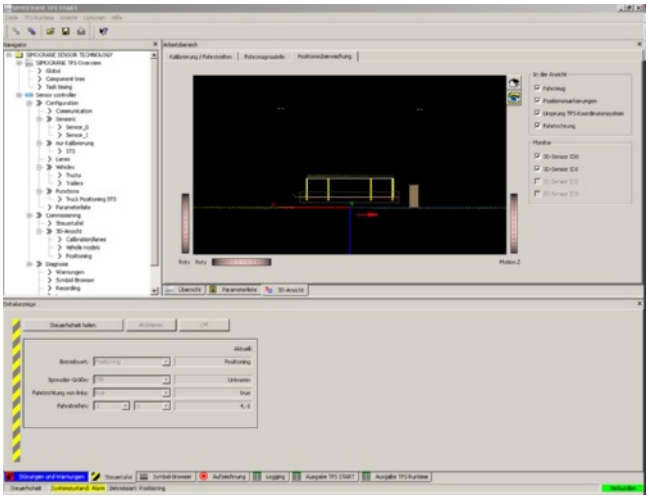
- TPS Runtime
- TPS START

Both software components run on the sensor controller under the Windows operating system.

The TPS Runtime software controls the 3D sensors, evaluates the scan data and calculates the target positions for the parameterized objects (trucks, trailers and containers). The resulting data is supplied via the OPC interface of the crane controller. In addition to this data, the interface also returns error messages and diagnostic information.

The TPS START software is the commissioning tool for SIMOCRANE TPS. As the performance capability of a system grows, so too do the requirements for its user friendliness. This is the only means of ensuring simple handling of the system. For this reason, particular attention was paid to the user friendliness of TPS START:

- The system can be configured simply by means of the parameter list.
- All models are displayed almost completely in graphic form using a 3D graphic display.
- In most cases, the basic functions can be tested using an operator panel without actual crane data.
- The "Error and warnings" tab displays a clear overview of the current system status.



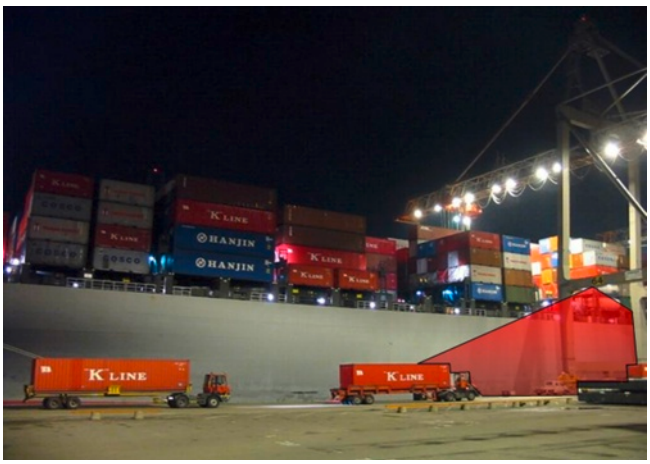
SIMOCRANE TPS START

Notes:

SIMOCRANE TPS does not intervene actively in the crane's process; it simply provides information. The system must therefore be regarded as an intelligent sensor. SIMOCRANE TPS is an assistance system for the crane and truck driver. The crane controller continues to be responsible for controlling the crane, and in particular for the control of the signaling unit (e.g. traffic light, display). Signal units are not contained in the scope of supply of SIMOCRANE TPS.

A virus scan cannot be run while the TPS Runtime is running. A system virus scan would have a negative impact on system performance and on TPS Runtime. This means no virus scanner is available on the SIMOCRANE sensor controller. We strongly recommend that you check the sensor controller for viruses at regular intervals, e.g. during the maintenance of your IT, and protect your company network with a firewall.

Function



Container handling

3D sensors are mounted on the crane. They are controlled and evaluated by the TPS runtime software. These 3D sensors are precisely aimed at the target area.

The core of SIMOCRANE TPS is the sensor controller. This controller performs the following tasks:

- Controls the 3D sensors
- Collects the raw data from the scanner and detects the scanned objects
- Detects the known vehicle types
- Processes logic for the operating sequences (parking procedure)
- Provides a command and data interface to the crane controller and for operation

TPS sequence

The 3D sensors acquire vehicles to be parked in their lane when they are approximately 20 m from the target point. From this point onwards, the vehicles are identified in terms of the loaded container size(s) or the characteristics of the trailer on which the container should be placed.

Once the truck/the container trailer or the container size(s) have been identified, the distance to the target position is calculated. This depends on various factors:

- Container size and spreader setting
- Characteristics of the container trailer
- Operating mode of SIMOCRANE TPS

The data are continuously transferred to the crane controller as a setpoint specification for positioning the vehicles.

Function (continued)

Preparations for use

The SIMOCRANE TPS has a very simple operator interface. The crane driver switches the system on and makes the following settings:

- Selects the vehicle lane
- Selects the vehicle approach direction

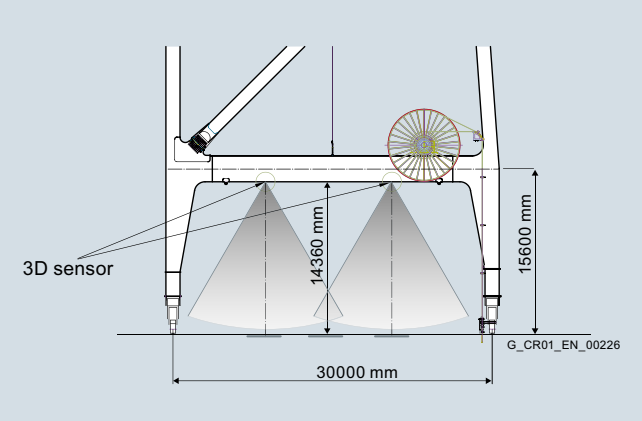
The type of vehicle and the position of the container (front, center or rear) are determined by SIMOCRANE TPS itself.

Several factors must be considered for the use of SIMOCRANE TPS:

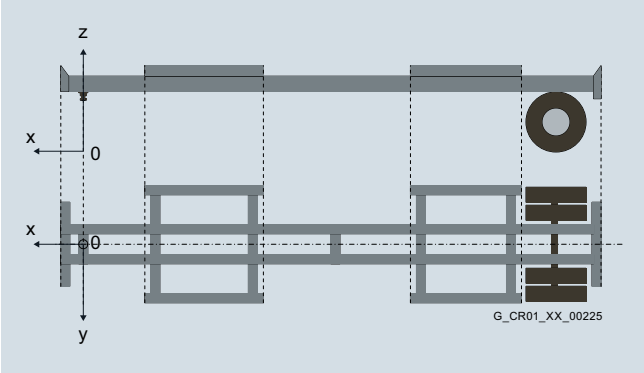
- Dimensions of the crane
- Mounting height of the 3D sensors

  Assuming that the usual mounting height of the 3D sensors is 14 m above the loading point, the range of the approach route is about 20 m on both sides.
- Container trailers used

  The characteristics and the dimensions of the vehicles to be detected by SIMOCRANE TPS must be entered in SIMOCRANE TPS START. The system uses the parameters to generate an object database.



Cross-section of the crane system



Typical design of a container trailer

- Number of different vehicle types

  The maximum number of vehicle types that can be recognized varies in accordance with the geometric dimensions. The less the dimensions between the vehicle types vary, the fewer types (models) can be distinguished. SIMOCRANE TPS V1.2 can distinguish between a maximum of 5 models of truck and 9 models of container trailer.
- Sequence of operations under the crane

  One or two 3D sensors will be required depending on the sequence of operations and the required reaction speed.
- Operational area with regard to contamination effects, weather effects and mechanical shocks
- Accessibility of 3D sensors for maintenance and service purposes (e.g. platform or stairways).

Note:

The system is based on optical sensors and is primarily affected by all effects that influence or impair the visibility of the target objects.

The system can only function with known vehicles. The system will only identify vehicles which are stored as models in TPS START. The system is incapable of identifying unknown vehicles.

Technical specifications

Product designation	**SIMOCRANE TPS V1.2 Sensor controller**
Type	6GA7220-1AA00-0AC0
SIMATIC Embedded industrial PC	
General technical specifications	
Installation	On standard rail
Supply voltage	DC 24 V 1 (-20 %/+20 %), electrically isolated
Short-time voltage interruption acc. to Namur	Min. 15 ms (at 20.4 V) Max. 10 events per hour; recovery time min. 1 s
Power input, max.	64.8 W (for 24 V)
Operating system	Windows 7
Processor	Intel Core i7-3517UE 1.7 GHz, 4 MB SLC
Main store	SO-DIMM Module, 4096 MB DDR3-SDRAM
Hard disk	1 × 2,5" SATA-SSD, 80 GB
Interface	
CAN-PCIe/402-2	• 2 × CAN (CAN 1, CAN 2)
PROFINET	• 3 × RJ45 connection, CP1616 compatible, onboard interface based on ERTEC 400, 10/100 MBit/s electrically isolated
USB	• 4 × USB 3.0, simultaneously operating of max. 2 high current
Ethernet	• 2 × Ethernet interface (RJ45) Intel 82579LM and Intel 82574L • 10/100/1000 MBit/s, electrically isolated, timing capable, 2 or 1 × Ethernet interface for equipment with PROFINET • Connection of displays with DVI connection
Degree of protection in accordance with IEC 60529	IP20
Protection class in accordance with IEC 61140	1
Ambient temperature	
• Operation • Storage	±0 ... +45 °C -40 ... +70 °C
Dimensions • Width • Height • Depth	 262 mm 133 mm 80.5 mm
Weight, approx.	3 kg

Product designation	**SIMOCRANE TPS V1.2 3D sensor**
Type	6GA7221-1AA21-0AB0
General technical specifications	
Supply voltage • Servo motor • Servo motor electronic circuits	 48 ± 2 V DC / (I_{max} = 15 A) 24 ± 3 % V DC / (max. ripple 500 mV)
Laser measurement sensor • Laser electronics • Heating, laser measurement sensor and control cabinet	 24 ± 3 % V DC / 2 A 24 ± 6 V DC / 10 A
LMS251 laser measurement sensor	
• Typical range (at 10 % remission) • Usable scanning angle • Angle resolution (scanner) • Measuring resolution (scanner) • Wavelength of laser diode • Laser/class • Beam divergence • Weight	40 m 180° 0.25°, 0.5°, 1° 13.6 mm Infrared light (λ = 905 nm) Class 1 (safe for eyes), according to EN/IEC 60825-1 and 21CFR1040.10 11.9 mrad 3.7 kg
Communication	
LMS251 laser measurement sensor	RS422 (9.6/19.2/38.4/500 kbaud) (default 500 k)
Servo motor	CAN (250 kbits/s)
Swiveling platform • Swivel angle, max. • Swivel angle resolution • Swiveling velocity • Weight	 180° (± 90°) 0.008° 100°/s (for positioning) 35 kg
Degree of protection in accordance with DIN EN 60529 • Laser measurement sensor • Servo motor	 IP67 IP66 (built into a RITTAL cabinet)
Shock and vibration resistance	IEC 68
Dimensions • Width • Height • Depth	 838 mm 300 mm 340 mm
Ambient temperature • Operation • Storage	 -30 ... +50 °C -25 ... +70 °C (max. 24 h)

SIMOCRANE TPS	
Communication	
OPC	SIMATIC NET OPC
General technical specifations	
Interface	Ethernet
Application range • Installation altitude • Transmission range • Vehicle models • Container types	Harbor area STS crane 14 m above loading point 20 m (along the lane) [1] 12.5 m (along the crane travel path) [1] Trucks: max. 5 Container trailers: max. 9 ISO 20 ft (6.096 m) ISO 30 ft (9.144 m) ISO 40 ft (12.192 m) ISO 45 ft (13.716 m) 2 × 20 ft (2 × 6.096 m)
No. of monitoring devices • Sensor controller • 3D sensor	 1 Max. 2
Accuracy	± 5 cm (approximate values for a typical installation height of 14 m)

Selection and ordering data

SIMOCRANE TPS is supplied preconfigured and ready to use. One sensor controller and two 3D sensors are required for the current version.

Description	Article No.
SIMOCRANE TPS V1.2 Sensor controller consisting of 1 item each • SIMATIC IPC for standard rail mounting, installed and pre-configured ready to use (e.g. in the electrical room of a crane) • SIMOCRANE TPS product CD • SIMOCRANE TPS Runtime V1.2 License key • SIMATIC.NET SOFTNET-IE S7 Lean License key V12	**6GA7220-1AA00-0AC0**
SIMOCRANE TPS V1.2 3D sensor consisting of 1 item each • Laser measurement sensor • Swiveling platform including control cabinet and servo motor (completely pre-assembled) • Plugs for the connection of power supply and data communication cables	**6GA7221-1AA21-0AB0**

Supplementary components

Description	Article No.
VScom USB-2COMi SI-M USB to 2 RS422/485 ports adapter (Isolated)	**644** **(supplied by VScom)**

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/

→ Product Support → (Enter search term) SIMOCRANE

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

https://support.industry.siemens.com/cs/

→ Application Examples → (Enter search term) Crane

You will find information about the SIMATIC IPC427D in Catalog ST 80/ST PC and in the Industry Mall under "Product Catalog/Automation Technology/PC-based Automation/Industrial PC/Box PC/SIMATIC IPC427D".

You can access information about SIMATIC IPC427D on the Internet at

https://support.industry.siemens.com/cs/ww/en/ps/16756

Training

Siemens Cranes offers crane-specific training courses:

http://www.siemens.nl/training/cranes

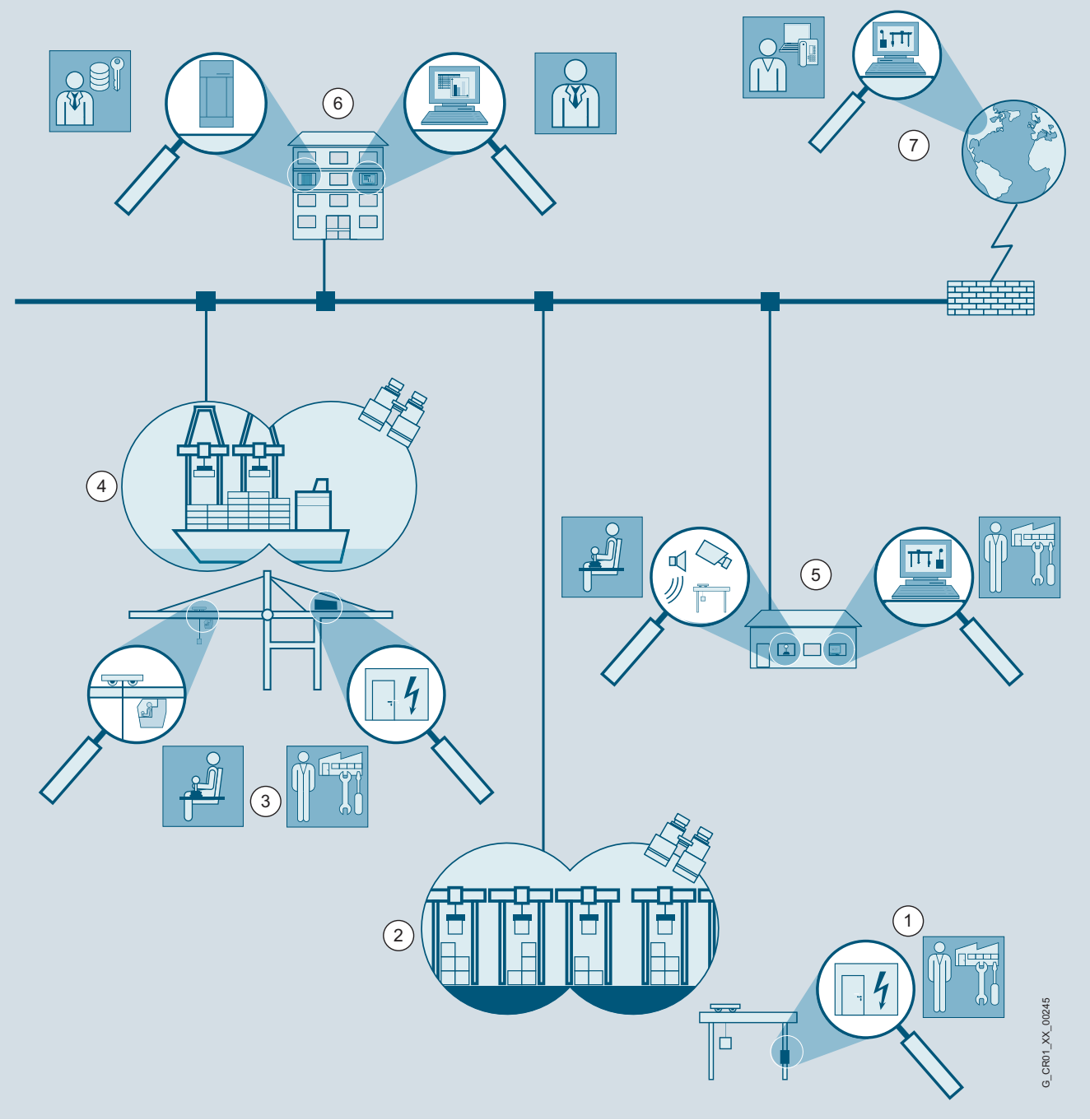
Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit http://www.siemens.com/industrialsecurity.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit http://support.automation.siemens.com.

Overview



SIMOCRANE CMS product overview, example of a harbor crane system

The product overview describes the implementation of SIMOCRANE CMS (Crane Management System) and its scalability based on the example of a harbor crane system. The application fields range from the control center/control room (Ethernet/WLAN) 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 a stacking crane for maintenance technicians
2. Remote access or remote control of stacking cranes in the stacking area of a container terminal
3. CMS station in the electrical room of a ship-to-shore crane for maintenance technicians and in the cabin for the crane driver
4. Remote access to ship-to-shore cranes in the plant area (quay) of a container terminal
5. Remote access and remote control from the maintenance building for maintenance technicians and crane drivers
6. Central administration building with system administration, data archiving and evaluation
7. Remote access is possible by specialists over the Internet, remote crane access over Internet connection to CMS or RCMS

Overview (continued)

The SIMOCRANE CMS Crane Management System is a PC-based visualization application (SCADA) for crane drivers, maintenance personnel and terminal operators.

It provides the following main functions:

- Graphical visualization of the crane system
- Alarm/event reporting system and support for diagnostics
- Recording measured values for various operating parameters
- Recording and analysis of cargo handling data
- Recording and evaluation of operating hours and counters - Web-based report function
- Replay function (playback function)

SIMOCRANE CMS is a graphics-based, user-oriented system that supports users in a simple manner during operation as well troubleshooting and rectification of faults.

By using SIMOCRANE CMS, the downtimes for a crane are shortened and the availability of cranes or the complete terminal is optimized. SIMOCRANE CMS provides the crane operator with important data for analysis. Critical 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.

WinCC has a number of available communication channels for connecting to automation systems of different manufacturers. The connection to higher-level logistics systems (such as TOS) is also possible thanks to the openness of the system.

4

Benefits

- **Clear, graphical presentation of the crane and its components**
  The most important parameters can be read at all times, and critical states are detected immediately.
- **Graphical User Interface (GUI) based on symbolic display**
  Easy and clear GUI based on symbolic pictograms
- **Integrated diagnosis 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 100% achieved. Thanks to SCADA WinCC integration into the SIMATIC automation landscape, fast and easy advanced diagnosis 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 activation (tool tip text) when moving the 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.
- **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 TFS 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
- **Standard Web based advanced reports for CMS Basic package**
  Advanced reporting included in the CMS Basic Package on CMS and RCMS, as well in Web Clients; easy generating of reports by one clock of the mouse
- **Fast trace of all 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
- **Calculation of KPI and other OEE parameter regarding the crane performance**
  Standard KPI's delivered with SIMOCRANE CMS and easy calculation for own defined KPI's or OEE regarding crane performance indicators; easy and comprehensive data representation in different graphics, e.g. Gantt views, Pareto, Table controls and many other graphical representation
- **Easy to order CMS and RCMS package structure with own ordering number (Article No.)**
  CMS Lean and CMS Basic packages for covering all types of cranes on harbor as well for industry market
- **Plenty standard functions on board as well the possibility to customize own project due to flexible configuration of CMS product and CMS application (user interface)**
  Customer can define own standard based on integrated function into the CMS and RCMS
- **Standard interfaces on board**
  Apart from Siemens controllers, automation systems from other manufacturers are also supported. For integrating 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, OPCA & E, OLE-DB).
- **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 full license 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.
- **Flexibility and 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.
- **Support and availability of expertise**
  Worldwide use of this product ensures extensive support and fast response times. The SIMOCRANE CMS and WinCC packages are worldwide supporded via Siemens product support

4

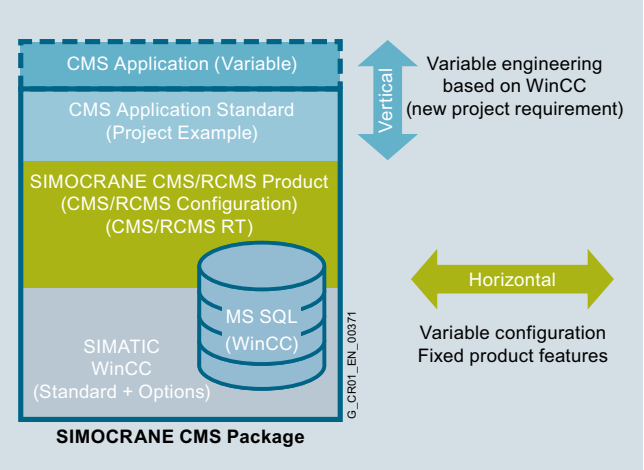
Application

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 in order to playback the data from long-term archiving into the screens on a CMS machine.

Design

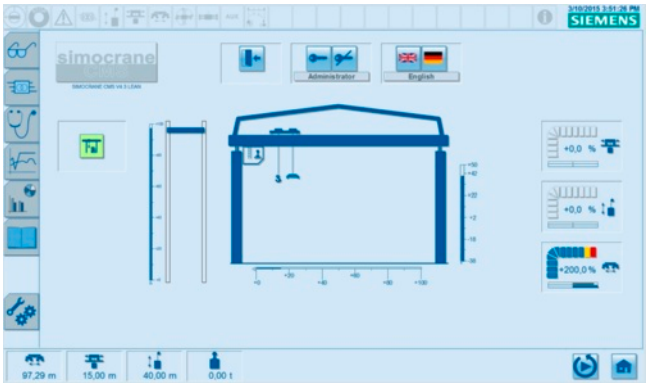
SIMOCRANE CMS and RCMS package components

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. In order to understand the components of the CMS & RCMS package, please refer to the picture below.



SIMOCRANE CMS/RCMS package components: SIMATIC WinCC (grey), SIMOCRANE CMS Product (green) and CMS Application (blue)

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



Example of customized screen for an industrial crane in steel pipe industry

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 used also 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 Microsoft SQL database.

SIMATIC WinCC options

WinCC optional packages like WebNavigator, Information Server, DataMonitor and Performance Monitor are required for evaluating data, reporting, KPI calculation and for accessing a CMS station remotely.

SIPLUS CMS (X-Tools)

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

SIMOCRANE CMS product (system software)

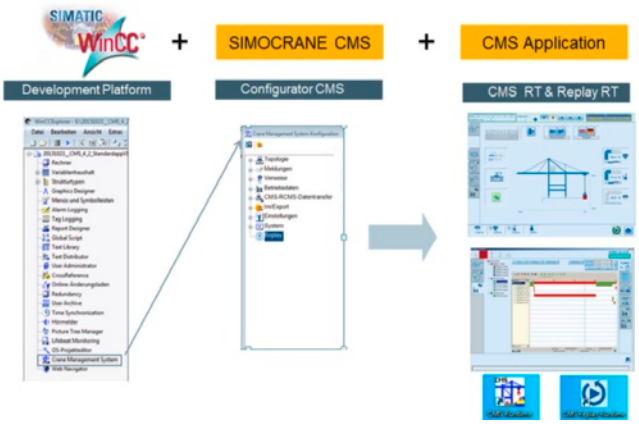
Based on the open interfaces of WinCC, the SIMOCRANE CMS system software package expands the basic system with the sector-specific crane technology functions. This covers for example the acquisition and processing of cargo handling data, expanded diagnostic functions, replay function (playback), jump functions (Step7 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 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 concrete implementation. The standard CMS Application is provided as an example and it can be any time modified and customized based on customer requirements. In the CMS standard Application the Replay Controller is also integrated for example. Such 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 a RTG/RMG crane. The CMS Basic is a project example of a CMS Application consisting of a WinCC project for a STS crane. The standard application can be extended for a large number of variants for crane applications. An example for an STS crane (CMS Basic) or RTG/RMG (CMS Lean) is provided and therefore makes starting a CMS project much easier. In the simplest case, it is sufficient to parameterize the interface at the controller end to obtain a fully functional Crane Management System ready to use with minimum engineering and configuration effort.

Design (continued)

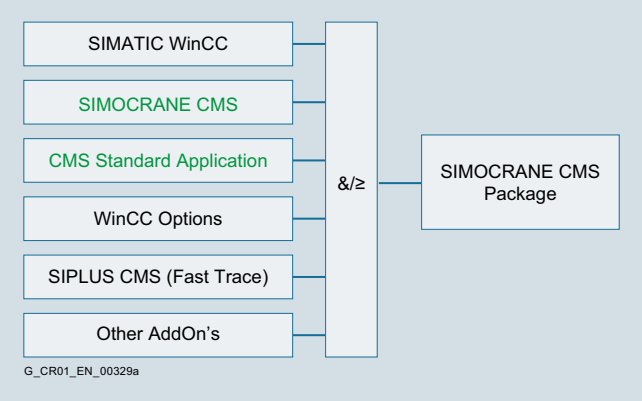


Overview of SIMOCRANE CMS/RCMS main components

Experience has shown that a number of functions always remain mostly 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 this 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.

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

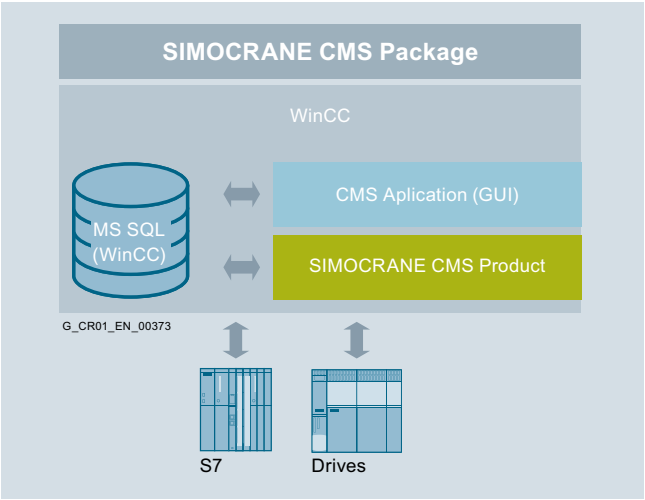
The CMS application is used by way of example and can be any time changed and adapted to the customer needs.



SIMOCRANE CMS package components: WinCC, CMS Application and CMS Product (green components are Cranes specific items based on own development)

Interface between PLC & Drives components and CMS

Normally the Crane Management System is connected directly to a PLC or Drive components. In case of the SIMOCRANE CMS, the channel used is an S7 channel available in WinCC for Siemens controllers of S7 type, S7 300 and S7 400. When S7-1500 TIA Portal is to be used, the interface should be tested and adapted to the customer requirements – please make enquiry for this kind of applications of our Customer Support department or Cranes Application Support (for contact data please refer to the separate section).



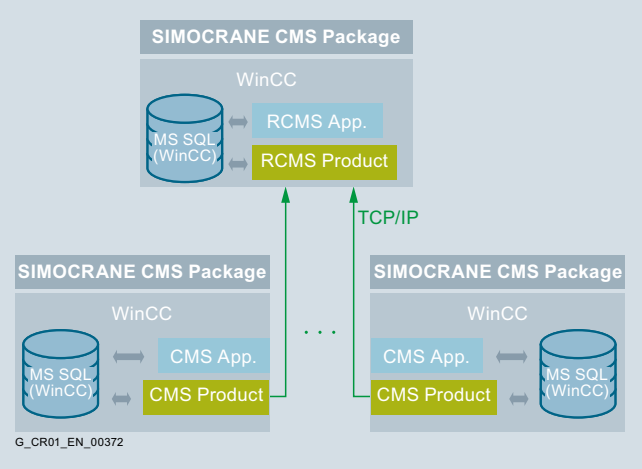
Standard interface between S7 and Drives and SIMOCRANE CMS

The interface is based on a defined standard based on a S7 300/400 controller. Such interface is standardized on using other SIMOCRANE based product family, 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, where the detailed tags in WinCC and DB structure in S7 is described. This document is to be downloaded free on the customer support page from Siemens. When using the standard S7 channel from WinCC, advanced diagnostic functions can be generated and used directly in the CMS Application project with a very limited effort. This makes possible that diagnosis functions from S7 layer are to be integrated directly into the CMS level.

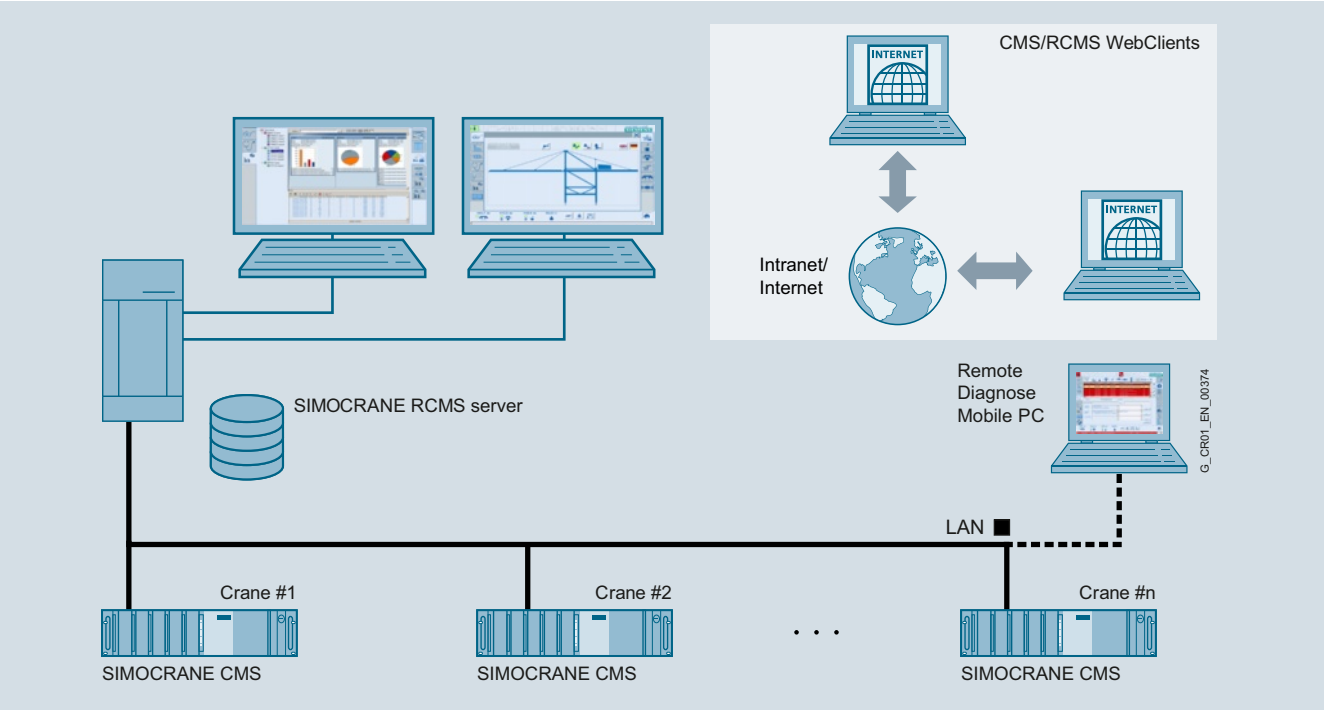
Design (continued)

Communication CMS stations to RCMS (Remote CMS)

The communication between CMS Lean/CMS Basic stations and RCMS station(s) is based on own developed 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 station. When the customer buys a CMS Lean or CMS Basic station and later needs to connect to a RCMS (Remote CMS station), the channel is included in the packages already bought. Only the configuration needs to be done on CMS and RCMS stations in order to define the crane topology structure for CMS and RCMS (e.g. crane names, IP address of CMS, name of RCMS, IP address of RCMS, etc.)



Configuration of connection for SIMOCRANE CMS to RCMS (Remote CMS)

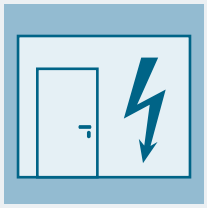


Overview of the configuration of SIMOCRANE CMS stations and one RCMS station

Design (continued)

Installation sites and environment

Electrical room



The drive and control technology and the CMS station are located in the electrical 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 moveable parts such as fan or hard drive, using a SSD card instead. In this way high availability of the hardware components can be achieved.

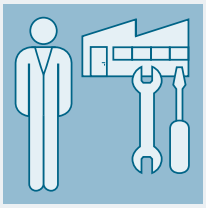
The user group mainly consists of service and maintenance technicians. It is possible to call up detailed diagnostic information here, by accessing documentation, circuit diagrams, S7 programmable data blocks, etc. Also the service and maintenance personnel can perform Replay/Playback actions at CMS in the electrical room.

Crane driver cabin

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

The crane driver receives information on the fault messages, the operating states and operating data, as well as readily understandable diagnostic 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 technological functions, such as sway control or truck positioning.

Maintenance building/remote crane access



The maintenance and system 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 crane in the terminal. From maintenance building the Replay function can be activated and used on the CMS system.
Remote control of cranes can also be performed from the maintenance building as well.

Control center/control room

In the case of a network of several cranes and 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, in order 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.

Design (continued)

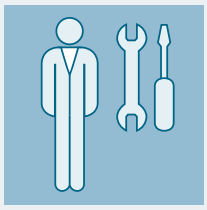
User groups and functions

Crane driver

The straightforward arrangement provides this user group with the most important information about the operating state of the crane. It is important in a fault situation that the crane drivers can detect the cause as fast as possible. They must be able to decide quickly whether they are capable of correcting the fault themselves or whether they require support from a technician.

Apart from presenting information, they can also make operational adjustments, i.e. by activating and deactivating options such as SIMOCRANE Sway Control, SIMOCRANE Truck Positioning, etc.

Maintenance technician



This user group has specific knowledge of the system and can therefore call up more extensive diagnostic information for fast rectification of faults. Maintenance technicians must be able to access the main sources of information quickly 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

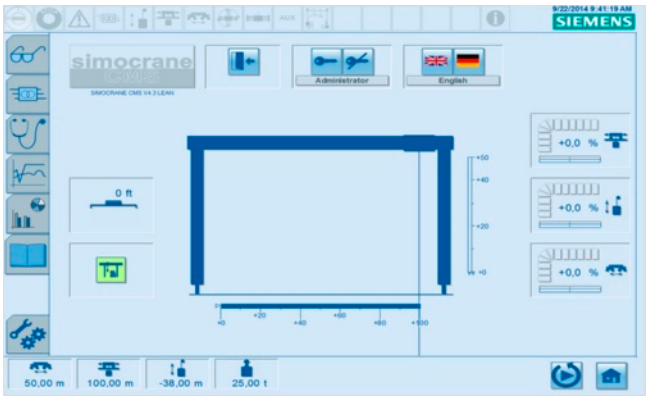
The administrator has access to all authorizations and can set up and manage users. This usually comprises the personnel of the IT department of the plant operator.

Overview

The package SIMOCRANE CMS V4.3 includes new functions and new optional packages compared to the previous version. The new version SIMATIC WinCC V7.2, as well release for Windows 7 SP1 and Windows 2008 Server R2 (both 64 bit operation systems), fixing bugs from the previous versions and improvements regarding Standard CMS Application (provided as an example project) are to be named as important updates for CMS V4.3.

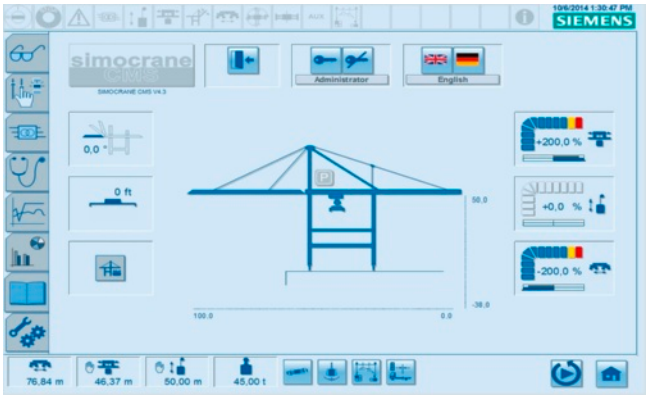
With SIMOCRANE CMS V4.3 two packages are available:

- SIMOCRANE CMS V4.3 Lean package, as to be used for crane types in harbor business, mainly for RTG, RMG, ASC and as well for industry cranes. Other types of cranes are also possible to be defined and configured via CMS Application.



Example of CMS Lean screen

- SIMOCRANE CMS V4.3 Basic package, as to be used mainly for crane types in harbor like STS and GSU. Other types of cranes are also possible to be defined and configured via CMS Application.



Example of CMS Basic screen

For both SIMOCRANE CMS V4.3 Lean and Basic packages, the CMS Application was modified and tuned for the specific crane type, the CMS Lean provided as an example for a RTG/RMG crane type and for CMS Basic provided as an example for an STS crane type.

Regarding new functions included in the SIMOCRANE CMS V4.3 Lean and Basic and RCMS V4.3 packages, please refer to the functional and delivery scope as described below.

Delivery scope SIMOCRANE CMS V4.3 Lean and Basic (Standard Package)

The SIMOCRANE CMS V4.3 Lean and Basic packages consist of different bundles and combination of WinCC Options and CMS/RCMS packages. The following bundles are delivered with standard package and options for CMS.

SIMOCRANE CMS Lean and CMS Basic V4.3

- WinCC V7.2 RT licenses
  - 2048 PowerTags/CMS Basic and
  - 512 PowerTags/CMS Lean
- WinCC 1500 Archive Tags
  (CMS Lean 512 Archive Tags)
- WinCC Information Server 3 WebClients
  (not for CMS Lean)
- SIMOCRANE CMS V4.3 Configuration
- SIMOCRANE CMS V4.3 RT
- Crane condition monitoring
- Replay function (playback)
- Message system and advanced fault diagnosis
- Cargo handling acquisition
- Acquisition of operating hours/counter values/timers
- Advanced reporting and data aggregation
  (option for CMS Lean)
- Dashboards, Business Intelligence Tools
  (option for CMS Lean)
- Distributed information of advanced reporting via web clients
  (option for CMS Lean)
- Export of archived data and messages from MS SQL to Excel
- Advanced S7 diagnosis
- Integrated webserver for SIMOTION, SINAMICS and S7
- Maintenance Instructions/Notes
  (advanced message diagnosis)
- 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, World, Excel, videos, etc.)
- Connection to RCMS

Overview (continued)

Options for SIMOCRANE CMS Lean package

SIMOCRANE CMS Lean + WebClients

- Scope of CMS Lean Standard Package
- WinCC WebNavigator: operation of one (1) or three (3) web clients in parallel (with simultaneous connection) with monitoring and control functions (full functionality)

SIMOCRANE CMS Lean + Central Crane DataMonitor (+ 1 WebClient)

- Scope of CMS Lean Standard Package
- WinCC DataMonitor: operation of one (1) web client with central monitoring function for all cranes (read only)
- Simultaneous connection to multiple cranes from one central station – remote station
- Extensive web statistical data analysis, remote connection to Microsoft SQL database on the crane
- Data aggregation from different cranes (CMS stations)
- Operation of one (1) web client with full monitoring and control functions and one (1) web client with central monitoring function

SIMOCRANE CMS Lean + Crane Performance Monitor (KPI)

- Scope of CMS Lean Standard Package
- WinCC Performance Monitor: KPI and OEE calculations including advanced reporting (Gantt views, statistical data representation, data mining) on CMS and remote access of data via WebClient

Options for SIMOCRANE CMS Basic package

SIMOCRANE CMS Basic + WebClient

- Scope of CMS Basic – Standard Package
- WinCC WebNavigator: operation of three (3) web clients in parallel (with simultaneous connection) with monitoring and control functions (full functionality)

SIMOCRANE CMS Basic + Crane Performance Monitor (KPI)

- Scope of CMS Basic – Standard Package
- WinCC Performance Monitor: KPI and OEE calculations including advanced reporting (Gantt views, statistical data representation, data mining) on CMS and remote access of data via WebClient

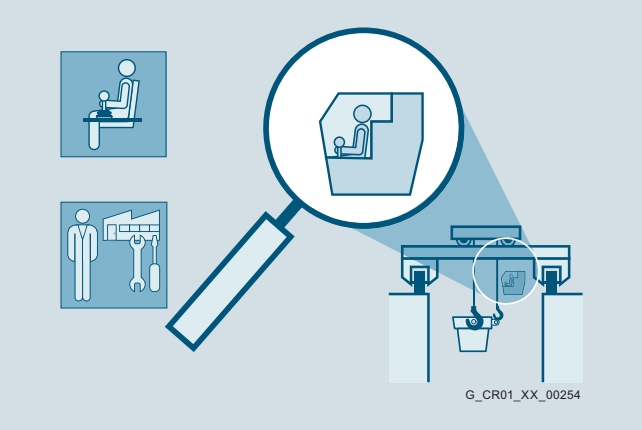
SIPLUS CMS Basic + Fast Trace (condition monitoring and vibration analysis)

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

- Scope of CMS Basic – Standard Package
- Fast Trace (up to 192 kHz per channel) based on SIPLUS CMS X-Tools Software including ION's

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

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 Basic) or a Webserver for additional operator panels (CMS with WebClients – 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

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 of solution:

CMS Lean
Article No. **6GA7214-0AA00-0AA0**

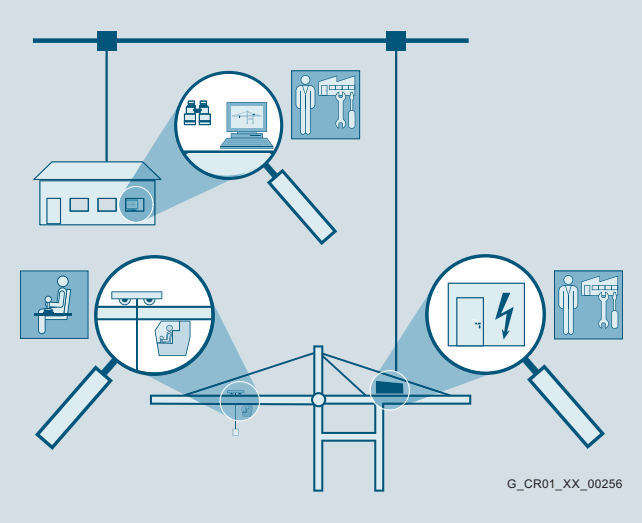
Panel PC 477 as the HMI device and CMS PC for example (this article number can be also different, depending of the Panel PC configuration: processor, RAM memory, hard drive as SSD, etc.):
Article No. **6AV7240-3CC07-0HA0**

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

Application

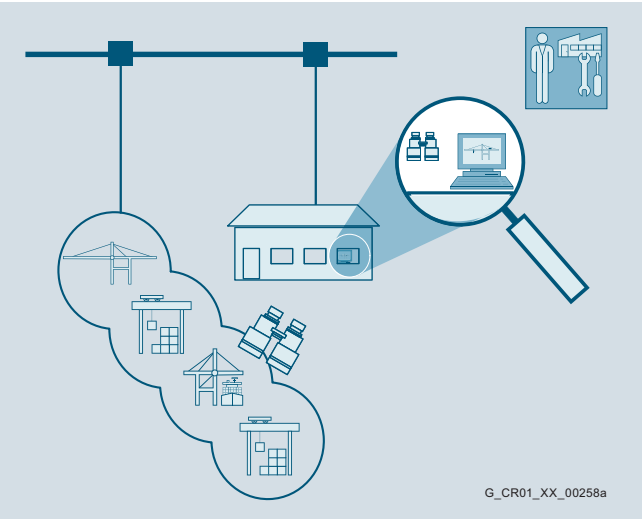
- Non-networked single-crane applications in which the focus is on the local application and less on remote access and data evaluation possibilities. Visualization of crane components and the alarm/event system are the most important components here.

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. In the case of large crane systems, this is usually performed in a central maintenance building. In case of a fault, diagnostic 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

Example of requirements for SIMOCRANE CMS:

- 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
- Crane driver must have an operator panel in the cabin
- Remote access must be possible from a maintenance building

Solution:

- SIMOCRANE CMS Lean with one (1) WebClient
  Article No. **6GA7214-1AA00-0AA0**
  or
  SIMOCRANE CMS Basic with one (3) WebClients
  Article No. **6GA7214-1AB00-0AA0**
- Panel PC 477 as operator panel for the crane driver and in the checker cabin, e.g.: Article No. **6AV7240-6DD17-0PA0**
- Rack PC 647 as the CMS PC in the electrical room, e.g.: Article No. **6AG4112-2GP30-0BX0**
- 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.

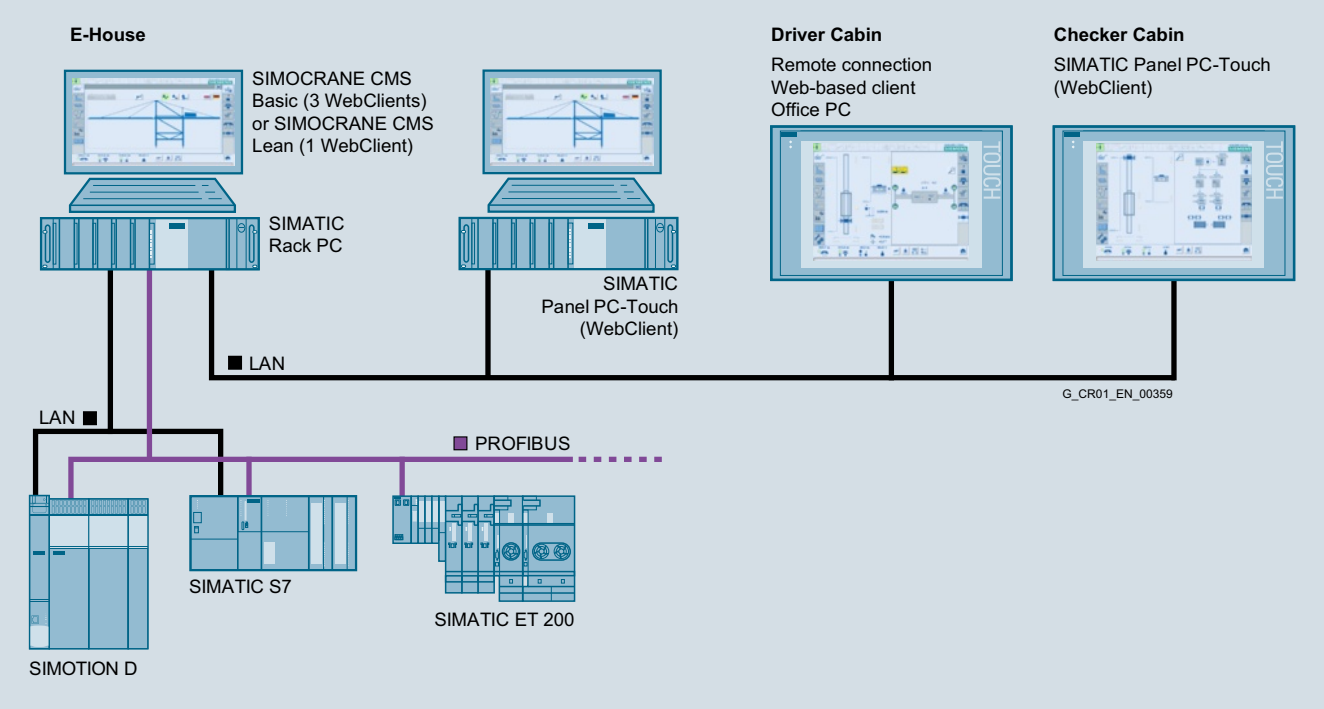
Application

- 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 CMS multi-user system (SIMOCRANE CMS Basic with WebClients)

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.

Standard package

Overview

The standard package of SIMOCRANE CMS Lean and CMS Basic consists of functions which are standard delivered with the package. By ordering the standard package, basic functions are to be realized for CMS Lean and CMS Basic in order to respond to the main requirements for Crane Management System on the crane market. In the next section the main functions are briefly described.

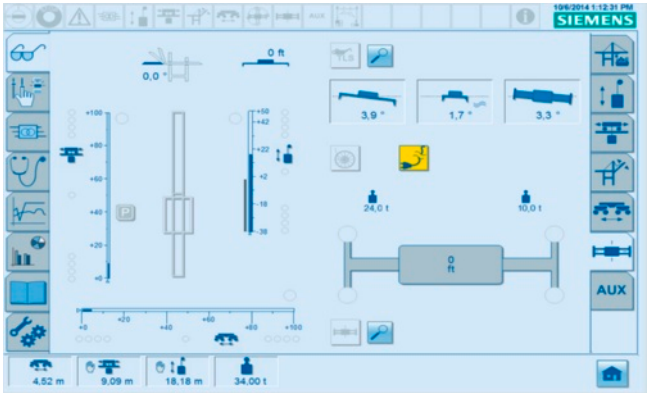
Function

Status display

The status display offers a symbol-oriented, graphical display of the crane and crane components complete with 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 detailed information and text can be visualized in 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.

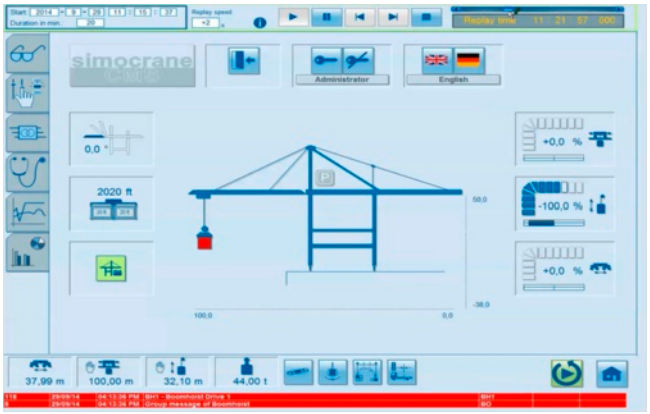
A status bar at the top of the screen displays fault states symbolically, and this is supplemented by text messages at the bottom of the screen.



Graphical status display for the spreader

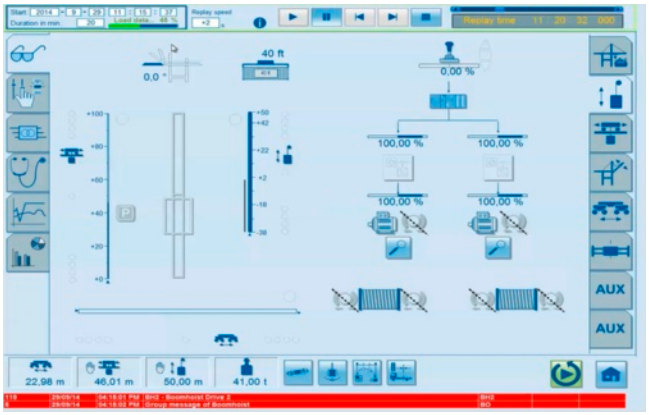
Replay function (playback)

The replay function is delivered in the standard basic package of SIMOCRANE CMS. This function enables the personal 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 operator 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.), navigate through different replayed screens. The screens for the replay/payback function can be freely configurable via Relay Configuration Editor.

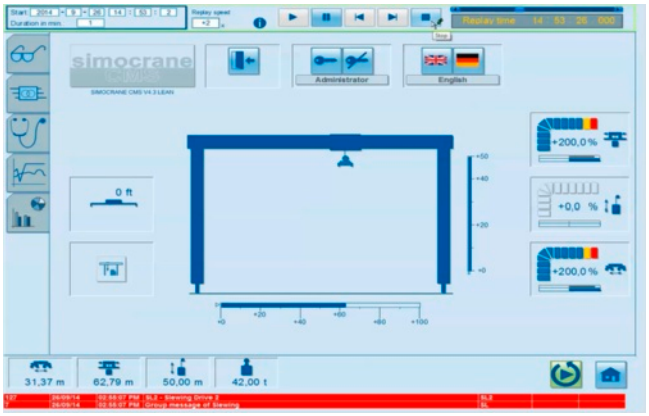


Example of replay home screen for an STS crane

Function (continued)

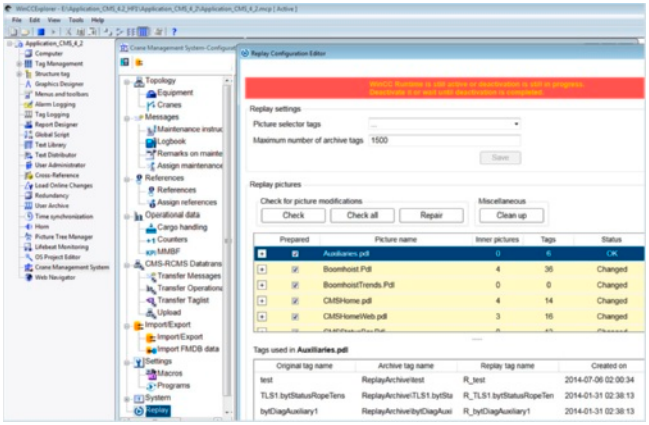


Example of replay screen for hoist screen of STS crane



Example of replay screen for an RTG crane

The screens for the replay/playback function can be 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 is working complete independent from CMS RT function, which is collecting the data continuously from field. The replay function is working in parallel with CMS RT data acquisition and can be switched on or off via graphical user interface any time the operator needs performing replay.



Replay Configuration Editor for replay screen configuration

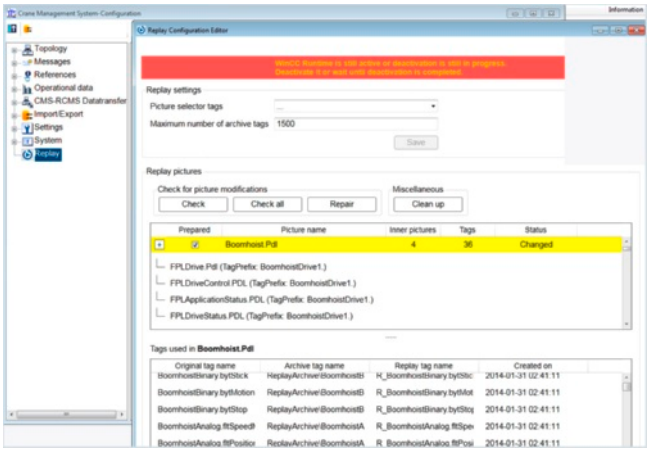
With the Replay Configuration Editor, you can make the following settings required for Replay:

- 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 group ReplayControl with ReplayControl structure tags
- Tags of the Screens group that are relevant for Replay
- Tags of the Settings group that are relevant for Replay
- Tags of the ReplayControl group that are relevant for Replay
- Picture selector tags
- ReplayArchive



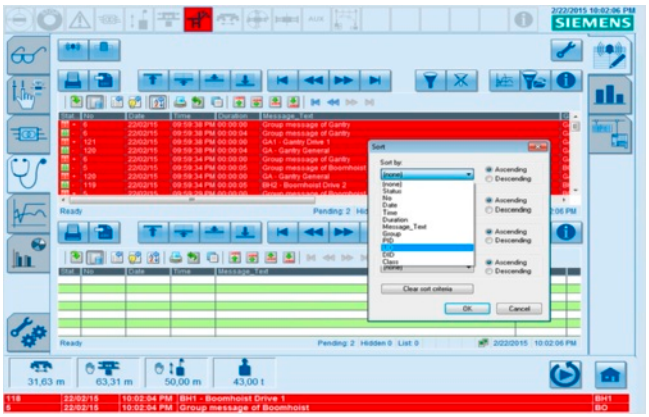
Replay Configuration Editor – replay screen automatic generation of modules by screen changes in WinCC project

4

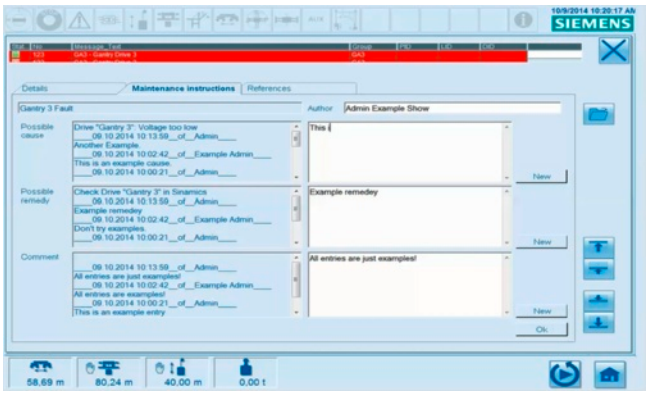
Function (continued)

Error messages and advanced diagnostics

In the event of a fault, the error message system helps with troubleshooting and fault rectification. These complex functions support maintenance technicians with their work and help to reduce downtime.Detailed error lists present the course of the fault chronologically. Many filtering and sorting functions increase clarity.



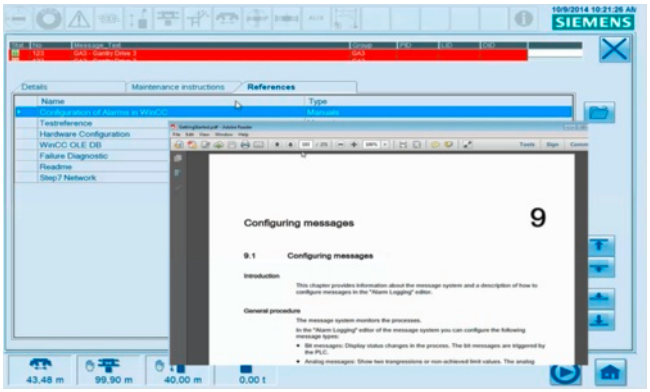
Comprehensive message system



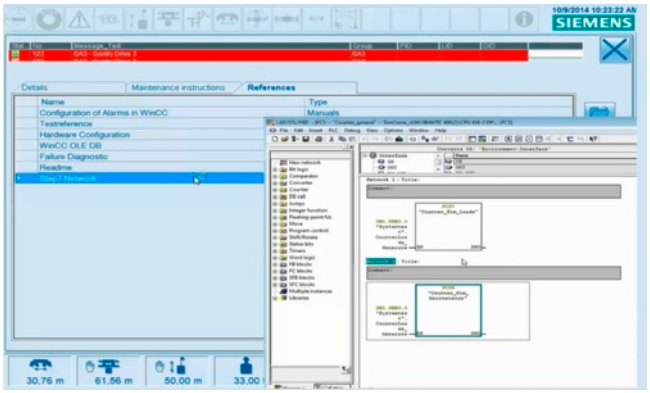
Example of screen for maintenance instruction function Chronological message bar – message instructions

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 Failure diagnosis
- Jump to different Microsoft programs, as Excel, PPT, World, 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



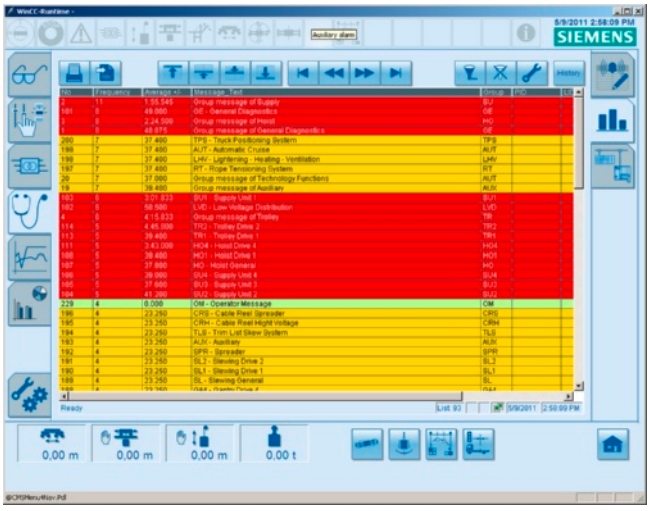
Jump functions to different CMS program content – in this example jump to manuals



Jump functions to different CMS program content – in this example jump to S7 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).

These make it easy to identify weak points and to obtain information about downtimes.



Example of statistical analysis (hit list) for messages

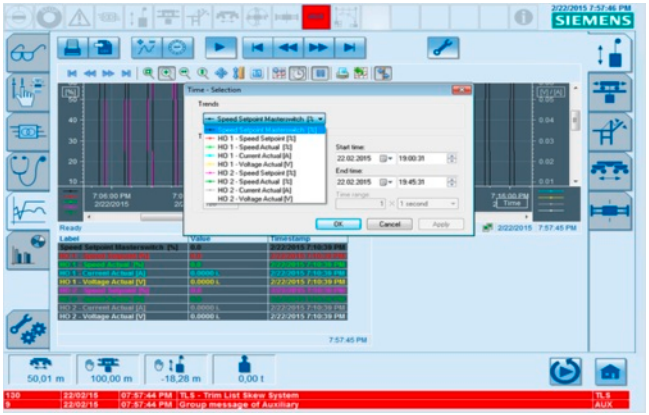
Function (continued)

Measured value acquisition

CMS continuously acquires and archives important parameters, such as

- Position values of different components of the crane – hoist, trolley, gentry, 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.

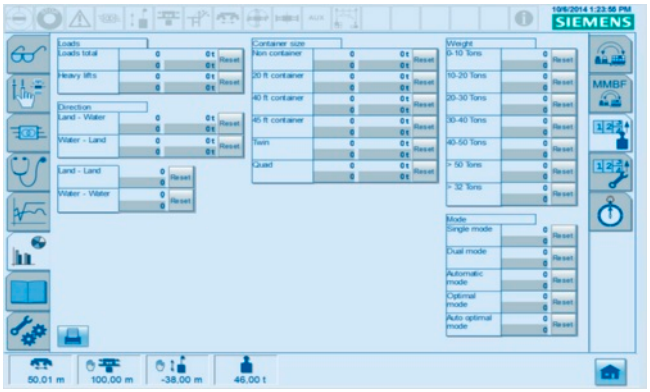


Crane parameter value acquisition – extended configuration in RT environment

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 set) is freely configurable and can therefore be adapted for every crane type.

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



Cargo handling data

Container handling list

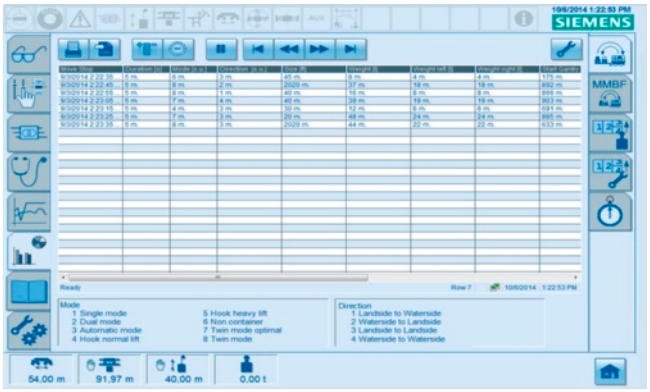
The archived data can be made available to higher-level systems for further evaluation.

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 originally acquired by the crane controller. The CMS acquires these values from the controller and makes them available to higher-level systems.



Screen with Move Data of containers Operating hour counter

It is possible to acquire operating hours and counter values and process them.

These values can be initialized or backed up in the controller via the CMS user interface. This function is extremely helpful if the CPU in the PLC has to be replaced.

4

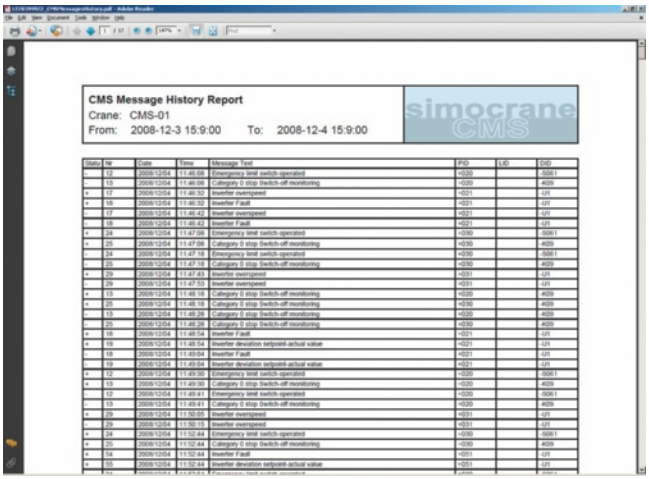
Function (continued)

Reporting lists

A simple form of report output is integrated into the system. The following reports can be output on the standard Windows printer:

- 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, and you can create and design your own reports.



This report in PDF format can easily be output on a PDF printer.

Advanced reporting

On each CMS station advanced reporting generation can be processed. This report is based on integration of different information regarding messages, operational data (e.g. move data, MMBF, counters, timers), statistics, data mining. The access is possible direct from Microsoft SQL database. The report is web based and can be pre-configured for standard data sets. Each report can be customized in order to fulfill the customer requirements.

- Advanced Reporting from CMS and RCMS stations possible on every mobile device.
- Being informed anytime – from everywhere: web-based reports and analyses using mobile devices
- Reporting and management using Microsoft SQL Server Reporting Services
- Transparent access to all historical CMS and RCMS data in Microsoft SQL database
- Cyclic activation based on demands or events
- Web-based administration and provision
- Transparent data access thanks to integration in MS Word, MS Excel and MS PowerPoint
- Automatic report distribution by email
- Customized dashboards and Business Intelligence tools on board

Advanced reporting of crane data using information server

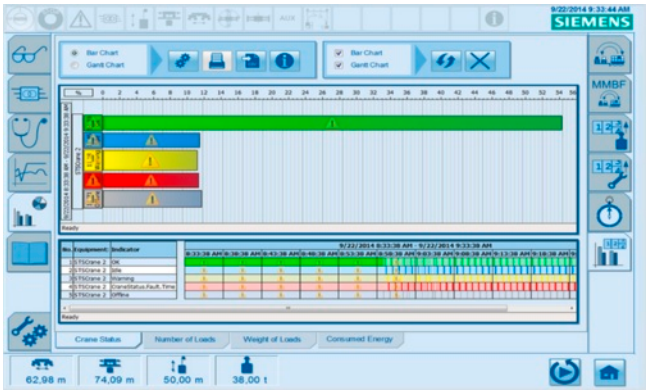
Overview

Additional functions can be offered via optional packages of SIMOCRANE CMS. These functions can be taken in project depending of customer requirements. In this manner, 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 by using Add-ons.
For more information please refer to the Chapter Additional components.

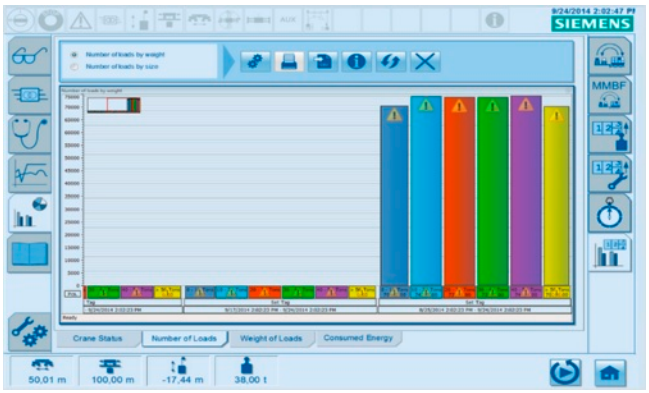
Function

Crane down time monitoring (crane availability and Gantt views)

On each CMS the KPI's or crane availability can be visualized thanks to the WinCC option package Performance Monitor. The calculation of KPI's or data representation for CMS is automatically integrated into the project. Pre-defined reports and data representation can any time recalled in order to generate advanced reports fast and easy. Data representation is very easy and the option package Performance Monitor has several very useful functions standard on board.



Example of screen in CMS for Crane Performance Monitor – crane availability and Gantt view graph



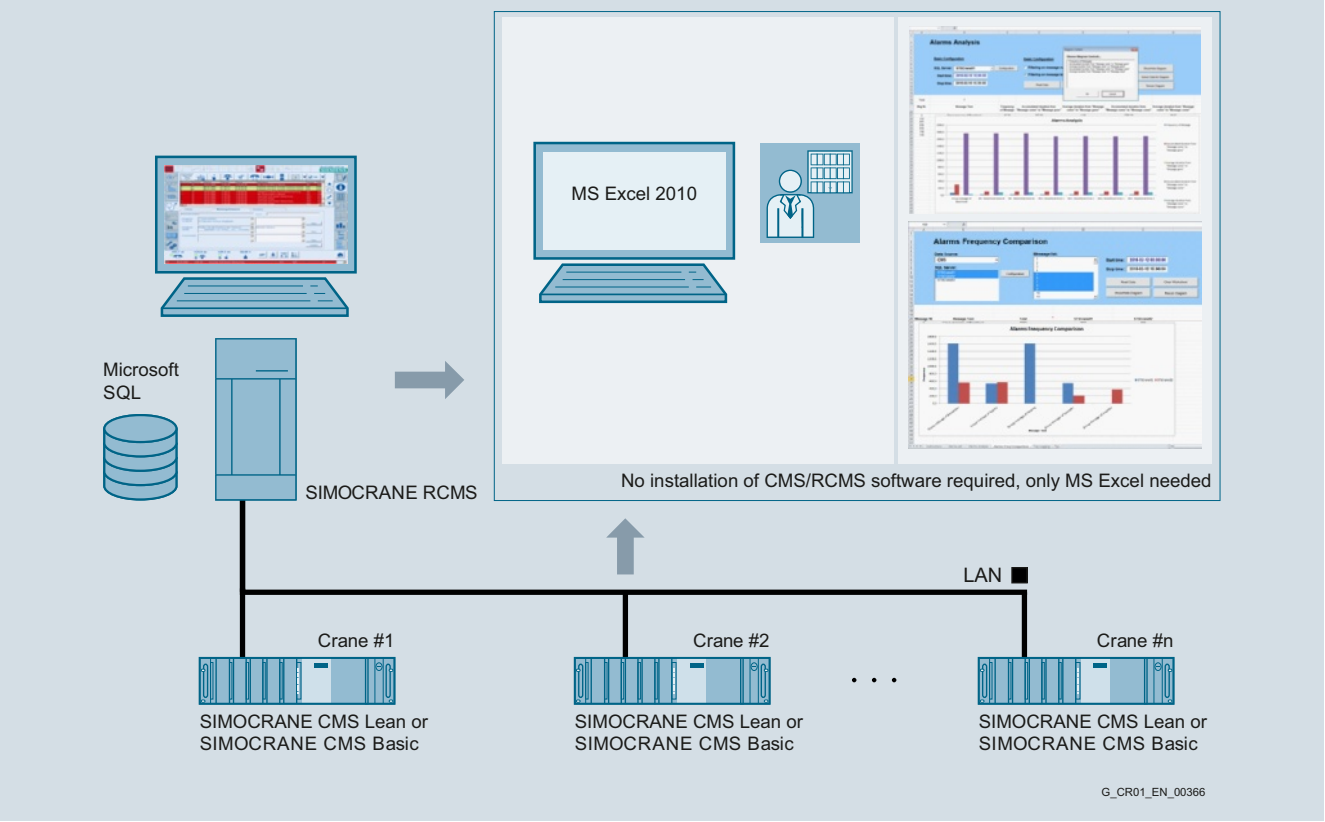
Example of screen in CMS for Crane Performance Monitor – reporting of data (number of loads)

In order to access MS SQL data and retrieve data at one click of the mouse, a tool in Microsoft Excel was developed. The Excel tool can be installed on any office PC in the terminal. The only prerequisite to access the MS SQL data from archive on CMS & RCMS stations is to have connection to the CMS & RCMS PC. This can be checked via integrated Topology Configuration Menu, where the CMS & RCMS stations, with PC name and IP address are to be defined.

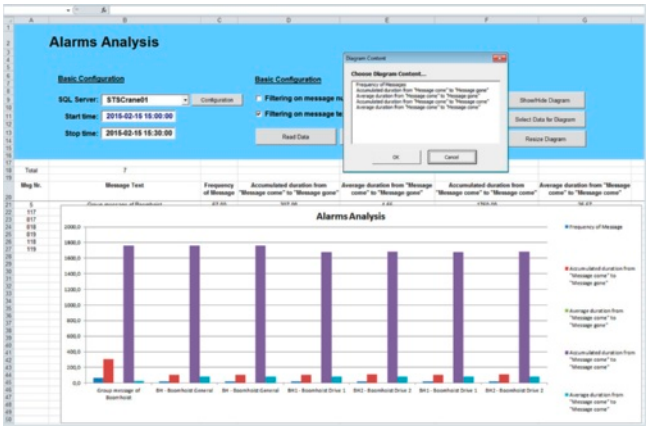
Using the Excel data access tool, all alarms and archive tags form achieves in CMS and RCMS stations can be retrieved and visualized in the Excel sheet integrated into the delivered tool. Statistics of alarms and information from operational data, such as moves, MMFB, counters, timers, etc. can be easy visualized and saved in the Excel data sheet. The Excel tool is an applicative solution, delivered standard with CMS Application and free of charge with the SIMOCRANE CMS and RCMS product.

4

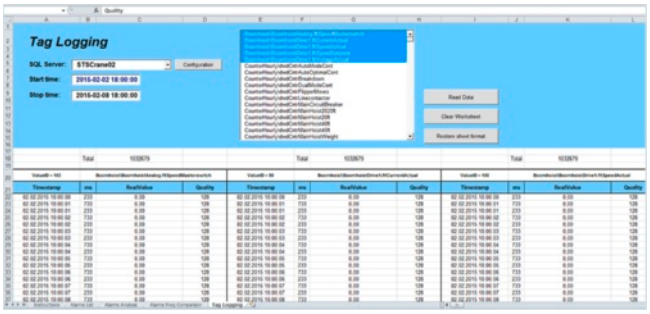
Function (continued)



Easy access of data from CMS and RCMS stations via Microsoft Excel



Example of screen in Excel for alarms analysis from SIMOCRANE CMS station



Example of screen in Excel for tag logging data analysis from SIMOCRANE CMS station; browsing of all archive data in Microsoft SQL database on CMS/ WinCC station

Function (continued)

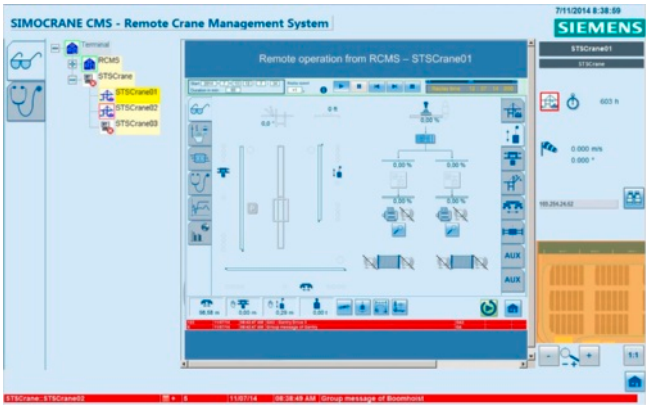
Multi-user system for CMS Lean and CMS Basic – WebClients

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 location in the crane.

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 option for the CMS Basic and CMS Lean packages.



Example of screen of a WebClient with WebNavigator

The number of WebClients offered standard are with the CMS Basic are three and for CMS Lean are two possibilities to order the WebClients: (1) with one WebClient or (2) with three WebClients. In case in the terminal more WebClients are needed for the local CMS, additional clients can be ordered separately.

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

4

Function (continued)

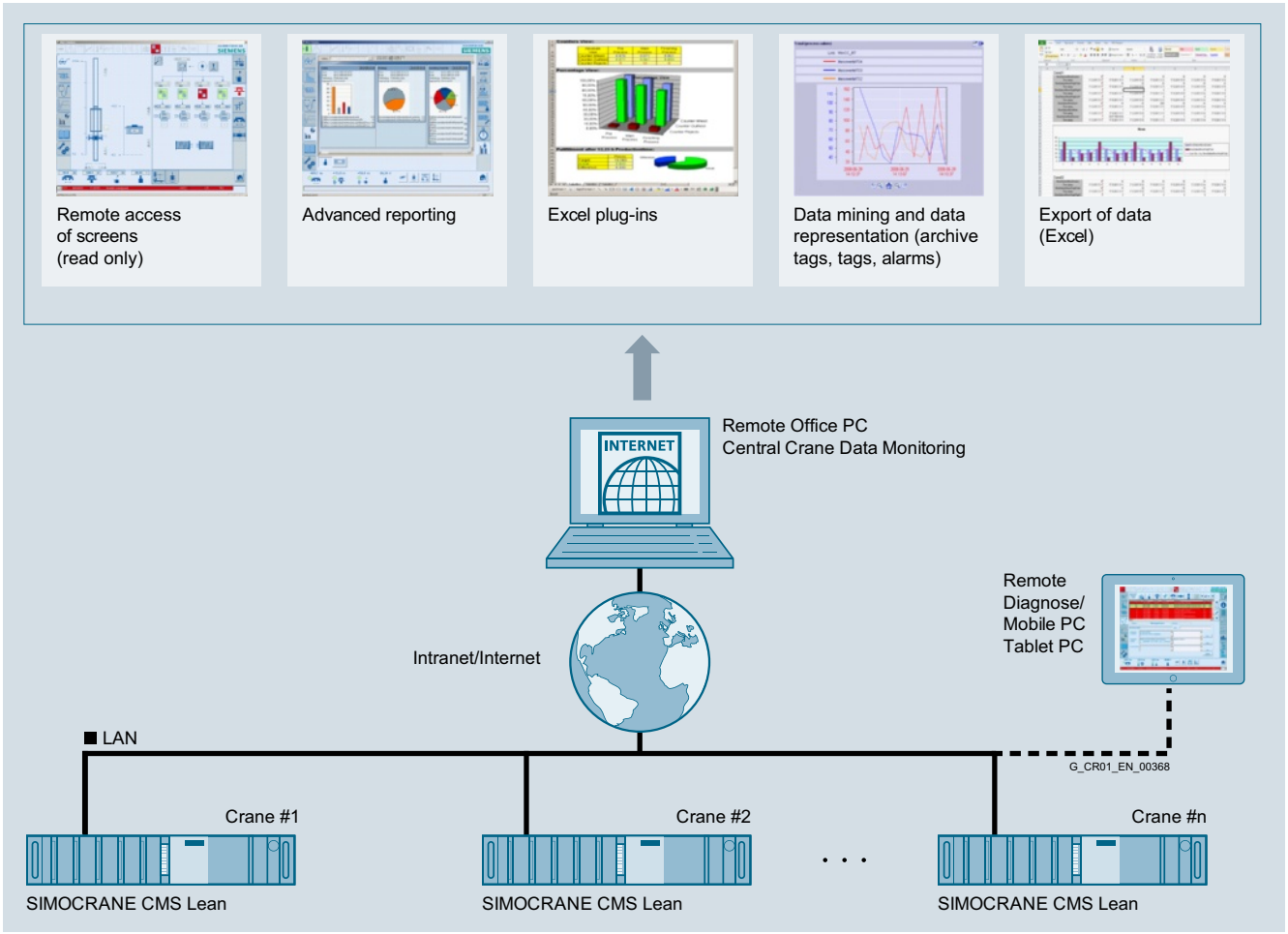
CMS Lean – Crane Central DataMonitor

On the CMS Lean package, the Crane DataMonitor concept is using a DataMonitor license only for one DataMonitor Client. This client is connected to all other local CMS stations, which are installed on the crane. The connection form each crane is done via encrypted connection from the DataMonitor webserver and the clients. The advantage of this configuration is that with a simple and cost effective solution different configurations can be provided for industry crane applications as well as for harbor area. When needed, the number of DataMonitor clients can be extended with additional licenses on the DataMonitor webserver.

With CMS DataMonitor a project already configured using DataMonitor is delivered with the standard CMS Application.

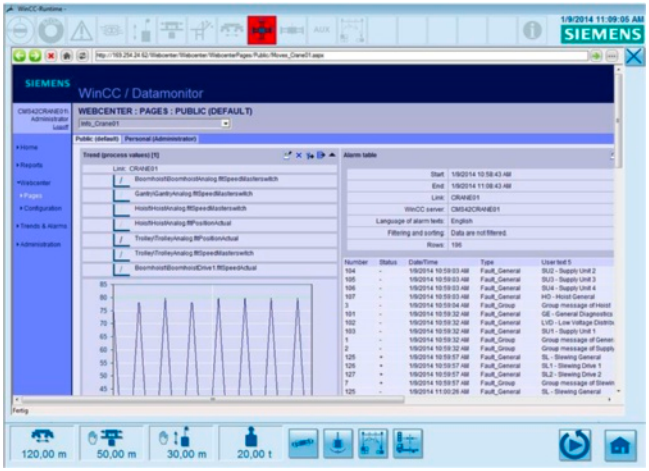
The optional package DataMonitor offers user-friendly functions for the graphical evaluation of cargo handling data, number of faults and other operating data of the crane. You can use a web-based user interface to create your own evaluations or adapt existing ones at any time.

These evaluations are possible directly on the CMS station or from a generally available office PC, which, however, must be connected to each CMS on the crane over the network.

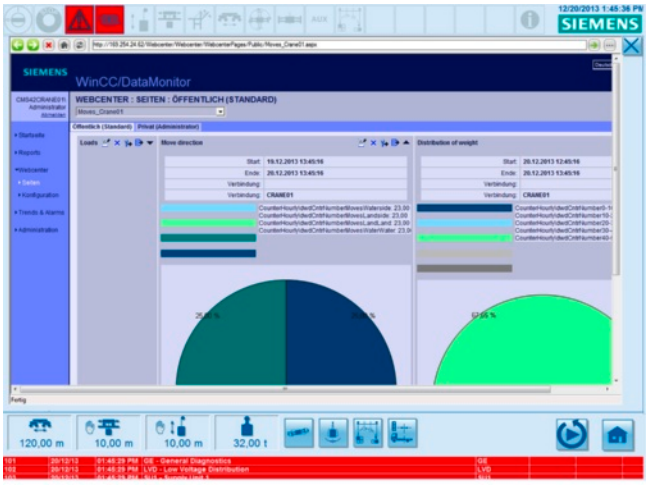


Overview of CMS Central Crane DataMonitor

Function (continued)



Data Aggregation using CMS Central Crane DataMonitor



Graphical data representation in DataMonitor

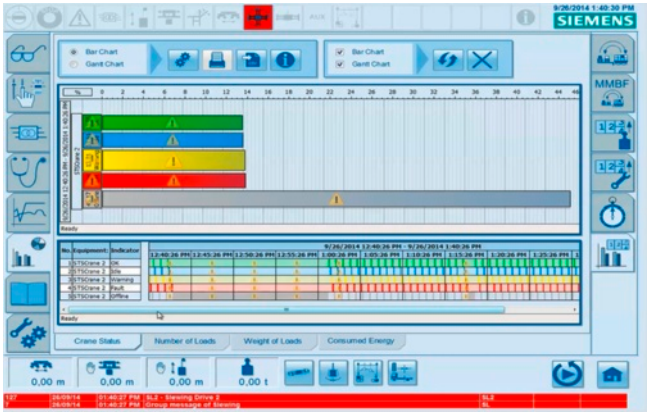
In addition to data evaluation, the DataMonitor can also be used for remote access to the local cranes and CMS user interface. In this case, however, it is purely a monitoring mode. For most applications, this is adequate as a remote access function. The option package CMS WebNavigator for remote access purposes is not necessary in this case.

CMS Lean and CMS Basic Crane Performance Monitor

For CMS Lean and CMS Basic packages the optional package from WinCC Performance Monitor can be used in order to calculate KPI's or perform crane availability for each crane. The WinCC Performance Monitor is delivered as optional package for CMS Lean and CMS Basic as separate article number – please refer to section for CMS Lean and CMS Basic ordering data.

When Crane Performance Monitor option is activated via the license, the screens predefined in the CMS Application can be activated via the settings menu in the CMS Application (WinCC project). The screens are predefined for standard reports on the CMS, showing information about crane status, number of loads, weight of loads, consumed energy, etc.

The calculation of KPI's for each crane can be modified depending of the project requirements. Own reports generated in runtime on the CMS station can be realised. The information of the Crane Performance Monitor can be visualized remote as well via WebNavigator using WebClients. In order to choose the right article number please refer to the ordering number structure of CMS Lean and CMS Basic packages.



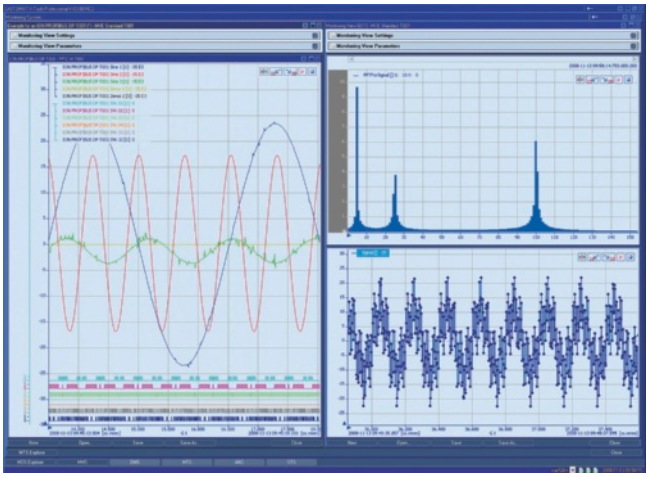
Example of screen for CMS Crane Performance Monitor option

4

Function (continued)

CMS Basic – Fast Trace function with SIPLUS CMS

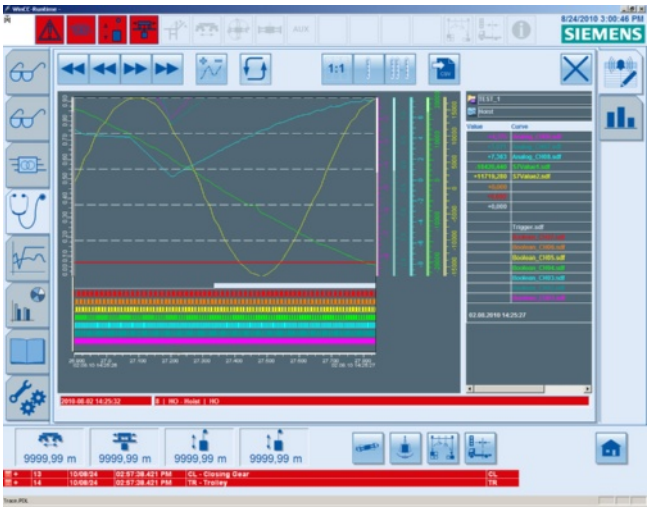
An important source of information in the event of a fault is the signal profile of: Speed, Torque, Current, Voltage, this in combination with a selection of important digital signals such as: Limit switches, Commands, etc.



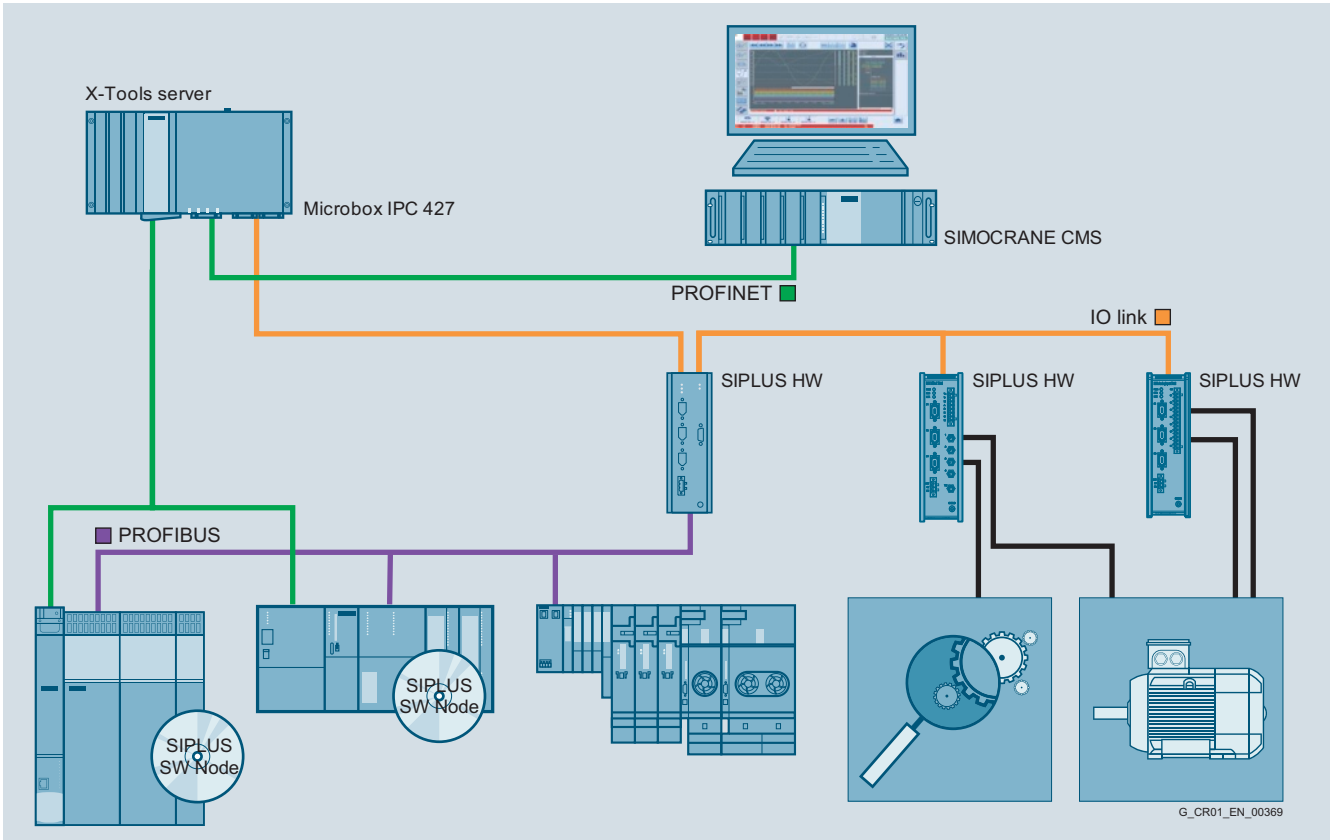
Example of screen in X-Tools for Fast Trace function

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 that is well-proven in other sectors. As well as recording trace data, the "X-Tools" program included in the scope of delivery offers high-performance tools for data analysis and continuous monitoring of operating parameters (Condition Monitoring). 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 as easily as possible. The maintenance technician requires no special training for this tool.



Trace display in WinCC picture



Configuration of using Fast Trace

Function (continued)

IONs – Input-Output Nodes

SIPLUS CMS offers "IONs" for acquiring measured values. These are hardware or software modules that acquire the measured values. The software nodes, ION's are included in the standard software X-Tools when this option is ordered. The hardware for ION's 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 arise. This avoids incorrect interpretations which may result due to the time taken to transmit 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)

Recommended hardware configuration

Configuration

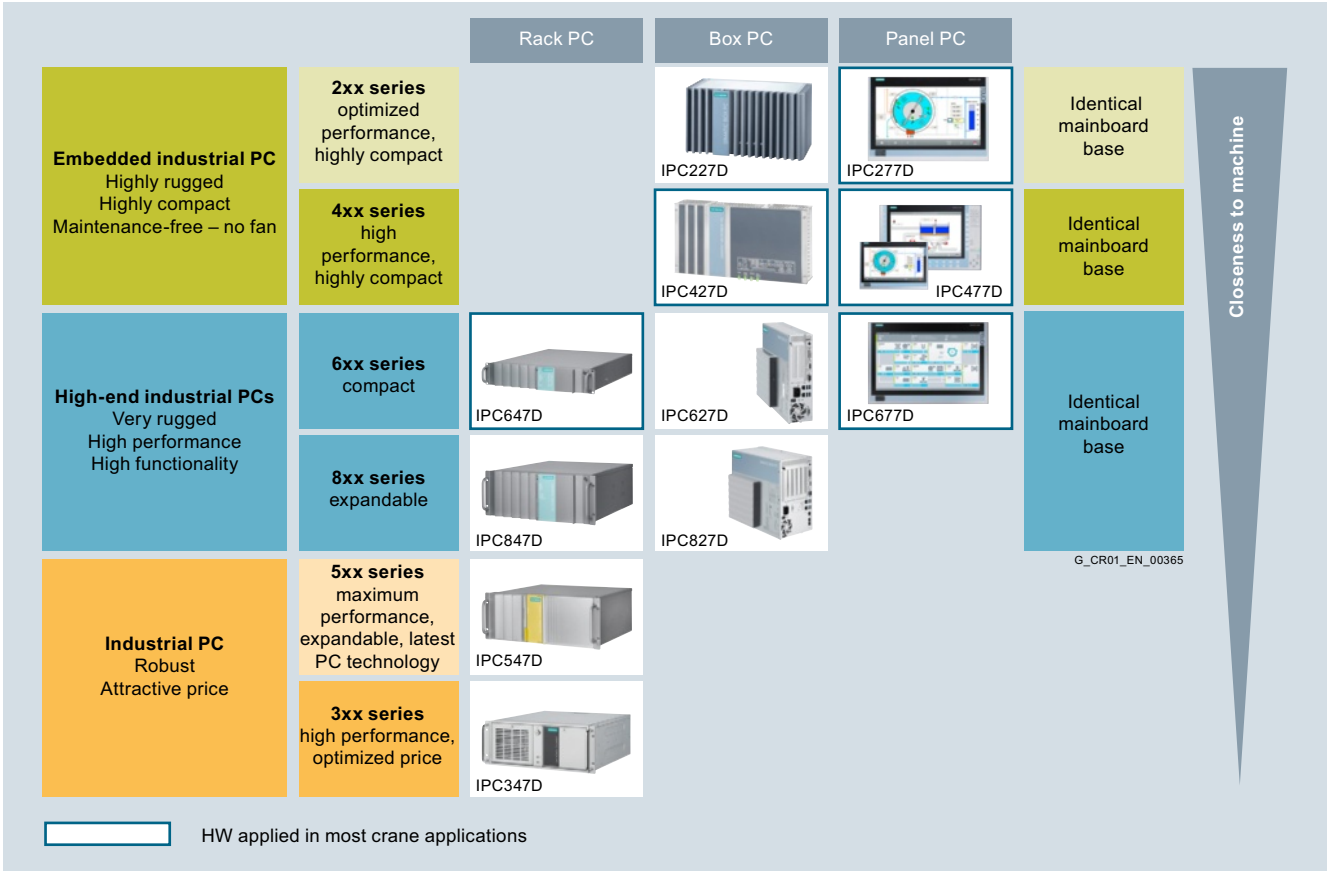
Hardware configurations from the SIMATIC IPC and SIMATIC Panel PC range are recommended for SIMOCRANE CMS Lean and CMS Basic software packages. In accordance with the recommendations, alternative computer hardware can also be used.

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

Recommended hardware configurations for CMS

SIMOCRANE CMS Lean or CMS Basic station on the crane (standard 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 IPC 427 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
	Other interfaces	USB
	Operating system	Windows 7 SP1 (64 bit)
SIMOCRANE CMS Lean or CMS Basic station on the crane (single-user or multi-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 PC 477, 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	Windows 7 SP1 (64 bit)
SIMOCRANE CMS Lean or CMS Basic operator panel on the crane		
WebClient 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 8GB)
	Mass storage	SSD 50 Gb/80 Gb or more (Solid State Card)
	Communications interfaces	Ethernet (PROFIBUS)
	Other interfaces	USB
	Operating system	Windows 7 SP1 (32 bit/64 bit)

Configuration (continued)



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

SIMOCRANE CMS Lean

Technical specifications

Ordering packages	SIMOCRANE CMS Lean			
	Standard (Single-User)	**Standard + WebClients (Multi-User) 1 WebClient 3 WebClients**	**Standard + Crane Central Data Monitor + WebClients**	**Standard + Crane Performance Monitor + WebClients**
Type	6GA7214-0AA00-0AA0	6GA7214-1.A00-0AA0 6GA7214-2.A00-0AA0	6GA7214-3.A00-0AA0 6GA7214-4.A00-0AA0	6GA7214-1.A00-1AA0 6GA7214-4.A00-0AA0
Configurable presentation				
• Crane types	✓	✓	✓	✓
- RMG/RTG [1]	✓	✓	✓	✓
- Industrial cranes (e.g. ladle crane)	✓	✓	✓	✓
• 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	✓	✓	✓	✓
- ry 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 [2]	✓	✓	✓	✓
• Truck Positioning modes [2]	✓	✓	✓	✓
Error diagnostics				
• Approx. 100 typical, preconfigured 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 WebServer (CPU diagnostics; CPU-dependent)	✓	✓	✓	✓
• SIMOTION WebServer integration (version dependent)	✓	✓	✓	✓

For legends and footnotes, see Page 4/29.

Technical specifications (continued)

Ordering packages	SIMOCRANE CMS Lean			
	Standard (Single-User)	**Standard + WebClients (Multi-User) 1 WebClient 3 WebClients**	**Standard + Crane Central Data Monitor + WebClients**	**Standard + Crane Performance Monitor + WebClients**
Type	6GA7214-0AA00-0AA0	6GA7214-1.A00-0AA0 6GA7214-2.A00-0AA0	6GA7214-3.A00-0AA0 6GA7214-4.A00-0AA0	6GA7214-1.A00-1AA0 6GA7214-4.A00-0AA0
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	✓	✓	–	✓
• Export in other file formats	–	–	✓	–
- PDF	–	–	✓	–
- Excel	–	–	✓	–
System features				
• 512 process tags	✓	✓	✓	✓
• 512 archive tags	✓	✓	✓	✓
• Communication channels	✓	✓	✓	✓
- SIMATIC S7 (PROFIBUS, Ethernet)	✓	✓	✓	✓
- SIMOTION (Ethernet)	✓	✓	✓	✓
- OPC	✓	✓	✓	✓
• Remote crane access	–	✓	✓	✓
- Multi-user capability (1 client including remote crane access 6GA7214-1.A00-0AA0 or 6GA7214-4.A00-0AA0)	–	✓	✓	✓
- Multi-user capability (3 clients including remote crane access 6GA7214-2.A00-0AA0)	–	✓	–	–
• Display and full remote operation	–	✓	✓	✓
• Replay function (playback)	✓	✓	✓	✓
• E-mail sending	–	–	✓	–
• Web Based Dashboards	–	–	✓	–
• Webbased 1 × direct access client to SQL database	–	–	✓	–
• KPI calculations and crane availability	–	–	–	✓
• Data reporting and advanced representation	–	–	–	✓
• Web visualization of KPI data for reporting	–	✓	✓	✓
• Fast Trace signal analysis [4]	–	–	–	–
• Export of archive data and messages to Excel (DataMonitor)	–	–	✓	–
• Office PC Excel Reporting Tool of SQL database – Crane Excel Workbook (connection to CMS and RCMS)	✓	✓	✓	✓
• Microsoft SQL Server standard delivered with CMS Lean	✓	✓	✓	✓

– Not included in the scope of delievery

✓ Included in the scope of delievery

[1] Standard delivered with CMS Lean Application. Adaptable for other crane types by adjusting the configuration.

[2] Configuration optional with additional screens to be integrated.

[3] More messages can be defined depending of the application.

[4] Fast Trace and Hardware vibration analysis should be ordered separately, not in bundle; please enquiry.

Selection and ordering data

Description	Article No.
SIMOCRANE CMS Lean Runtime languages: multilanguage interface supported UNICODE • European: De, En, It, Fr, Es, Ru, etc. – standard • Asia: Ch, Ch. trad, Jp., Ko. etc. – to be delivered on request Scope of functions: • WinCC V7.2 RT licenses (512 PowerTags) [1] • 512 Archive Tags [2] • SIMOCRANE CMS V4.3 Configuration • SIMOCRANE CMS V4.3 RT • CMS V4.3 Standard Application, configurable (WinCC project example "ready to run", example for a RMG/RTG/industrial crane) • Crane condition monitoring • Replay function (playback) • Message system and advanced fault diagnosis • Cargo handling acquisition • Acquisition of operating hours/counter values/timers • Advanced reporting and data aggregation (option for CMS Lean) • Dashboards, Business Intelligence Tools (option for CMS Lean) • Distributed information of advanced reporting via web clients (option for CMS Lean) • Export of archived data and messages from MS SQL to Excel • Advanced S7 diagnosis • Integrated webserver for SIMOTION, SINAMICS and S7 • Maintenance Instructions /Notes (advanced message diagnosis) • 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, World, Excel, videos, etc.) • Connection to RCMS	
Single user (Standard)	**6GA7214-0AA00-0AA0**
Single user + PerformanceMonitor (KPI) Crane Performance Monitor (KPI/OEE/ advanced reporting, Gantt views, data mining, crane down time)	**6GA7214-0BA00-0AA0**
Multi-user (1 WebClient) Standard + 1 WebClient	**6GA7214-1AA00-0AA0**
Multi-user (1 WebClient) + PerformanceMonitor (KPI) Crane Performance Monitor (KPI/OEE/ advanced reporting, Gantt views, data mining, crane down time)	**6GA7214-1BA00-0AA0**
Multi-user (3 WebClients) Standard + 3 WebClients	**6GA7214-2AA00-0AA0**
Multi-user (3 WebClients) + PerformanceMonitor (KPI) Crane Performance Monitor (KPI/OEE/ advanced reporting, Gantt views, data mining, crane down time)	**6GA7214-2BA00-0AA0**
Multi-user Central DataMonitor (RCMS w/o MS SQL) Standard + Central DataMonitor	**6GA7214-3AA00-0AA0**
Multi-user (Central DataMonitor) + PerformanceMonitor (KPI) Crane Performance Monitor (KPI/OEE/ advanced reporting, Gantt views, data mining, crane down time)	**6GA7214-3BA00-0AA0**
Multi-user (Central DataMonitor) + 1 WebClient	**6GA7214-4AA00-0AA0**
Multi-user (Central DataMonitor) + 1 WebClient + PerformanceMonitor (KPI) Crane Performance Monitor (KPI/OEE/ advanced reporting, Gantt views, data mining, crane down time)	**6GA7214-4BA00-0AA0**

More information

Siemens product support

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

http://support.industry.siemens.com/cs/

→ Product Examples → (enter search term) SIMOCRANE

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

http://support.industry.siemens.com/cs/

→ 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:

http://www.siemens.nl/training/cranes

[1] Additional Power Tags can be ordered separately; please refer to the HMI Catalog ST 80 WinCC section.

[2] Additional Archive Tags can be ordered separately; please refer to the HMI Catalog ST 80 WinCC section.

Technical specifications

Ordering packages	SIMOCRANE CMS Basic			
	Standard (Single-User)	**Standard + 3 WebClients (Multi-User)**	**Standard + Crane Performance Monitor**	**Standard + Condition Monitoring (Fast Trace)**
Type	6GA7214-0AB00-0AA0	6GA7214-1A.00-.AA0	6GA7214-.BB00-.AA0	6GA7214-1..00-1AA0
Configurable presentation				
• Crane types	✓	✓	✓	✓
- STS [1]	✓	✓	✓	✓
- RMG/RTG [2]	✓	✓	✓	✓
- Industrial cranes (e.g. ladle crane) [2]	✓	✓	✓	✓
• 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	✓	✓	✓	✓
Condition monitoring				
• Crane components	✓	✓	✓	✓
- Crane overview	✓	✓	✓	✓
- Boom	✓	✓	✓	✓
- ry 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	✓	✓	✓	✓
• 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 blocks entry point (symbolic or absolute)	✓	✓	✓	✓
• Process values to accompany messages (e.g. positions)	✓	✓	✓	✓
• SIMATIC S7 WebServer (CPU diagnostics; CPU-dependent)	✓	✓	✓	✓
• SIMOTION WebServer integration (version dependent)	✓	✓	✓	✓

For legends and footnotes, see Page 4/32.

Technical specifications (continued)

Ordering packages	SIMOCRANE CMS Basic			
	Standard (Single-User)	**Standard + 3 WebClients (Multi-User)**	**Standard + Crane Performance Monitor**	**Standard + Condition Monitoring (Fast Trace)**
Type	6GA7214-0AB00-0AA0	6GA7214-1A.00-.AA0	6GA7214-.BB00-.AA0	6GA7214-1..00-1AA0
Operating data acquisition				
• Acquisition of cargo handling data ("Moves")	✓	✓	✓	✓
• Acquisition of operating hours counts	✓	✓	✓	✓
• 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	✓	✓	–	✓
• Export in other file formats	✓	✓	✓	✓
- PDF	✓	✓	✓	✓
- MS Office	✓	✓	✓	✓
System features				
• 2048 process tags	✓	✓	✓	✓
• 1500 archive tags	✓	✓	✓	✓
• Communication channels	✓	✓	✓	✓
- SIMATIC S7 (PROFIBUS, Ethernet)	✓	✓	✓	✓
- SIMOTION (Ethernet)	✓	✓	✓	✓
- OPC	✓	✓	✓	✓
• Remote crane access	–	✓	✓	✓
• Multi-user capability (3 clients including remote crane access)	–	✓	–	–
- Display and full remote operation	–	✓	–	–
- Replay function (playback)	✓	✓	✓	✓
• Advanced reporting including Information Server	✓	✓	✓	✓
• E-mail sending	✓	✓	✓	✓
• Web Based Dashboards	✓	✓	✓	✓
• Webbased 3 × direct access clients to SQL database	✓	✓	✓	✓
• Reporting on mobile devices (e.g. technical specifications, tablet)	✓	✓	✓	✓
• KPI calculations and crane availability	–	–	✓	–
• Data reporting and advanced representation	–	–	✓	–
• Web visualization of KPI data for reporting	–	✓	✓	–
• Fast Trace analysis	–	–	–	✓
• Vibration analysis [4]	–	–	–	✓
• Export of archive data and messages to EXCEL (Information Server)	✓	✓	✓	✓
• Office PC EXCEL Reporting Tool of SQL database – Crane Excel WorkBook (connection to CMS and RCMS)	✓	✓	✓	✓
• Microsoft SQL Server standard delivered with CMS Basic	✓	✓	✓	✓

– Not included in the scope of delievery

✓ Included in the scope of delievery

[1] Standard delivered with CMS Basic Application. Adaptable for other crane types by adjusting the configuration.

[2] Configuration optional with additional screens to be integrated.

[3] More messages can be defined depending of the application.

[4] For Vibration analysis extra hardware is necessary depending of application; please contact Application Support for more details.

Selection and ordering data

Description	Article No.
SIMOCRANE CMS Basic	
Runtime languages: multilanguage interface supported UNICODE • European: De, En, It, Fr, Es, Ru, etc. – standard • Asia: Ch, Ch. trad, Jp., Ko. etc. – to be delivered on request	
Scope of functions: • WinCC V7.2 RT licenses (2048 PowerTags) [1] • 1500 Archive Tags [2] • SIMOCRANE CMS V4.3 Configuration • SIMOCRANE CMS V4.3 RT • CMS V4.3 Standard Application, configurable (WinCC project example ''ready to run'', example for a STS crane) • Information Server (3 WebClients included): Advanced Reporting, Dashboards, BI tools • Crane condition monitoring • Replay (playback) • Message system and advanced fault diagnosis • Cargo handling acquisition • Acquisition of operating hours/counter values/timers • Data aggregation • Advanced reporting • Dashboards, Business Inteligence Tools • Distributed information of advanced reporting via 3 × Webclients • Export of data and messages to Excel • Advanced S7 diagnosis • Integraded webserver for SIMOTION, SINAMICS and S7 • Maintenance Instructions/Notes (advanced message diagnosis) • 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, World, Excel, videos, etc.) • Connection to RCMS	
Single user (Standard)	
• Trace min. 500 ms sample rate	**6GA7214-0AB00-0AA0**
• Trace < 500 ms sample rate – SIPLUS CMS/ X-Tools Professional V4.01 with SW-ION'S S7/SIMOTION	**6GA7214-0AB00-1AA0**
Single user (Standard) + Performance Monitor (KPI) Crane Performance Monitor (KPI/OEE/advanced reporting, Gantt views, data mining, crane down time, table controls, crane performance indicators)	
• Trace min. 500 ms sample rate	**6GA7214-0BB00-0AA0**
• Trace < 500 ms sample rate – SIPLUS CMS/X-Tools Professional V4.01 with SW-ION'S S7/SIMOTION	**6GA7214-0BB00-1AA0**
Multi-user (WebClients) Standard + 3 WebClients (full functionality)	
• Trace min. 500 ms sample rate	**6GA7214-1AB00-0AA0**
• Trace < 500 ms sample rate – SIPLUS CMS/ X-Tools Professional V4.01 with SW-ION'S S7/SIMOTION	**6GA7214-1AB00-1AA0**
Multi-user (WebClients) + Performance Monitor (KPI) Standard + 3 WebClients (full functionality) + Crane Performance Monitor (KPI/OEE/advanced reporting, Gantt views, data mining, crane down time, table controls, crane performance indicators)	
• Standard, Trace min. 500 ms sample rate	**6GA7214-1BB00-0AA0**
• Trace < 500 ms sample rate – SIPLUS CMS/ X-Tools Professional V4.01 with SW-ION'S S7/SIMOTION	**6GA7214-1BB00-1AA0**

More information

Siemens product support

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

http://support.industry.siemens.com/cs/

→ Product Examples → (enter search term) SIMOCRANE

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

http://support.industry.siemens.com/cs/

→ 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:

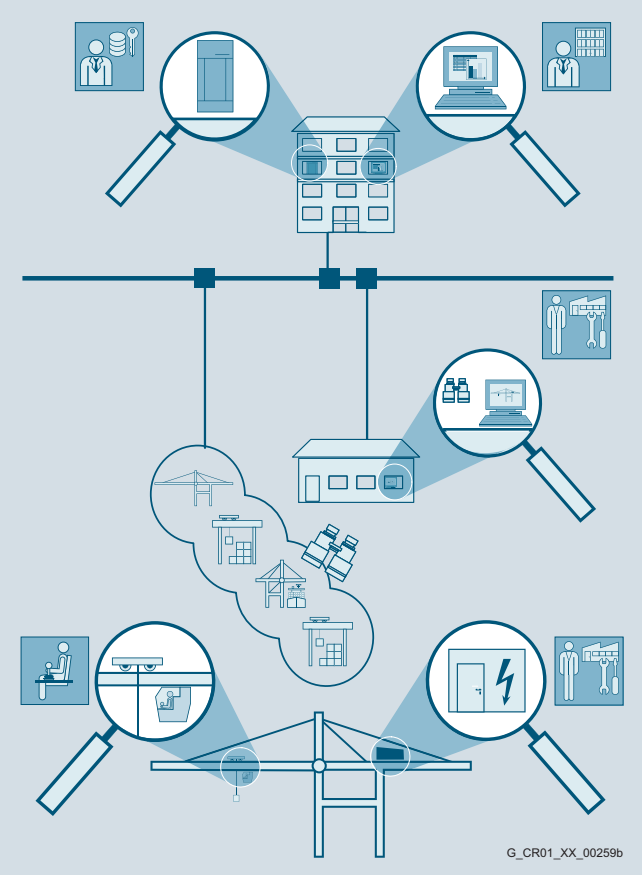
http://www.siemens.nl/training/cranes

[1] Additional Power Tags can be ordered separately; please refer to the HMI Catalog ST 80 WinCC section.

[2] Additional Archive Tags can be ordered separately; please refer to the HMI Catalog ST 80 WinCC section.

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 usually have a control room with one or more operator 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.

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 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 too. The CMS server is used as an application server for central software components such as for maintenance planning, downtime monitoring, advanced reporting etc.

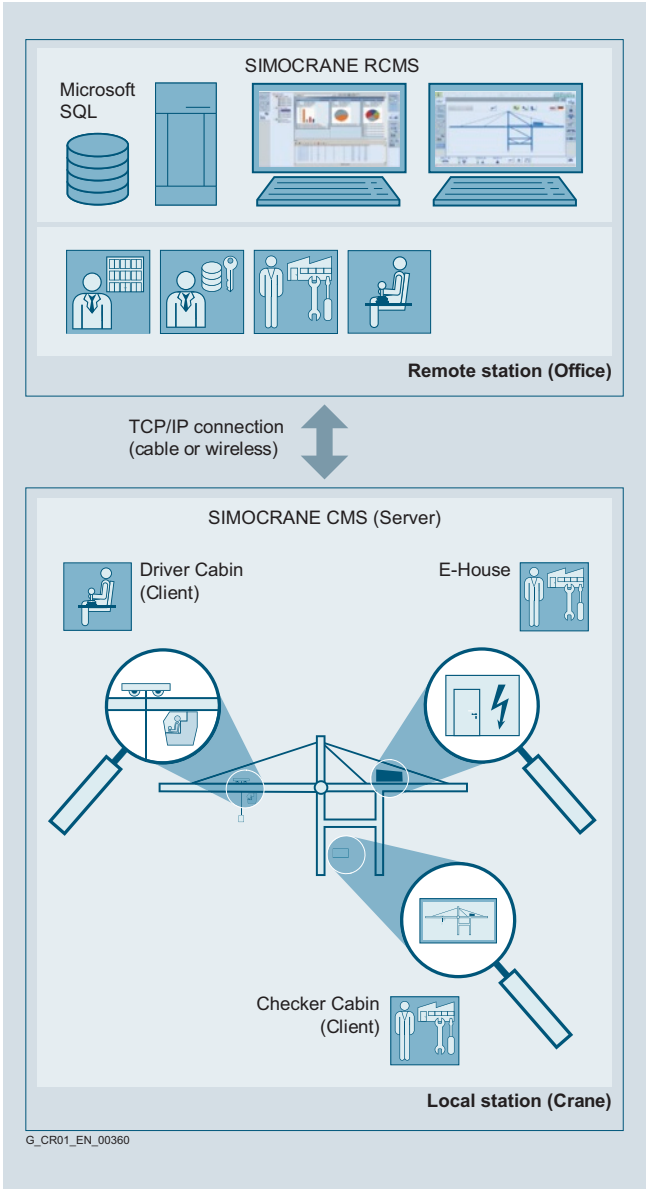
Requirements:

- 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 computer is installed in the electrical room
- Crane driver must have an operator panel in the cabin
- Remote crane access must be possible from a maintenance building
- A central server must record and archive the data from all cranes with long-term archiving using SQL database
- Graphical evaluations must be possible in the control center with regard to productivity, error statistics and availability

Solution of configuration using SIMOCRANE CMS and RCMS configuration:

- SIMOCRANE CMS (Basic with WebClients – Webnavigator)
  Article No. **6GA7214-1AB00-0AA0**
  on each crane
- SIMOCRANE RCMS single station (Standard)
  Article No. **6GA7215-0AA00-0AA0**
- Panel PC 477 as operator panel for the crane driver and in the checker cabin, e.g.:
  Article No. **6AV7240-6DD17-0PA0**
- Rack PC 647 as the CMS PC in the E-House (electrical room), e.g.:
  Article No. **6AG4112-2GP30-0BX0**
- Rack PC 647 as RCMS single station, on remote stations, e.g.:
  Article No. **6AG4112-2KP40-0FX0**
- Rack PC 647 as RCMS operator station, on remote station e.g.:
  Article No. **6AG4112-2GP30-0BX0** or standard office PC's with equivalent configuration

Overview (continued)



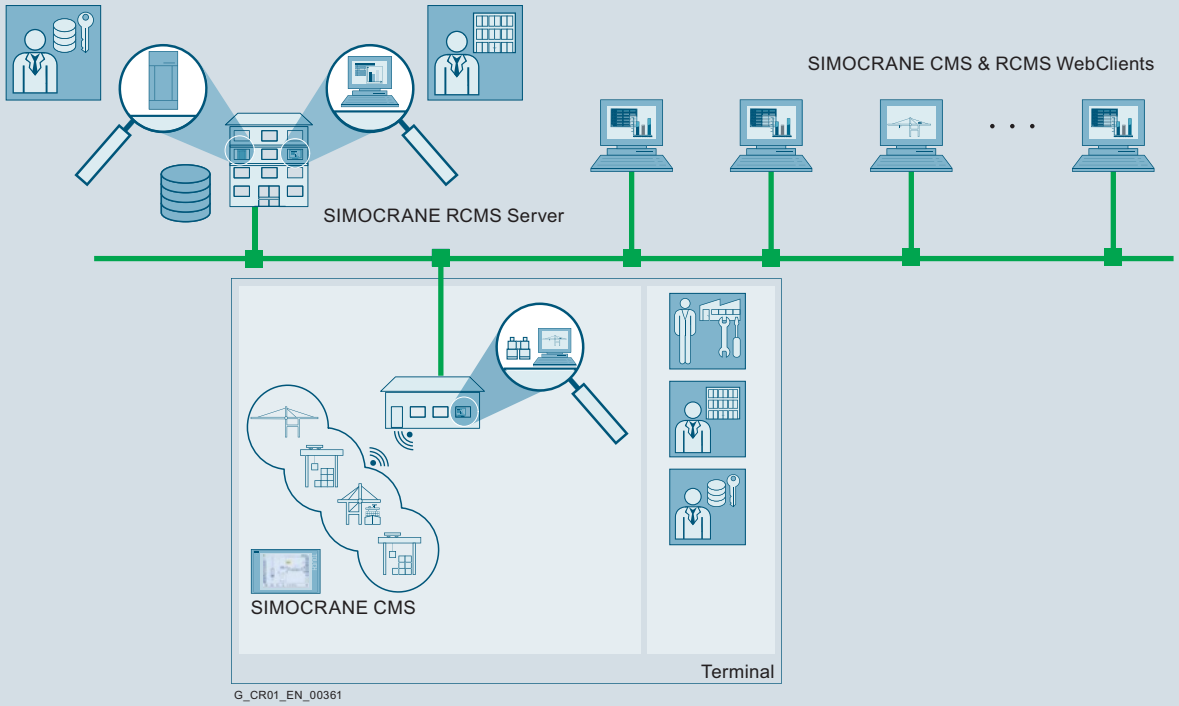
Example for solution configuration for an STS crane using SIMOCRANE CMS and RCMS

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

Remark:

The SIMOCRANE RCMS is standard equipped with one RCMS WebClient with full access to the screens and all components of the RCMS single station. Additional WebClients can be added by buying extra WebClients, for example 3, 10, 50 and 150 WebClients can be connected to one RCMS single station. All WebClients are working in parallel, accessing the information at the same time. Different configurations using WebClients are possible to be also added based on customer requirements.

Overview (continued)



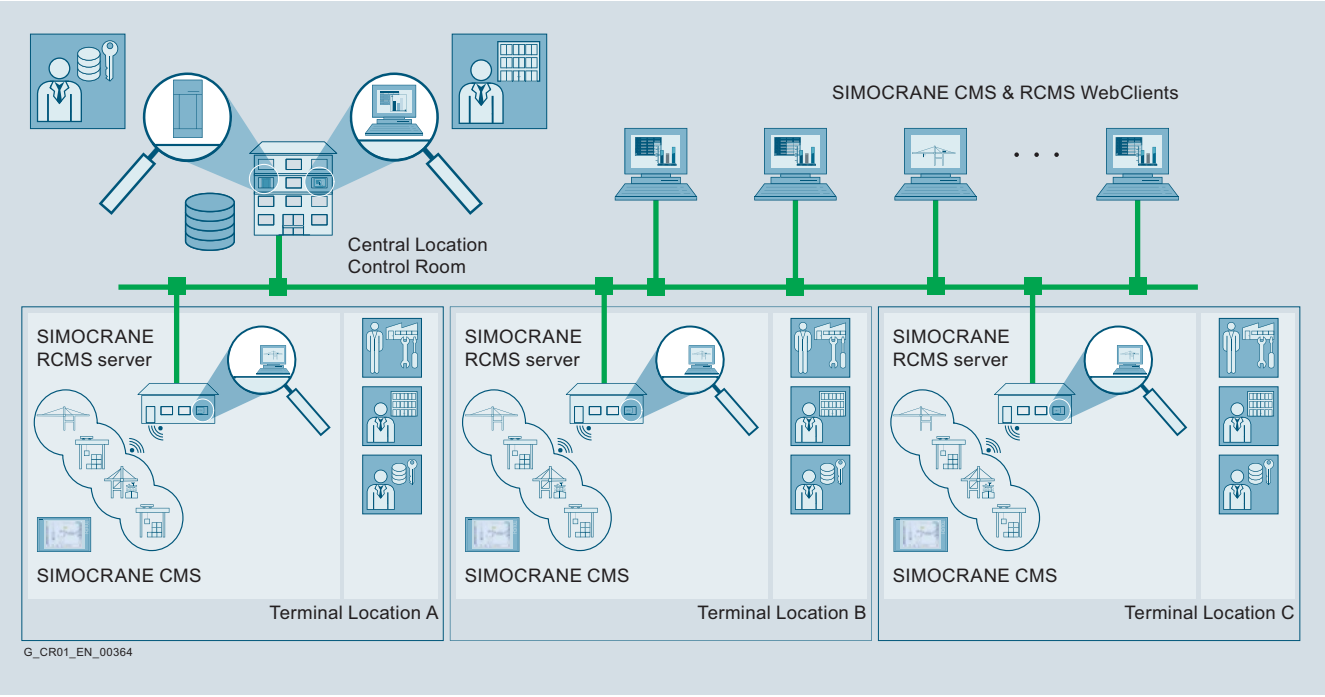
Typical configuration for SIMOCRANE RCMS single station with WebClients

Overview (continued)

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 webclients 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 & 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 100 % 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

Application

- Large harbor crane systems, such as container terminals.

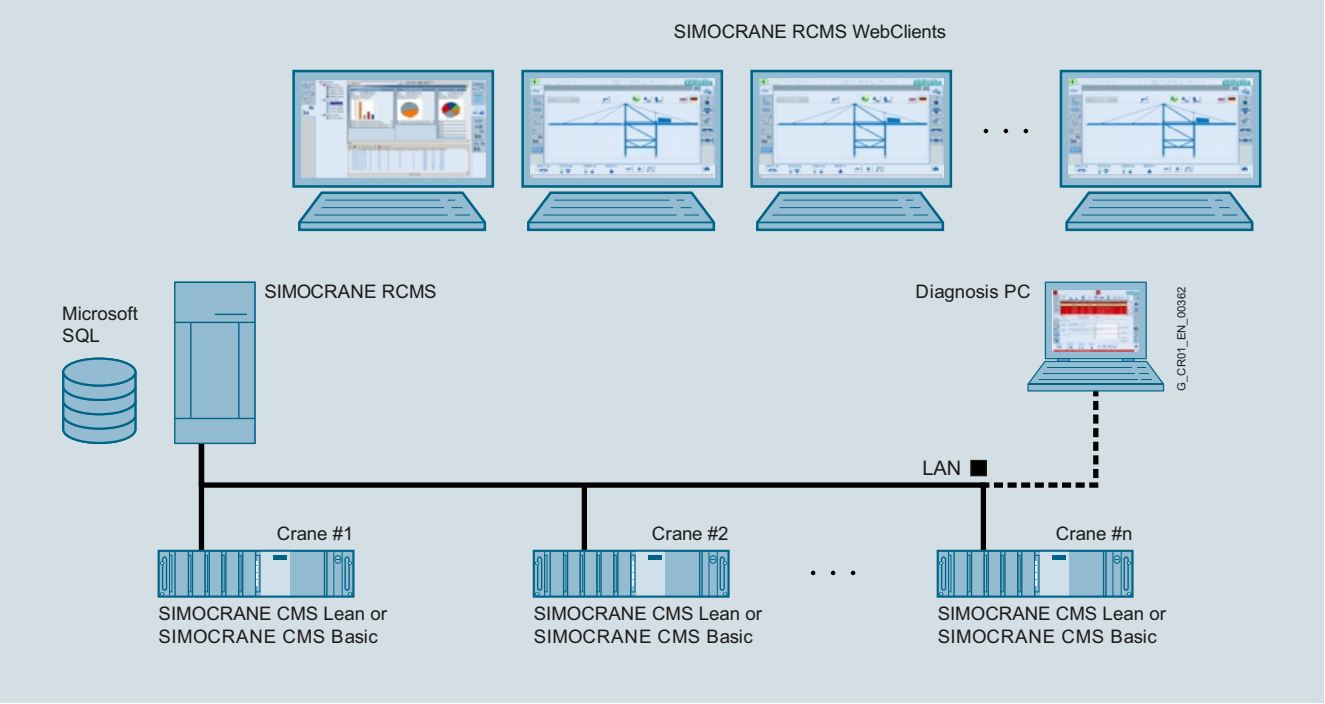
In addition to the diagnostic possibilities on the individual crane, productivity data acquisition and reporting play a decisive role. The availability of acquired cargo handling data, downtimes as well as performance data are important aspects regarding crane terminal operation and data mining.

Examples

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

Design

SIMOCRANE RCMS architecture



Topology of SIMOCRANE RCMS standard package (one WebClient included in the standard package)

Remarks:

SIMOCRANE RCMS is delivered standard with one RCMS WebClient. Additional WebClients can be ordered separate, to a maximum of 150 WebClients.

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 SQL database. RCMS is equipped with a Microsoft SQL database included standard in the RCMS package. This includes data storage with long-term archive capabilities integrated into the SCADA WinCC system.

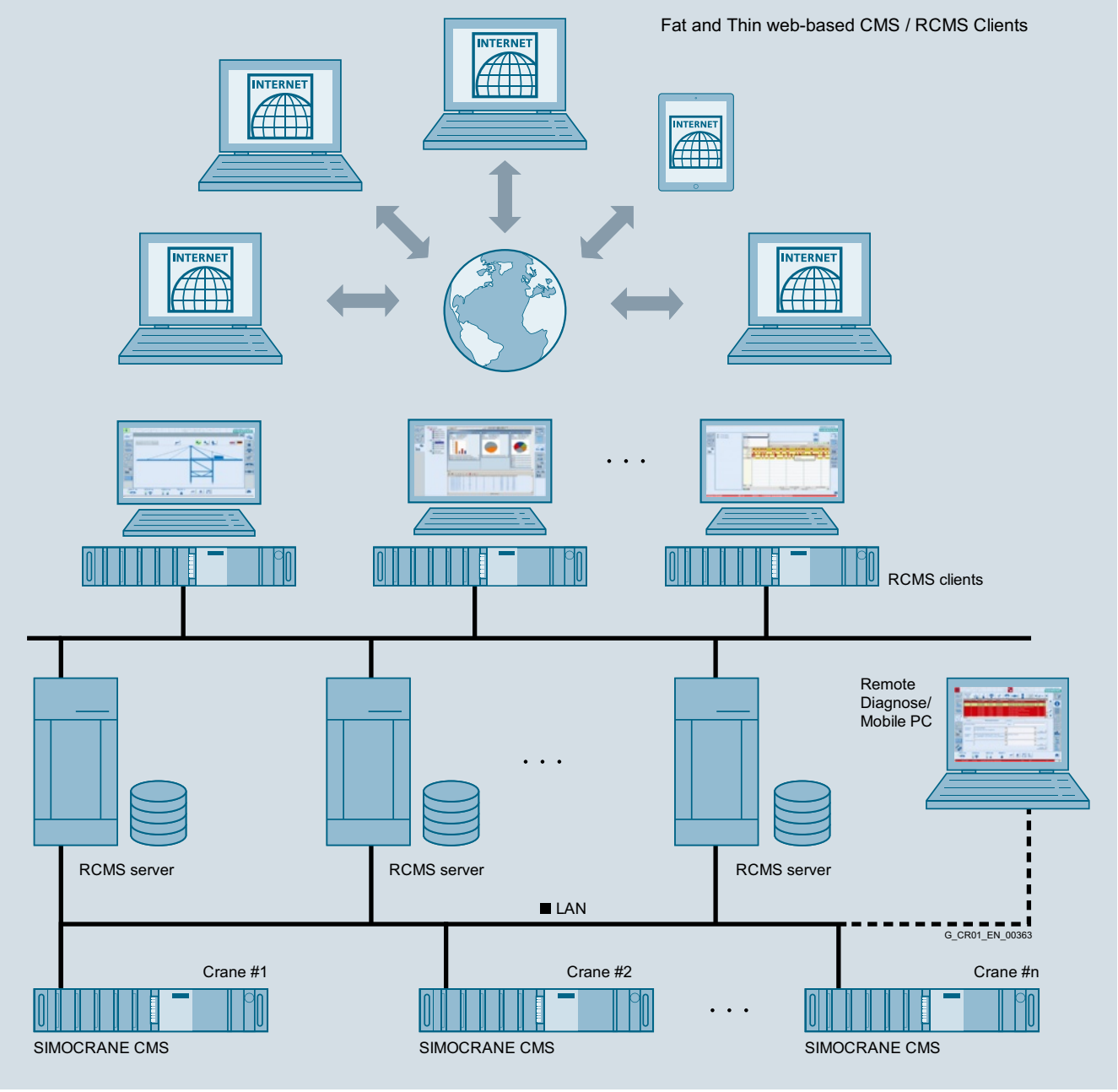
Design (continued)

RCMS server-single or RCMS server-client 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.

Especially in harbor applications, multiple RCMS server stations can be sued in order to distribute the information to different RCMS client systems. The RCMS clients have own database, which makes possible the data transferred from different RCMS servers to be merged and perform advanced reports from different CMS and RCMS stations at the same time.

Using standard Internet or Intranet web-based connections, fat or thin clients can be connected in different terminal access points in order to access the data from Microsoft SQL database, long-term archived server. These web-based clients can be mobile devices as PC tables 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

Function

RCMS central server and remote CMS

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.

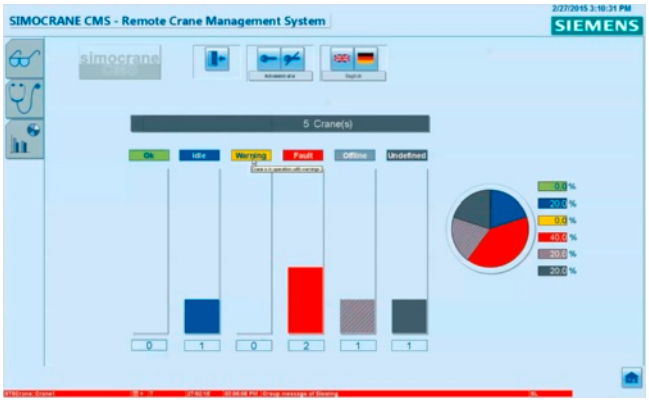
- As well as offering remote access to the CMS stations of the cranes, the central RCMS offers additional functions such as:
- Plant-wide crane overview
- Remote access to individual cranes
- Central data acquisition and evaluation
- Availability overview and Gantt charts
- Performance evaluation
- Excel reporting tool for data evaluation and exporting from MS SQL from CMS and RCMS
- Replay/Playback from RCMS on each CMS using WebClient functionality
- Long-Term Archiving in MS SQL on RCMS

The central RCMS focuses on the entire plant, not the single crane. Cranes of the same type can be compared and weak points therefore 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 has to 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.

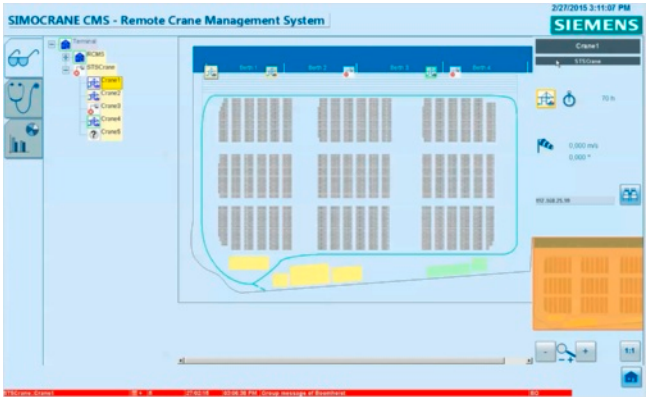
Plant-wide crane overview

The plant-wide crane overview is a project-oriented plant display based on a layout plan. The project engineer stores this plan as background in a format that is suitable for WinCC. Individual cranes are depicted using symbols. This display is not included in the scope of the product, but the data interface is provided.



Example of screen for RCMS – statistical overview

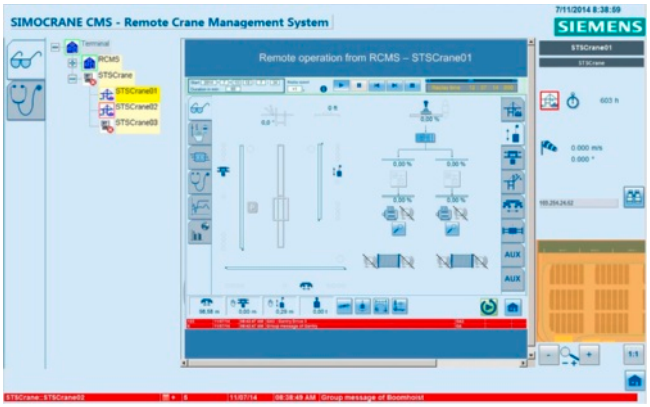
An alternative display is the hierarchic view as a topology tree. The different types of crane are displayed here in groups. The status of the individual cranes is visualized using different colors.



Example of screen for RCMS – node tree manager and cartographical overview

Remote access to individual cranes

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



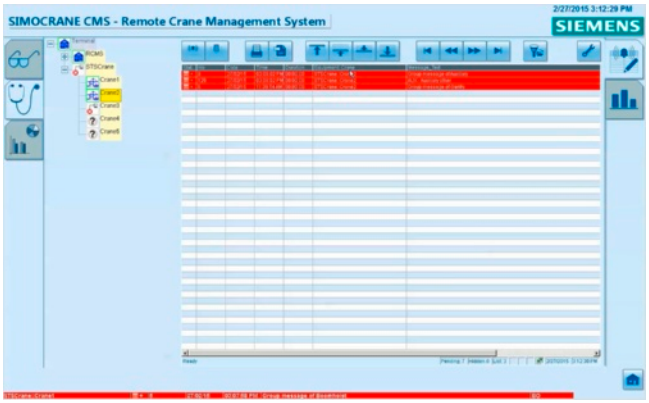
Example of integrated remote access of CMS into RCMS

Central data acquisition and evaluation

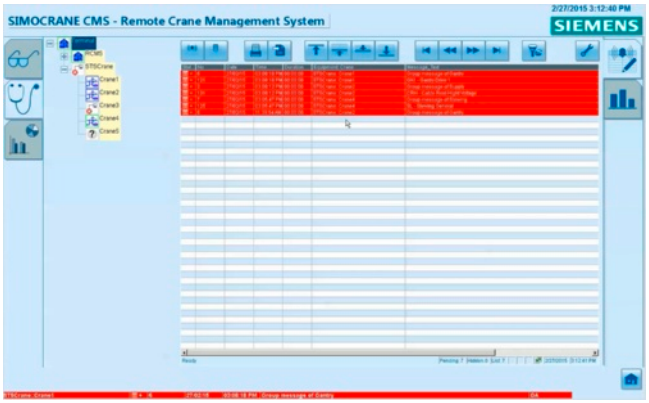
The cargo handling data, error messages, and counter values acquired for each crane are synchronized with the RCMS server. This server makes the consolidated data for all assigned cranes available for further evaluations. All data from different cranes (CMS stations), e.g. operational data, tags, messages, are sent to the remote RCMS. The Remote CMS (RCMS) can be also called as ''central CMS station'', which means there is a central station where the data from all cranes are collected. An RCMS has a Microsoft SQL database with Long-Term Archive integrated into WinCC station. This means the data is stored for long term in a Microsoft SQL database. The configuration for segments and data backup is to be configured at the beginning of the project for RCMS configuration. More details please refer to the CMS manuals and WinCC information on the support site.

On the RCMS a central fault message system is applied in order 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 SQL.

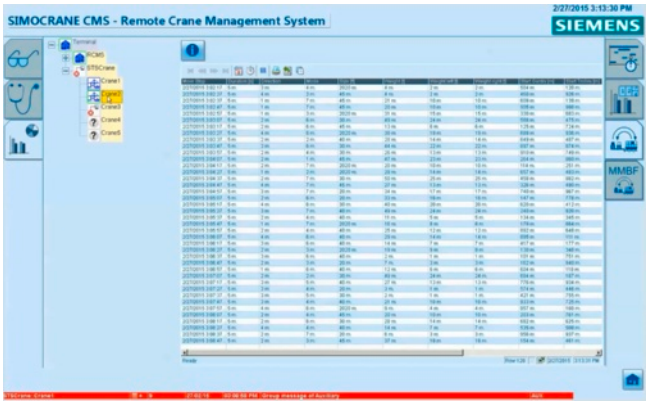
Function (continued)



RCMS – message list for one crane

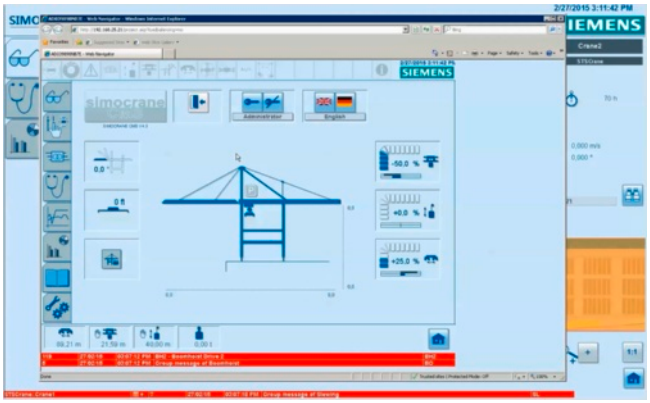


RCMS – message list for all cranes in the terminal



Crane operational data on 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. In a tabular from an overview with the most important data is shown. Filtering and data export can be performed on each individual crane.



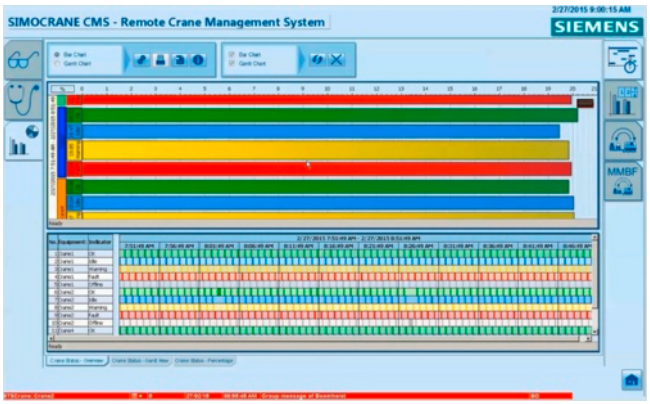
Remote system activation from RCMS on the crane (CMS station)

From RCMS each crane can be accessed in parallel remotely 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 as well – when the operator is operating the crane from local CMS, on the RCMS different information can be visualized remotely.

Availability overview and Gantt charts

The WinCC option Performance Monitor continuously acquires the operating states of all assigned cranes. 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 compared and weak points are to be identified in the Gantt charts.

The crane availability is easy to be visualized and extra information can be obtained by clicking on each crane. Different time intervals can be chosen in order to visualize the information from the past.

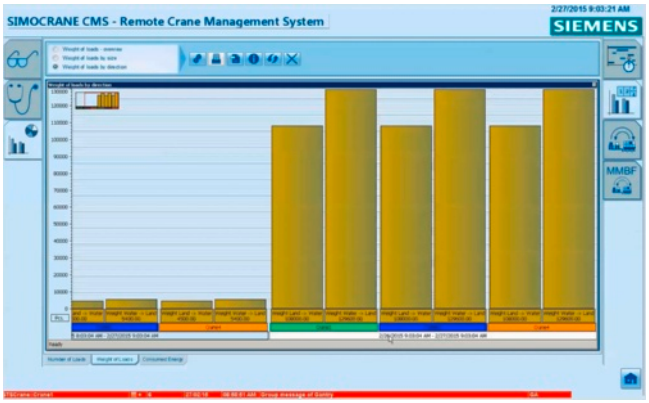


Gantt chart of cranes availability

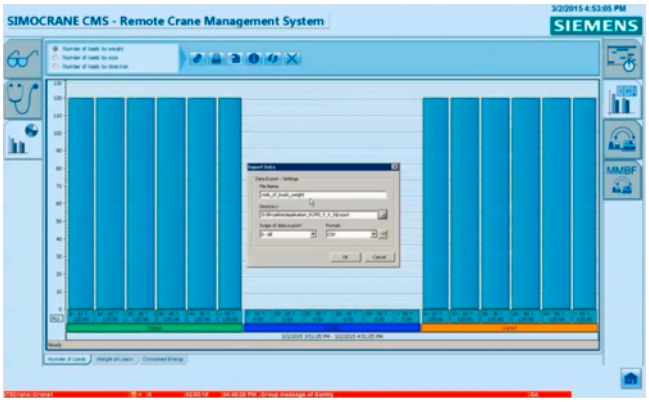
Function (continued)

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.

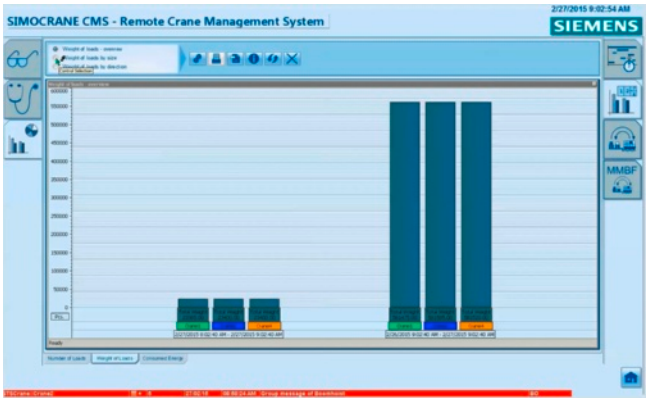


Bar diagram representation in Performance Monitor



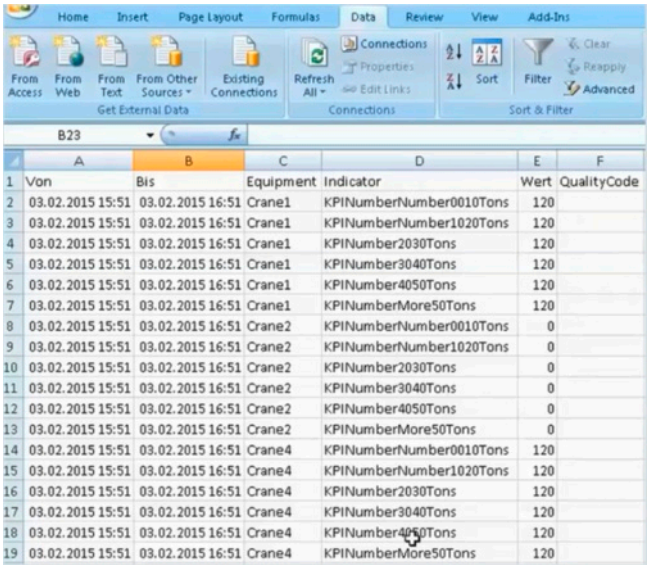
Data export to a table as CSV format

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



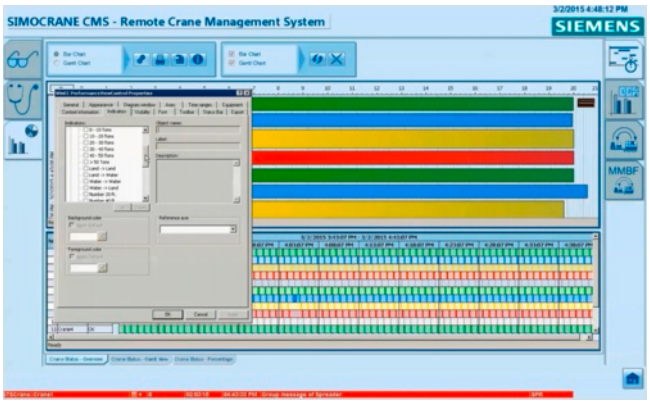
Bar diagram representation in Performance Monitor – representation of KPI for each crane

When needed the data and KPI's can be exported to a tabular form as a CSV or XLS 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.



	A	B	C	D	E	F
1	Von	Bis	Equipment	Indicator	Wert	QualityCode
2	03.02.2015 15:51	03.02.2015 16:51	Crane1	KPINumberNumber0010Tons	120	
3	03.02.2015 15:51	03.02.2015 16:51	Crane1	KPINumberNumber1020Tons	120	
4	03.02.2015 15:51	03.02.2015 16:51	Crane1	KPINumber2030Tons	120	
5	03.02.2015 15:51	03.02.2015 16:51	Crane1	KPINumber3040Tons	120	
6	03.02.2015 15:51	03.02.2015 16:51	Crane1	KPINumber4050Tons	120	
7	03.02.2015 15:51	03.02.2015 16:51	Crane1	KPINumberMore50Tons	120	
8	03.02.2015 15:51	03.02.2015 16:51	Crane2	KPINumberNumber0010Tons	0	
9	03.02.2015 15:51	03.02.2015 16:51	Crane2	KPINumberNumber1020Tons	0	
10	03.02.2015 15:51	03.02.2015 16:51	Crane2	KPINumber2030Tons	0	
11	03.02.2015 15:51	03.02.2015 16:51	Crane2	KPINumber3040Tons	0	
12	03.02.2015 15:51	03.02.2015 16:51	Crane2	KPINumber4050Tons	0	
13	03.02.2015 15:51	03.02.2015 16:51	Crane2	KPINumberMore50Tons	0	
14	03.02.2015 15:51	03.02.2015 16:51	Crane4	KPINumberNumber0010Tons	120	
15	03.02.2015 15:51	03.02.2015 16:51	Crane4	KPINumberNumber1020Tons	120	
16	03.02.2015 15:51	03.02.2015 16:51	Crane4	KPINumber2030Tons	120	
17	03.02.2015 15:51	03.02.2015 16:51	Crane4	KPINumber3040Tons	120	
18	03.02.2015 15:51	03.02.2015 16:51	Crane4	KPINumber4050Tons	120	
19	03.02.2015 15:51	03.02.2015 16:51	Crane4	KPINumberMore50Tons	120	

Example of export table of KPI's

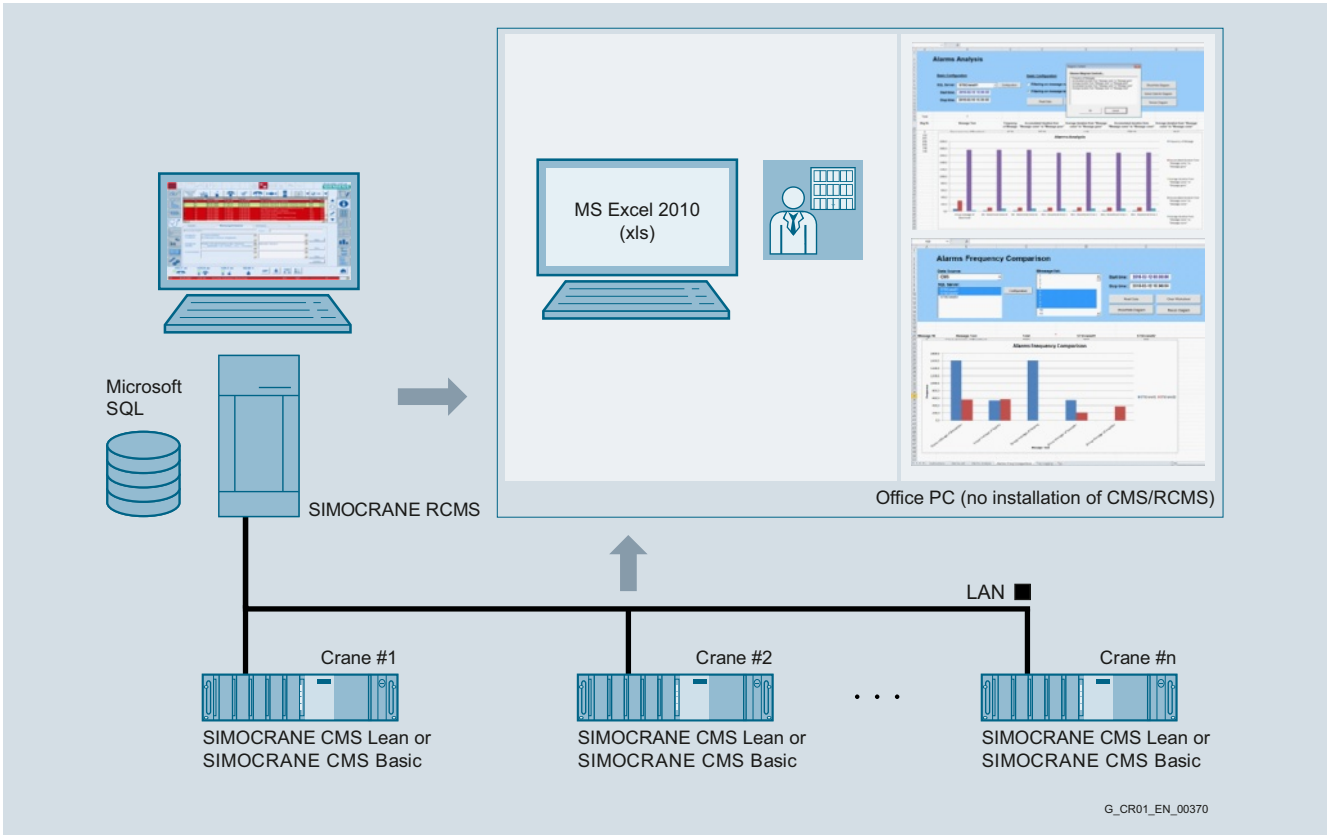


Changing of properties for data representation and settings in Performance Monitor

Function (continued)

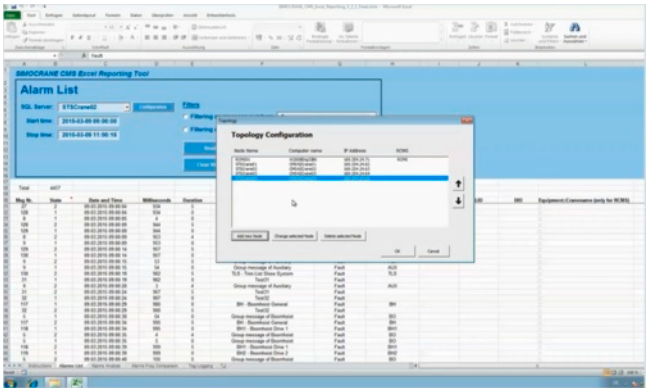
Microsoft SQL data retrieving and reporting using Excel

From the version V4.3 of SIMOCRANE CMS the possibility to easy extract the data from Microsoft (MS) SQL for CMS and RCMS is offered by using standard Microsoft programs such as Excel. The MS Excel can be installed on any office PC in the terminal. The PC should have access to the CMS or RCMS stations in the network. No installation of CMS or RCMS on the office PC is required, only a plug in for data access on the MS SQL database in order to facilitate the connection from a remote PC to the local MS SQL database. The Excel reporting tool needs to be configured in the beginning, regarding the name of the PC and the IP address. The operational data (moves, counters, timers, etc.) and other data stored in the archive tags on CMS or RCMS can be easily accessed remotely from an office PC. Fault message scan be retrieved as well as statistical analysis can be performed from different message groups.

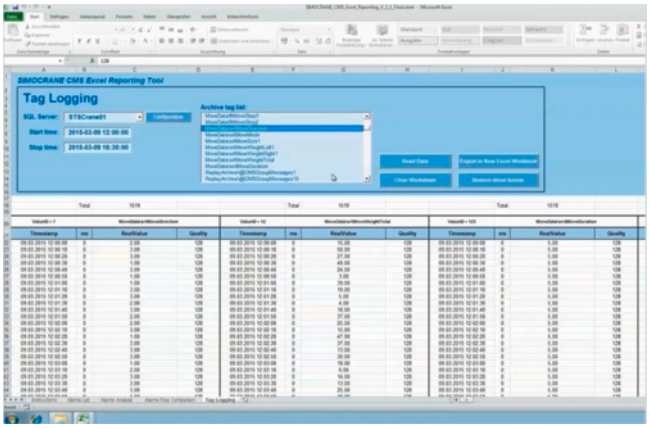


Microsoft Excel tool for data retrieving and data representation/reporting from MS SQL databases on CMS and RCMS

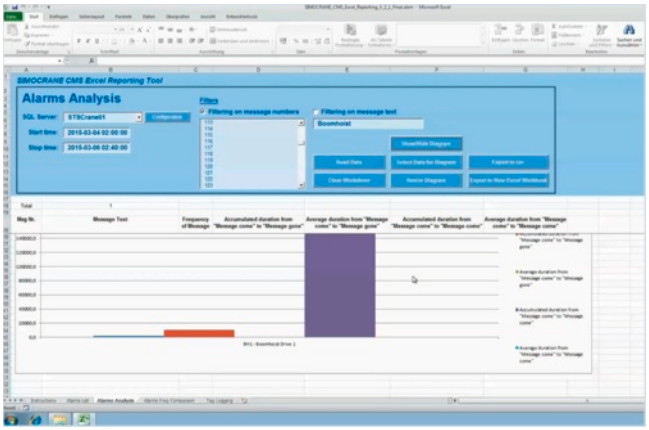
Function (continued)



Example of window in MS Excel reporting tool for topology configuration



Example of window in MS Excel reporting tool for archive tags reporting



Example of window in MS Excel reporting tool for alarm analysis

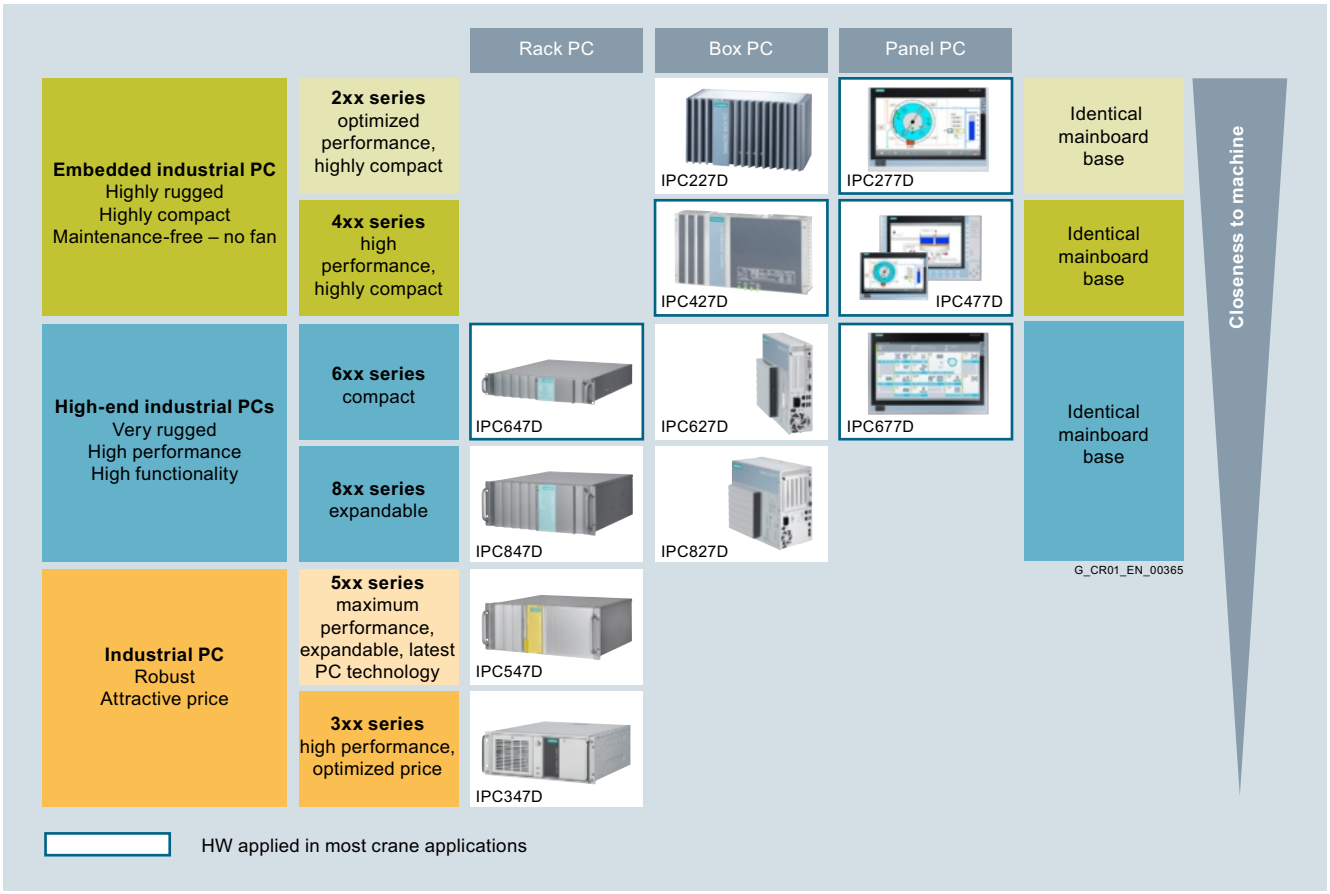
Configuration

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 enquiry in order to 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	Windows Server 2008 R2 (64 bit)

SIMOCRANE RCMS operator station		
SIMATIC IPC647 or IPC847 or Office PC 1 - 2 displays if necessary, preferably widescreen format	Processor	Core i5, or better performance
	Memory configuration	Minimum 8 GB
	Hard drive	1 Tb or more (as option RAID controller)
	Optical drives	DVD±R
	Graphics card	2 × DVI or 2 × VGA
	Communications interfaces	Ethernet
	Other interfaces	USB
	Operating system	Windows 7 SP1 (64 bit)



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

Technical specifications

Ordering packages	SIMOCRANE RCMS		
	Standard (1 WebClient)	**Standard + extra WebClients (3, 10, 50 and 150)**	**Standard + Operator station**
Type	6GA7215-0AA00-0AA0	6GA7215-0.A00-0AA0	6GA7215-1.A00-0AA0
Crane overview			
• Cartographic plant overview (example only map can be addapted)	✓	✓	✓
- Zooming and scrolling possible	✓	✓	✓
- Dynamic position display	✓	✓	✓
- Status display (operation, fault, maintenance, etc.)	✓	✓	✓
- Call-up of detailed information per crane	✓	✓	✓
• Hierarchic 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 WebClient	✓	✓	✓
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	✓	✓	✓
• KPI's per crane	✓	✓	✓
- KPI's for a group of cranes or entire terminal	✓	✓	✓
- MMBF values (Mean Moves Between Failures)	✓	✓	✓
- Customer-specific KPIs (configurable)	✓	✓	✓
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)	✓	✓	✓
System features			
• WebClients for remote screens and data access (1 × WebClient)	✓	–	–
• WebClients for remote screens and data access (additional WebClients to a max. of 150)	–	✓	✓
• 128 process tags [1]	✓	✓	✓
• Up to 32 RCMS operator stations can be used	–	–	✓
• Archive tags	–	–	–
- 512 archive tags [2]	–	–	✓
- 5000 archive tags [3]	✓	✓	–
• Data evaluation & advanced reporting (Information Server – standard 3 Clients)	✓	✓	✓
• Crane Performance Monitor & KPI calculation [4]	✓	✓	✓
• CMS to RCMS connection [5]	✓	✓	✓
• Office PC EXCEL Reporting Tool of SQL database – Crane Excel Workbook (connection to CMS and RCMS)	✓	✓	✓
• Microsoft SQL Server (long-term archiving) delivered standard with RCMS	✓	✓	✓

– Not included in the scope of delievery

✓ Included in the scope of delievery

[1] No standard connection to PLC on RCMS. Only on request to be delivered.

[2] Extra tags for local operator station.

[3] Standard delivered with RCMS – possible to be extended to max. 120000 Archive Tags for each RCMS station.

[4] Standard with RCMS 1500 Performance Monitor (PMO) archive tags for KPI definition in SQL database are provided. Up to 5000 PMO archive tags are tested in WinCC V7.2.

[5] Maximum number of CMS stations connected to one RCMS depends of data volume and maximum data handling by WinCC and SQL (to be checked in CMS manuals). For more information please get in contact with hotline CMS or application support.

Selection and ordering data

Description	Article No.
SIMOCRANE RCMS server	
Runtime languages: multilanguage interface supported UNICODE	
• European: De, En, It, Fr, Es, Ru, etc. – standard • Asia: Ch, Ch. trad, Jp., Ko.etc. – to be delivered on request	
Scope of functions:	
• Central message and advanced fault diagnosis in Microsoft SQL database • Central Archive Tag system in Microsoft SQL database • Microsoft SQL license delivered with RCMS • Cranes and terminal overview (Tree Manager, Plant Model) • Interactive maps • Remote maintenance • Standard 1 × RCMS WebClient • Remote access to cranes, individual or in parallel • Cargo handling acquisition • Acquisition of operating hours/counter values/timers • Data aggregation • Advanced reporting • Dashboards, Business Inteligence Tools • Export of data and messages to Excel • Advanced S7 diagnosis on CMS from RCMS • Replay function on CMS from RCMS for each crane • Webserver SIMOTION, SINAMICS and S7 remote from RCMS • Microsoft SQL including Long-Term Archive server + Backup • Crane Performance Monitor (KPI, OEE, Gantt views, advanced reporting, data mining, crane down time monitoring, table controls)	
SIMOCRANE RCMS server – Single station	
(No connection to RCMS operator stations)	
• 1 RCMS WebClient (Standard)	**6GA7215-0AA00-0AA0**
• 3 RCMS WebClients	**6GA7215-0BA00-0AA0**
• 10 RCMS WebClients	**6GA7215-0CA00-0AA0**
• 50 RCMS WebClients	**6GA7215-0DA00-0AA0**
• 150 RCMS WebClients	**6GA7215-0EA00-0AA0**
SIMOCRANE RCMS server + operator station	
(Possible to connect up to 32 RCMS operator stations – Clients in parallel)	
• 1 RCMS WebClient (Standard)	**6GA7215-1AA00-0AA0**
• 3 RCMS WebClients	**6GA7215-1BA00-0AA0**
• 10 RCMS WebClients	**6GA7215-1CA00-0AA0**
• 50 RCMS WebClients	**6GA7215-1DA00-0AA0**
• 150 RCMS WebClients	**6GA7215-1EA00-0AA0**

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/

→ Product Support → (Enter search term) SIMOCRANE

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

https://support.industry.siemens.com/cs/

→ 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:

http://www.siemens.nl/training/cranes

Overview

SIMOCRANE CMS and RCMS upgrade packages

In order to make upgrades from previous versions to the latest version of SIMOCRANE CMS V4.3, upgrade packages are offered with separate article numbers. Therefore, when in the terminal are already cranes equipped with versions CMS V4.2 (or CMS V4.1), crossing combinations are possible, but limitations due to different versions used are to be taken into account (please refer to the customer support web page for more information). When in the terminal new cranes are added to the existing ones, using CMS upgrade packages the already installed CMS packages can be upgraded to the latest version available, of version V4.3. In order to upgrade CMS Lean to CMS Basic, upgrade packages are also available.

The following upgrade packages can be ordered:

- Upgrade license from SIMOCRANE CMS Lean to CMS Basic package
- Upgrade license from SIMOCRANE CMS V 4.1, V4.1 SP1 and V4.2 to CMS V4.3
- Upgrade license from SIMOCRANE RCMS V 4.1, V4.1 SP1 and V4.2 to RCMS V4.3

The upgrade licenses for CMS Lean to CMS Basic includes the extra licenses for WinCC Power Tags and Archive Tags. The other options contained in CMS Lean will be as well valid for CMS Basic. For the upgrades of CMS & RCMS older versions to V4.3, upgrades for WinCC tags and options are delivered with the upgrade licenses. Please refer to the section CMS & RCMS ordering data specifications and upgrade packages.

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

Selection and ordering data

Description	Article No.
Upgrade SIMOCRANE CMS V4.3 Lean Package to Basic Package • WinCC 7.2 RT Upgrade 512 to 2048 Tags • WinCC Archive 1500 Tags • Runtime languages: multilanguage interface supported UNICODE - European: De, En, It, Fr, Es, Ru, etc. – standard - Asia: Ch, Ch. trad, Jp., Ko. etc. – to be delivered on request • SIMOCRANE CMS V4.3 RT • SIMOCRANE CMS V4.3 Configuration • CMS V4.3 Standard Application, configurable (WinCC project example "ready to run")	**6GA7216-0AA00-0AA0**
Upgrade SIMOCRANE CMS Package V4.1, V4.1SP1, V4.2 to V4.3 • WinCC 6.2 RT & 7.0 RT Upgrade to WinCC 7.2 RT • Upgrade WebNavigator • Upgrade DataMonitor • Update WinCC Archive • Runtime languages: multilanguage interface supported UNICODE - European: De, En, It, Fr, Es, Ru, etc. – standard - Asia: Ch, Ch. trad, Jp., Ko. etc. – to be delivered on request • SIMOCRANE CMS V4.3 RT (Runtime) • SIMOCRANE CMS V4.3 Configuration • CMS V4.3 Standard Application, configurable (WinCC project example "ready to run", CMS HMI Interface)	**6GA7216-0AB00-0AA0**
Upgrade SIMOCRANE RCMS Package V4.1, V4.1SP1, V4.2 to V4.3 • RCMS V4.3 RT (Runtime) • RCMS V4.3 Configuration • RCMS V4.3 Standard Application (WinCC Project example) • WinCC 6.2 RT & 7.0 RT Upgrade to WinCC 7.2 RT • Upgrade Web.Navigator • Upgrade DataMonitor • Update WinCC Archive • Upgrade DownTimeMonitor to Performance Monitor • Information Server 3 × WebClients • Runtime languages: multilanguage interface supported UNICODE - European: De, En, It, Fr, Es, Ru, etc. – standard - Asia: Ch, Ch. trad, Jp., Ko. etc. – to be delivered on request	**6GA7216-0AC00-0AA0**

Overview

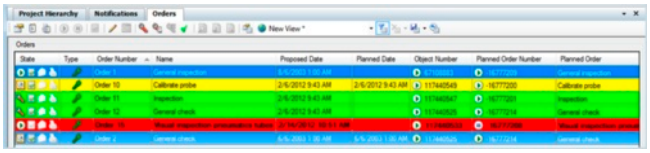
Products that are listed below are not components of the SIMOCRANE CMS & RCMS packages. These additional components are recommended to perform extra tasks on the CMS or/ and on the RCMS stations. Such components described here can be ordered separately based on WinCC options and add-ons. Please read the technical specifications and ordering information at the specified Internet address. Also for more information or enquiry, please take contact with the CMS Application Support department.

Function

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. 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 allows besides purely calendar based planning also a performance based planning of job maintenance that is based on real operating hours and operation cycles. PM-Maint supports the maintenance process also for the recording of jobs and complete documentation of unplanned repairs by providing easy and comprehensible workflows combined with a high degree of ease of use.

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

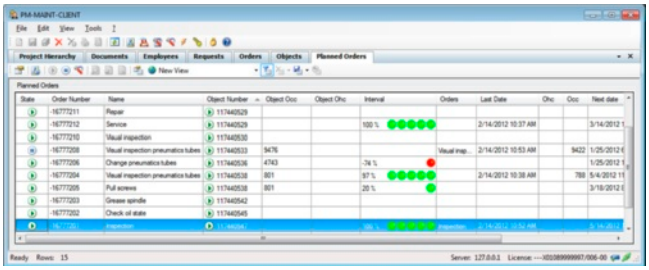


PM-MAINT user interface displaying the “orders” view

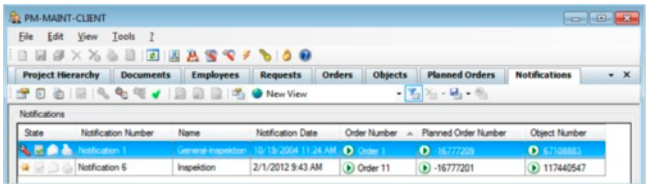
Characteristics of PM-MAINT:

- 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
- Excel Plug-in for comfortable 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

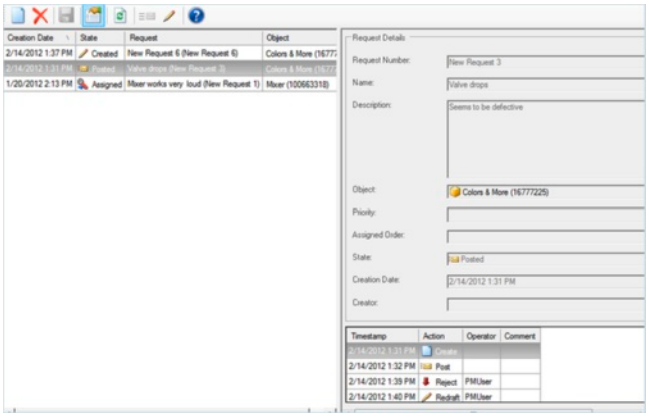
Function (continued)



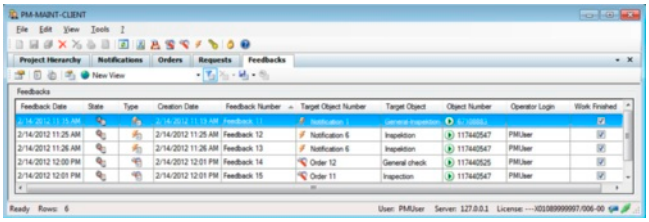
PM-MAINT user interface displaying planned orders view



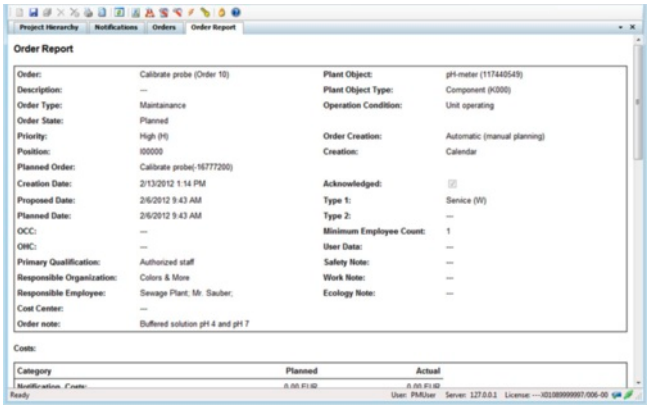
PM-MAINT user interface displaying notification view



PM-MAINT request control



PM-MAINT notifications listed in feedback view



PM-MAINT example of reporting

PM-MAINT System Software Version 9	
System Package Type S [7] • Single-user system/Multi-user system server • inclusive PM-SERVER [2] and PM-AGENT [3] • executable in environment with SIMATIC WinCC (V6/7), • with SIMATIC WinCC flexible 2008 (via OPC DA), • with SIMATIC WinCC (TIA Portal) RT Advanced (V11/12) • (via OPC DA) and RT Professional (V11/12) [4], • single license, runtime software (R-SW) incl. Configuration system, • German/English, copy protection [1] • electronic manual on CD. • Operating systems: • Windows XP Prof. (32 Bit), Windows 2003 Server (32 Bit), • Windows 7 (32/64 Bit), Windows 2008 Server (32/64 Bit)	9AE7 104-2SS30-1AA0-Z [1]
System Package Type C [7] • Multi-user system client • executable with System Package Type S in an environment with • SIMATIC WinCC (V6/7), with WinCC flexible 2008 PC runtime, • with SIMATIC WinCC (TIA Portal) RT Advanced (V11/12) and • RT Professional (V11/12) [4] or • as Thin Client (without WinCC), • single license, runtime software (R-SW), • German/English, copy protection [1]. • Operating systems: • Windows XP Prof. (32 Bit), Windows 2003 Server (32 Bit), • Windows 7 (32/64 Bit), Windows 2008 Server (32/64 Bit)	9AE7 104-4SC00-1AA0-Z [1]

More Information in Internet:
http://www.siemens.com/process-management

Note:

The runtime meters of CMS remain available independently of this AddOn 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
www.siemens.com/process-management
→ Premium Add ons → PM-MAINT

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

Function (continued)

WinCC User Archive for job related tasks on CMS

Job related tasks are to be registered on the CMS station via WinCC User Archive optional package. A crane operator, for example, can enter parameter sets (the operating parameters of a crane) in CMS, store them in the WinCC User Archive and forward them to the automation level as needed. On the other hand, an automation system can continuously acquire operation parameters during a shift and send them to WinCC at the end of the shift. Further application examples are the acquisition of batch data, the specification of production parameters or the administration of storage management data. The data are to be replayed as well using Replay function on CMS using the same mechanism in User Archive from WinCC.

- Storing and managing of any user data in data sets
- Flexible display via WinCC User Archive Control, with optional table and form view
- Easy connecting of data set fields to the process via direct tag connection
- Import/export functions for further processing with other tools (e.g. Microsoft Excel)

WinCC user archives are conveniently created in a separate editor and preallocated with data. Special ActiveX Controls, which are integrated in the object palette of WinCC Graphics Designer, are used to display data from the user archives during runtime in CMS Application. These controls can also run on the CMS Web-Client via WebNavigator in an Internet environment.
The coupling of data sets and fields from user archives to the process is easily done via direct tag connection in CMS Application via WinCC tag configuration.

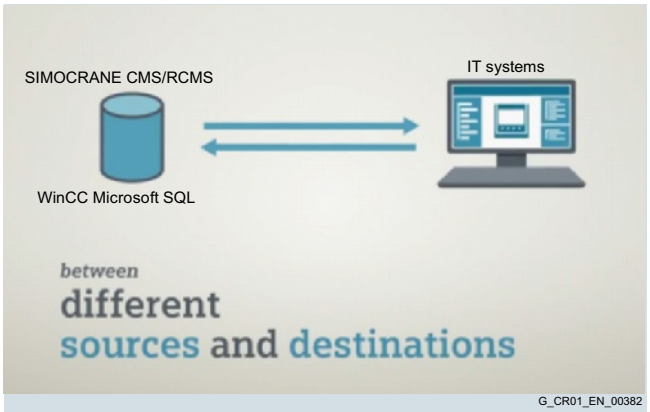
WinCC User Archive V7.2	6AV6371-1CB07-2AX0

WinCC/Industrial Data Bridge – connection CMS & RCMS to other databases

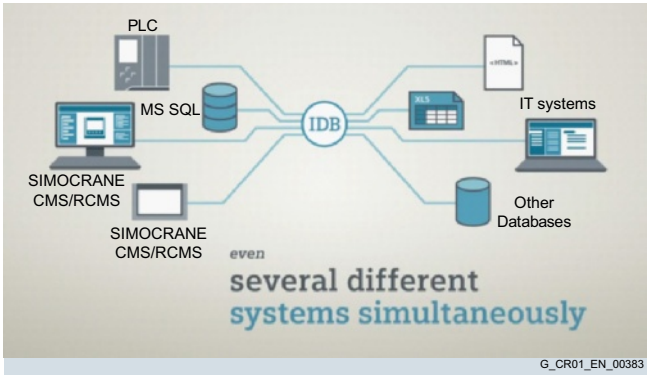
WinCC/Industrial Data Bridge uses standard interfaces to link the automation level (controls) from CMS & RCMS stations to the IT world and to ensure a flow of information in both directions. Systems from different manufacturers can be integrated by using a variety of standard interfaces (e.g., OPC, OLE-DB, 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 guarantee the security of the transmission.

- Connection of CMS & 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
	MS Excel 2003, 2007, 2010, 2013
MS Access 2003, 2007, 2010, 2013	MS Access 2003, 2007, 2010, 2013
MS SQL Server 2005, 2008, 2008R2, 2012	MS SQL Server 2005, 2008, 2008R2, 2012
My SQL 3.5, 5.1, 5.5, 5.6	My SQL 3.5, 5.1, 5.5, 5.6
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 V7.2, V7.3 (via OLE DB) WinCC UserArchives V7.2, V7.3	WinCC UserArchives V7.2, V7.3
WinCC RT Professional V13 SP1 (via OLE DB)	WinCC RT Professional V13 SP1 (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)

WinCC/Industrial DataBridge V7.2	
• with 128 Tag license	6AV6 371-1DX07-2AX0
• with 512 Tag license	6AV6 371-1DX07-2BX0
• with 2048 Tag license	6AV6 371-1DX07-2CX0
• with 10000 Tag license	6AV6 371-1DX07-2DX0

4

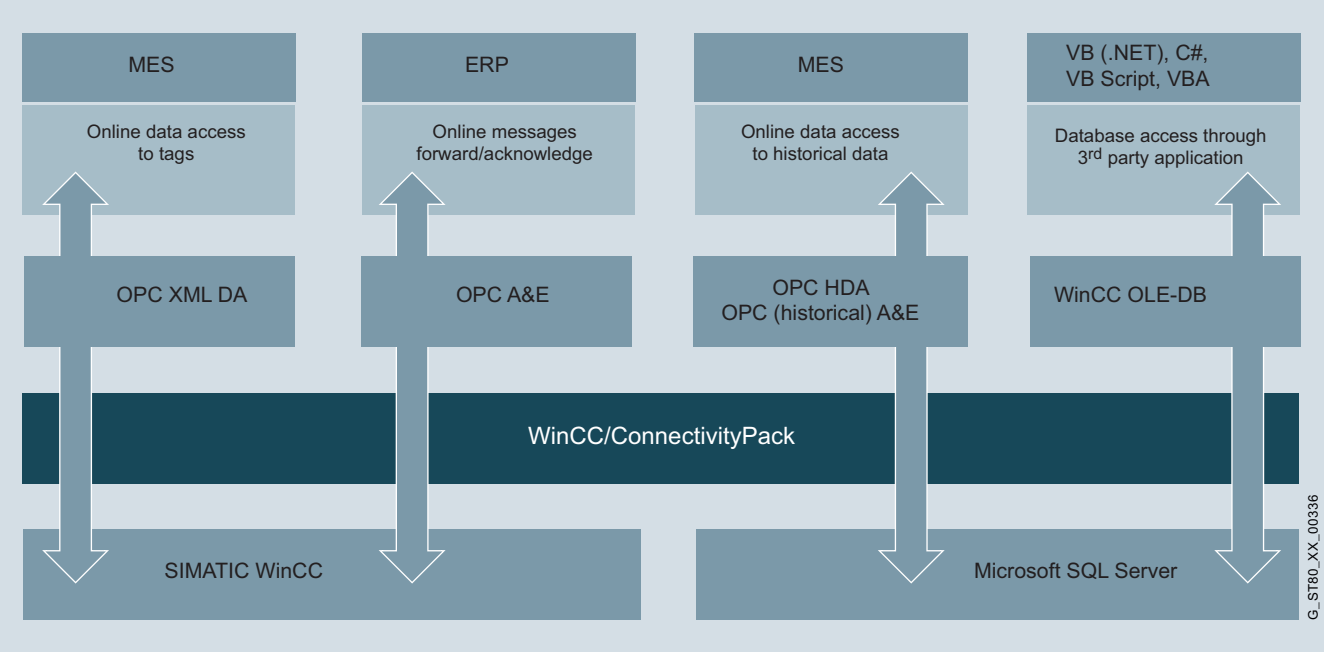
Function (continued)

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 as a client read data from another application - across the Web too. The WinCC/Connectivity Pack offers additional options for already existed SIMOCRANE CMS & RCMS stations.

This means that the system can transfer pre-processed process and production data of a crane to higher level systems for information conditioning (e.g. Manufacturing Execution Systems, Enterprise Resource Planning systems or 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 & RCMS stations
- Access to online and historical data from any computers you like 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



Overview of connection between SIMATIC WinCC SCADA level and other systems from IT level (ERP, MES, etc.)

Access to messages and historical data from CMS and RCMS via OPC/WinCC OLE-DB

The WinCC/Connectivity Pack includes the OPC HDA 1.1 (Historical Data Access) and OPC A&E 1.0 (Alarm & Events) servers for accessing historical data of the WinCC archive system or for transferring/acknowledging messages. As an OPC XML DA 1.0 server, WinCC can even send data on a cross-platform basis across the Web to PPS/MES systems; in the opposite direction, it can take OPC XML DA client order or recipe data. As an HDA server WinCC makes available historical data 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 already conditioned data 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.

WinCC Connectivity Pack V7.2 [1]	6AV6371-1DR07-2AX0

[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.

Function (continued)

S7 Pdiag and WinCC ProAgent on CMS stations – advanced system diagnosis on SCADA level (fault cause analysis and drill down analysis)

ProAgent is available for various devices and software platforms from the SIMATIC HMI whereas SCADA WinCC as well. ProAgent contains standard views, which are tuned to the requirements of the process error diagnosis of a plant or machine. During configuration, the data that is relevant to process error diagnostics such as symbols, comments and alarm texts are saved in a standardized data management system. During runtime, the standard screens are then filled with process-specific data.

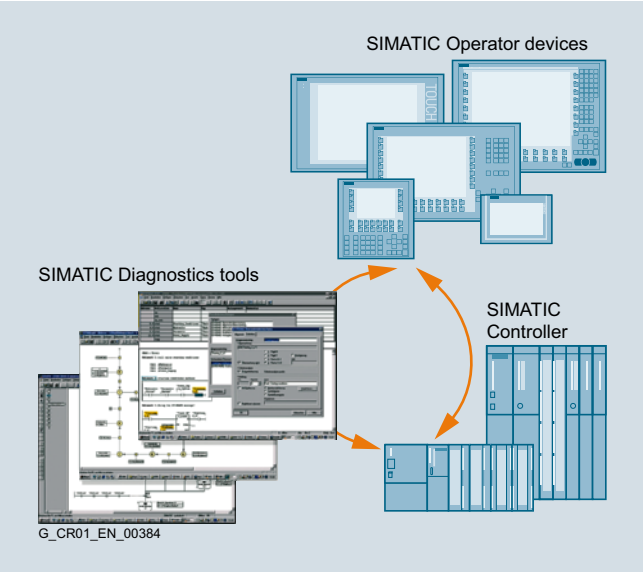
Benefits

Component of Totally Integrated Automation Siemens concept:

- Increases productivity, minimizes engineering outlay, reduces lifecycle costs
- Support for troubleshooting, increased machine and plant availability, shorter downtimes
- No additional configuration costs for the diagnostics functionality due to automatic generation of the diagnostics-related parts for the controller and HMI
- Frees up controller capacity with regard to memory requirements and program execution time
- No special knowledge required to operate Design and function

In the event of a process fault, process error diagnostics with SIMATIC ProAgent will provide information about the location and cause of that fault and support personnel with troubleshooting.

The ProAgent solution has been optimized specifically for use with SIMATIC S7-300/S7-400 and SIMATIC WinAC. It can be used in combination with the S7-PDIAG, S7-GRAPH STEP 7 engineering tools. The ProAgent option package features standard displays that are updated with process-specific data during runtime.



Process diagnostics with WinCC/ProAgent and the Step 7 Engineering Tools

Functional scope

- Context-sensitive diagnostics initiation due to process error message
- Output of the operands with symbols and comment Switch-over capability between LAD, STL and signal list
- Supporting fault rectification by means of direct process access when using the motion view
- Output of the faulty operands directly in the alarm including address, symbol and comment
- Consistency test in runtime: Inconsistent diagnostics units are marked with icons. This permits quick locating of faults regarding configured data in the commissioning phase.
- Direct, unit-related entry point in the diagnostics view from user displays (by using ProAgent functions)
- Unit or alarm-related entry to STEP 7, e.g. LAD/STL/FBD editor, S7-GRAPH, HW CONFIG upon system error messages, is supported fully automatically
- S7-GRAPH OCX for the graphical display of step sequences (overview display)

S7-PDIAG supports the configuring of process diagnostics for SIMATIC with the LAD, FBD or IL programming languages.

Using process diagnostics it is possible to recognize faulty states outside the automation system (such as limit switch not reached).

In conjunction with WinCC/SIMOCRANE CMS and the special process diagnostics option package SIMATIC ProAgent, it is possible to design a powerful system:

- to display errors in user-defined text
- to display the cause signal (criteria analysis) at link level
- to clear process errors

S7-PDIAG offers the following functions:

- Configuration for detection of process faults:
- S7-PDIAG permits definition of signal monitoring (including criteria analysis) and the associated message texts within the LAD/CSF/IL editor.
- Configured FB call (optional) on diagnostics event
- Online modification of monitoring times Supporting troubleshooting
- In addition to the display and detection of process faults, S7-PDIAG and ProAgent provide the user with the facility to control or modify movements and operating modes directly from the HMI display unit.

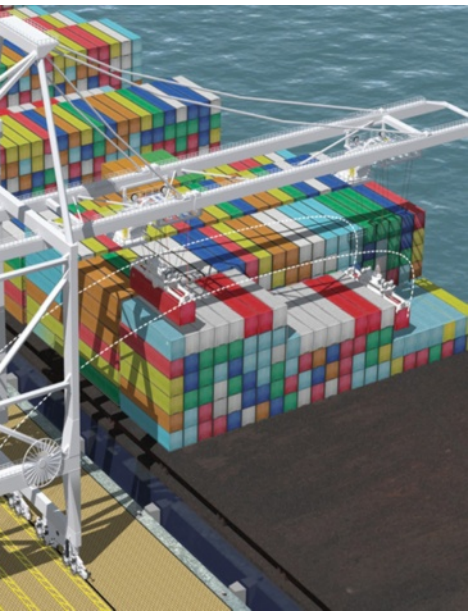
WinCC/ProAgent V7.2	6AV6371-1DG07-2AX0
SIMATIC S7, S7-PDIAG V5.3 incl. SP6 [1] FLOATING LICENSE FOR 1 USER,	6ES7840-0CC04-0YA5

[1] S7-PDIAG is released for STEP 7 V5.4 with SP5 (or higher)

Notes

SIMOCRANE application examples

5



Overview

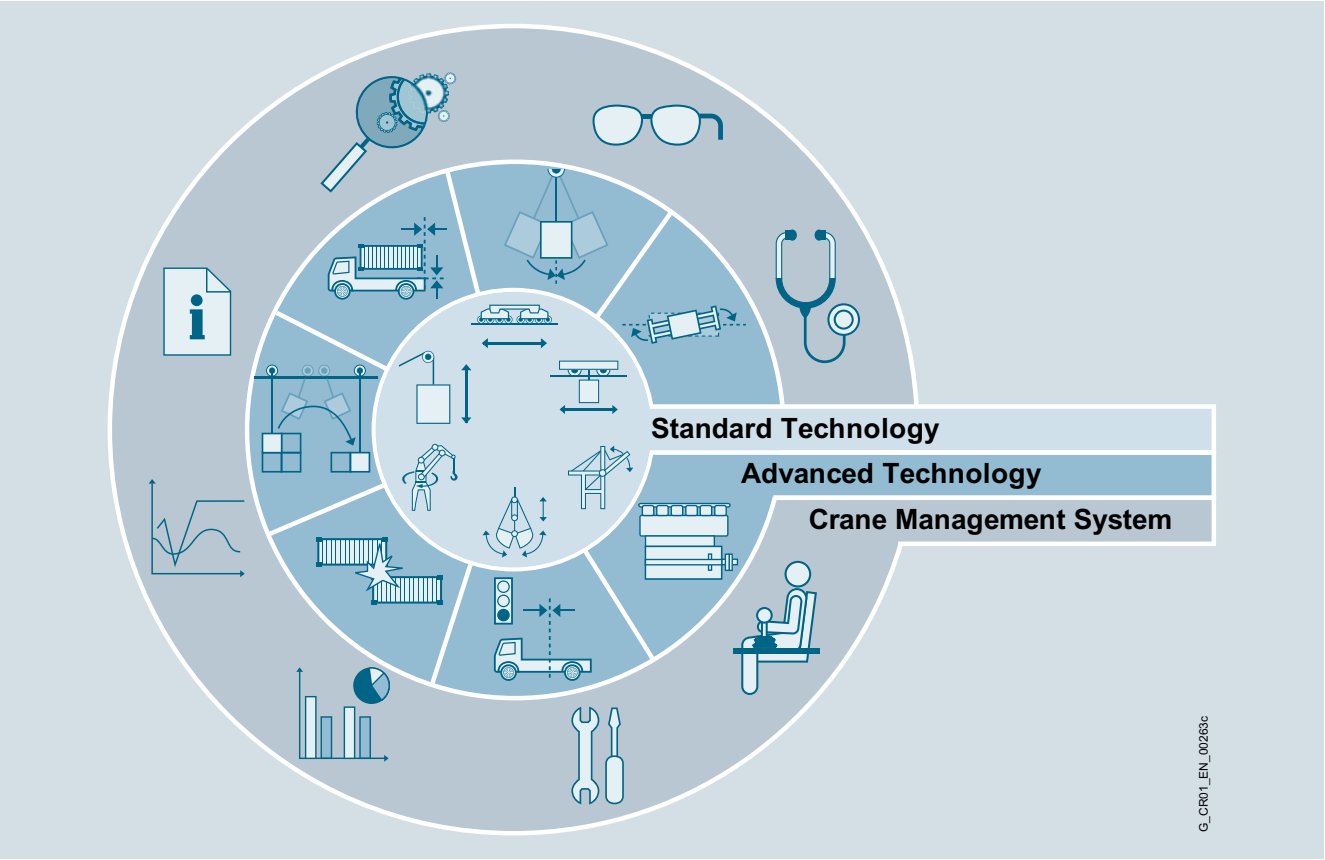
SIMOCRANE offers a range of coordinated products that, in different combinations, fulfill a wide range of different requirements.

The SIMOCRANE product family is based on standard Siemens products. Our customers therefore enjoy all the usual advantages regarding service and innovation.

The 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 diversity and combination possibilities of SIMOCRANE products for implementing the different requirements will be illustrated here.

The detailed functional scope of the individual products is described in the corresponding sections. In the following application examples, only those functions required for the solution are listed.



SIMOCRANE product range

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 rpm 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, 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

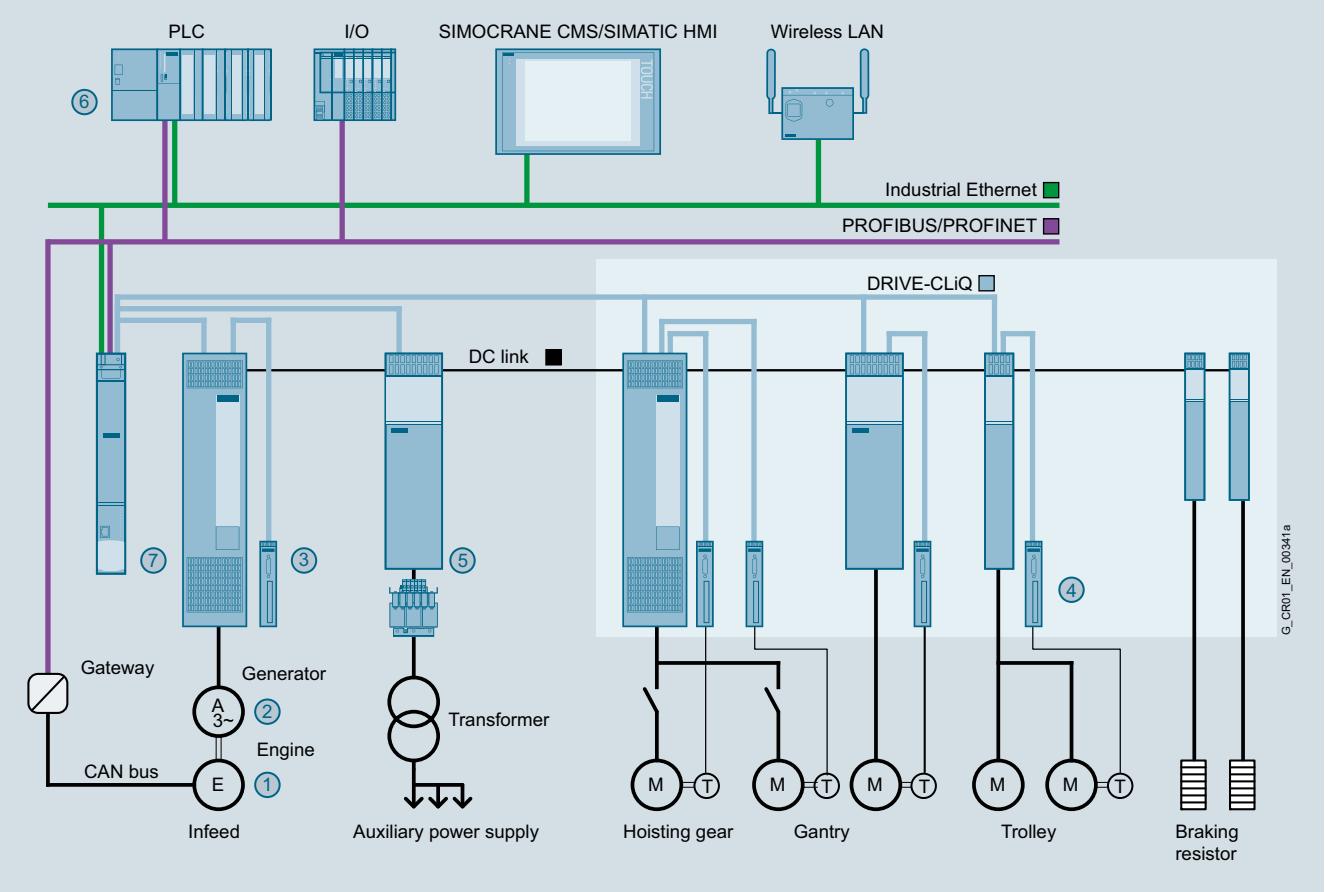
In this example of an upgrade to SIMOCRANE ECO Technology, a configuration with SIMOCRANE Basic Technology was selected. SIMOCRANE Basic Technology is equipped with tested crane functionality. The Basic Technology package comprises SIMOTION D with a CompactFlash card. The ready-to-use application with 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 V4.3 Lean
  Article No. **6GA7214-0AA00-0AA0**
- 1 × SINAMICS S120 Motor Module in chassis format as infeed
- 1 × SINAMICS S120 Motor Module in booksize or chassis format with sinewave filter as an auxiliary drive

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 Chapters:

- SIMOCRANE Standard Technology
- SIMOCRANE Advanced Technology (sway control systems, truck positioning)
- SIMOCRANE CMS (Crane Management System)

Design (continued)

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 feedback 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 lower engine 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 460 V AC/400 V AC/50 kVA/50 Hz

All the auxiliary loads must be connected after a converter with sinewave filter and transformer for 2-phase (L+N) components. A SINAMICS S120 Motor Module in booksize or chassis format can be used as an auxiliary drive. The application example and the software included in the ECO Technology package supply the settings for operation of the Motor Module (inverter) as an auxiliary supply.

Selection of the converter 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 and preparation for RCMS

When upgrading to ECO Technology, no criteria influence this selection.

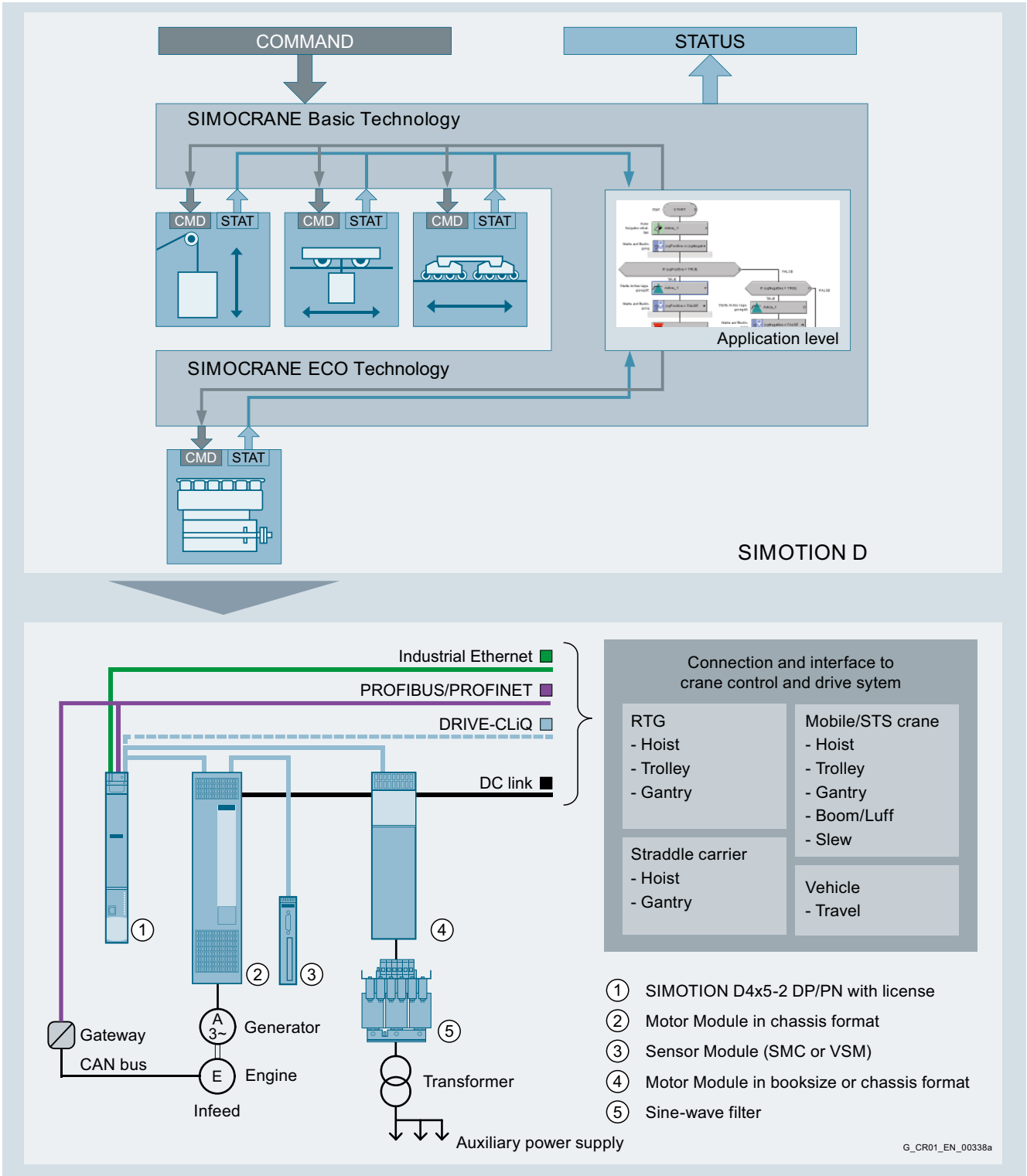
7. SIMOCRANE ECO Technology

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.

5

Design (continued)

The basic components required for an ECO package are shown in the overview diagram below:



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.

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 V4.3 Lean	**6GA7214-0AA00-0AA0**

Suggestion for additionally required components, e.g.:

Description	Article No.
SIMOTION SCOUT V4.3 SP1	**6AU1810-1BA43-1XA0**
Optional package	
Drive Control Chart (DCC) V2.2 SP1 for SIMOTION/SINAMICS	**6AU1810-1JA22-1XA0**

Further information on selection and ordering of supplementary components can be found in Catalog PM 21 SIMOTION, SINAMICS & SIMOTICS:

- SINAMICS S120 drive system
- Permanent-magnet synchronous motor with encoder
- SIMOTION CX32-2 Controller Extension

Straddle carrier (SC)

Application

This application example describes an ECO configuration for a straddle carrier (SC).

Application example

The objective is to reduce the fuel consumption by operating the diesel engine/electrically driven straddle carrier 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 SIMOCRANE 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 rpm 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, however, be determined by the actual design and use of the crane.

To achieve savings, the following factors must be taken into account:

- Selection of combustion engine; every combustion engine has typical dynamic behavior and typical consumption.
- Design of the straddle carrier (total weight, components, gears, tires, spreaders, etc.)
- Speed, acceleration times and design of hoist and gantry drives
- 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 straddle carrier

The different straddle carrier types always differ with regard to their specification and relevant design, so it is extremely difficult to determine the possible savings. 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.

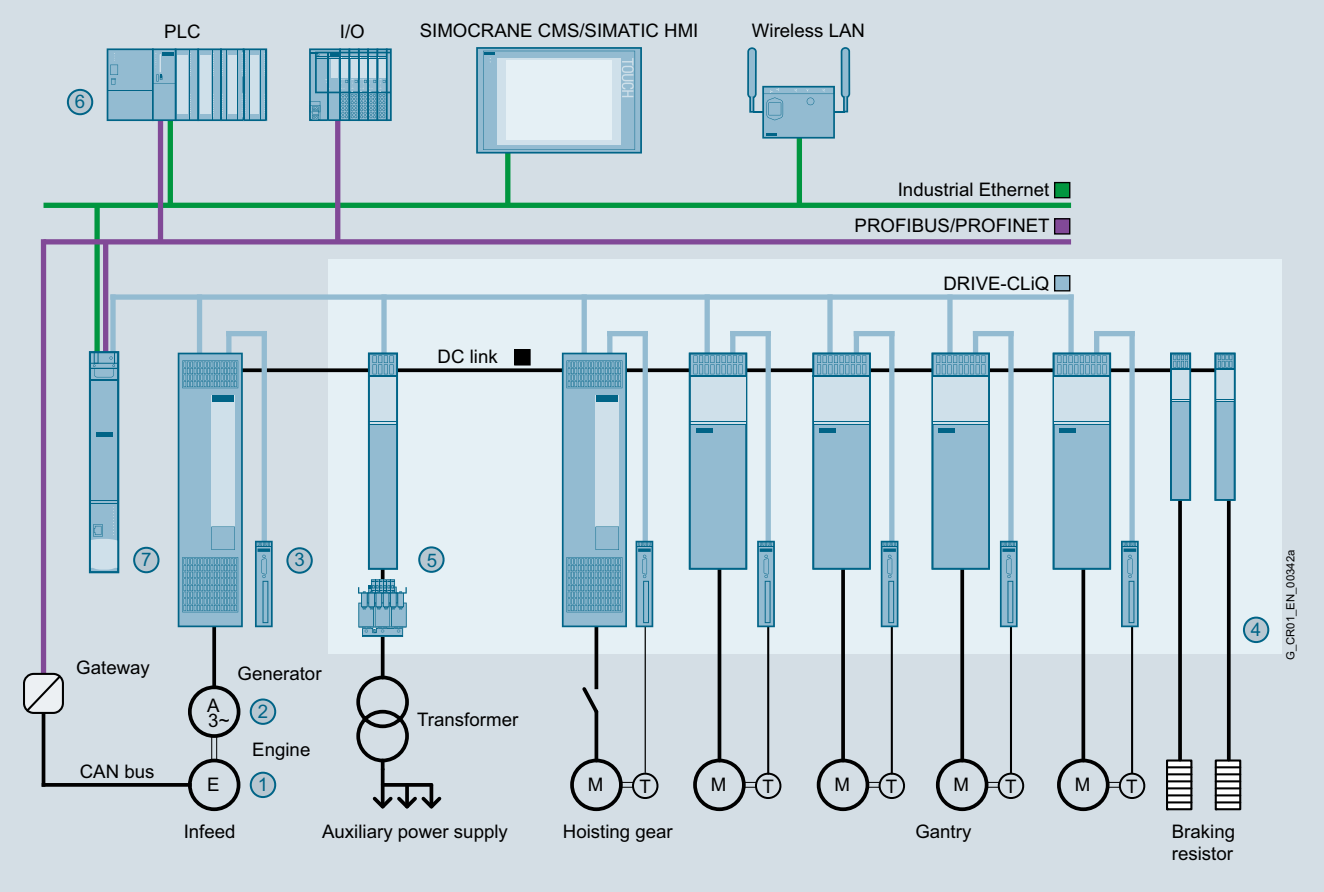
Solution

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 × SIMCORANE CMS V4.3 Lean
  Article No. **6GA7214-0AA00-0AA0**
- 1 × SINAMICS S120 Motor Module in chassis format as infeed
- 1 × SINAMICS S120 Motor Module in booksize or chassis format with sinewave filter as an auxiliary drive

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 SC" (see below).



Topology of SIMOCRANE ECO Technology for SC

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 Chapters:

- SIMOCRANE Standard Technology
- SIMOCRANE CMS (Crane Management System)

Design (continued)

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 feedback 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 should 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 lower engine speeds of the diesel engine. A typical straddle carrier selection comprises 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, traversing units and braking modules

When upgrading to ECO Technology, no criteria influence this motion package and the selection of the braking module.

5. Auxiliary supply 460 V AC/400 V AC/50 kVA/50 Hz

All the auxiliary loads must be connected after a converter with sinewave filter and transformer for 2-phase (L+N) components. A SINAMICS S120 Motor Module in booksize or chassis format can be used as an auxiliary drive. The application example and the software included in the ECO Technology package supply the settings for operation of the Motor Module (inverter) as an auxiliary supply. To reduce voltage fluctuations in the system to a minimum, the converter must operate at a pulse frequency of 8 kHz or 4 kHz. This increase in pulse frequency should, as for temperature and IGBT checks, be taken into account in the calculation of derating for the drive.

Selection of the converter 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

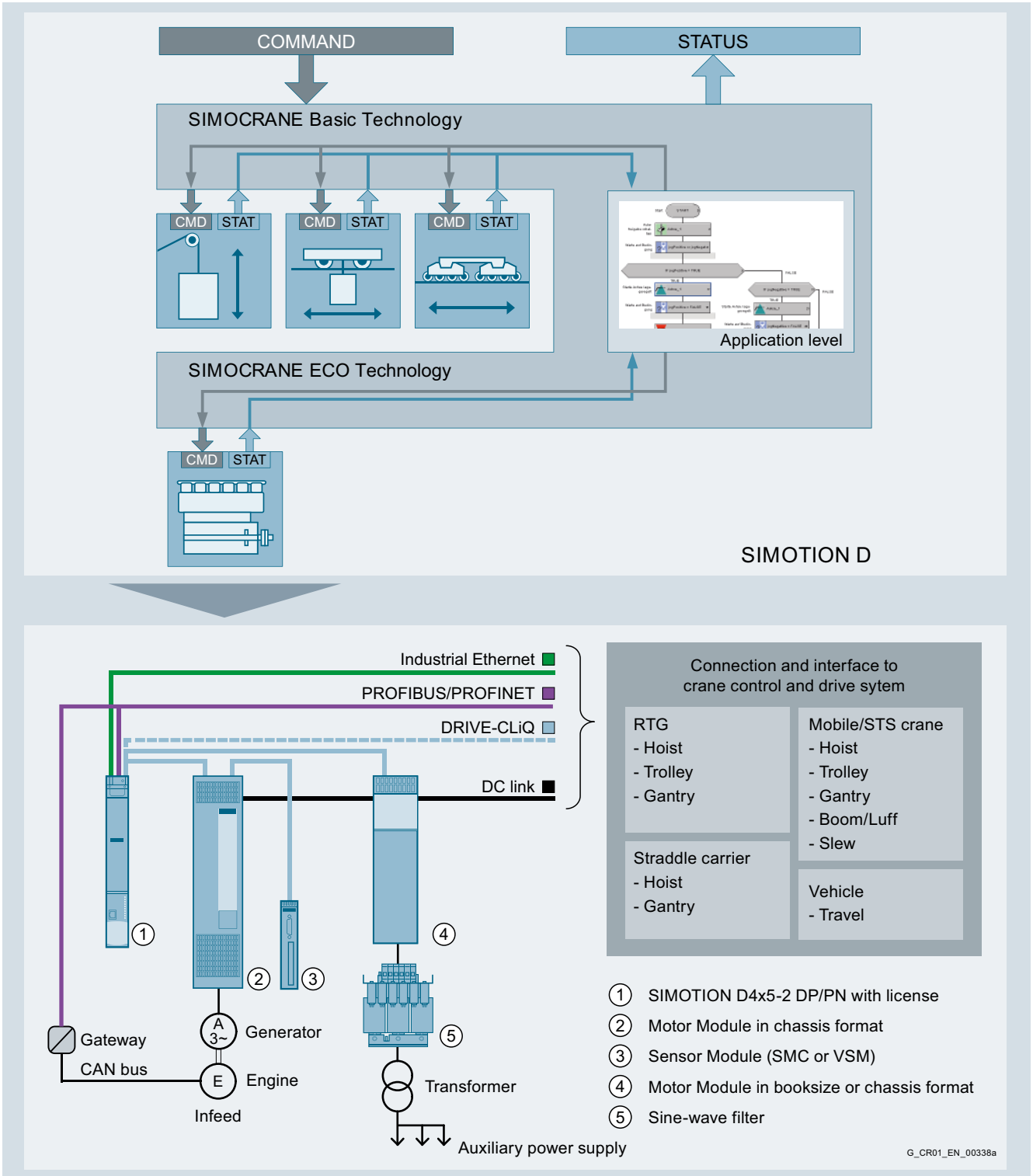
When upgrading to ECO Technology, no criteria influence this selection.

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.

Design (continued)

The basic components required for an ECO package are shown in the overview diagram below:



SIMOCRANE ECO Technology configuration for SC

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.

Selection and ordering data

SIMOCRANE components required for ECO SC 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 V4.3 Lean or **SIMOCRANE CMS V4.3 Basic**	**6GA7214-0AA00-0AA0** **6GA7214-0AB00-0AA0**

Suggestion for additionally required components, e.g.:

Description	Article No.
SIMOTION SCOUT V4.3 SP1	**6AU1810-1BA43-1XA0**
Optional package	
Drive Control Chart (DCC) V2.2 SP1 for SIMOTION/SINAMICS	**6AU1810-1JA22-1XA0**

Further information on selection and ordering of supplementary components can be found in Catalog PM 21 SIMOTION, SINAMICS & SIMOTICS:

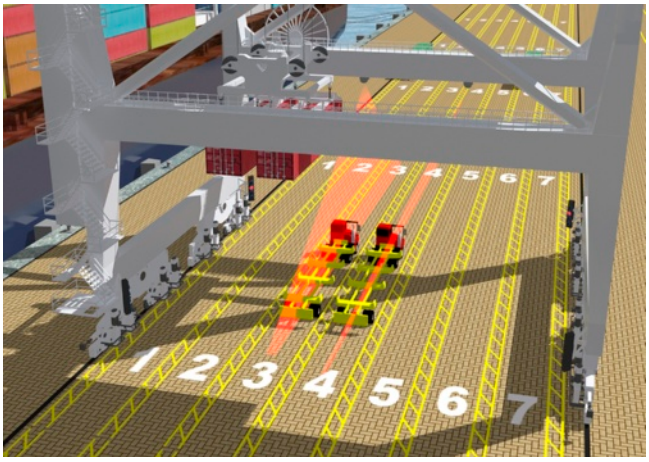
- SINAMICS S120 drive system
- Permanent-magnet synchronous motor with encoder
- SIMOTION CX32-2 Controller Extension

Application

This application example describes a common solution for positioning terminal vehicles under a container quay crane.

Application example

The system supports the truck driver during parking with the aid of a simple control signal. A signal unit visible to the truck driver should be mounted at each corner of the crane. The crane driver operates the system and specifies the lanes in which loading takes place and from which direction the trucks arrive. The system must be able to operate two adjacent lanes at the same time (tandem mode). The operating range with the 7 lanes is 32 m wide overall. On the basis of the presets for lane and direction of travel, the system must be able to position different trucks and trailers independently.



Crane with TPS

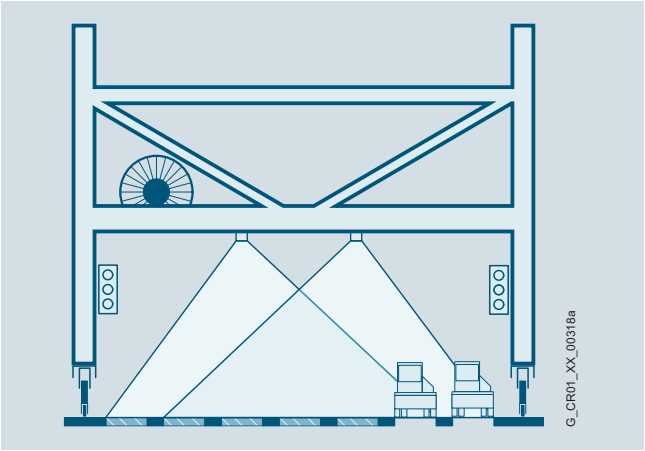
Solution

In order to fulfill this function, the following SIMOCRANE products are required:

- 1 × SIMOCRANE Truck Positioning System (TPS) V1.2, sensor controller
  Article No. **6GA7220-1AA00-0AC0**
- 2 × SIMOCRANE Truck Positioning System (TPS) V1.2, 3D sensor
  Article No.**6GA7221-1AA21-0AB0**

The required width of working area between the crane uprights of up to 32 m can be operated because the 3D sensors are mounted at the bottom of the gantry bar. This corresponds to a typical 3D sensor installation height of approx. 13 to 15 m above quay level.

The mounting positions of the 3D sensors are selected so that both have an optimum view of the respective lanes. The following diagram shows the positions of the 3D sensors and the lanes assigned to them.



Arrangement of 3D sensors

In addition to the SIMOCRANE products, additional components are required for operating the system and for displaying positioning signals. The following list contains suggestions for Siemens products that are ideal for this task:

- 1 × SIMATIC HMI IPC477D, 19" touch display as an HMI device for the crane driver with SIMOCRANE CMS V4.3 installed as software, e.g.:
  Article No. **6AV7240-6DD17-0PA0, 6GA7214-0AB00-0AA0**
- 1 × SIMATIC S7-300, CPU317-2 DP PLC as the crane controller, e.g.:
  Article No. **6ES7317-2AK14-0AB0**
- 4 × LED signal encoder (with 3 LEDs) e.g.:
  Article No. **L24757-C2323-A101**
- 8 × Support for fixing signal encoders 119 mm, e.g.:
  Article No. **C24121-A35-C93**

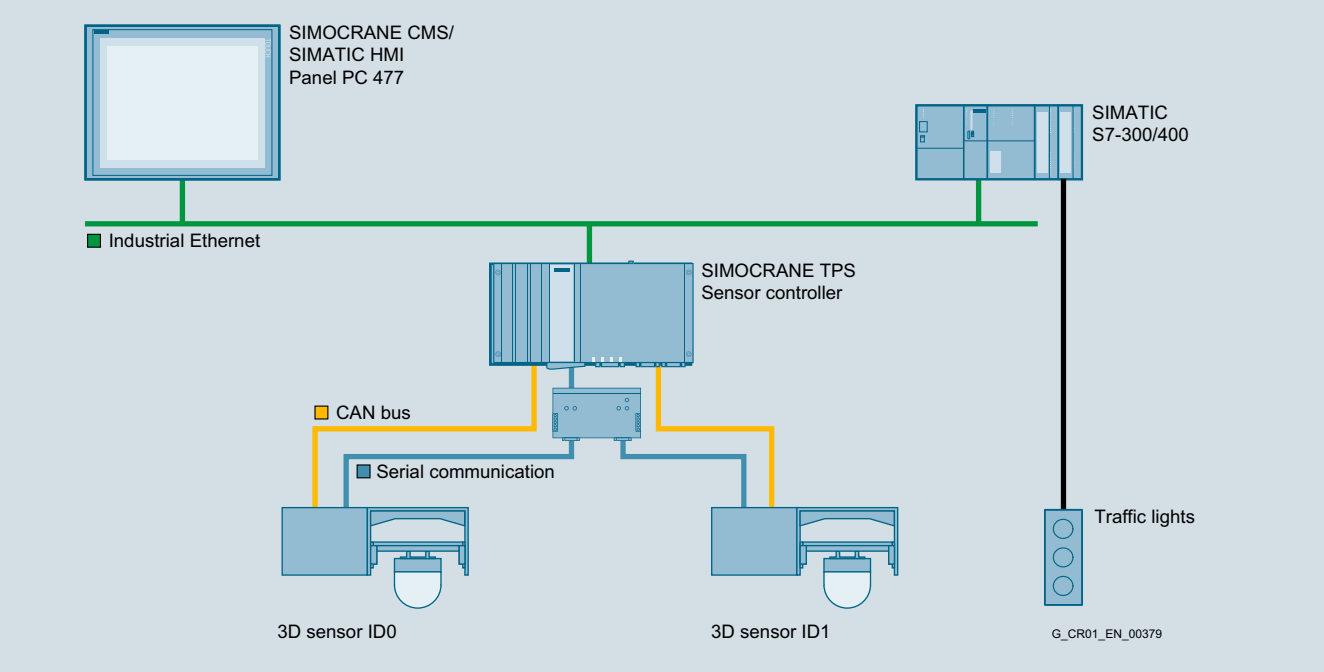
The product SIMOCRANE TPS has a standardized interface to SIMOCRANE CMS. SIMOCRANE CMS contains preconfigured WinCC sample images for operating and monitoring TPS. TPS is operated in the cabin on the PC 477C Panel that has a Client-Server connection with the main CMS computer.

For cranes without SIMOCRANE CMS, an application example from the version CMS V4.3, the customer can use CMS Lean. More information regarding CMS Lean please see Chapter 4.

Design

The figure below shows a common topology of the described application. Communication to the HMI and crane controller is implemented via an Ethernet interface.

Signal control is integrated into the crane controller (PLC). The activations for the signal units are generated here on the basis of TPS position values.



TPS topology for STS crane

For details of the individual SIMOCRANE products as well as further configuration options, see Chapters:

- SIMOCRANE Standard Technology
- SIMOCRANE Advanced Technology
- SIMOCRANE CMS (Crane Management System)

Selection and ordering data

SIMOCRANE components required for this configuration:

Description	Article No.
SIMOCRANE Truck Positioning System (TPS) V1.2 comprising	
• SIMOCRANE TPS V1.2, sensor controller (1 item)	**6GA7220-1AA00-0AC0**
• SIMOCRANE TPS V1.2, 3D sensor (2 items)	**6GA7221-1AA21-0AB0**
• SIMOCRANE CMS Crane Management System V4.3 Basic	**6GA7214-0AB00-0AA0**

Suggestion for additionally required components, e.g.:

Description	Article No.
SIMATIC HMI IPC477D 19" touch display as an HMI device for the crane driver (1 item)	**6AV7240-6DD17-0PA0**
SIMATIC S7-300, CPU317-2 DP PLC (1 item)	**6ES7317-2AK14-0AB0**
LED signal encoder with 3 LEDs (4 items)	**L24757-C2323-A101**
Support for fixing signal encoders 119 mm (8 items)	**C24121-A35-C93**

Application

This application example describes a solution for automatic loading and unloading a load on and off a terminal vehicle using the SIMOCRANE technology.

Application example

The positioning system must assist the truck driver when parking with the aid of a simple "traffic light" control. A traffic light visible to the truck driver is mounted at each corner of the crane. The crane driver operates the system and specifies the lanes for loading and the direction of travel of the truck. The working area between the lanes is 32 m in total and has seven lanes. On the basis of the presets for lane and direction of travel, the system must be able to position different trucks and trailers independently.

A positioning system must assist the crane driver when setting down and picking up the containers. The journey from the ship to the selected working lane and vice versa must be completed automatically and in the shortest possible time. For safety reasons, the spreader must always stop at a safe height. Automatic travel should be possible without a teach-in journey. The crane driver is responsible for lowering the load from the safe height and making the correct system settings, for example, for stacking type or working lane. The crane driver must be able at any time to interrupt automatic travel of the trolley and hoisting gear. The transitions from automatic to manual travel and vice versa should be performed smoothly.

Solution

The application example formulated above can be implemented using SIMOCRANE products in combination with a crane application. For this application example, the products and their functions described below are put to use.

Basic function:

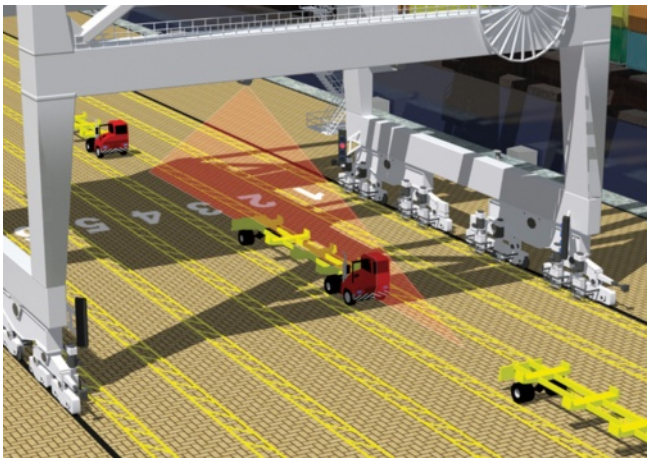
- **STS crane basic functions**
  SIMOCRANE Basic Technology forms the basis for this application and controls the standard motion control functions of hoist and trolley.
- **Crane Management System – SIMOCRANE CMS**
  SIMOCRANE CMS records faults and operating data and allows parameters to be set for crane operation.

  There is a touch panel PC in the driver's cab that allows the crane driver to activate commands or display operating data and operating states.

Procedure

1. Controlled parking of a truck

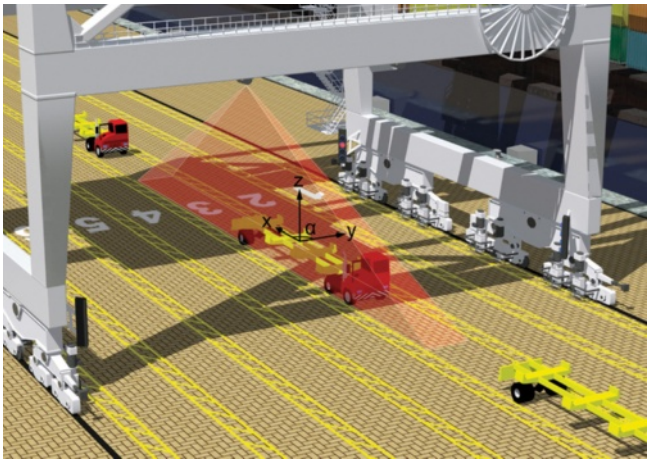
SIMOCRANE TPS is used to detect an approaching truck and to determine the exact target position. The driver is guided to the target position using a signaling system (e.g. traffic light).



TPS – Parking procedure

2. Precise target position measurement for the parking truck

Parking is still performed manually by means of the parking attendant. 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!

Application (continued)

3. Fetching or bringing a container from the ship

This procedure can be performed in parallel with step 1 and step 2.

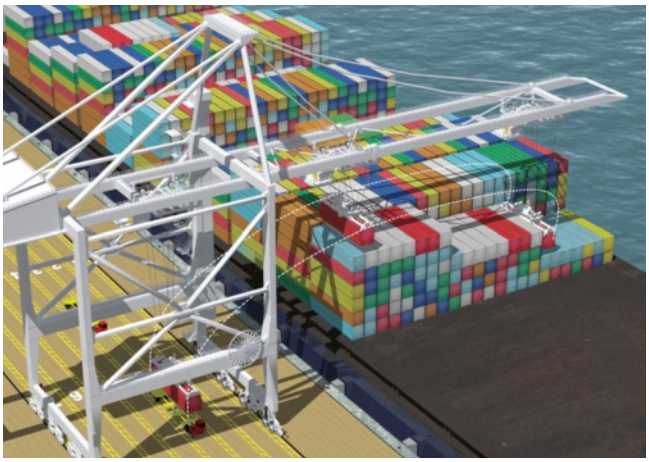
The SIMOCRANE Sway Control System covers the following functions here:

- Time-optimized, reliable and automatic motion control of the trolley and hoisting gear.
- Closed-loop control of load swaying.
- Closed-loop control of the angle of rotation of the load (skew control). The skew controller sends the setpoints for the trim, list and skew cylinders to the crane controller.

Note:

The control solution for the individual cylinders must be implemented in an application in accordance with the type of mechanical system installed.

When this is combined with acquisition of the height and hindrance profiles by means of an appropriate distance sensor system, performance and collision avoidance can also be improved.

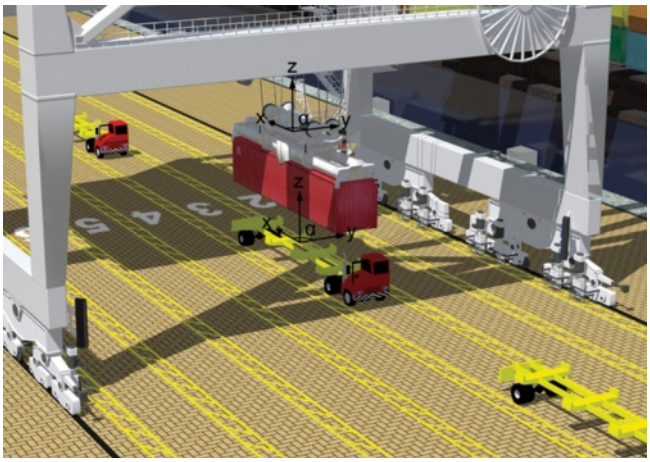


TPS – Scenario on-board ship

4. Putting a container down on the truck

The decisive factor in this step is accurate interplay of the SIMOCRANE components used.

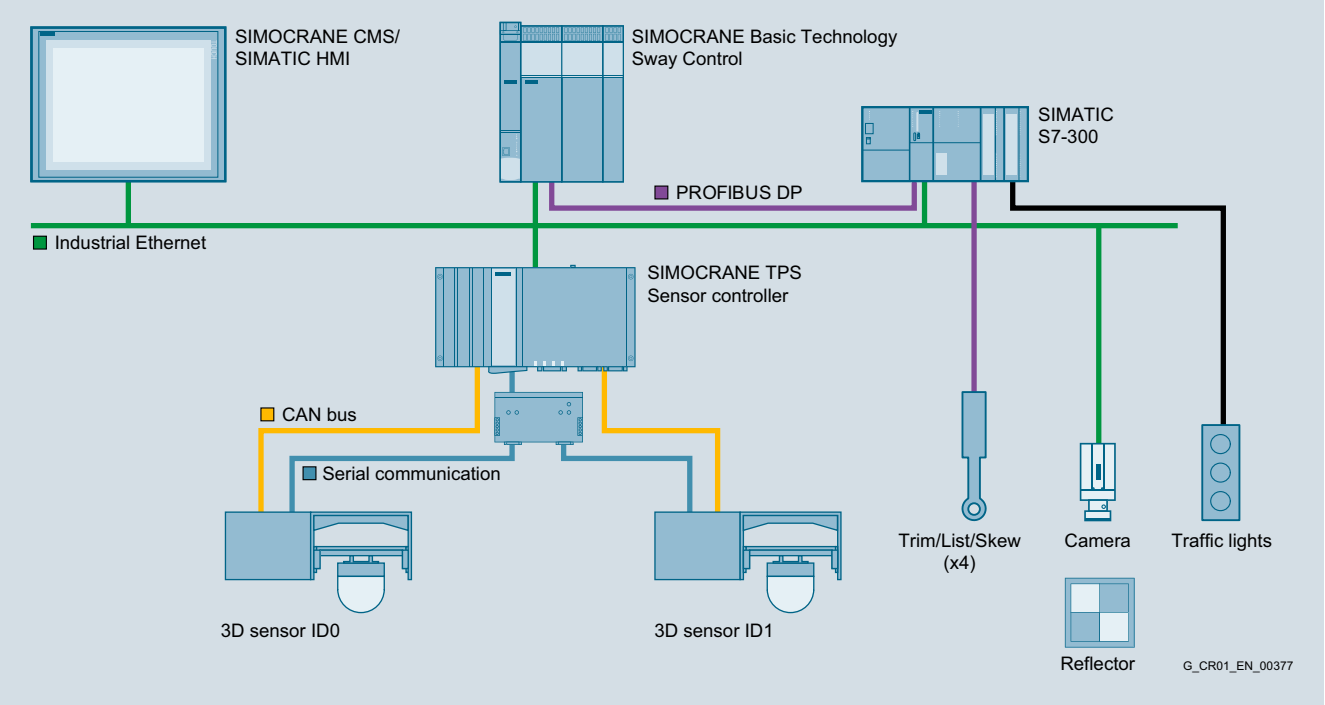
- The load position is determined by the SIMOCRANE Sway Control System and it is output at the interface for the crane controller.
- The target position is determined by SIMOCRANE TPS and it is output at the interface for the crane controller.
- The crane application can determine the setpoints for the final positioning operation from this. With this information, SIMOCRANE Basic Technology controls the relevant axes to complete the positioning operation.
- If skew control is implemented, this is also controlled by the crane application. The corresponding setpoints are determined here on the basis of the load and target position data.



TPS – Setting down a container

Design

System structure



Topology of semi-automatic STS crane

Application part

The individual products process input parameters and output results or setpoints. The technological procedure, interlocks, and crane-specific conversions etc. must be performed and taken into consideration in the crane application.

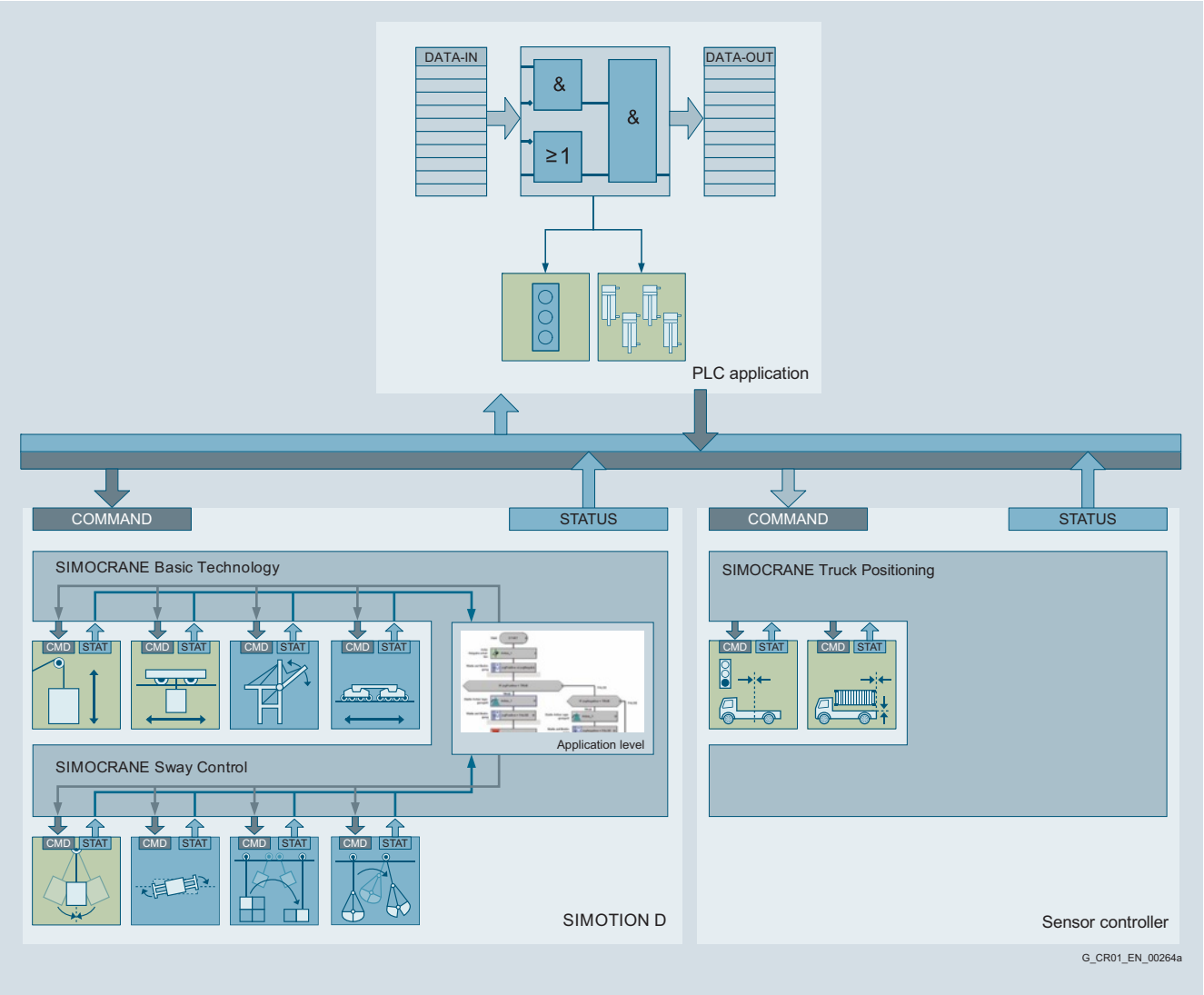
- Coordinate transformation
- Setpoint calculation for motion control
- Crane controller signaling system
- Control of TLS closed-loop control (skew control)
- Evaluation of the laser for height profile acquisition (bay scanner)
- Structure of procedure and control of axes
- Safety functions

Details of the individual SIMOCRANE products as well as further configuration options can be found in the sections:

- SIMOCRANE Standard Technology
- SIMOCRANE Advanced Technology
- SIMOCRANE CMS (Crane Management System)

Design (continued)

Software structure and function modules



Function blocks of the application example for a semi-automatic STS crane

The figure shows where which software modules execute or are implemented. The symbols with a green background indicate those function modules that are required especially for the application described here.

The "sensor controller" includes all function modules for determining the positions of the containers or vehicles. The **sway control functions** of SIMOCRANE SC execute on SIMOTION D as well as the motion control of SIMOCRANE Basic Technology. The application-specific parts, such as traffic light and cylinder controllers are implemented on the crane controller (PLC).

Data is exchanged between the 3 units sensor controller, SIMOTION D and PLC over defined interfaces which is symbolized in the figure by "COMMAND" and "STATUS".

Selection and ordering data

The list shows all the relevant SIMOCRANE components for this configuration:

Description	Article No.
SIMOCRANE Basic Technology V3.0	**6AU1660-4AA20-0AA0**
incl. SIMOTION D435-2 (1 item)	
SIMOCRANE Truck Positioning System (TPS) V1.2	
consisting of	
• SIMOCRANE TPS V1.2, sensor controller (1 item)	**6GA7220-1AA00-0AC0**
• SIMOCRANE TPS V1.1, 3D sensor (2 items)	**6GA7221-1AA21-0AB0**
SIMOCRANE Sway Control System	
consisting of	
• SIMOCRANE SC integrated software type – STS/GSU V2.1 SP1	**6GA7200-0AA01-1AA0**
• SIMOCRANE CenSOR V2.0 Camera for swing angle measurement with 25 mm lens	**6GA7202-1AA10-1CF1**
• Retroreflector 500 × 500 mm, lifting height up to 55 m	**6GA7201-1AA02-0AA0**
SIMOCRANE CMS (HMI)	
• SIMOCRANE CMS V4.3 Lean	**6GA7214-0AA00-0AA0**
or	
• SIMOCRANE CMS V4.3 Basic	**6GA7214-0AB00-0AA0**

Application

This application example describes a simple configuration for an overhead bridge crane (OHBC) which applies the SIMOCRANE solution for mid-performance market.

Application example

The objective is to equip an overhead crane with necessary crane-specific technology such as start-pulse function for hoist, and masterswitch function for trolley (cross travel) and gantry (long travel). Furthermore, a sway damping is required for manual operation of trolley and gantry. In this way, it can relieve a crane operator and increases the crane productivity.

The following example shows a typical hardware configuration used in mid-performance crane applications. It involves an overhead bridge crane (OHBC), controlled by using I/O signals. The SIMOCRANE Drive-Based Technology provides crane-specific functions, e.g. start-pulse and load-depending field-weakening for hoist, and masterswitch and prelimit function for trolley and gantry. Furthermore, the SIMOCRANE Drive-Based Sway Control can damp sway in manual operation for trolley and gantry, so both products meet the challenge of most applications in mid-performance market.

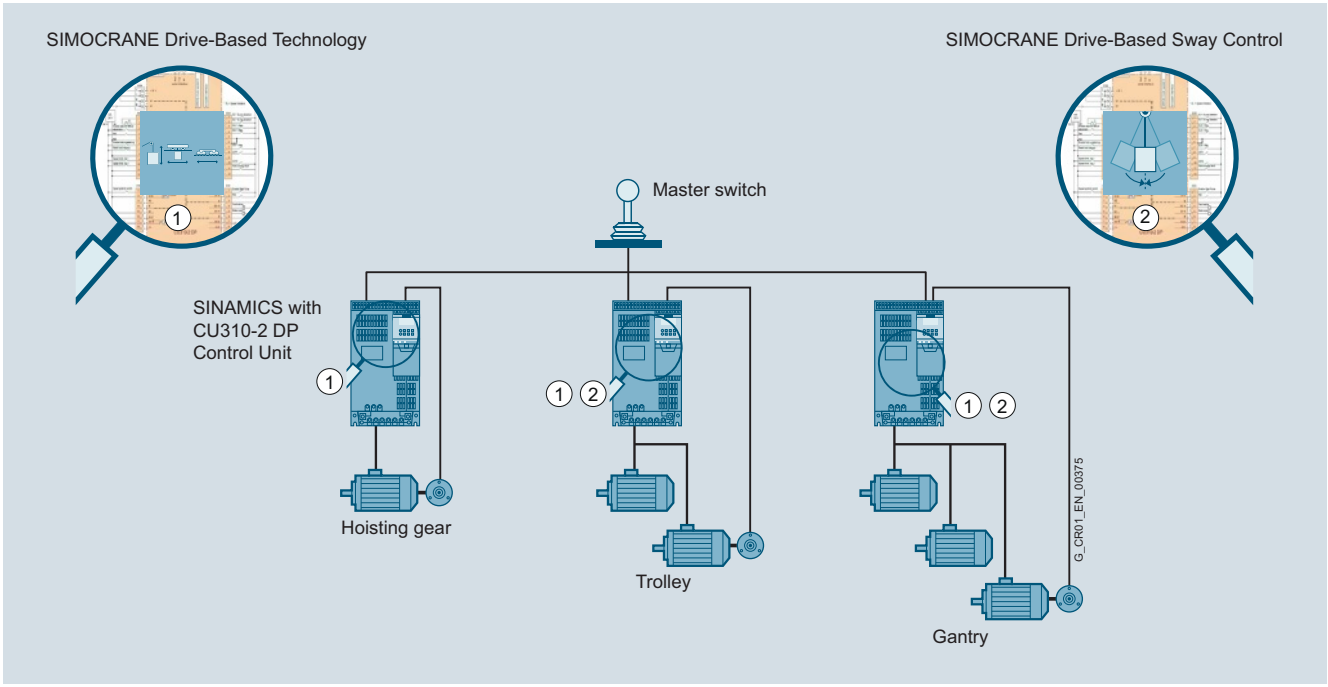
Solution

In order to fulfill the requirement, the following SIMOCRANE products are required:

- 1 × SIMOCRANE Drive-Based Technology V1.0 SP1 HF2
  Article No. **6GA7270-1AA11-0AA0**
- 2 × SIMOCRANE Drive-Based Sway Control V1.0
  Article No. **6GA7280-1AA10-0AB0**

Design

The configuration shows a crane topology with three AC/AC single-drives. It is especially important to note that the crane can be controlled by just using the onboard I/O of the SINAMICS Control Unit. For hoist applications, an encoder is requested for safety reasons and for providing pendulum length to cross travel (trolley) and long travel (gantry). For insure the sway control performance, encoders for trolley and gantry are recommended.



Selection and ordering data

SIMOCRANE components required for this configuration:

Description	Article No.
SIMOCRANE Drive-Based Technology V1.0 SP1 HF2 1 item	**6GA7270-1AA11-0AA0**
SIMOCRANE Drive-Based Sway Control V1.0 2 items	**6GA7280-1AA10-0AB0**

Suggestion for additionally required components, e.g.:

Description	Article No.
DCC SINAMICS V2.3 (full license) 1 item	**6AU1810-1HA23-0XA0**
SINAMICS S120 Control Unit CU310-2 DP 2 items	**6SL3040-1LA00-0AA0**

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 condition 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 operating 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 V4.3 Basic (STS cranes)
  Article No. **6GA7214-0AB00-0AA0**
- 16 × SIMOCRANE CMS V4.3 Lean (RTG cranes)
  Article No. **6GA7214-0AA00-0AA0**
- 1 × SIMOCRANE RCMS V4.3 Single station
  Article No. **6GA7215-0AA00-0AA0**

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 are needed.

- 20 × CMS stations: The minimum requirements are as follows:
  - Processor: Intel Core i3 or higher
  - Main memory: minimum of 4 GB
  - Hard disk: minimum 160 GB (preferably more)
  - Drives: DVD ROM drive
  - Operating system: Windows 7 SP1 (64 bit, enterprise/ professional), MUI (Multilingual User Interface), system language English, US

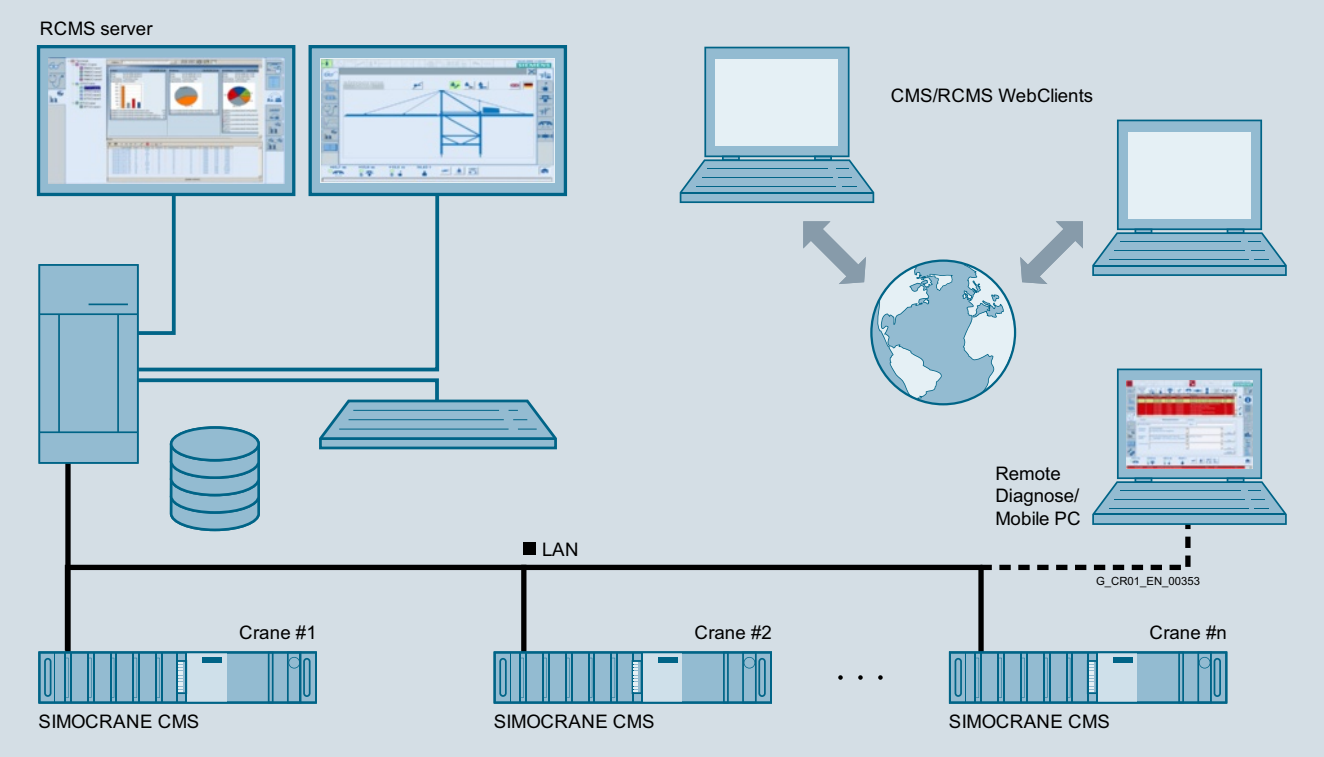
We recommend using a SIMATIC IPC477D for every CMS station on the terminal.

- 1 × RCMS station: The minimum requirements are:
  - Processor: Intel Quad Core i7 or higher
  - Main memory: minimum of 8 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 × 200
  - Operating system: Windows Server 2008 R2 SP1 (64 bit), MUI (Multilingual User Interface), system language English, US

For the RCMS server we recommend using a SIMATIC IPC847D or SIMATIC IPC647D.

Design

On each crane SIMOCRANE CMS is installed on a Panel PC with a direct connection the crane PLC. Furthermore, each crane is connected to the RCMS server (Rack PC) via TCP/IP communication 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 V4.3 Basic 4 items	**6GA7214-0AB00-0AA0**
SIMOCRANE CMS V4.3 Lean 16 items	**6GA7214-0AA00-0AA0**
SIMOCRANE CMS V4.3 RCMS Single station 1 item	**6GA7215-0AA00-0AA0**

Overview

Flexibility for successful crane concepts

As part of the SINAMICS drive family, the SINAMICS S120 drive system 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.

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.

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 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 motors without a DRIVE-CLiQ interface.

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!

Modular design ensures flexibility and scalability

Motor Modules (DC/AC units) – available in compact booksize, booksize and chassis formats – are characterized by their modular design. All the drive intelligence is combined in 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 (AC/DC units) – available in compact booksize, booksize and chassis formats – feed energy centrally into the 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.

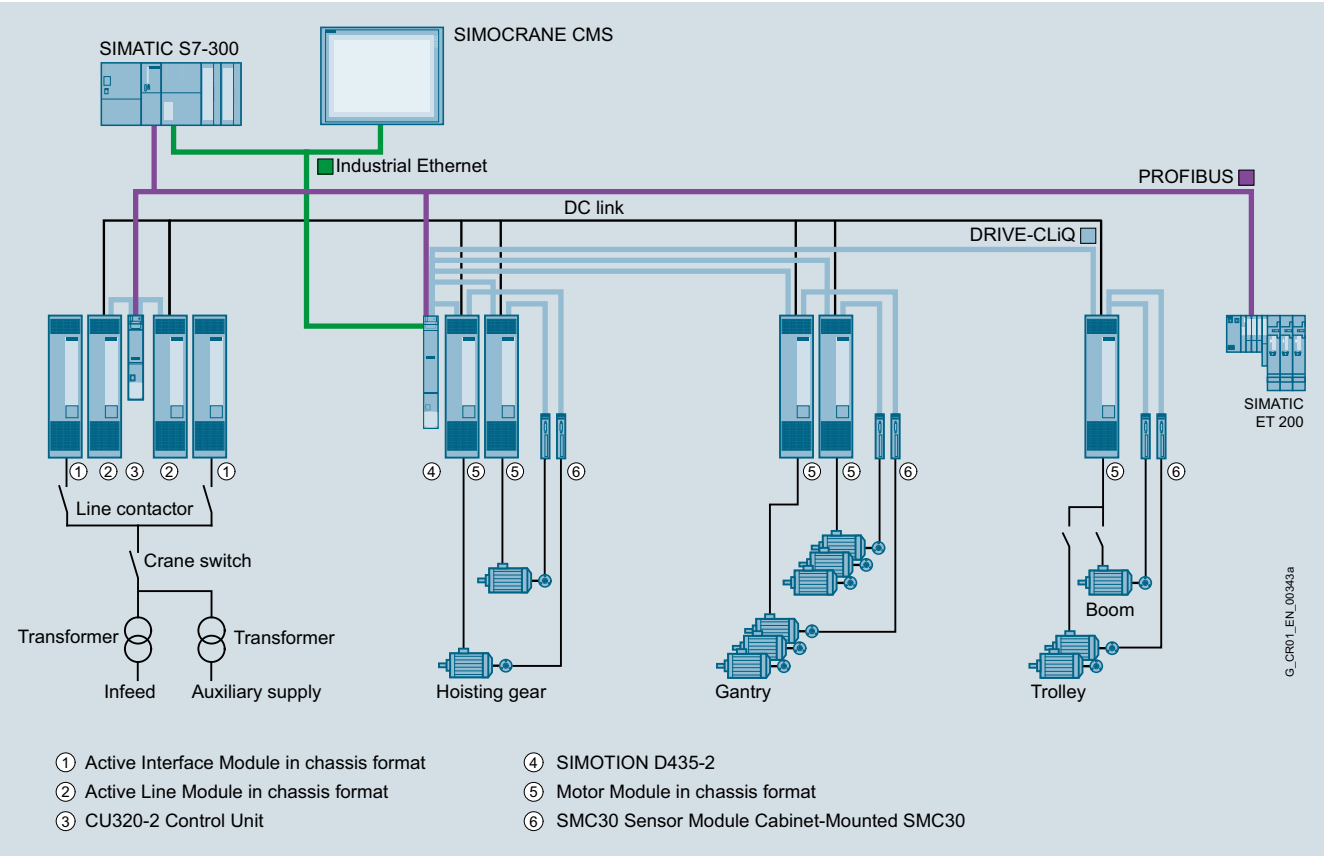
On AC/AC units, the infeed and motor power supply functions are combined in a single device, the Power Module – available in blocksize and chassis formats. For single-axis applications, drive control functions are performed by a special Control Unit (CU310-2) mounted on the Power Module and for multi-axis 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.

Overview (continued)

SINAMICS S120 blocksize, booksize compact, booksize, chassis and Cabinet Module formats

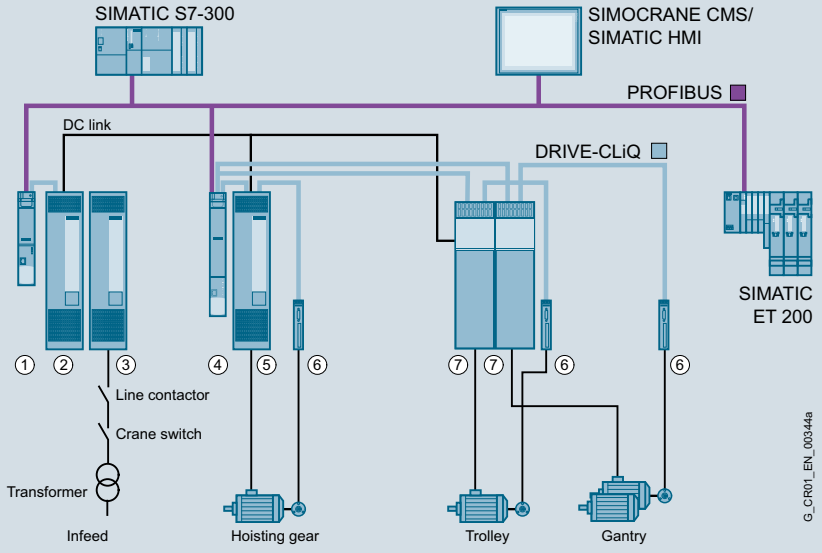
All formats can be combined as required

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.



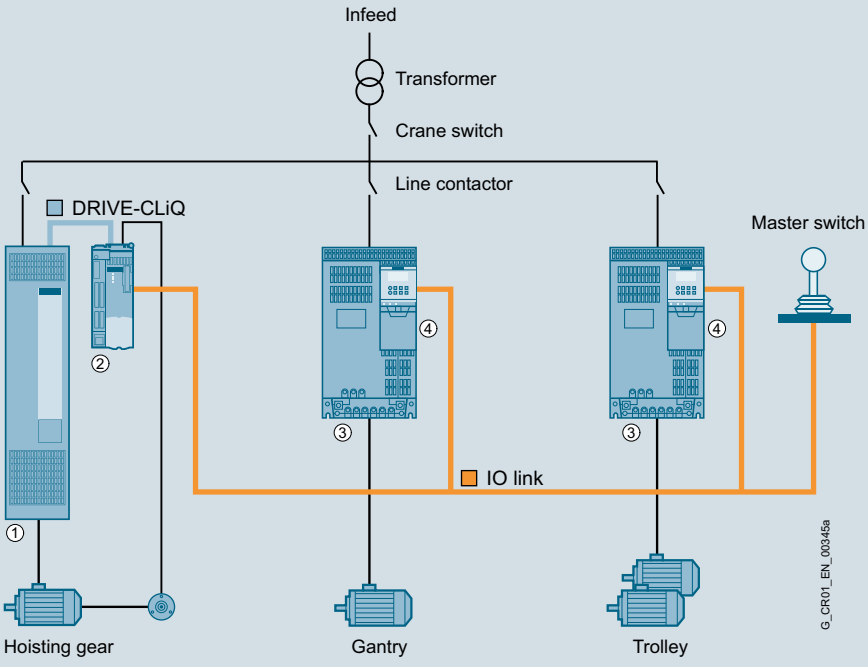
Container crane topology with chassis format

Overview (continued)



① CU320-2 Control Unit
② Active Line Module in chassis format
③ Active Interface Module in chassis format
④ SIMOTION D435-2
⑤ Motor Module in chassis format
⑥ SMC30 Sensor Module Cabinet-Mounted
⑦ Motor Module in booksize format

Bridge crane topology with chassis and booksize formats



① Power Module in chassis format
② CU310-2 Control Unit
③ Power Module in blocksize format
④ CU310-2 Control Unit (plugged into Power Module)

Bridge crane topology with Power Modules in chassis and blocksize formats

Overview (continued)

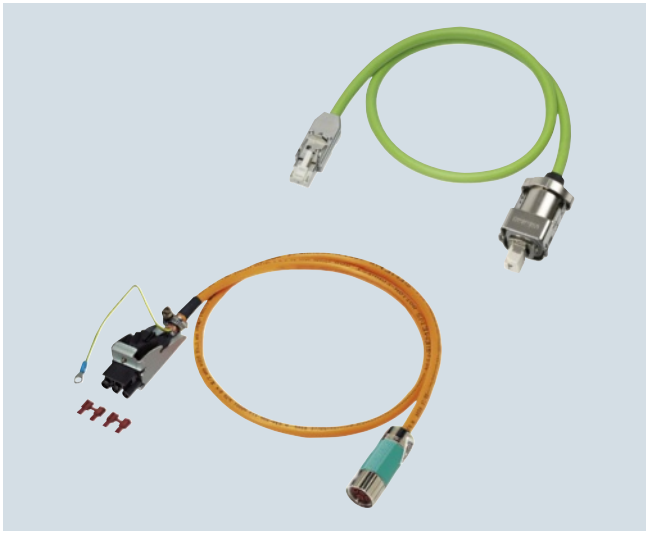
Powerful tools and competent support

Siemens offers expert advice and efficient tools to help users select the right drive solution. Experienced specialists are always ready to lend a hand in designing mechanically integrated motor solutions.

- SIZER for Siemens Drives engineering tool
  - User-friendly support in dimensioning motor and gear unit
  http://www.siemens.com/sizer
- CAD Creator
  - Dimensional drawing and 2D/3D CAD generator
  http://www.siemens.com/cadcreator

Connection system MOTION-CONNECT

MOTION-CONNECT includes connection systems and components which are optimally tailored to individual applications. MOTION-CONNECT cables feature state-of-the-art connection systems to ensure fast, reliable connection of different components. The use of pre-assembled MOTION-CONNECT cables ensures high quality and system-tested, problem-free operation.



Power cable and signal cable

MOTION-CONNECT cables are available in two versions to suit different applications:

- **MOTION-CONNECT 500**
  The solution for predominantly fixed installation.
- **MOTION-CONNECT 800PLUS**
  Ideally satisfies all requirements for use in machine tools and production machines. The cables meet all exacting mechanical requirements for application in cable carriers on machine tools and production machines and are resistant to cutting oils.

MOTION-CONNECT cables are available as power cables or signal cables, pre-assembled or by the meter depending on the application. The pre-assembled cables can be ordered in length units of 10 cm (3.94 in) and can be extended, if necessary.

Overview

With its separate power units and Control Units, the SINAMICS S120 drive system can be perfectly adapted to a wide variety of different drive tasks.

The Control Unit is selected according to the number of drives to be controlled and the required performance level, while the power unit must be rated to meet the energy requirements of the system. The connection between the Control Unit and power unit is made very simply using the digital system interface DRIVE-CLiQ.

Control Units

CU310-2 PN and SIMOTION D4x5-2 Control Units

CU310-2 DP and CU310-2 PN Control Units

CU310-2 Control Units are designed to control a single drive. They feature as standard a PROFIBUS interface (CU310-2 DP) or PROFINET interface (CU310-2 PN) and a TTL/HTL encoder evaluation circuit.

CU320-2 Control Unit

The CU320-2 Control Unit has been designed to control multiple drives. A CU320-2 Control Unit is capable of operating up to

- 6 drives in vector control mode.

The CU320-2 Control Unit can be used to control a group of single drives and implement basic drive technology functions.

SIMOTION D Control Units

SIMOCRANE Basic Technology uses the SIMOTION D435-2 Control Unit from the SIMOTION Motion Control System product range for the implementation of standard functions and the motion control of all main drives of a crane.

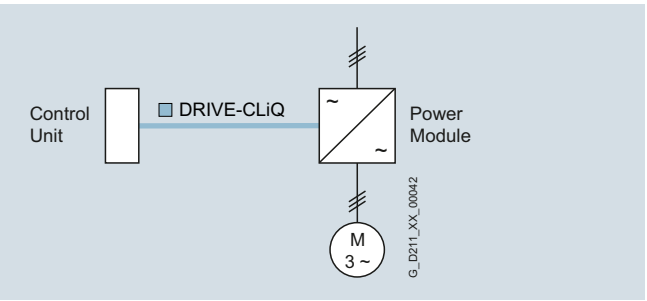
The STARTER commissioning tool is used to commission and diagnose the various Control Units. The SCOUT engineering software, which includes the STARTER tool, is required for SIMOTION D Control Units.

For further information about STARTER, see the section "Starter Commissioning Tool". For further information about the SIMOTION Motion Control System and SCOUT, see the section SIMOCRANE Basic Technology.

Power Modules

The simplest version of a SINAMICS S120 drive system consists of a CU310-2 Control Unit and a Power Module. A line rectifier, a voltage-source DC link and an inverter for supplying a motor are integrated in the Power Module.

Power Module in blocksize format with CU310-2 Control Unit



Power Modules are designed for single drives which are not capable of regenerating energy to the supply. Generated energy produced during braking is converted to heat via braking resistors.

Power Modules can also be operated by a CU320-2 Control Unit, SIMOTION D4x5-2 or CX32-2 Controller Extension, e.g. in configurations where a single drive has been added to a multi-axis drive group. In this case, the Power Modules in blocksize format must be equipped with the CUA31/CUA32 Control Unit Adapter. This is connected with the CU320-2 Control Unit, SIMOTION D4x5-2 or CX32-2 Controller Extension using DRIVE-CLiQ. Power Modules in chassis format can be directly connected to the Control Unit using a DRIVE-CLiQ cable.

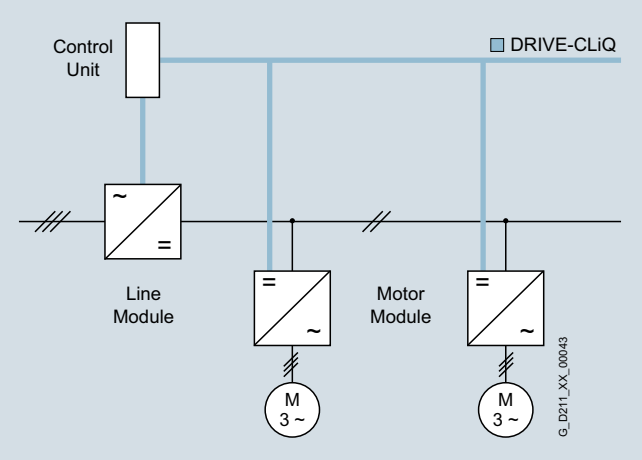
Overview (continued)

Motor Modules

A voltage-source DC link and an inverter for supplying a motor are integrated in the Motor Module.

Power Modules are designed for single drives which are not capable of regenerating energy to the supply. Generated energy produced during braking is converted to heat via braking resistors.

CU320-2 Control Unit, Line Module and three Motor Modules in booksize format



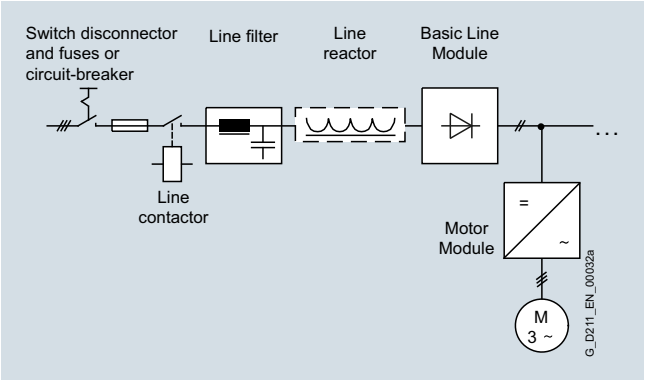
Motor Modules are designed for multi-axis drive systems and are controlled by a CU320-2 Control Unit, a SIMOTION D4x5-2 or CX32-2 Controller Extension. Motor Modules are interconnected by means of a shared DC busbar. Since the Motor Modules have a common DC link, they can exchange energy with one another, i.e. if one Motor Module operating in generator mode produces energy, the energy can be used by another Motor Module operating in motor mode. The voltage-source DC link is supplied with mains voltage by a Line Module.

Line Modules

Line Modules generate a DC voltage from the line voltage and supply Motor Modules with energy via the voltage-source DC link.

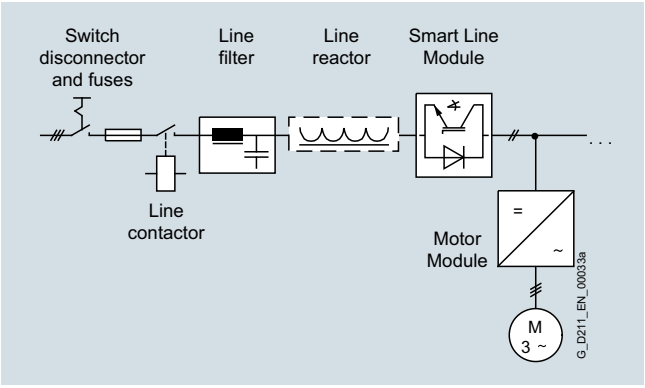
Basic Line Modules

Basic Line Modules are designed only for infeed operation, i.e. they are not capable of feeding regenerative energy back into the supply system. If regenerative energy is produced, e.g. when drives brake, it must be converted to heat by means of a Braking Module and a braking resistor. When a Basic Line Module is used as the infeed, the matching line reactor must be installed. A line filter can be installed optionally to restrict conducted interference to Class C2 limits (EN 61800-3).



Smart Line Modules

Smart Line Modules can supply energy and return regenerative energy to the supply system. Braking Modules and braking resistors are required only if the drives need to be decelerated in a controlled manner after a power failure – i.e. when energy cannot be regenerated into the line supply. When a Smart Line Module is used as the infeed, the matching line reactor must be installed. A line filter can be installed optionally to restrict conducted interference to Class C2 limits (EN 61800-3).

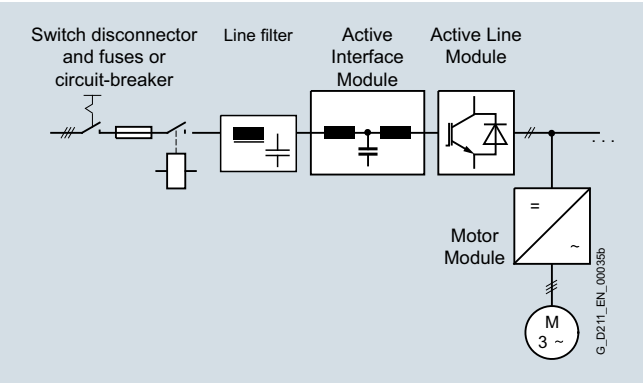


Overview (continued)

Active Line Modules

Active Line Modules can supply energy and return regenerative energy to the supply system. Braking Modules and braking resistors are required only if the drives need to be decelerated in a controlled manner after a power failure – i.e. when energy cannot be regenerated into the line supply. In contrast to Basic Line Modules and Smart Line Modules, however, Active Line Modules generate a regulated DC voltage which remains constant despite fluctuations in the line voltage. In this case, the line voltage must remain within the permissible tolerance range. Active Line Modules draw a virtually sinusoidal current from the supply which limits any harmful harmonics.

In order to operate an Active Line Module, it is absolutely essential to use the Active Interface Module for the appropriate rating. A line filter can be installed optionally to restrict conducted interference to Class C2 limits (EN 61800-3).



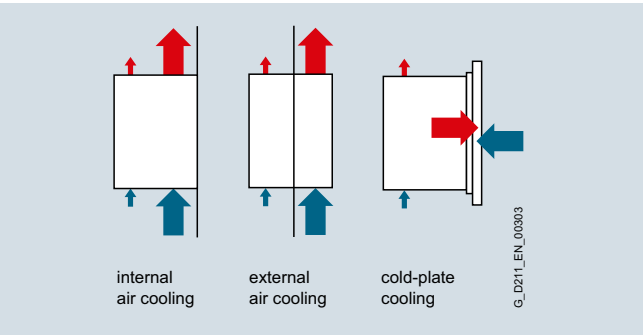
Please refer to the System Description for more information about designing a drive system with SINAMICS S120.

Power Modules, Motor Modules and Line Modules are available in booksize, booksize compact, blocksize and chassis formats:

- Power Modules in blocksize and chassis formats
- Motor Modules and Line Modules in booksize, booksize compact and chassis formats.

Cooling methods

Depending on the format, there are several cooling options for crane applications:



SINAMICS S120 booksize, cooling methods

Internal air cooling

In this standard solution, the power loss from the electronics and power units of the drive components is removed by natural cooling or by a forced-ventilation system and routed to the interior of the control cabinet.

External air cooling

External air cooling uses the "through-hole" method. The components' power unit heat sinks pass through the mounting surface in the control cabinet and can thus release the heat losses of the power circuit to a separate external cooling circuit. The only heat loss that remains in the cabinet is emitted by the electronics. Degree of protection IP54 can be achieved at this "mechanical interface". The heat sink, with its cooling fins and the fan unit (part of the scope of supply), protrudes through the back into a separate ventilation area, which can also open outwards.

Cold-plate cooling

Units designed with cold-plate cooling can pass the power unit heat losses to an external heat sink via a thermal interface on the unit's rear panel. This external heat sink is water-cooled, for example.

Energy efficiency

The SINAMICS S120 drive system saves energy by recovering energy from the axes and using it within the DC link group of a multi-axis configuration and by feeding it back into the supply system. Even at full infeed capacity, no unnecessary heat is generated in the control cabinet. Because the Active Line Modules prevent capacitive and inductive reactive currents, SINAMICS S120 also ensures that no unnecessary power losses occur in the power supply and that no current harmonics occur. This not only prevents detrimental effects on other loads, but it also reduces the heat generated in the control cabinet.

System components

System components are divided into the following categories:

- **DC link components**
  e.g. Braking Modules and braking resistors
- **Load-side power components**
  e.g. motor reactors
- **Supplementary system components**
  e.g. Terminal Modules, Operator Panels and Communication Boards
- **Encoder system interface**
  for connecting various types of encoders to SINAMICS S120

Overview (continued)

Booksize format

Booksize format units are optimized for multi-axis applications and are mounted adjacent to one another. The connection for the shared voltage-source DC link is an integral feature. The booksize format offers the full range of cooling options for crane applications: internal air cooling, external air cooling and cold plate cooling.

Booksize compact format

Derived from the booksize format we developed the booksize compact format for machines with particularly high requirements for the compactness of their drives. The booksize compact format combines all benefits of the booksize format and provides the same performance with an even smaller overall height and an extended overload capability. The booksize compact format is thus particularly well suitable for integration into machines with high dynamic requirements and confined installation conditions.

The booksize compact format has the same design for the cooling methods of internal air cooling and cold plate cooling.

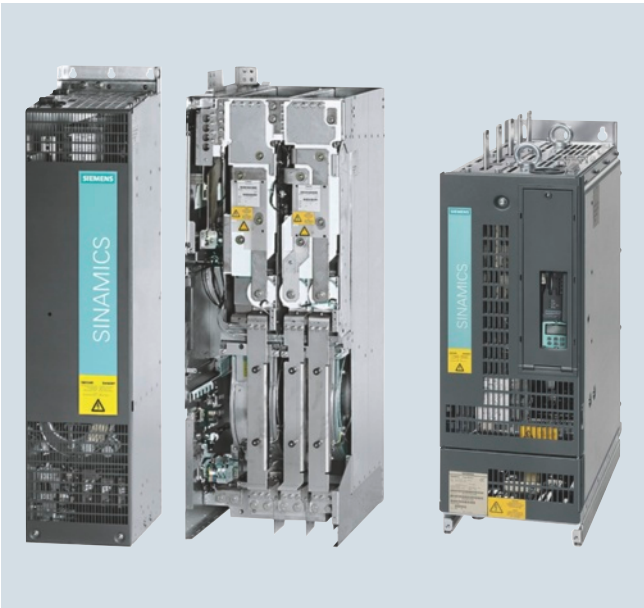
Blocksize format

Blocksize format units are optimized for single-axis applications and are supplied only as Power Modules.

The CU310-2 Control Unit can be snapped onto them directly. The units are cooled by internal air cooling or liquid cooling.

Chassis format

Higher-output units (approximately 100 kW (150 hp) and above) are constructed in chassis format. These are available as Line Modules, Power Modules and Motor Modules. Chassis format units are cooled by an internal air cooling circuit. The CU310-2 Control Unit can be integrated in the Power Modules.



Technical specifications

Unless specified otherwise, the following technical specifications are valid for all the following components of the SINAMICS S120 drive system.

Electronics power supply	**24 V DC, -15 %/+20 %**
Vibratory load	
• Transport [1] acc. to EN 60721-3-2	
- All units and components except for chassis format	Class 2M3
- Chassis format units	Class 2M2
• Operation Test values acc. to EN 60068-2-6	Test Fc
	10 ... 58 Hz: Constant deflection 0.075 mm
	58 ... 150 Hz: Constant acceleration = 9.81 m/s^2 (1 × *g*)
Shock stressing	
• Transport [1] acc. to EN 60721-3-2	
- All units and components except for chassis format	Class 2M3
- Chassis format units	Class 2M2
• Operation Test values acc. to EN 60068-2-27	Test Ea
- Booksize and blocksize formats FSA to FSC	147 m/s^2 (15 x *g*)/11 ms
- Blocksize format FSD to FSF	49 m/s^2 (5 × *g*)/30 ms
- Chassis format	98 m/s^2 (10 × *g*)/20 ms
Ambient conditions	
• Protection class according to EN 61800-5-1	Class I (with protective conductor system) and Class III (PELV)
• Touch protection	DIN VDE 0106 Part 100 and BGV A 3 when used properly
• Type of cooling	Internal/external air cooling, power units with forced air cooling by means of built-in fan
Permissible ambient/coolant temperature (air) during operation	
• For line-side components, Power Modules, Line Modules and Motor Modules	0 ... 40 °C (32 ... 104 °F) without derating, > 40 ... 55 °C (104 ... 131 °F), see derating characteristics
• For Control Units, supplementary system components, DC link components, and Sensor Modules	0 … 55 °C (32 … 131 °F) up to 2000 m (6562 ft) above sea level
Climatic ambient conditions	
• Storage [1] acc. to EN 60721-3-1	Class 1K4 Temperature -25 ... +70 °C (-77 ... +158 °F)
• Transport [1] acc. to EN 60721-3-2	Class 2K4 Temperature -40 … +70 °C (-104 ... +158 °F) Max. air humidity 95 % at 40 °C (104 °F)
• Operation according to EN 60721-3-3	Class 3K3 Temperature 0 ... 55 °C (32 ... 131 °F) Condensation, splashwater, and ice formation are not permitted (EN 60204, Part 1)
Environmental class/harmful chemical substances	
• Storage [1] acc. to EN 60721-3-1	Class 1C2
• Transport [1] acc. to EN 60721-3-2	Class 2C2
• Operation according to EN 60721-3-3	Class 3C2
Organic/biological influences	
• Storage [1] acc. to EN 60721-3-1	Class 1B1
• Transport [1] acc. to EN 60721-3-2	Class 2B1
• Operation according to EN 60721-3-3	Class 3B1
Degree of contamination According to EN 61800-5-1	2

European Standards	
EN 954-1	Safety of machinery – safety-related parts of control systems Part 1: General design principles
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
EN 50370-1	Electromagnetic compatibility (EMC) – Product family standard for machine tools Part 1: Radiated interference
EN 55011	Industrial, scientific and medical high-frequency devices (ISM devices) – radio interference – limit values and measuring techniques
EN 60204-1	Electrical equipment of machines Part 1: General definitions
EN 61800-3	Variable-speed electric drives Part 3: EMC product standard 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
North American standards	
UL508C	Power Conversion Equipment
CSA C22.2 No. 14	Industrial Control Equipment
Approvals	
cULus	Testing by UL (Underwriters Laboratories, http://www.ul.com) according to UL and CSA standards

More information

For satisfactory and reliable operation of the drive system, original components of the SINAMICS system and the original Siemens accessories as described in this Catalog and the Configuration Manuals, in the functional descriptions or user manuals should be used.

The user must observe the configuring instructions.

Combinations that differ from the configuring instructions (also in conjunction with non-Siemens products) require a special agreement.

If no original components are used, for example, for repairs, approvals such as UL, EN and Safety Integrated can become invalid and thus the operation authorization for the machine with the non-Siemens components installed becomes invalid.

All of the 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 are used for their intended purpose. In other cases, the vendor of these products is responsible for arranging that new certificates are issued.

Please refer to Catalog PM21 Chapter System description – Dimensioning for more engineering guidance to design a drive system with SINAMICS S120.

Note:

The products described in this catalog may cause high-frequency disturbances in a residential environment and necessitate the implementation of interference-suppression measures.

[1] In transport packaging.

Overview

Innovative system architecture with a central Control Unit

Electronically coordinated single drives work together to perform your drive tasks. Higher-level controllers operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the controller and the drives. This exchange usually took place via a field bus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach: A central Control Unit controls the drives for all connected axes and also establishes the technological links between the drives and/or axes. Since all the required data is stored in the central Control Unit, it does not need to be transferred. Inter-axis connections can be established within a Control Unit and easily configured in the STARTER commissioning tool using a mouse.

- Simple technological tasks can be carried out automatically by the SINAMICS S120 Control Unit
- The **CU310-2 DP** or **CU310-2 PN** Control Unit are available for single drives
- The **CU320-2** Control Unit is designed for multi-axis applications
- Sophisticated Motion Control tasks can be implemented with the support of the more powerful **D410-2, D425-2, D435-2, D445-2** and **D455-2** Control Units of SIMOTION D (graded according to performance)

Drive objects

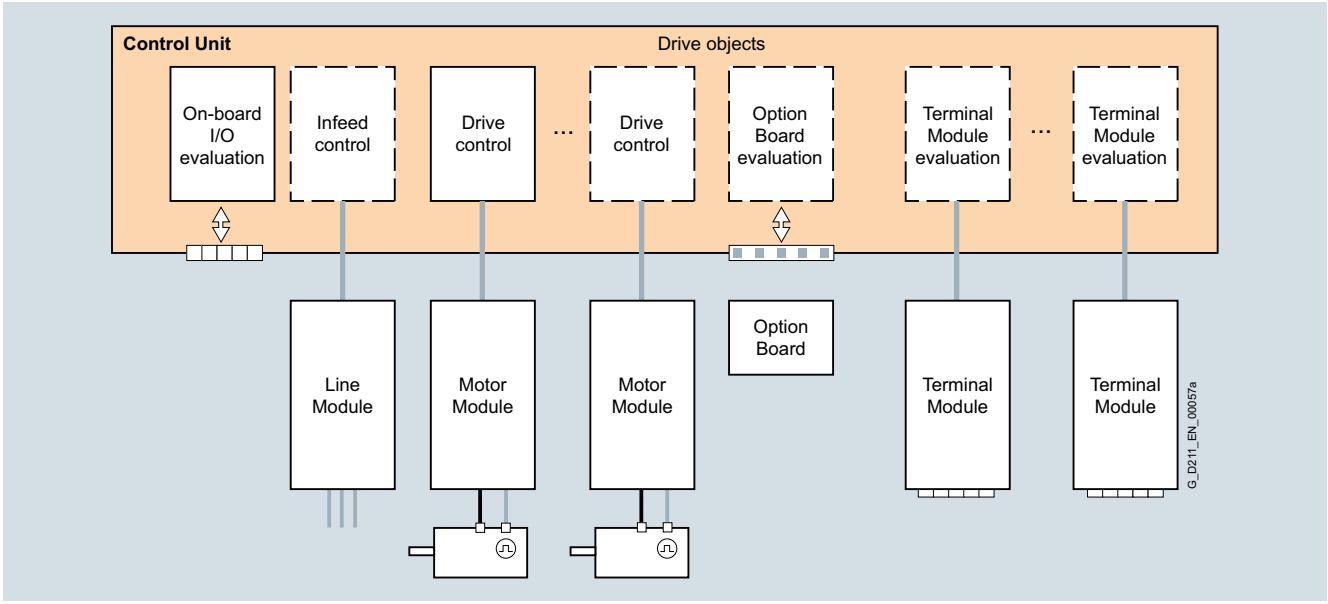
A drive object is a self-contained software function with its own parameters and, if necessary, its own fault messages and alarms.

Each of these Control Units is based on an object-oriented

SINAMICS S120 standard firmware which contains all of the most popular control modes and can be scaled to meet even the most advanced performance requirements.

The drive controls are supplied as ready-to-configure drive objects:

- Infeed Control for line infeed,
- Vector Control for the broad scope of rugged asynchronous (induction) motor applications
- Servo Control for permanent-field synchronous motors with demanding dynamic requirements
- *V/f* control modes for simple applications such as group drives with SIEMOSYN motors



Extended technology with SIMOTION

SIMOTION D Control Units support the coordinated Motion Control of multiple drives. Technology objects are implemented in addition to drive objects on these Control Units. These are grouped to form technology packages and make available extended Motion Control functions (e.g. synchronous operation, cam disk, path interpolation and others) or technological functions (e.g. a cam controller, a temperature or pressure control). The IEC 61131-3-compliant PLC integrated in SIMOTION D Control Units means that they are not just capable of controlling sequences of motions, but the entire machine including HMI and I/Os.

Comprehensive package of open-loop and closed-loop control functions

A wide variety of standard functions such as setpoint input, data set changeover, controller optimization and kinetic buffering ensure a high degree of functional reliability and excellent flexibility of application.

Overview (continued)

Overview of key open-loop and closed-loop control functions

	Closed-loop control types S120	Open-loop control types S120	Main functions S120 for booksize/chassis	Comment, note
Infeed Control	• Booksize - Current control with/without mains sensor - V_{DC} control with/without mains sensor • Chassis - Current control with mains sensor - V_{DC} control with mains sensor	• Booksize/chassis - Basic Mode Rectification only - Smart Mode Rectification and regenerative feedback	• Mains identification • Controller optimization • Harmonics filter • Automatic restart	The mains sensor is the VSM 10 Voltage Sensing Module; "current" is the line current; 3-phase with line frequency
Vector Control	• Asynchronous (induction) motor - Torque control with/without encoder - Speed control with/without encoder • Torque motor - Torque control with encoder - Speed control with/without encoder • Asynchronous (induction) motor, torque motor - Position control with encoder	• Linear/parabolic characteristic • Fixed-frequency characteristic (textile) • Independent voltage setpoint input	• Data set changeover • Extended setpoint input • Motor identification • Current/speed controller optimization • Technology controller • Basic positioner • Automatic restart • Flying restart with/without encoder • Kinetic buffering • Synchronization • Droop • Brake control	Mixed operation with *V/f* control modes is possible; it is for this reason that the *V/f* control modes are stored only once in the "Vector Control" drive object Position control can be selected as a function module from both Servo and Vector mode. Synchronous motors (1FK and 1FT) and linear motors can be operated only in Servo mode.
Servo control	• Asynchronous (induction) motor - Torque control with encoder - Speed control with/without encoder • Synchronous motor, linear motor and torque motor - Torque control with encoder - Speed control with encoder • For all motor types - Position control with encoder	• Linear/parabolic characteristic • Fixed-frequency characteristic (textile) • Independent voltage setpoint input	• Data set changeover • Setpoint input • Motor identification • Damping application • Technology controller • Basic positioner • Brake control	Mixed operation with *V/f* control modes is possible; it is for this reason that the *V/f* control modes are stored only once in the "Vector Control" drive object Position control can be selected as a function module from both Servo and Vector mode.

Overview (continued)

BICO technology

Every drive object contains a large number of input and output variables which can be freely and independently interconnected using Binector Connector Technology (BICO). A binector is a logic signal which can assume the value 0 or 1. A connector is a numerical value, e.g. the actual speed or current setpoint.

Drive Control Chart (DCC)

DCC Drive Control Chart for SINAMICS S120 for simple, graphical configuration of control, logic and calculation functions at the drive level.

It expands the possibilities for easy configuring of technology functions for the SIMOTION Motion Control system as well as for the SINAMICS S120 drive system.

The user-friendly DCC editor supports easy graphical configuration and a clear presentation of control loop structures.

The associated block library contains a large choice of closed-loop control, calculation and logic modules as well as more complex open-loop and closed-loop control functions.

Drive Control Chart for SINAMICS S120 therefore provides a convenient basis for resolving drive-level open-loop and closed-loop control tasks directly in the converter.

Function module

The basic positioner EPos can be called on all SINAMICS S120 Control Units as an additionally activatable function module. The basic positioner can be used to resolve basic Motion Control tasks without additional external technological outlay from the drive itself.

The **Technology controller** is designed as a PID controller. It is suitable for implementing controls for regulating variables such as fill level, temperature, tension, pressure, flow rate and dancer position.

Integral safety functions (Safety Integrated)

The Control Units support comprehensive safety functions.

The integrated safety functions are the Safety Integrated Basic Functions

- STO = Safe Torque Off
- SBC= Safe Brake Control
- SS1 = Safe Stop 1

and the Safety Integrated Extended Functions that require a license

- SS2 = Safe Stop 2
- SOS= Safe Operating Stop
- SLS = Safely-Limited Speed
- SSM= Safe Speed Monitor
- SDI = Safe Direction
- SLP = Safely-Limited Position

(abbreviations in accordance with IEC 61800-5-2)

If the extended integrated safety functions are used, licenses, supplementary system components such as TM54F terminal modules, or suitable safety controls will be necessary.
For further information information about Safety Integrated visit:
http://www.siemens.com/safety-integrated

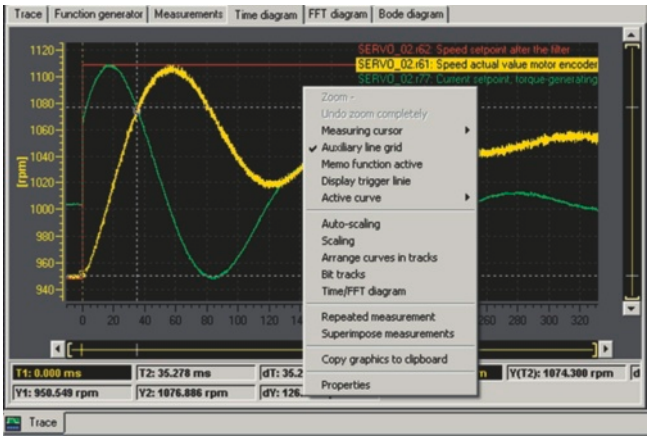
CompactFlash card

The functions of the SINAMICS S120 drives are stored on a CompactFlash card. This card contains the firmware and parameter settings for all drives in the form of a project. The CompactFlash card can also hold additional projects, which means that the correct project can be accessed immediately when series machines of different types are commissioned. When the Control Unit has booted, the data on the CompactFlash card are read and loaded to the RAM.

The firmware is organized in objects. Drive objects are used to implement open-loop and closed-loop control functions for Line Modules, Motor Modules, Power Modules and other system components connected by DRIVE-CLiQ.

Diagnostics optimally supported by trace function

The time characteristics of input and output variables associated with drive objects can be measured by the integrated trace function and displayed using the STARTER commissioning tool. The trace can record up to 4 signals simultaneously. A recording can be triggered dependent on freely selectable boundary conditions, e.g. the value of an input or output variable.



Overview

CU310-2 PN and CU310-2 DP Control Units

The CU310-2 Control Unit that is designed for the communication and open-loop/closed-loop control functions of a SINAMICS S120 (AC/AC) is combined with the PM340 Power Module to create a powerful single-axis drive. PROFINET (PN) and PROFIBUS (DP) variants are available for fieldbus communication.

CompactFlash Card for CU310-2 Control Units

The CompactFlash card contains the firmware and parameter settings. The CompactFlash card is plugged into the appropriate slot on the CU310-2 Control Unit.

A CU310-2 Control Unit can perform the communication, open-loop and closed-loop control functions for one Power Module. The performance expansion is not required in this case.

In addition to the firmware, the CompactFlash card also contains licensing codes which are required to enable firmware options.

Currently, the following firmware options can be ordered in addition to the article number:

- Safety Integrated Extended Functions, order code **F01**
- High output frequency [1], order code **J01**
- DCB Extension, order code **U01**

The firmware option can also be enabled on-site, for example, if the Safety Integrated Extended functions should be enabled later. You will need the serial number of the CompactFlash card and the Article No. of the firmware option to be enabled. With this information, you can purchase the associated license code from a license database and enable the firmware option. The license code is only valid for the CompactFlash card declared and cannot be transferred to other CompactFlash cards.

[1] For more information, visit http://support.automation.siemens.com/WW/view/en/104020669

[2] In order to use the digital outputs, a 24 V supply voltage must be connected to terminal X124.

Design

The CU310-2 Control Unit features the following connections and interfaces as standard:

- Fieldbus interface
  - CU310-2 PN: 1 PROFINET interface with 2 ports (RJ45 sockets) with PROFIdrive V4 profile
  - CU310-2 DP: 1 PROFIBUS interface with PROFIdrive V4 profile
- 1 DRIVE-CLiQ socket for communication with the DRIVE-CLiQ motor or other DRIVE-CLiQ devices (e.g. Sensor Modules or Terminal Modules)
- 1 encoder evaluation for evaluating the following encoder signals
  - Incremental encoder TTL/HTL
  - SSI encoder without incremental signals
- 1 PE/protective conductor connection
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 temperature sensor input (KTY84-130 or PTC)
- 3 parameterizable, fail-safe (can be used with firmware version 4.5 and higher) digital inputs (isolated) or alternatively 6 parameterizable digital inputs (isolated).
  The fail-safe digital inputs can be routed, i.e. they can be routed via PROFIsafe to a higher-level controller.
- 5 parameterizable digital inputs (isolated)
- 1 parameterizable, fail-safe (can be used with firmware version 4.5 and higher) digital output (floating) or alternatively 1 digital output (floating) [2]
- 8 parameterizable bidirectional digital inputs/outputs (non-floating) [2]
- 1 analog input, either ± 10 V (resolution 12 bit + sign) or ± 20 mA (11 bit + sign)
- 1 Ethernet interface (socket RJ45) for commissioning and diagnostics
- 1 slot for the CompactFlash card on which firmware and parameters are stored
- 1 PM-IF interface for communication with the Power Modules in blocksize format
- 3 test sockets and one reference ground for commissioning support
- 1 interface to the BOP20 Basic Operator Panel

The status of the CU310-2 Control Unit is indicated via multi-color LEDs.

A BOP20 Basic Operator Panel can also be snapped directly onto the CU310-2 Control Unit for diagnostic purposes, for example.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

Integration

The CU310-2 Control Unit controls Power Modules in blocksize format via the PM-IF interface. DRIVE-CLiQ motors as well as Sensor Modules (SMC) can be connected to the integrated DRIVE-CLiQ socket to permit the operation of motors without a DRIVE-CLiQ interface.

With the BOP20 Basic Operator Panel, parameters can be changed directly on the device. The BOP20 Basic Operator Panel can also be snapped onto the CU310-2 Control Unit during operation to perform troubleshooting procedures.

The CU310-2 Control Unit and other connected components are commissioned and diagnosed with the STARTER commissioning tool. The CU310-2 Control Unit requires a CompactFlash card with firmware version V4.4 or higher.

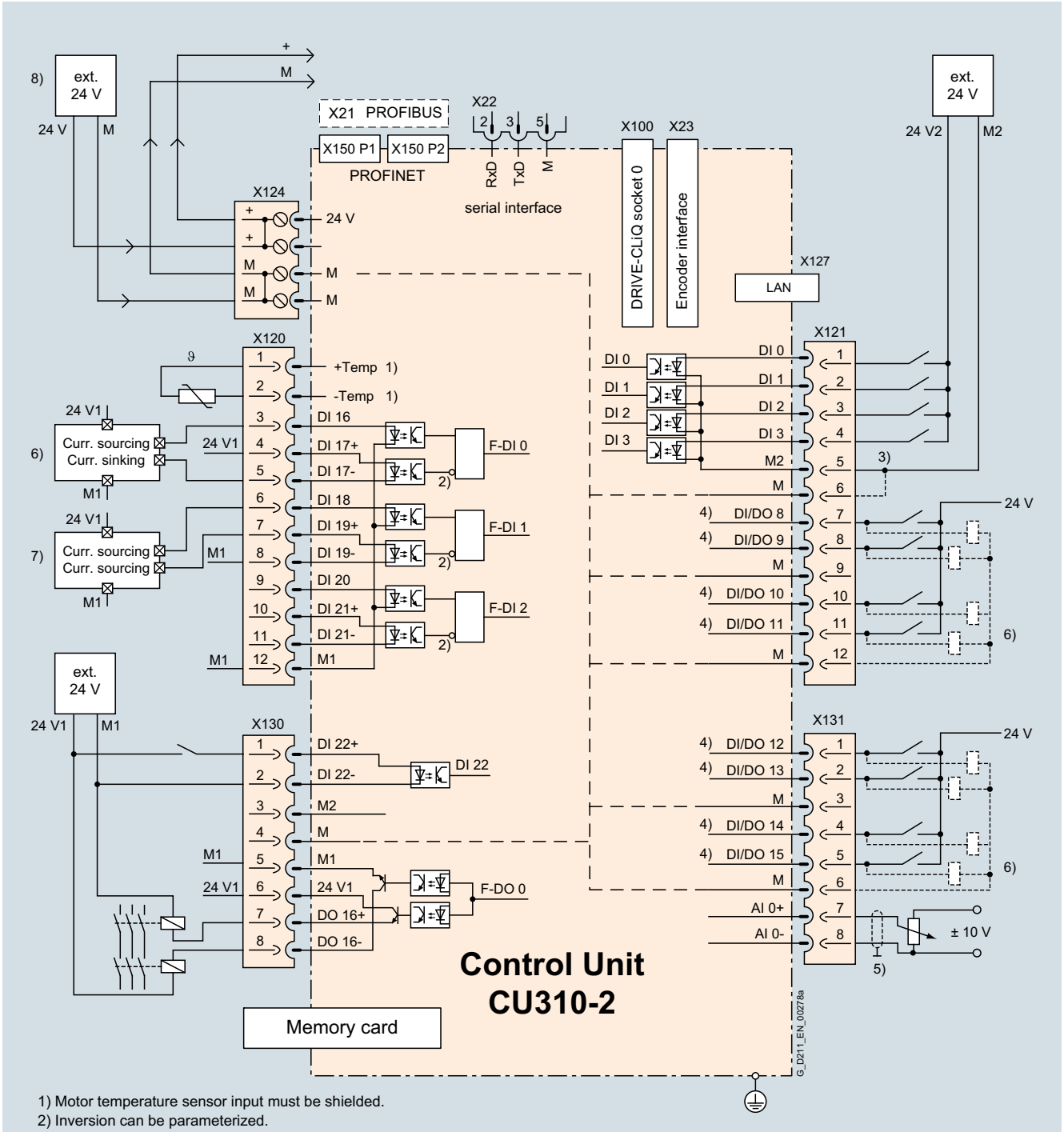
A CU310-2 PN Control Unit communicates with the higher-level control system using PROFINET IO and the PROFIdrive V4 profile.

The SINAMICS S120 drive system with the CU310-2 PN Control Unit then assumes the function of a PROFINET IO device and can perform the following functions:

- PROFINET IO device
- 100 Mbit/s full duplex
- Supports real-time classes of PROFINET IO:
  - RT (Real-Time)
  - IRT (Isochronous Real-Time), minimum send cycle 500 µs
- Connects to controls as PROFINET IO devices using PROFIdrive compliant with Specification V4
- Standard TCP/IP communication for engineering processes with the STARTER commissioning tool and for accessing the integrated web server
- Integrated 2-port switch with two RJ45 sockets based on the ERTEC ASIC. The optimum topology (line, star, tree) can therefore be configured without additional external switches.

A 24 V supply voltage must be connected to terminal X124 for the digital outputs to be used. A CompactFlash card with firmware V4.4 or higher is essential for the operation of the CU310-2 Control Unit.

Integration (continued)



1) Motor temperature sensor input must be shielded.
2) Inversion can be parameterized.
3) Jumper open, isolation for digital inputs (DI).
4) High-speed inputs must be shielded.
5) Analog input must be shielded.
6) Safety-related control with current sourcing and current sinking outputs.
7) Safety-related control with two current sourcing outputs.
8) In order to use the digital outputs, an external 24 V power supply must be connected to terminal X124.

Connection example of the CU310-2 Control Unit

Technical specifications

CU310-2 Control Unit PROFINET: 6SL3040-1LA01-0AA0 PROFIBUS: 6SL3040-1LA00-0AA0	
Power requirement, max. At 24 V DC, without taking account of digital outputs and DRIVE-CLiQ supply	0.35 A for CU310-2 + 0.5 A for PM340 Power Module
Conductor cross-section, max.	2.5 mm^2
Fuse protection, max.	20 A
Digital inputs	In accordance with IEC 61131-2 Type 1
	5 floating digital inputs
	8 bidirectional non-floating digital inputs/digital outputs
	3 parameterizable, fail-safe digital inputs (floating) or alternatively 6 parameterizable digital inputs (floating)
	5 bidirectional floating digital inputs/ outputs
• Voltage	-3 ... +30 V
• Low level (an open digital input is interpreted as "low")	-3 ... +5 V
• High level	15 ... 30 V
• Current consumption at 24 V DC, typ.	10 mA
• Delay time of digital inputs [1], approx.	
- L → H	50 µs
- H → L	100 µs
• Delay time of high-speed digital inputs [1], approx. (high-speed digital inputs can be used for position detection)	
- L → H	5 µs
- H → L	50 µs
• Conductor cross-section, max.	1.5 mm^2
Digital outputs (continuously short-circuit-proof)	8 bidirectional non-floating digital outputs/digital inputs
• Voltage	24 V DC
• Load current per digital output [2], max.	500 mA
• Delay time [1], typ./max.	
- L → H	150 µs/400 µs
- H → L	75 µs/100 µs
• Conductor cross-section, max.	1.5 mm^2
Analog input	The analog input can be switched between current input and voltage input
• As voltage input	-10 ... +10 V; R_i > 100 kΩ
	Resolution: 12 bit + sign (with respect to the maximum range that can be resolved -11 ... +11 V)
• As current input	-20 ... +20 mA; R_i > 250 Ω
	Resolution: 11 bit + sign (based on -22 ... 22 mA)
	Max. range that can be resolved: -44 ... +44 mA

CU310-2 Control Unit PROFINET: 6SL3040-1LA01-0AA0 PROFIBUS: 6SL3040-1LA00-0AA0	
Encoder evaluation	• Incremental encoder TTL/HTL • SSI encoder without incremental signals
• Input impedance	
- TTL	570 Ω
- HTL, max.	16 mA
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Encoder frequency, max.	300 kHz
• SSI baud rate	100 ... 250 kbaud
• Resolution absolute position SSI	30 bit
• Cable length, max.	
- TTL encoder	100 m (328 ft) (only bipolar signals permitted) [3]
- HTL encoder	100 m (328 ft) for unipolar signals 300 m (984 ft) for bipolar signals [3]
- SSI encoder	100 m (328 ft)
Power loss	<20 W
PE connection	M5 screw
Dimensions	
• Width	73 mm (2.87 in)
• Height	
- CU310-2 PN	191 mm (7.52 in)
- CU310-2 DP	187 mm (7.36 in)
• Depth	75 mm (2.95 in)
Weight, approx.	0.95 kg (2.09 lb)
Approvals, according to	cULus

[1] The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input or output is processed.

[2] In order to use the digital outputs, an external 24 V power supply must be connected to terminal X124.

[3] Signal cables twisted in pairs and shielded.

Selection and ordering data

Description	Article No.
CU310-2 PN Control Unit Without CompactFlash card	**6SL3040-1LA01-0AA0**
CU310-2 DP Control Unit Without CompactFlash card	**6SL3040-1LA00-0AA0**
CompactFlash Card for Control Units CU310-2 PN, CU310-2 DP With firmware V4.7 incl. Certificate of Licence	**6SL3054-0EH00-1BA0**
• and with Safety license	**6SL3054-0EH00-1BA0-Z F01**
• and with high output frequency [1]	**6SL3054-0EH00-1BA0-Z J01**
• and with DCB Extension license (firmware V4.6 and higher) (further information about DCB Extension and license upgrades can be found under Drive Control Chart (DCC))	**6SL3054-0EH00-1BA0-Z U01**
License upgrades	
• High output frequency [1] Option high output frequency for activating output frequencies above 550 Hz for upgrading the license of a CompactFlash card	**6SL3074-0AA02-0AA0**
• Safety license Option Safety Integrated Extended Functions incl. Certificate of Licence for one axis for upgrading the license of a CompactFlash card	**6SL3074-0AA10-0AA0**
Accessories	
Basic Operator Panel BOP20	**6SL3055-0AA00-4BA0**
STARTER commissioning tool [2] On DVD-ROM	**6SL3072-0AA00-0AG0**
Accessories for re-ordering	
SINAMICS/SINUMERIK/SIMOTION dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

More information

Firmware version

The firmware version is encoded as follows in the Article No. printed on the CompactFlash card:

Description	Article No.		
CompactFlash card for CU310-2 PN and CU310-2 DPControl Units with saftey license including Certificate of License and with saftey license	**6SL3054-0E**	■	**00-1BA0**
• Firmware **V4.4**		**E**	
• Firmware **V4.5**		**F**	
• Firmware **V4.6**		**G**	
• Firmware **V4.7**		**H**	

Example:

A CompactFlash card with firmware version V4.7 and a safety license for a CU310-2 PN Control Unit are required:
Article No.: 6SL3054-0EH00-1BA0-**Z**
F01

[1] For more information, visit http://support.automation.siemens.com/WW/view/en/104020669

[2] The STARTER commissioning tool is also available on the Internet at http://support.automation.siemens.com/WW/view/en/10804985/133100

Overview

The communication, open-loop and closed-loop control functions for one or more Motor Modules and the Line Module are executed in a CU320-2 Control Unit. The CU320-2 Control Unit is designed for multi-axis operation.

CU320-2 DP Control Unit with BOP20 Basic Operator Panel

CompactFlash card for CU320-2 Control Units

The CompactFlash card contains the firmware and parameter settings. The CompactFlash card is plugged into the appropriate slot on the CU320-2 Control Unit.

A CU320-2 Control Unit can perform the communication, open-loop and closed-loop control functions for several Motor Modules. The computing capacity required increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. For the CU320-2 Control Unit, the performance expansion is necessary from the 4th axis. The utilization of the CU320-2 Control Unit can be calculated with the SIZER engineering tool.

In addition to the firmware, the CompactFlash Card also contains licensing codes which are required to enable firmware options.

In addition to the Article No., the following firmware options can currently be ordered with or without performance expansion:

- Safety Integrated Extended Functions, order codes per axis **F01** to **F06** (see Catalog PM 21, Chapter Safety Integrated)
- High output frequency [1], order code **J01**
- DCB Extension, order code **U01**

The firmware options can also be enabled on-site, for example, if the performance expansions required are not known at the time of placing the order or the Safety Integrated Extended Functions are to be enabled retrospectively. You will need the serial number of the CompactFlash card and the Article No. of the firmware option to be enabled. With this information, you can purchase the associated license code from a license database and enable the firmware option. The license code is only valid for the CompactFlash card declared and cannot be transferred to other CompactFlash cards.

6

[1] For further information see
http://support.automation.siemens.com/WW/view/en/104020669

Design

CU320-2 Control Units feature the following interfaces as standard:

- 4 DRIVE-CLiQ sockets for communication with other DRIVE-CLiQ devices, e.g. Motor Modules, Active Line Modules, Sensor Modules, Terminal Modules
- CU320-2 PN: 1 PROFINET interface with 2 ports (RJ45 sockets) with PROFIdrive V4 profile
- CU320-2 DP: 1 PROFIBUS interface with PROFIdrive V4 profile
- 12 parameterizable digital inputs (floating)
- 8 parameterizable bidirectional digital inputs/digital outputs (non-floating)
- 1 serial RS232 interface
- 1 interface for the BOP20 Basic Operator Panel
- 1 slot for the CompactFlash card on which firmware and parameters are stored
- 1 slot for mounting an option module (e.g. TB30 Terminal Board)
- 2 rotary coding switches for manually setting the PROFIBUS address
- 1 Ethernet interface for commissioning and diagnostics
- 3 test sockets and one reference ground for commissioning support
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE (protective earth) connection
- 1 ground connection

A shield connection for the signal cable shield on the option module is located on the CU320-2 Control Unit.

The available option slot is used to expand the interfaces, for example, to include additional terminals or for communication purposes.

The status of the CU320-2 Control Unit is indicated via multi-color LEDs.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

The CU320-2 Control Unit can be mounted on the side of the Line Module in booksize format via brackets integrated in a Line Module. The CU320-2 Control Unit can also be fixed to the wall of the control cabinet using the integrated fixing lugs. As the CU320-2 Control Unit is not as deep as the Line Modules, suitable spacers are available to increase the depth of the CU320-2 Control Unit to 270 mm (10.6 in).

Integration

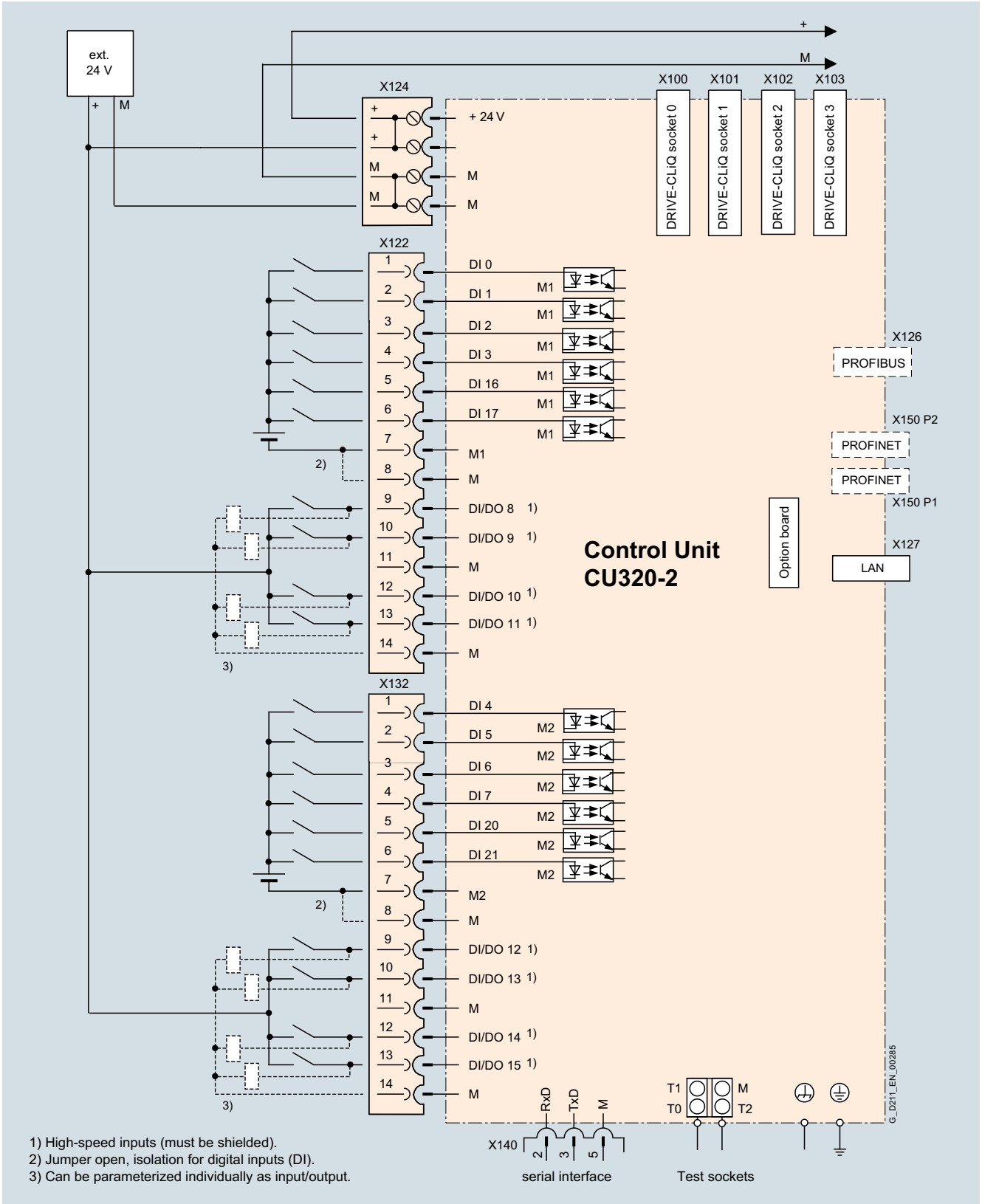
DRIVE-CLiQ components, for example, Motor Modules and Active Line Modules, can be connected to a CU320-2 Control Unit. The number of modules depends on the performance required, including duty type and additional functions.

The BOP20 Basic Operator Panel can also be snapped onto the CU320-2 Control Unit during operation to perform troubleshooting procedures.

The CU320-2 Control Unit and other connected components are commissioned and diagnosed with the STARTER commissioning tool.

The CU320-2 PN Control Unit requires a CompactFlash card with firmware V4.4 or higher.
The CU320-2 DP Control Unit requires a CompactFlash card with firmware V4.3 or higher.

Integration (continued)



Connection example of a CU320-2 Control Unit

Technical specifications

CU320-2 DP Control Unit	
PROFINET: 6SL3040-1MA01-0AA0 PROFIBUS: 6SL3040-1MA00-0AA0	
Power requirement, max.	1.0 A
At 24 V DC, without taking account of digital outputs, expansion option slot and DRIVE-CLiQ supply	
Conductor cross-section, max.	2.5 mm^2
Fuse protection, max.	20 A
Digital inputs	In accordance with IEC 61131 2 type 1 12 floating digital inputs 8 bidirectional non-floating digital inputs/digital outputs
• Voltage	-3 … +30 V
• Low level (an open digital input is interpreted as "low")	-3 … +5 V
• High level	15 … 30 V
• Current consumption at 24 V DC, typ.	9 mA
• Delay time of digital inputs [1], approx.	
- L → H	5 µs
- H → L	50 µs
• Conductor cross-section, max.	1.5 mm^2
Digital outputs	8 bidirectional non-floating digital outputs/digital inputs
(sustained short-circuit strength)	
• Voltage	24 V DC
• Load current per digital output, max.	500 mA
• Delay time [1], typ./max.	
- L → H	150 µs/400 µs
- H → L	75 µs/100 µs
• Conductor cross-section, max.	1.5 mm^2
Power loss	24 W
PE connection	M5 screw
Ground connection	M5 screw
Dimensions	
• Width	50 mm (1.97 in)
• Height	300 mm (11.8 in)
• Depth	226 mm (8.90 in)
Weight, approx.	2.3 kg (5 lb)
Approvals, according to	cULus

[1] The specified delay times refer to the hardware. The actual reaction time depends on the time slice in which the digital input or output is processed.

[2] The specified delay times refer to the hardware. The actual reaction time depends on the time slice in which the digital input or output is processedFor further information see http://support.automation.siemens.com/WW/view/en/104020669

Selection and ordering data

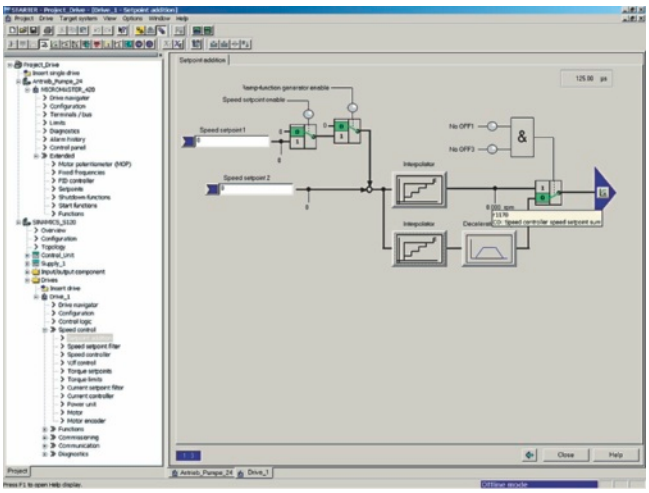
Description	Order No.
CU320-2 PN Control Unit Without CompactFlash card	**6SL3040-1MA01-0AA0**
CU320-2 DP Control Unit Without CompactFlash card	**6SL3040 1MA00 0AA0**
CompactFlash card for CU320-2 Control Unit without Safety license	
- Without performance expansion	**6SL3054-0E ■ 00-1BA0**
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0**
CompactFlash card for CU320-2 Control Unit with Safety license	
• For **1 axis**	
- Without performance expansion	**6SL3054-0E ■ 00-1BA0-Z F01**
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0-Z F01**
• For **2 axes**	
- Without performance expansion	**6SL3054-0E ■ 00-1BA0-Z F02**
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0-Z F02**
• For **3 axes**	
- Without performance expansion	**6SL3054-0E ■ 00-1BA0-Z F03**
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0-Z F03**
• For **4 axes**	
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0-Z F04**
• For **5 axes**	
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0-Z F05**
• For **6 axes**	
- With performance expansion firmware option	**6SL3054-0E ■ 01-1BA0-Z F06**
• and with high output frequency [2]	**6SL3054-0E ■ 00-1BA0-Z J01**
• and with DCB Extension license (firmware V4.6 and higher) (more information about DCB Extension and license upgrades can be found under Drive Control Chart (DCC))	**6SL3054-0E ■ 01-1BA0-Z U01**
Firmware **V4.4**	**E**
Firmware **V4.5**	**F**
Firmware V4**.6**	**G**
Firmware **V4.7**	**H**
Post-licensing	
• Performance expansion Performance expansion option including Certificate of License for upgrading the license of a CompactFlash card	**6SL3074-0AA01-0AA0**
• High output frequency [2] High output frequency option for enabling output frequencies above 550 Hz for upgrading the license of a CompactFlash card	**6SL3074-0AA02-0AA0**
• Safety license Safety Integrated Extended Functions option including Certificate of License for one axis for upgrading the license of a CompactFlash card. This option should be ordered once for each axis, max. 6 × for a CompactFlash card	**6SL3074-0AA10-0AA0**

Selection and ordering data (continued)

Description	Order No.
Accessories	
Spacers (2 units) For increasing the depth of the CU320-2 Control Unit to 270 mm (10.6 in) (if the integrated brackets are not used, but the depth still has to be 270 mm (10.6 in))	**6SL3064-1BB00-0AA0**
BOP20 Basic Operator Panel	**6SL3055-0AA00-4BA0**
STARTER commissioning tool	**6SL3072-0AA00-0AG0**
Accessories for re-ordering	
SINAMICS/SINUMERIK/SIMOTION dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

STARTER commissioning tool

Overview



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

- Commissioning
- Optimization
- Diagnostics

This software can be operated as a standalone PC application, or integrated as a TIA-compatible program in SIMATIC STEP 7, or highly integrated into the SCOUT Engineering System (for SIMOTION). The basic functions and handling are the same in both cases.

In addition to the SINAMICS drives, STARTER also supports MICROMASTER 4 devices.

The project wizards can be used to create the drives within the structure of the project tree.

Beginners are supported by solution-based dialog guidance, whereby a standard graphics-based display maximizes clarity when setting the drive parameters.

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 individual settings required are made using graphics-based parameterization screens, which also precisely visualize the principle of operation of the drive.

Examples of individual settings that can be made include:

- How terminals are used
- Bus interface
- Setpoint channel (e.g., fixed setpoints)
- Closed-loop speed control (e.g., ramp-function generator, limits)
- BICO interconnections
- Diagnostics

For experts, the expert list can be used to specifically and quickly access individual parameters at any time. An individual compilation of frequently used parameters can be saved in dedicated user lists and watch tables.

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

- Self-optimization of the controller settings (depending on drive unit)
- Setup and evaluation of trace recordings [1)]
  Tool function for recording 2 × 8 signals with
- Measuring cursor function
- Extensive trigger functions
- Several Y scales
- Sampling times in the current controller cycle clock

Diagnostics functions provide information about:

- Control/status words
- Parameter status
- Operating conditions
- Communication states

Performance features

- User-friendly: Only a small number of settings need to be made for successful first commissioning: The motor starts to rotate
- Solution-oriented dialog-based user guidance simplifies commissioning
- Self-optimization functions reduce manual effort for optimization.

Minimum system requirements

The following minimum requirements must be complied with:

- Hardware
  - PG or PC with Pentium III min. 1 GHz (recommended >1 GHz)
  - Work memory 1 GB (2 GB recommended)
  - Screen resolution 1024 × 768 pixels, 16-bit color depth
  - Free hard disk memory: min. 3 GB
- Software
  - Microsoft Internet Explorer V6.0 or higher
  - 32-bit operating systems:
    Microsoft Windows XP Professional SP3
    Microsoft Windows 7 Professional incl. SP1
    Microsoft Windows 7 Ultimate incl. SP1
    Microsoft Windows 7 Enterprise incl. SP1 (standard installation)
  - 64-bit operating systems:
    Microsoft Windows 7 Professional SP1
    Microsoft Windows 7 Ultimate SP1
    Microsoft Windows 7 Enterprise SP1 (standard installation)
    Microsoft Windows Server 2008 R2 SP1

[1)] Depending on drive unit. Not supported for MICROMASTER 4, SINAMICS G110, SINAMICS G120 <firmware V4.4, SINAMICS G110D and SINAMICS G120D <firmware V4.5.

Integration

Data can be exchanged (depending on the version) via PROFIBUS or PROFINET/Ethernet or via a serial interface.

For commissioning and service, a PG/PC can be connected to the CU320-2 Control Unit via PROFIBUS. A PROFIBUS connection must be available with a connecting cable at the PG/PC.

Further, communication between a CU320-2 Control Unit and PG/PC can also be established via Ethernet, either via an (optional) CBE20 Communication Board or the Ethernet interface -X127 on the CU320-2 Control Unit.

Note:

The terminal strip -X127 is suitable as a communication link to the PG/PC only for the purposes of servicing and commissioning.

Selection and ordering data

Description	Article No.
STARTER commissioning tool for SINAMICS and MICROMASTER English, French, German, Italian, Spanish	**6SL3072-0AA00-0AG0**

Note:

In addition to the STARTER commissioning tool, SINAMICS Drive Control Chart (SINAMICS DCC) can be installed. This allows the device functionality in the SINAMICS drive system to be expanded with technology functions as required.

More information about SINAMICS DCC can be found in section "SINAMICS Drive Control Chart (SINAMICS DCC)".

Accessories

Depending on the version of the Control Unit (CU), the Control Unit of the drive unit can communicate with the programming device (PG) or PC via PROFIBUS or PROFINET/Ethernet or via a serial interface. The following accessories are available for the particular drive system as listed in the following table.

Description		Recommended accessories For communication between the drive unit and the programming device or PC Article No.
SINAMICS S120		
• RS232	**SIMATIC S7 connecting cable** Null modem cable, 6 m (19.69 ft)	**6ES7901-1BF00-0XA0**
• PROFIBUS	**CP 5711 communication module** USB adapter for connecting a PG or notebook to PROFIBUS or MPI USB cable (2 m/6.56 ft) included in scope of supply	**6GK1571-1AA00**
	SIMATIC DP plug-in cable 12 MBaud, for PG connection, pre-assembled with 2 × 9-pin SUB D connector, 3 m (9.84 ft)	**6ES7901-4BD00-0XA0**
• PROFINET/ Ethernet	Standard CAT5 Ethernet cable or PROFINET cable	–

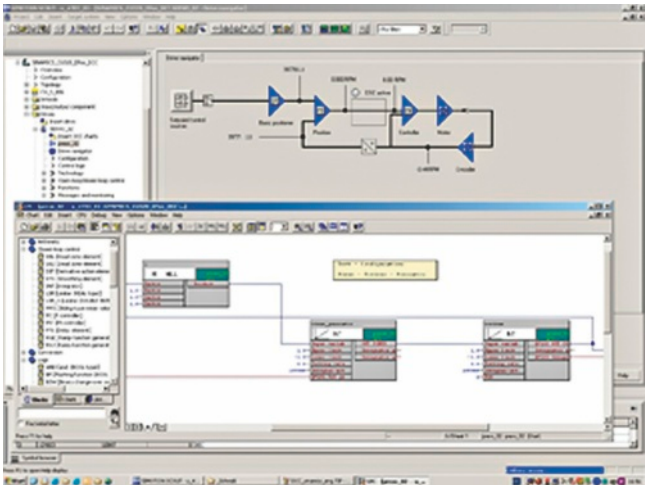
More information

The STARTER commissioning tool is also available for update purposes on the Internet at
http://www.siemens.com/starter

SINAMICS Drive Control Chart (SINAMICS DCC)

Overview

SINAMICS Drive Control Chart (SINAMICS DCC) expands the scope of device functions by means of freely available closed-loop control, arithmetic and logic blocks and offers a means by which technological functions can be graphically configured in the SINAMICS drive system. SINAMICS DCC is the first stage of the Advanced Technology Function and is installed as an add-on to the STARTER commissioning tool.



SINAMICS DCC provides users with greater scope to adapt these systems to the specific functions of their machines. SINAMICS DCC does not limit the number of functions that can be used. The number of functions is limited only by the performance capability of the Control Unit.

SINAMICS DCC is available for the following SINAMICS drive systems:

- SINAMICS G130
- SINAMICS G150
- SINAMICS S120
- SINAMICS S150
- SINAMICS DCM
- SINAMICS GM150
- SINAMICS SM150
- SINAMICS GL150
- SINAMICS SL150

The user-friendly DCC editor enables easy graphics-based configuration, allows control loop structures to be clearly represented and provides a high degree of reusability of diagrams that have already been created.

The open-loop and closed-loop control functions are defined by using multi-instance-capable blocks (Drive Control Blocks (DCBs)) from a library (DCB library) that are selected and graphically linked with one another by dragging and dropping. Test and diagnostic functions allow the program behavior to be verified and, in the case of a fault, the cause identified.

Two types of DCB library are available, i.e. DCB Standard and DCB Extension. The DCB Standard library supplied with SINAMICS DCC contains a large selection of closed-loop, arithmetic and logic blocks, as well as comprehensive open-loop and closed-loop control functions.

For logically combining, evaluating and acquiring binary signals, all commonly used logic functions are available for selection (AND, XOR, on/off delay, RS flipflop, counter, etc.). A wide range of arithmetic functions, such as absolute value generation, dividers and minimum/maximum evaluation are available to monitor and evaluate numerical quantities. In addition to the closed-loop drive control, axial winder functions, PI controllers, ramp-function generators or wobble generators are simple to configure.

In addition to the standard library, the DCB Extension library is also available with SINAMICS DCC, firmware version V4.6 and higher. This contains an extended range of blocks that can be used as an additional, independent library in the DCC Editor.

DCB Extension provides new motion control blocks as a GMC library.

Using these blocks, it is possible to implement the following positioning and synchronous operation functions with SINAMICS DCC:

- Positioning
- 1:1 synchronous operation
- Gearing
- Gearing and positioning
- Camming

These applications are available for downloading from the Internet on the Siemens Application Support pages at http://www.siemens.com/sinamics-applications

With the blocks provided by DCB Extension, it is also possible to commission the programming of user-specific blocks.

SINAMICS DCC provides a convenient basis for resolving drive-level open-loop and closed-loop control tasks directly in the converter. This further extends the possibility of adapting SINAMICS to the particular application. Local data processing in the drive supports the implementation of modular machine concepts and results in an increase in the overall machine performance.

Minimum hardware and software requirements

See STARTER commissioning tool.

Selection and ordering data

SINAMICS DCC comprises the graphical configuring tool (DCC Editor) and the DCB standard library. SINAMICS DCC is installed as an add-on to the STARTER commissioning tool.

The necessary engineering license for each PC (floating) for SINAMICS DCC is acquired at the same time the order is placed. No runtime license is required for the DCB standard library included in the scope of supply.

Existing licenses for SINAMICS DCC V2.1 and V2.2 SP1 are also valid for SINAMICS DCC V2.3.
An upgrade variant for the engineering license is available for SINAMICS DCC V2.0.

Description	Article No.
SINAMICS DCC V2.3	
for STARTER V4.4	
Graphic configuring with SINAMICS DCC	
DCC Editor + DCB standard library	
• Single-user engineering license, with data carrier	**6AU1810-1HA23-0XA0**
• Upgrade engineering license, with data carrier	**6AU1810-1HA23-0XE0**

The blocks of the DCB Extension library are also configured with the graphical configuring tool (DCC Editor). Use of these blocks requires a runtime license.

Description	Article No.
SINAMICS DCB Extension license	**6SL3077-0AA00-0AB0**
Runtime license for license upgrading with firmware version V4.6 or higher (can also be ordered in conjunction with the CompactFlash card, see CompactFlash card for CU310-2 and CU320-2 Control Units)	

Design

PM340 Power Modules in blocksize format, frame sizes FSA to FSF

The PM340 Power Modules in blocksize format feature the following connections and interfaces as standard:

- Line connection
- PM-IF interface for connection of the PM340 Power Module and CU310-2/SIMOTION D410-2 Control Unit or CUA31/ CUA32 Control Unit Adapter. The PM340 Power Module also supplies power to the CU310-2/SIMOTION D410-2 Control Unit or CUA31/CUA32 Control Unit Adapter by means of an integrated power supply
- Terminals DCP/R1 and R2 for connection of an external braking resistor
- Motor connection made with screw-type terminals or screw studs
- Control circuit for the Safe Brake Relay for controlling a holding brake
- 2 PE (protective earth) connections

Power Modules without integrated line filter can be connected to grounded TN/TT and non-grounded IT systems. Power Modules with integrated line filter are suitable only for connection to TN systems with grounded star point.

The integrated Braking Unit (Braking Chopper) is rated with the capability to continuously utilize the external braking resistor. The temperature of the external braking resistor must be monitored to provide protection against thermal overloading.

Selection and ordering data

Rated output current	Type rating	Frame size	**Air-cooled PM340 Power Module in blocksize format without line filter**	**Air-cooled PM340 Power Module in blocksize format with integrated line filter**
A	kW (hp)		Article No.	Article No.
Line voltage 200 ... 240 V 1 AC				
0.9	0.12 (0.2)	FSA	**6SL3210-1SB11-0UA0**	**6SL3210-1SB11-0AA0**
2.3	0.37 (0.5)	FSA	**6SL3210-1SB12-3UA0**	**6SL3210-1SB12-3AA0**
3.9	0.75 (0.75)	FSA	**6SL3210-1SB14-0UA0**	**6SL3210-1SB14-0AA0**
Line voltage 380 ... 480 V 3 AC				
1.3	0.37 (0.5)	FSA	**6SL3210-1SE11-3UA0**	–
1.7	0.55 (0.75)	FSA	**6SL3210-1SE11-7UA0**	–
2.2	0.75 (1)	FSA	**6SL3210-1SE12-2UA0**	–
3.1	1.1 (1.5)	FSA	**6SL3210-1SE13-1UA0**	–
4.1	1.5 (2)	FSA	**6SL3210-1SE14-1UA0**	–
5.9	2.2 (3)	FSB	**6SL3210-1SE16-0UA0**	**6SL3210-1SE16-0AA0**
7.7	3 (5)	FSB	**6SL3210-1SE17-7UA0**	**6SL3210-1SE17-7AA0**
10.2	4 (5)	FSB	**6SL3210-1SE21-0UA0**	**6SL3210-1SE21-0AA0**
18	7.5 (10)	FSC	**6SL3210-1SE21-8UA0**	**6SL3210-1SE21-8AA0**
25	11 (15)	FSC	**6SL3210-1SE22-5UA0**	**6SL3210-1SE22-5AA0**
32	15 (20)	FSC	**6SL3210-1SE23-2UA0**	**6SL3210-1SE23-2AA0**
38	18.5 (25)	FSD	**6SL3210-1SE23-8UA0**	**6SL3210-1SE23-8AA0**
45	22 (30)	FSD	**6SL3210-1SE24-5UA0**	**6SL3210-1SE24-5AA0**
60	30 (37)	FSD	**6SL3210-1SE26-0UA0**	**6SL3210-1SE26-0AA0**
75	37 (50)	FSE	**6SL3210-1SE27-5UA0**	**6SL3210-1SE27-5AA0**
90	45 (60)	FSE	**6SL3210-1SE31-0UA0**	**6SL3210-1SE31-0AA0**
110	55 (75)	FSF	**6SL3210-1SE31-1UA0**	**6SL3210-1SE31-1AA0**
145	75 (100)	FSF	**6SL3210-1SE31-5UA0**	**6SL3210-1SE31-5AA0**
178	90 (125)	FSF	**6SL3210-1SE31-8UA0**	**6SL3210-1SE31-8AA0**

Accessories

For technical specifications, selection and ordering data for the associated line reactors, line filters and the recommended line-side components, see Catalog PM 21, Section 3 "Power Modules".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Power Modules".

Design

Power Module in chassis format with Control Unit (not included in scope of supply)

The Power Modules in chassis format feature the following connections and interfaces as standard:

- 1 power connection
- 2 DC link connections for options, e.g. Braking Modules
- 3 DRIVE-CLiQ sockets
- 1 safe standstill input (enable pulses)
- 1 temperature sensor input (KTY84-130 or PTC/Pt100)
- 1 electronics power supply connection
- 1 motor connection
- 1 connection for Safe Brake Adapter
- 2 PE (protective earth) connections

The CU310-2/SIMOTION D410-2 Control Unit can be mounted in Power Modules of chassis format.

The scope of supply of the Power Modules includes:

- 1 DRIVE-CLiQ cable
  for connection to the CU310-2/SIMOTION D410-2 Control Unit
- One 24 V supply cable
  for connection to the CU310-2/SIMOTION D410-2 Control Unit
- 1 mounting plate
  for attaching the CU310-2/SIMOTION D410-2 Control Unit
- 1 set of warning signs in 30 languages

Power Modules in the chassis format can be connected to grounded TN/TT systems and non-grounded IT systems.

Application in multi-axis systems

Power Modules in chassis format can also be connected directly via DRIVE-CLiQ to a separate CU320-2 or SIMOTION D4x5-2 Control Unit or Controller Extension CX32-2. The appropriate DRIVE-CLiQ cable for the required distance must be ordered as an additional accessory (see Chapter MOTION CONNECT Connection system). A CUA31/CUA32 adapter module need not be installed in the Power Module in chassis format.

Selection and ordering data

Rated output current	Type rating	**Air-cooled Power Module in chassis format**
A	kW (hp)	Article No.
Line voltage 380 ... 480 V 3 AC		
210	110 (150)	**6SL3310-1TE32-1AA3**
260	132 (200)	**6SL3310-1TE32-6AA3**
310	160 (250)	**6SL3310-1TE33-1AA3**
380	200 (300)	**6SL3310-1TE33-8AA3**
490	250 (400)	**6SL3310-1TE35-0AA3**

Accessories

For technical specifications, selection and ordering data for the associated line reactors, line filters and the recommended line-side components, see Catalog PM 21, Chapter 3 "Power Modules ".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Power Modules.

Overview

Basic Line Modules in booksize format

Basic Line Modules are used for applications in which no energy is returned to the supply or where the energy exchange between motor and generator axes takes place in the DC link. Basic Line Modules can only feed energy from the supply system into the DC link, energy cannot be fed back into the supply system. The DC link voltage is directly derived from the 3-phase line voltage via a 6-pulse bridge circuit. Basic Line Modules are designed for connection to grounded, star TN/TT systems and non-grounded, symmetrical IT systems. The connected Motor Modules are pre-charged over the integrated pre-charging resistors (20 kW and 40 kW) or through activation of the thyristors (100 kW).

The 20 kW and 40 kW Basic Line Modules are equipped with an integrated brake chopper. With the addition of an external braking resistor, they can be used for applications with intermittent regenerative operation such as stopping. A Braking Module is required with a 100 kW Basic Line Module in addition to an external braking resistor for regenerative operation.

Design

The Basic Line Modules in booksize format feature the following connections and interfaces as standard:

- 1 power connection
- 1 connection for the 24 V DC electronics power supply
- 1 DC link connection
- 3 DRIVE-CLiQ sockets
- 1 connection for braking resistor (20 kW and 40 kW Basic Line Modules only)
- 1 temperature sensor input

The status of the Basic Line Modules is indicated via two multi-color LEDs.

The scope of supply of the Basic Line Modules includes:

- DRIVE-CLiQ cable for connection to the adjacent Control Unit on the left for drive control, length 0.11 m (4.33 in)
- DRIVE-CLiQ cable (length depends on module width) to connect Basic Line Module to adjacent Motor Module, length = width of Basic Line Module + 0.11 m (4.33 in)
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- 1 set of warning signs in 30 languages
- 1 heat conducting foil (for Basic Line Modules with cold platecooling only)

Selection and ordering data

Description	Basic Line Modules in booksize format Article No.
Line voltage 380 ... 480 V 3 AC	
Internal air cooling	
Rated supply power:	
• 20 kW (25 hp)	**6SL3130-1TE22-0AA0**
• 40 kW (50 hp)	**6SL3130-1TE24-0AA0**
• 100 kW (125 HP)	**6SL3130-1TE31-0AA0**
Cold plate cooling	
Rated supply power	
• 20 kW (25 hp)	**6SL3136-1TE22-0AA0**
• 40 kW (50 hp)	**6SL3136-1TE24-0AA0**
• 100 kW (125 hp)	**6SL3136-1TE31-0AA0**

Accessories

For technical specifications, selection and ordering data for the associated line reactors, line filters and the recommended line-side components, see Catalog PM 21, Chapter 3 "Basic Line Modules in booksize format".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 Basic Line Modules in booksize format.

Basic Line Modules in chassis format

Overview

Basic Line Modules are used for applications in which no energy is returned to the supply or where the energy exchange between motor and generator axes takes place in the DC link. The connected Motor Modules are pre-charged via the thyristor gate control. The thyristors are always fired at a delay angle of 0° in operation. Basic Line Modules are designed for connection to grounded TN/TT systems and non-grounded IT systems.

In a Basic Line Module in chassis format, a Braking Module of the corresponding size can be installed to support generating mode of the drive system in combination with an external braking resistor.

Design

The Basic Line Modules in chassis format feature the following connections and interfaces as standard:

- 1 power connection
- 1 connection for the 24 V DC electronics power supply
- 1 DC link connection (DCP, DCN) for supplying the connected Motor Modules
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 1 temperature sensor input (KTY84-130 or PTC/Pt100)
- 3 DRIVE-CLiQ sockets

The status of the Basic Line Modules is indicated via two multicolor LEDs.

The scope of supply of the Basic Line Modules includes:

- 0.6 m (1.97 ft) DRIVE-CLiQ cable for connection to a CU320-2 or SIMOTION D4x5-2 Control Unit or Controller Extension CX32-2
- 1.45 m (4.76 ft) DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module

Selection and ordering data

Rated power	**Basic Line Module in chassis format**
kW (hp)	Article No.
Line voltage 380 ... 480 V 3 AC	
200 (300)	**6SL3330-1TE34-2AA3**
250 (400)	**6SL3330-1TE35-3AA3**
400 (600)	**6SL3330-1TE38-2AA3**
560 (800)	**6SL3330-1TE41-2AA3**
710 (1000)	**6SL3330-1TE41-5AA3**
Line voltage 500 ... 690 V 3 AC	
250	**6SL3330-1TG33-0AA3**
355	**6SL3330-1TG34-3AA3**
560	**6SL3330-1TG36-8AA3**
900	**6SL3330-1TG41-1AA3**
1100	**6SL3330-1TG41-4AA3**

Accessories

For technical specifications, selection and ordering data for the associated line reactors, line filters and the recommended line-side components, see Catalog D 21.3, Chapter 3 "System components".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 Basic Line Modules in chassis format.

Overview

Smart Line Modules are non-regulated, line-commutated feed/feedback units (diode bridge for incoming supply; linecommutated feedback via IGBTs) with 100 % continuous regenerative feedback power. The regenerative feedback capability of the modules can be deactivated by means of a digital input (Smart Line Modules 5 kW and 10 kW) or by means of parameterization (Smart Line Modules 16 kW, 36 kW and 55 kW). Smart Line Modules are designed for connection to grounded TN/TT and non-grounded IT systems.

The DC link is pre-charged via integrated pre-charging resistors.

The associated line reactor is absolutely essential for operating a Smart Line Module.

Design

Smart Line Modules in booksize format feature the following connections and interfaces as standard:

- 1 power connection via screw-type terminals
- 1 connection for the 24 V DC electronics power supply via the24 V terminal adapter included in the scope of supply
- 1 DC link connection via integrated DC link busbars
- 2 PE (protective earth) connections
- 2 digital inputs
  (only on 5 kW and 10 kW Smart Line Modules)
- 1 digital output
  (only on 5 kW and 10 kW Smart Line Modules)
- 3 DRIVE-CLiQ sockets
  (only on 16 kW, 36 kW and 55 kW Smart Line Modules)

The status of the Smart Line Modules is indicated via two multicolor LEDs.

The signal cable shield can be connected to the Line Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

The scope of supply of the Smart Line Modules includes:

- DRIVE-CLiQ cable for connection to the adjacent Control Unit on the left for drive control, length 0.11 m (4.33 in)
  (on 16 kW, 36 kW and 55 kW Smart Line Modules only)
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
  (on 16 kW, 36 kW and 55 kW Smart Line Modules only)
- DRIVE-CLiQ cable (length depends on module width) to connect Smart Line Module to adjacent Motor Module,
  length = width of Smart Line Module + 0.11 m (4.33 in)
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21 for digital inputs and outputs
- Connector X22 for digital inputs and outputs
  (on 5 kW and 10 kW Smart Line Modules only)
- Connector X1 for line supply connection
  (on 5 kW and 10 kW Smart Line Modules only)
- 1 set of warning signs in 30 languages
- 1 heat conducting foil
  (for Smart Line Modules with cold plate cooling only)

Selection and ordering data

Description	Article No.
Line voltage 380 ... 480 V 3 AC	
Smart Line Module in booksize format	
Internal air cooling	
Rated power	
• 5 kW (5 hp)	**6SL3130-6AE15-0AB1**
• 10 kW (10 hp)	**6SL3130-6AE21-0AB1**
• 16 kW (18 hp)	**6SL3130-6TE21-6AA3**
• 36 kW (40 hp)	**6SL3130-6TE23-6AA3**
• 55 kW (60 hp)	**6SL3130-6TE25-5AA3**
External air cooling	
Rated power	
• 5 kW (5 hp)	**6SL3131-6AE15-0AA1**
• 10 kW (10 hp)	**6SL3131-6AE21-0AA1**
• 16 kW (18 hp)	**6SL3131-6TE21-6AA3**
• 36 kW (40 hp)	**6SL3131-6TE23-6AA3**
• 55 kW (60 hp)	**6SL3131-6TE25-5AA3**
Cold-plate cooling	
Rated power	
• 5 kW (5 hp)	**6SL3136-6AE15-0AA1**
• 10 kW (10 hp)	**6SL3136-6AE21-0AA1**

Accessories

For technical specifications, selection and ordering data for the associated line reactors, line filters and the recommended line-side components, see Catalog PM 21, Chapter 3 "Smart Line Modules in booksize format".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Smart Line Modules in booksize format.§

Overview

Smart Line Modules are non-regulated feed/feedback units with 100 % continuous regenerative feedback power. The regenerative feedback capability of the modules can be deactivated by-means of parameterization.
Smart Line Modules are designed for connection to grounded TN/TT and non-grounded IT systems.

The DC link is pre-charged via integrated pre-charging resistors.

The associated line reactor is absolutely essential for operating a Smart Line Module.

Design

The Smart Line Modules have the following interfaces as standard:

- 1 power connection
- 1 connection for the 24 V DC electronics power supply
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 3 DRIVE-CLiQ sockets
- 1 PE (protective earth) connection (2 connections for frame sizes HX and JX)

The status of the Smart Line Modules is indicated via two multi-color LEDs.

The scope of supply of the Smart Line Modules includes:

- DRIVE-CLiQ cable to connect to a CU320-2 or SIMOTION D4x5-2 Control Unit or Controller Extension CX32-2
- DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module (type dependent)

Selection and ordering data

Rated power	**Smart Line Module in chassis format**
kW (hp)	Article No.
Line voltage 380 ... 480 V 3 AC	
250 (400)	**6SL3330-6TE35-5AA3**
355 (500)	**6SL3330-6TE37-3AA3**
500 (700)	**6SL3330-6TE41-1AA3**
630 (800)	**6SL3330-6TE41-3AA3**
800 (1000)	**6SL3330-6TE41-7AA3**
Line voltage 500 ... 690 V 3 AC	
450	**6SL3330-6TG35-5AA3**
710	**6SL3330-6TG38-8AA3**
1000	**6SL3330-6TG41-2AA3**
1400	**6SL3330-6TG41-7AA3**

Accessories

For accessories, technical specifications, and selection and ordering data for the associated line reactors, line filters and the recommended line-side components, see Catalog D 21.3, Chapter 2 "System components".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Smart Line Modules in chassis format".

Overview

Active Line Modules are self-commutated feed/feedback units (with IGBTs in infeed and regenerative feedback directions) and generate a regulated DC link voltage. This means that the connected Motor Modules are decoupled from the line voltage. Line voltage fluctuations within the permissible supply tolerances have no effect on the motor voltage. Active Line Modules are designed for connection to grounded, star (TN, TT) and non-grounded, symmetrical IT systems.

The DC link is pre-charged via integrated pre-charging resistors.

In order to operate an Active Line Module, it is absolutely essential to use the appropriate Active Interface Module.

Design

The Active Line Modules in booksize format feature the following connections and interfaces as standard:

- 1 power connection via screw-type terminals
- 1 connection for the 24 V DC electronics power supply via the 24 V terminal adapter included in the scope of supply
- 1 DC link connection via integrated DC link busbars
- 3 DRIVE-CLiQ sockets
- 2 PE (protective earth) connections

The status of the Active Line Modules is indicated via two multi-color LEDs.

On the 100 mm (3.94 in) wide Active Line Module, the shield for the power supply cable can be connected to the integrated shield connection plate via a shield connection terminal or tube clip, e.g. Weidmüller type KLBÜ CO 4. The shield connection terminal must not be used for strain relief. Shield connection plates are available for the 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.81 in) wide modules.

The signal cable shield can be connected to the Line Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

The scope of supply of the Active Line Modules includes:

- DRIVE-CLiQ cable for connection to the adjacent Control Unit on the left for drive control, length 0.11 m (4.33 in)
- DRIVE-CLiQ cable (length depends on module width) to connect Active Line Module to adjacent Motor Module, length = width of Active Line Module + 0.11 m (4.33 in)
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21 for digital inputs
- Fan insert for Active Line Modules of 80 kW (107 hp) and 120 kW (161 hp) (the voltage is supplied by the Active Line Module)
- 1 set of warning signs in 30 languages
- 1 heat conducting foil (for Active Line Modules with cold plate cooling only)

Selection and ordering data

Description	Active Line Module in booksize format Article No.
Line voltage 380 ... 480 V 3 AC	
Internal air cooling	
Rated power	
• 16 kW (18 hp)	**6SL3130-7TE21-6AA3**
• 36 kW (40 hp)	**6SL3130-7TE23-6AA3**
• 55 kW (60 hp)	**6SL3130-7TE25-5AA3**
• 80 kW (100 hp)	**6SL3130-7TE28-0AA3**
• 120 kW (150 hp)	**6SL3130-7TE31-2AA3**
External air cooling	
Rated power	
• 16 kW (18 hp)	**6SL3131-7TE21-6AA3**
• 36 kW (40 hp)	**6SL3131-7TE23-6AA3**
• 55 kW (60 hp)	**6SL3131-7TE25-5AA3**
• 80 kW (100 hp)	**6SL3131-7TE28-0AA3**
• 120 kW (150 hp)	**6SL3131-7TE31-2AA3**
Cold-plate cooling	
Rated power	
• 16 kW (18 hp)	**6SL3136-7TE21-6AA3**
• 36 kW (40 hp)	**6SL3136-7TE23-6AA3**
• 55 kW (60 hp)	**6SL3136-7TE25-5AA3**
• 80 kW (100 hp)	**6SL3136-7TE28-0AA3**
• 120 kW (150 hp)	**6SL3136-7TE31-2AA3**
Liquid cooling	
Rated power	
• 120 kW (150 hp)	**6SL3135-7TE31-2AA3**

Accessories

For technical specifications, selection and ordering data for the line reactors, Wideband Line Filters, Basic Line Filters and the recommended line-side components, see Catalog PM 21, Chapter 3 "Active Line Modules in booksize format".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Active Line Modules in booksize format".

Active Interface Modules in booksize format

Overview

Active Interface Modules for 16 kW, 36 kW, 55 kW and 80 kW/120 kW

The Active Interface Modules combine with the Active Line Modules to form a functional unit and are essential for operation of the associated Active Line Module. The Active Interface Modules contain a Clean Power Filter, reactor, and basic interference suppression to ensure compliance with Category C3 in accordance with EN 61800-3 regarding emitted interference.

The Clean Power Filter protects the line supply from switching-frequency harmonics. The drive system therefore draws a sinusoidal current from the supply and causes virtually no harmonics.

The Active Line Modules in combination with the Active Interface Module can also be operated with supply systems with an isolated star point (IT systems).

Design

The scope of supply of the Active Interface Modules includes:

- Connector X21 for temperature evaluation and fan control
- Connector X24 for connecting the 24 V supply for the integrated fan
- DRIVE-CLiQ cable for connecting the Control Unit to the Active Line Module; length of the DRIVE-CLiQ cable = width of the Active Interface Module + 0.11 m (4.33 in)
- Shield connection plate for Active Interface Module 16 kW
- 1 set of warning signs in 30 languages

Selection and ordering data

Rated power of the Active Line Module kW (hp)	Suitable for Active Line Module in booksize format	**Active Interface Module in booksize format** Article No.
Line voltage 380 ... 480 V 3 AC		
16 (18)	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3 6SL3136-7TE21-6AA3	**6SL3100-0BE21-6AB0**
36 (40)	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3 6SL3136-7TE23-6AA3	**6SL3100-0BE23-6AB0**
55 (60)	6SL3130-7TE25-5AA3 6SL3131-7TE25-5AA3 6SL3136-7TE25-5AA3	**6SL3100-0BE25-5AB0**
80 (100)	6SL3130-7TE28-0AA3 6SL3131-7TE28-0AA3 6SL3136-7TE28-0AA3	**6SL3100-0BE28-0AB0**
120 (150)	6SL3130-7TE31-2AA3 6SL3131-7TE31-2AA3 6SL3135-7TE31-2AA3 6SL3136-7TE31-2AA3	**6SL3100-0BE31-2AB0**

Accessories

For technical specifications, selection and ordering data for the line reactors, Wideband Line Filters, Basic Line Filters and the recommended line-side components, see Catalog PM 21, Chapter 3 "Active Line Modules in booksize format".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Active Line Modules in booksize format".

Overview

The self-commutated feed/feedback units (with IGBTs in infeed and regenerative feedback directions) generate a regulated DC link voltage. This means that the connected Motor Modules are decoupled from the line voltage. Line voltage fluctuations within the permissible supply tolerances have no effect on the motor voltage.

Active Line Modules can if necessary feed a prespecified fundamental reactive current (capacitive or inductive) to the supply system so as to support simple compensation tasks.

Active Line Modules are designed for connection to grounded TN/TT and non-grounded IT systems.

In order to operate an Active Line Module, it is absolutely essential to use the appropriate Active Interface Module.

Design

The Active Line Modules in chassis format feature the following connections and interfaces as standard:

- 1 power connection
- 1 connection for the 24 V DC electronics power supply
- 1 DC link connection (DCP, DCN) for supplying the connected Motor Modules
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 1 temperature sensor input (KTY84-130 or PTC/Pt100)
- 3 DRIVE-CLiQ sockets
- 2 PE (protective earth) connections

The status of the Active Line Modules is indicated via two multi-color LEDs.

The scope of supply of the Active Line Modules includes:

- Frame sizes FX and GX:
  - 0.60 m (23.6 in) DRIVE-CLiQ cable for connection to the CU320-2 or SIMOTION D4x5-2 Control Unit or Controller Extension CX32-2
- Frame sizes HX and JX
  - 0.35 m (13.8 in) DRIVE-CLiQ cable for connection to the CU320-2 or SIMOTION D4x5-2 Control Unit or Controller Extension CX32-2
  - 2.10 m (6.89 ft) DRIVE-CLiQ cable for connection to the first Motor Module

Selection and ordering data

Rated power	**Active Line Module in chassis format**
kW (hp)	Article No.
Line voltage 380 ... 480 V 3 AC	
132 (200)	**6SL3330-7TE32-1AA3**
160 (225)	**6SL3330-7TE32-6AA3**
235 (350)	**6SL3330-7TE33-8AA3**
300 (450)	**6SL3330-7TE35-0AA3**
380 (550)	**6SL3330-7TE36-1AA3**
500 (700)	**6SL3330-7TE37-5AA3**
630 (800)	**6SL3330-7TE38-4AA3**
900 (1150)	**6SL3330-7TE41-0AA3**
Line voltage 500 ... 690 V 3 AC	
560	**6SL3330-7TG35-8AA3**
800	**6SL3330-7TG37-4AA3**
1100	**6SL3330-7TG41-0AA3**
1400	**6SL3330-7TG41-3AA3**

Accessories

For technical specifications, selection and ordering data for the line reactors, Wideband Line Filters, Basic Line Filters and the recommended line-side components, see Catalog PM 21, Chapter 3 "Active Line Modules in booksize format".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Active Line Modules in chassis format".

Overview

Active Interface Modules are used in combination with Active Line Modules in chassis format. Active Interface Modules contain a Clean Power Filter with basic RI suppression, reactor, the pre-charging circuit for the Active Line Module, the line voltage sensing circuit and monitoring sensors. The bypass connector is an integral component in types FI and GI, thereby making the module very compact. The bypass contactor must be provided separately for frame sizes HI and JI.

The vast majority of line harmonics are suppressed by the Clean Power Filter.

The scope of supply of the Active Interface Modules includes:

- DRIVE-CLiQ cable for connection between Active Interface Module and Active Line Module
- DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module

Selection and ordering data

Rated power of the Active Line Module kW (hp)	Suitable for Active Line Module in chassis format	**Active Interface Module** Article No.
Line voltage 380 ... 480 V 3 AC		
132 (200)	6SL3330-7TE32-1AA3	**6SL3300-7TE32-6AA0**
160 (225)	6SL3330-7TE32-6AA3	**6SL3300-7TE32-6AA0**
235 (350)	6SL3330-7TE33-8AA3	**6SL3300-7TE33-8AA0**
300 (450)	6SL3330-7TE35-0AA3	**6SL3300-7TE35-0AA0**
380 (550)	6SL3330-7TE36-1AA3	**6SL3300-7TE38-4AA0**
450 (600)	6SL3330-7TE37-5AA3	**6SL3300-7TE38-4AA0**
500 (700)	6SL3330-7TE38-4AA3	**6SL3300-7TE38-4AA0**
630 (800)	6SL3330-7TE41-0AA3	**6SL3300-7TE41-4AA0**
800 (1000)	6SL3330-7TE41-2AA3	**6SL3300-7TE41-4AA0**
900 (1150)	6SL3330-7TE41-4AA3	**6SL3300-7TE41-4AA0**
Line voltage 500 ... 690 V 3 AC		
560	6SL3330-7TG35-8AA3	**6SL3300-7TG35-8AA0**
800	6SL3330-7TG37-4AA3	**6SL3300-7TG37-4AA0**
1100	6SL3330-7TG41-0AA3	**6SL3300-7TG41-3AA0**
1400	6SL3330-7TG41-3AA3	**6SL3300-7TG41-3AA0**

Accessories

For accessories, see Catalog D 21.3, Chapter 2 "System Components".

More information

For detailed technical information, see Catalog PM 21 Chapter 3 "Active Line Modules in chassis format".

Design

Single Motor Module in booksize format

In principle, all Single Motor Modules can be operated on Basic Line Modules, Smart Line Modules, or Active Line Modules of the appropriate voltage range.
A broad range of Single Motor Modules is available graded according to current and power.

The Single Motor Modules in booksize format feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 1 electronics power supply connection via integrated 24 V DC busbars
- 3 DRIVE-CLiQ sockets
- 1 motor connection, plug-in (not included in scope of supply) or screw-stud depending on rated output current
- 1 safe standstill input (enable pulses)
- 1 safe motor brake control
- 1 temperature sensor input (KTY84-130 or PTC)
- 2 PE (protective earth) connections

The status of the Motor Modules is indicated via two multi-color LEDs.

The motor cable shield is inside the connector on 50 mm (1.97 in) and 100 mm (3.94 in) wide Motor Modules. A shield connection plate can be supplied for 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.8 in) wide Motor Modules. On these modules, the motor cable shield can be connected using a tube clip.

The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable appropriate to the width of the Motor Module for connection to the adjacent Motor Module, length = width of Motor Module + 0.06 m (2.4 in)
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connector X21
- Connector X11 for the motor brake connection (for Motor Modules with a rated output current of 45 A to 200 A)
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Fan insert for the 132 A and 200 A Motor Modules (the voltage for the fan insert is supplied by the Motor Module)
- 1 set of warning signs in 30 languages
- 1 heat conducting foil (for Motor Modules with cold plate cooling only)

Selection and ordering data

Rated output current	Type rating	Single Motor Module in booksize format			
		Internal air cooling	**External air cooling**	**Cold-plate cooling**	**Liquid cooling**
A	kW (hp) [1]	Article No.	Article No.	Article No.	Article No.
DC link voltage 510 ... 720 V DC					
3	1.6 (1.5)	**6SL3120-1TE13-0AA4**	**6SL3121-1TE13-0AA4**	**6SL3126-1TE13-0AA4**	**–**
5	2.7 (3)	**6SL3120-1TE15-0AA4**	**6SL3121-1TE15-0AA4**	**6SL3126-1TE15-0AA4**	**–**
9	4.8 (5)	**6SL3120-1TE21-0AA4**	**6SL3121-1TE21-0AA4**	**6SL3126-1TE21-0AA4**	**–**
18	9.7 (10)	**6SL3120-1TE21-8AA4**	**6SL3121-1TE21-8AA4**	**6SL3126-1TE21-8AA4**	**–**
30	16 (20)	**6SL3120-1TE23-0AA3**	**6SL3121-1TE23-0AA3**	**6SL3126-1TE23-0AA3**	**–**
45	24 (30)	**6SL3120-1TE24-5AA3**	**6SL3121-1TE24-5AA3**	**6SL3126-1TE24-5AA3**	**–**
60	32 (40)	**6SL3120-1TE26-0AA3**	**6SL3121-1TE26-0AA3**	**6SL3126-1TE26-0AA3**	**–**
85	46 (60)	**6SL3120-1TE28-5AA3**	**6SL3121-1TE28-5AA3**	**6SL3126-1TE28-5AA3**	**–**
132	71 (100)	**6SL3120-1TE31-3AA3**	**6SL3121-1TE31-3AA3**	**6SL3126-1TE31-3AA3**	**–**
200	107 (150)	**6SL3120-1TE32-0AA4**	**6SL3121-1TE32-0AA4**	**6SL3126-1TE32-0AA4**	**6SL3125-1TE32-0AA4**

Accessories

For selection and ordering data regarding the load-side power components and the DC link components, see Catalog PM 21, Chapter 3 "Load-side power components" and "DC link components".

More information

For detailed technical information, see Catalog PM 21, Chapter 3 "Single Motor Modules in booksize format".

Design

A Motor Module comprises a self-commutated inverter with IGBTs. It generates a variable voltage with variable frequency from the DC link voltage that feeds the connected motor. Several Motor Modules can be interconnected through a common DC bus. This permits energy to be transferred between the Motor Modules.
This means that if one Motor Module operating in generator mode produces energy, the energy can be used by another Motor Module operating in motor mode.
Motor Modules are controlled by a Control Unit.

Single Motor Modules in chassis format

The Single Motor Modules in chassis format feature the following connections and interfaces as standard:

- 1 DC link connection (DCP, DCN) for connecting to the supply DC busbar
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 1 electronics power supply connection
- 3 DRIVE-CLiQ sockets
- 1 motor connection
- 1 safe standstill input (enable pulses)
- 1 temperature sensor input (KTY84-130 or Pt100 two-wire, or PTC)
- 1 connection for Safe Brake Adapter
- 1 PE (protective earth) connection

The status of the Motor Modules is indicated via two multi-color LEDs.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable for connection to the adjacent Motor Module (depends on type)
- DRIVE-CLiQ cable for connection to the CU320 Control Unit or SIMOTION D4x5 Control Unit

Selection and ordering data

Rated output current	Type rating	**Single Motor Module in chassis format**
A	kW (hp) [1]	Article No.
DC link voltage 510 ... 720 V DC		
210	110 (150)	**6SL3320-1TE32-1AA3**
260	132 (200)	**6SL3320-1TE32-6AA3**
310	160 (250)	**6SL3320-1TE33-1AA3**
380	200 (300)	**6SL3320-1TE33-8AA3**
490	250 (400)	**6SL3320-1TE35-0AA3**
605	315 (500)	**6SL3320-1TE36-1AA3**
745	400 (600)	**6SL3320-1TE37-5AA3**
840	450 (700)	**6SL3320-1TE38-4AA3**
985	560 (800)	**6SL3320-1TE41-0AA3**
1260	710 (1000)	**6SL3320-1TE41-2AA3**
1405	800 (1150)	**6SL3320-1TE41-4AA3**
DC link voltage 675 ... 1035 V DC		
85	75	**6SL3320-1TG28-5AA3**
100	90	**6SL3320-1TG31-0AA3**
120	110	**6SL3320-1TG31-2AA3**
150	132	**6SL3320-1TG31-5AA3**
175	160	**6SL3320-1TG31-8AA3**
215	200	**6SL3320-1TG32-2AA3**
260	250	**6SL3320-1TG32-6AA3**
330	315	**6SL3320-1TG33-3AA3**
410	400	**6SL3320-1TG34-1AA3**
465	450	**6SL3320-1TG34-7AA3**
575	560	**6SL3320-1TG35-8AA3**
735	710	**6SL3320-1TG37-4AA3**
810	800	**6SL3320-1TG38-1AA3**
910	900	**6SL3320-1TG38-8AA3**
1025	1000	**6SL3320-1TG41-0AA3**
1270	1200	**6SL3320-1TG41-3AA3**

Accessories

For selection and ordering data for the load-side power components and the DC link components, see Catalog D 21.3, Chapter 2 "System Components".

More information

For detailed technical information, see Catalog PM 21 Chapter 3 "Single Motor Modules in chassis format".

[1] Nominal hp ratings based on asynchronous (induction) motors. Match the motor nameplate current for specific sizing.

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:

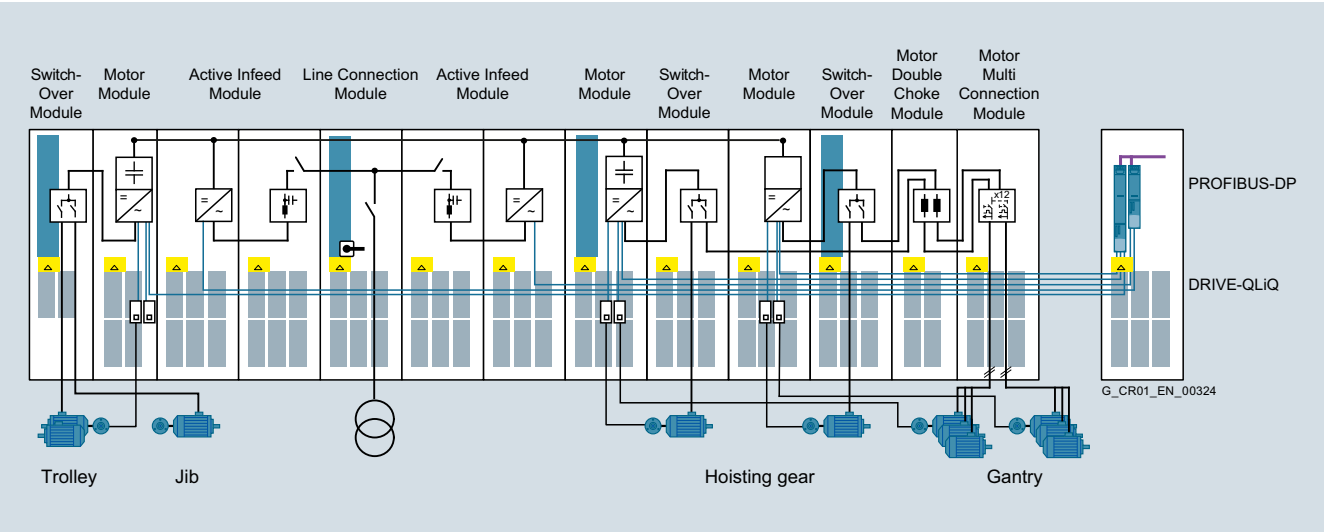
- Line Connection Modules with line-side components such as contactors, fuses and circuit breakers
- Line Modules for infeed in the Active Line Module version for four-quadrant mode with negligible line harmonic distortion and integrated line contactors
- Motor Modules in chassis format for controlling 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 EN 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 DIN EN 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 G120 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	Current derating factor (as a % of the rated current) for an ambient/air intake temperature of						
	m	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				
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				
6SL3720-...	kW	A	2.0 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz
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 %	60 %	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

Characteristic curves (continued)

The following table lists the maximum achievable output frequency as a function of the pulse frequency:

Pulse frequency	Max. achievable output frequency
1.25 kHz	100 Hz
2.00 kHz	160 Hz
2.50 kHz	200 Hz
≥ 4.00 kHz	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.

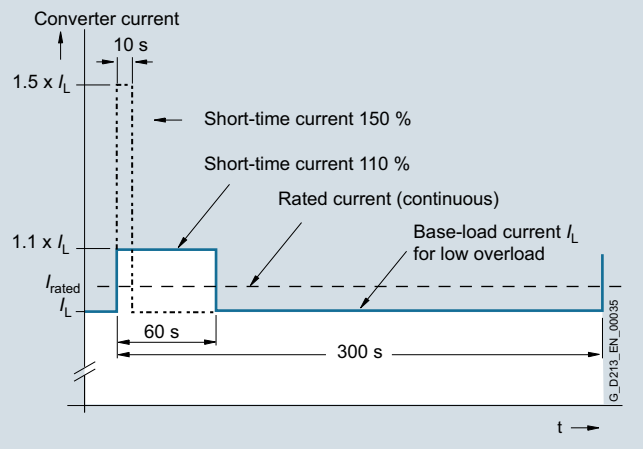
Permissible overload assumes that the drive converter is operated at its base-load current before and after the overload occurs, based on a duty cycle duration of 300 s.

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.

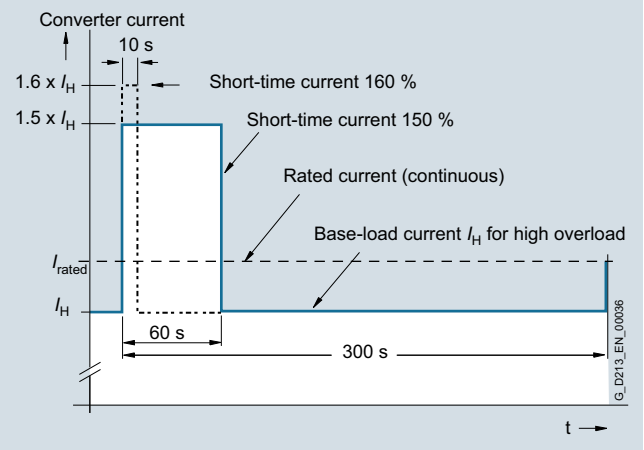
Motor Modules in chassis format

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.

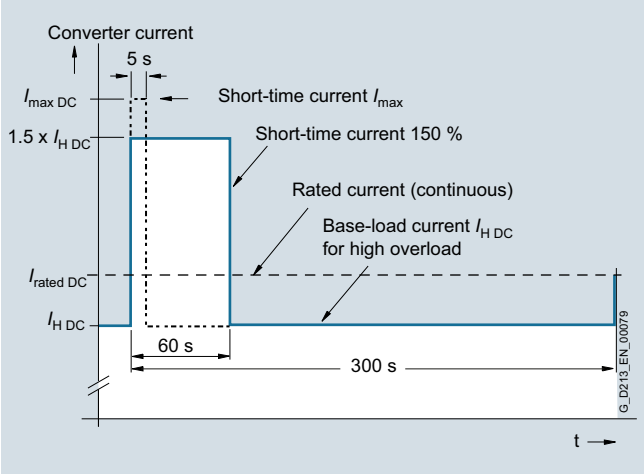


The base-load current for a high overload I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s.



Line Modules in chassis format

The base-load current for a high overload $I_{H\,DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\,DC}$ for 5 s.



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.

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, ±10 % (-15 % < 1 min)		
Line supply types	Isolated systems (IT systems)		
Line frequency	47 ... 63 Hz		
Output frequency	0 … 300 Hz (> 100/160 Hz, observe the derating)		
Line power factor Fundamental	Active Line Module Adjustable (factory-set to $\cos\varphi = 1$)		
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/BGV A3 for the intended purpose		
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 60146-1-1		
Ambient conditions	**Storage** [1]	**Transport** [1]	**Operation**
Ambient temperature	-25 ... +55 °C	-25 ... +70 °C above -40 °C[2] 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	5 ... 95 % at 40 °C Class 2K3 acc. to IEC 60721-3-2	5 ... 95 % [2] Class 3K3 acc. to IEC 60721-3-3
Environmental class/harmful chemical substances	Class 1C2 acc. to EN 60721-3-1	Class 2C2 acc. to EN 60721-3-2	Class 3C2 acc. to EN 60721-3-3
Organic/biological influences	Class 1B1 acc. to EN 60721-3-1	Class 2B1 acc. to EN 60721-3-2	Class 3B1 acc. to EN 60721-3-3
Degree of pollution	2 acc. to EN 61800-5-1	2 acc. to EN 61800-5-1	2 acc. to 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 • Deflection - With option **B70** • Acceleration - With option **B70**	Class 1M1 acc. to EN 60721-3-1 1.5 mm at 5 ... 9 Hz – 5 m/s² at > 9 ... 200 Hz –	Class 2M1 acc. to EN 60721-3-2 3.1 mm at 5 ... 9 Hz – 10 m/s² at > 9 ... 200 Hz –	– 0.075 mm at 10 ... 58 Hz 1.0 mm at 2 ... 13.2 Hz 9.8 m/s² at > 58 ... 200 Hz 6.8 m/s² at > 13.2 ... 100 Hz
Shock load • Acceleration	Class 1M1 acc. to EN 60721-3-1 40 m/s² at 22 ms	Class 2M1 acc. to EN 60721-3-2 100 m/s² at 11 ms	Class 3M1 acc. to EN 60721-3-3 100 m/s² at 11 ms
Compliance with standards			
Conformances/approvals, according to	CE (EMC directive No. 2004/108/EC and low-voltage directive No. 2006/95/EC) and Machinery Directive No. 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 (continued)

Listed below are the most important directives and standards that apply to the SINAMICS S120 Cabinet Modules drive system. They must be carefully observed to achieve a system design that is functionally reliable, operationally safe and compliant with EMC guidelines

European directives	
2006/95/EC	Low-voltage directive: Legal guidelines of the EU member states concerning electrical equipment for use within specified voltage limits
2004/108/EC	EMC directive: Legal guidelines of the EU member states for electromagnetic compatibility
2006/42/EC	Machinery directive: Legal guidelines of the EU member states for machines
European standards	
EN ISO 3744	Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface, accuracy class 2, for an essentially free acoustic field over a reflecting plane.
EN ISO 13849-1	Safety of machinery – safety-related parts of control systems Part 1: General design principles (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)
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
EN 61800-2	Variable-speed electric drives Part 2: General requirements – Rating specifications for low voltage adjustable frequency AC power drive systems
EN 61800-3	Variable-speed electric drives 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)

Overview

Line Connection Modules (LCM) contain the line-side infeed with main circuit breaker and fuse switch disconnector or circuit breaker and provide the connection between the plant power system and the Line Modules.

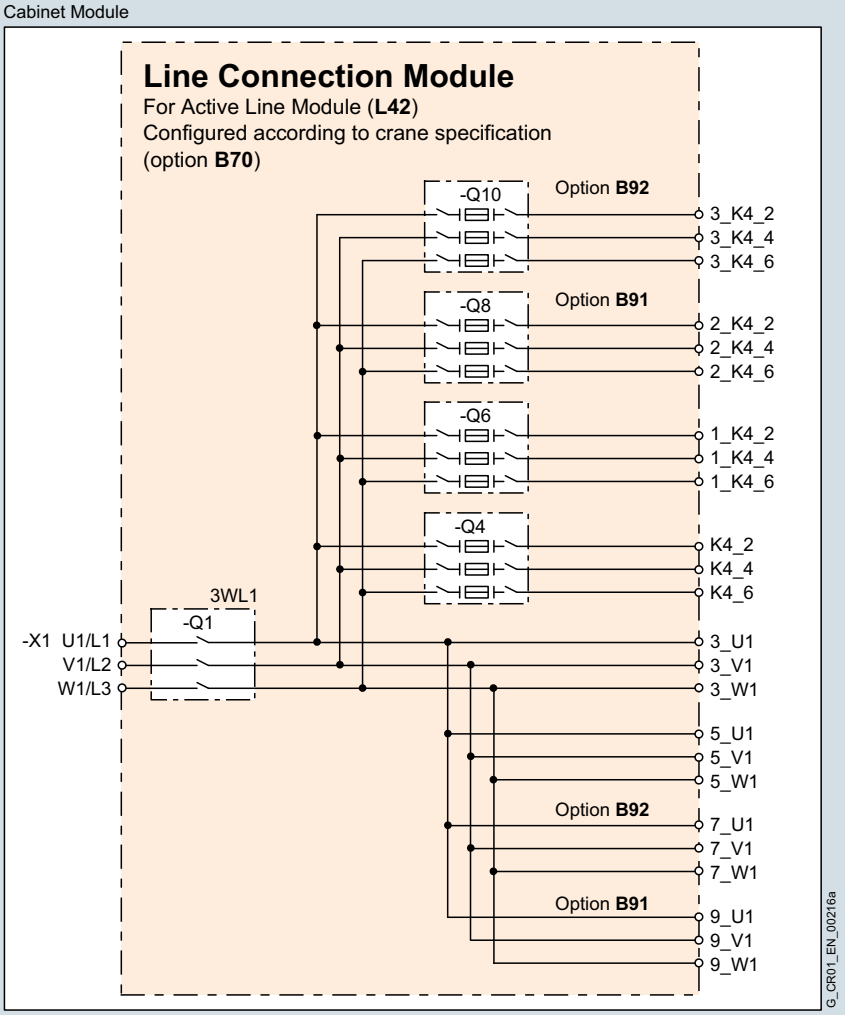
Line Connection Modules are available for the following voltages and currents:

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



Connection example of a Line Connection Module ≥ 2000 A for connection to Active Line Modules in parallel connection

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 $I_{rated\ E}$	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/L44**	kW	0.29	0.41	0.6	0.95	1.8	1.8
• at 60 Hz 460 V							
- Option **L42/L44**	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		5/M12 + 4/M16	5/M12 + 4/M16	5/M12 + 4/M16	5/M12 + 4/M16	64/M12	64/M12
• Conductor cross-section, max. (IEC)	mm^2	10 × 240	10 × 240	10 × 240	10 × 240	64 × 240	64 × 240
PE/GND connection		PE bar	PE bar	PE bar	PE bar	PE bar	PE bar
• Busbar cross-section	mm^2	600	600	600	600	600	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/L44**	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 industy 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
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 B91**
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".

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**
Indicator for supply system variables	**B81**
Transformer fuse for 350 kVA transformer output	**B82**
Surge arrester 600 V	**B83**
Additional connection for left of Active Line Module	**B91**
Additional connection for right of Active Line Module	**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 × 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)

Options (continued)

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

6

Active Line Modules including Active Interface Modules

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.-.B**C**3), which results in a very compact design for the line infeed.

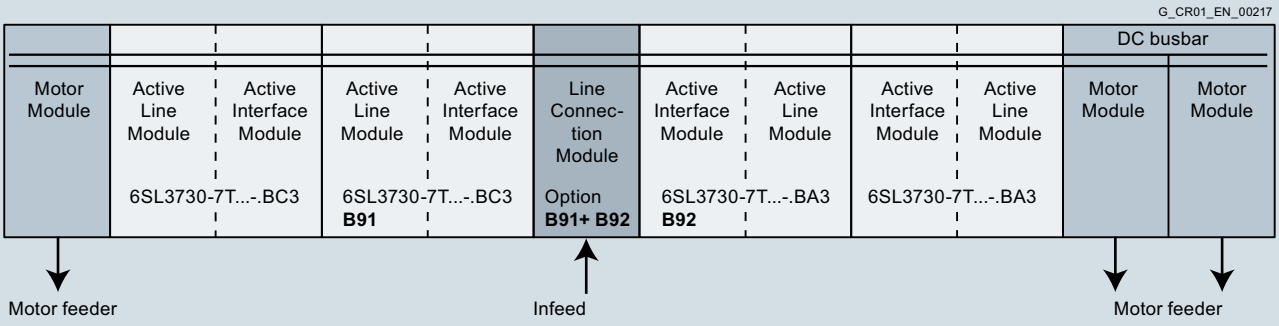
If a second Active Line Module has to be arranged on the left side, the option **B91** must be specified for the version "2nd parallel infeed on left". If a second Active Line Module has to be arranged on the right side, the option **B92** must be specified for the version "2nd parallel infeed on right".

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.

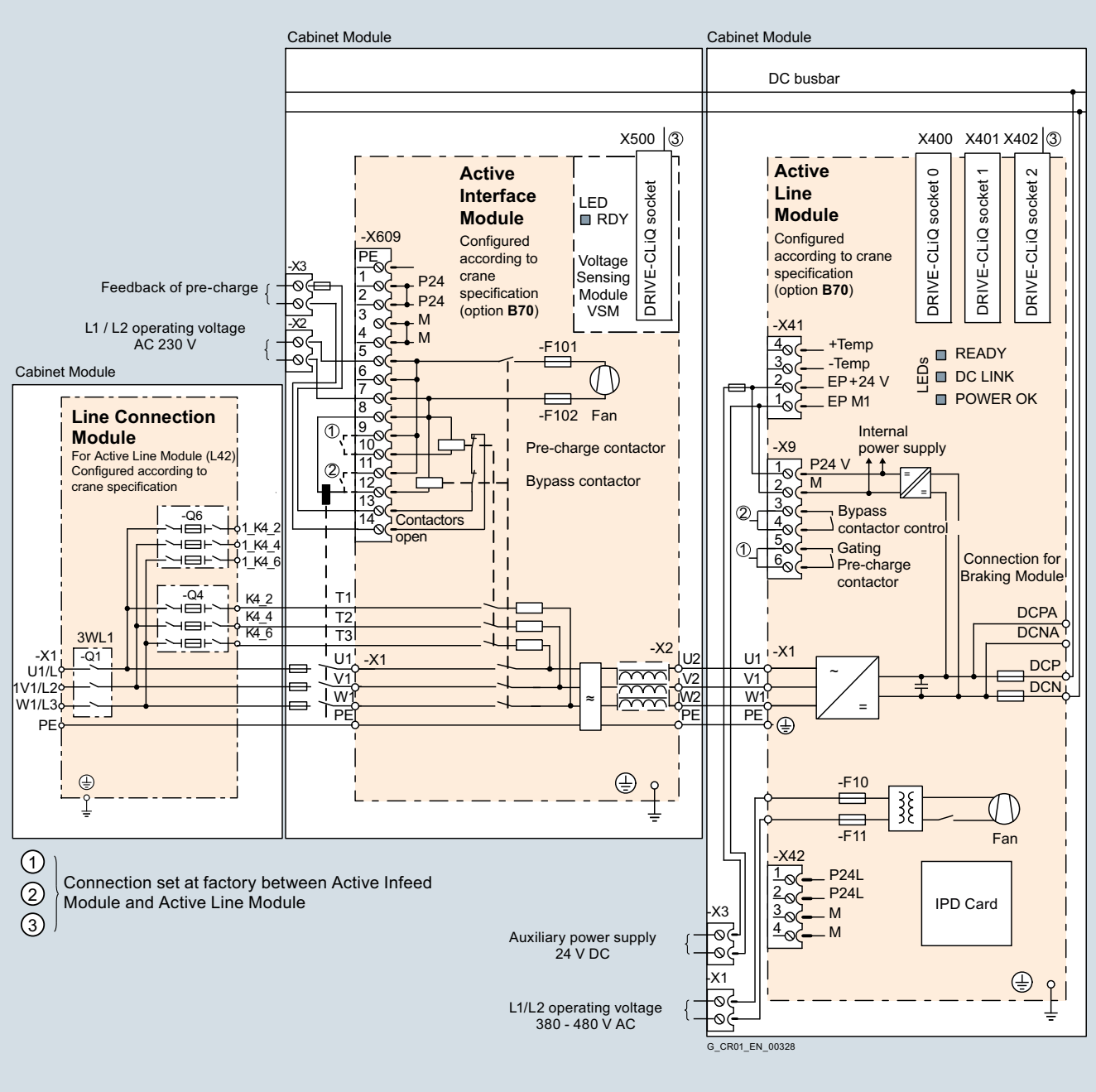
A connection of the Active Line Modules in parallel using DRIVE-CLiQ must be taken into consideration.

For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.



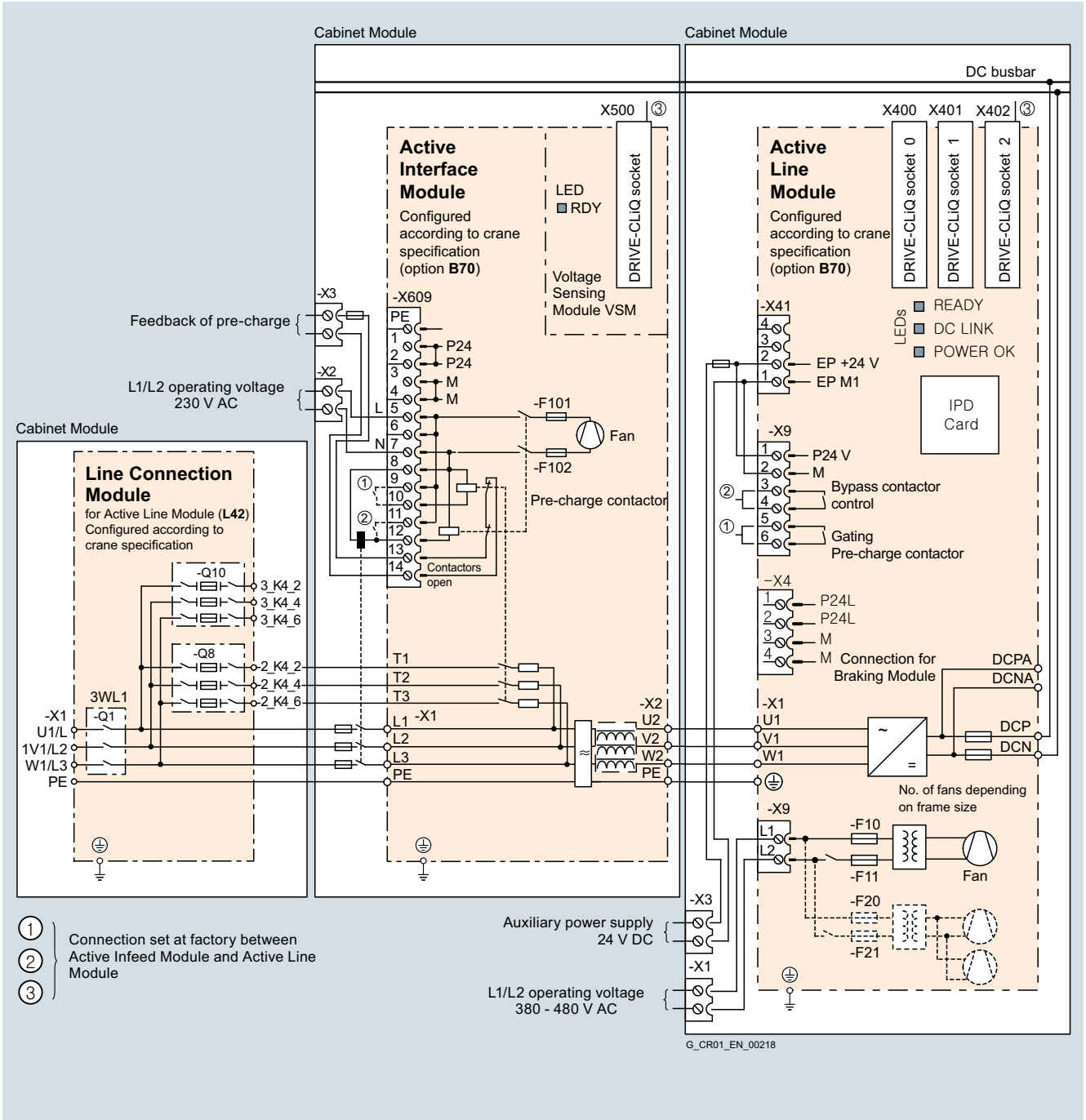
Integration

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 (continued)



Example of connection of an Active Line Module (frame sizes HI/HX and JI/JX)

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 $I_{rated\ DC}$ (50 Hz 400 V)	kW	**300**	**500**	**630**	**900**
• at $I_{H\ DC}$ (50 Hz 400 V)	kW	270	465	545	780
• at $I_{rated\ DC}$ (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 $I_{rated\ DC}$	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 $I_{rated\ E}$	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.

Active Line Modules including Active Interface Modules

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)

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**
Additional connection for left of Active Line Module	**B91**
Additional connection for right of Active Line Module	**B92**
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 × 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)

[1] For further special versions with order codes, see "Options".

Options (continued)

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

6

Motor Modules in chassis format

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

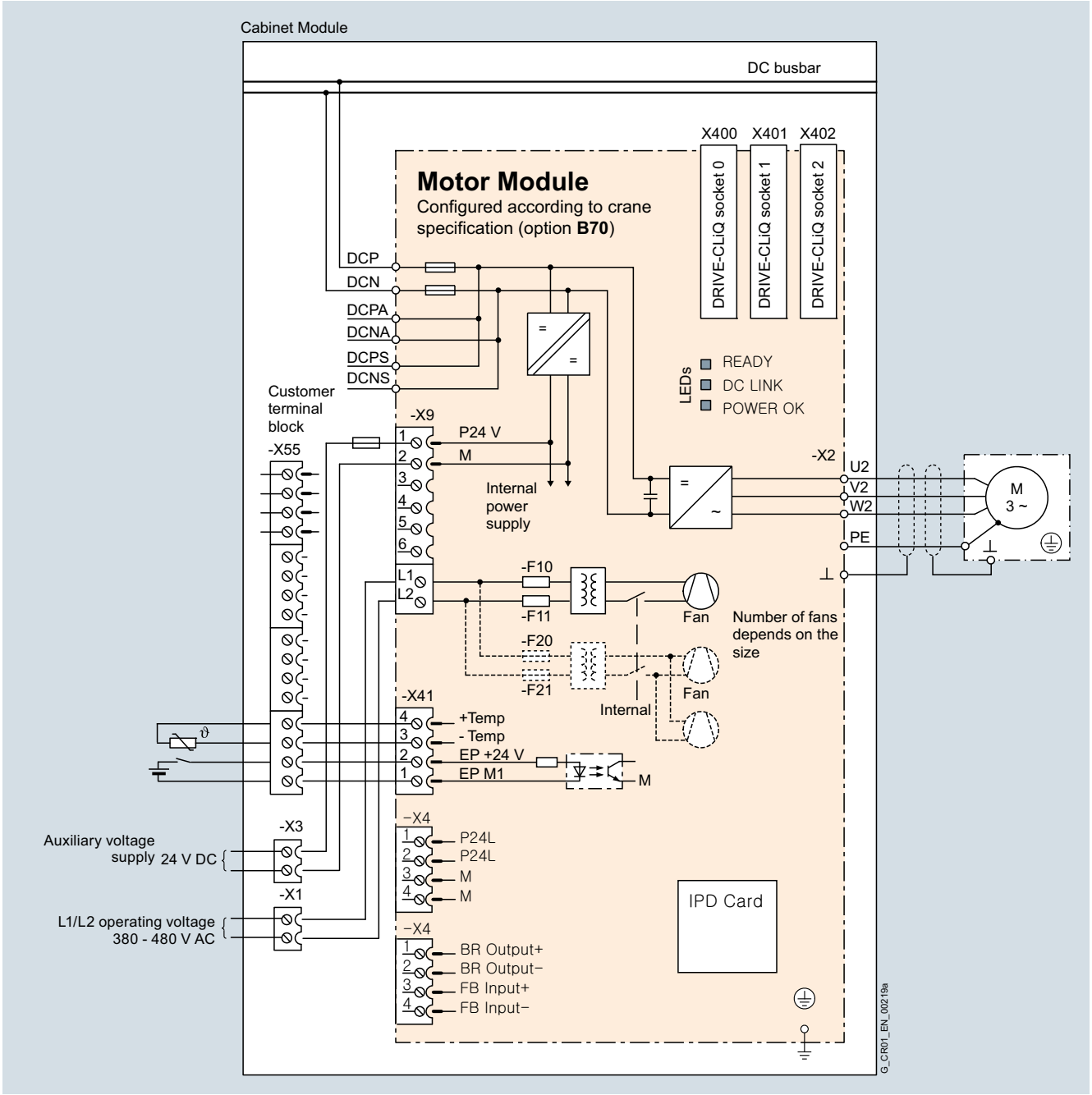
Design

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 x 10 mm), including jumper for looping through to the next Cabinet Module
- EMC-compliant design thanks to additional shielding measures and appropriate cable routing

Integration

Motor Modules are controlled by the CU320-2 DP or CU320-2 PN Control Unit. Communication takes place over the DRIVE-CLiQ connection. 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 $I_{rated\ A}$ [3]	A	210	260	310	380	490	605
• Base-load current I_L [4]	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 $I_{rated\ DC}$ when supplied from							
- Basic/Smart Line Module	A	252	312	372	456	588	726
- Active Line Module	A	227	281	335	411	529	653
• Base-load current $I_{L\ DC}$ [3] when supplied from							
- Basic/Smart Line Module	A	245	304	362	444	573	707
- Active Line Module	A	221	273	326	400	515	636
• Base-load current $I_{H\ DC}$ [4] when supplied from							
- Basic/Smart Line Module	A	224	277	331	405	523	646
- 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	12600
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	7.5
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	m^3/s	0.17	0.23	0.36	0.36	0.36	0.78
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	67	69	69	69	69	72
Motor connection		M12 screws	M12 screws	M12 screws	M12 screws	M12 screws	M12 screws
U2, V2, W2							
• Conductor cross-section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240	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		PE bar	PE bar	PE bar	PE bar	PE bar	PE bar
• Busbar cross-section	mm^2	600	600	600	600	600	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	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	286	490
Frame size		FX	FX	GX	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] For details of the relationship between pulse frequency and maximum output current/output frequency, see Catalog PM 21.

[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.

Technical specifications (continued)

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 $I_{rated\ A}$ [3]	A	745	840	985	1260	1405
• Base-load current I_L [3]	A	725	820	960	1230	1370
• Base-load current I_H [4]	A	570	700	860	1127	1257
• Maximum current $I_{max\ A}$	A	1087	1230	1440	1845	2055
DC link current						
• Rated current $I_{rated\ DC}$ when supplied from						
- Basic/Smart Line Module	A	894	1008	1182	1512	1686
- Active Line Module	A	805	907	1064	1361	1517
• Base-load current $I_{L\ DC}$ [3] when supplied from						
- Basic/Smart Line Module	A	871	982	1152	1474	1643
- Active Line Module	A	784	884	1037	1326	1479
• Base-load current $I_{H\ DC}$ [4] when supplied from						
- Basic/Smart Line Module	A	795	897	1051	1345	1500
- 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	28800
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	7.5	7.5	7.5	7.5	7.5
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	1.1
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	72	72	72	72	72
Motor connection		M12 screws	M12 screws	M12 screws	M12 screws	M12 screws
U2, V2, W2						
• 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	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	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	700
Frame size		HX	HX	JX	JX	JX

[1] Rated power of a typ. 6-pole standard induction motor based on IL or IH at 400 V 3 AC 50 Hz.

[2] Rated power of a typ. 6-pole standard induction motor based on IL or IH at 460 V 3 AC 60 Hz.

[3] The base-load current IL 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 IH 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] For details of the relationship between pulse frequency and maximum output current/output frequency, see Catalog PM 21.

[6] 6) The specified power loss represents the maximum value at 100 % capacity utilization. The value is lower under normal operating conditions.

[7] 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_{rated}	**Motor Modules in chassis format** Article No. with order code **B70** for Cranes industry version. [1]
kW	A	
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".

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 × 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

Motor Double Choke Modules

Overview

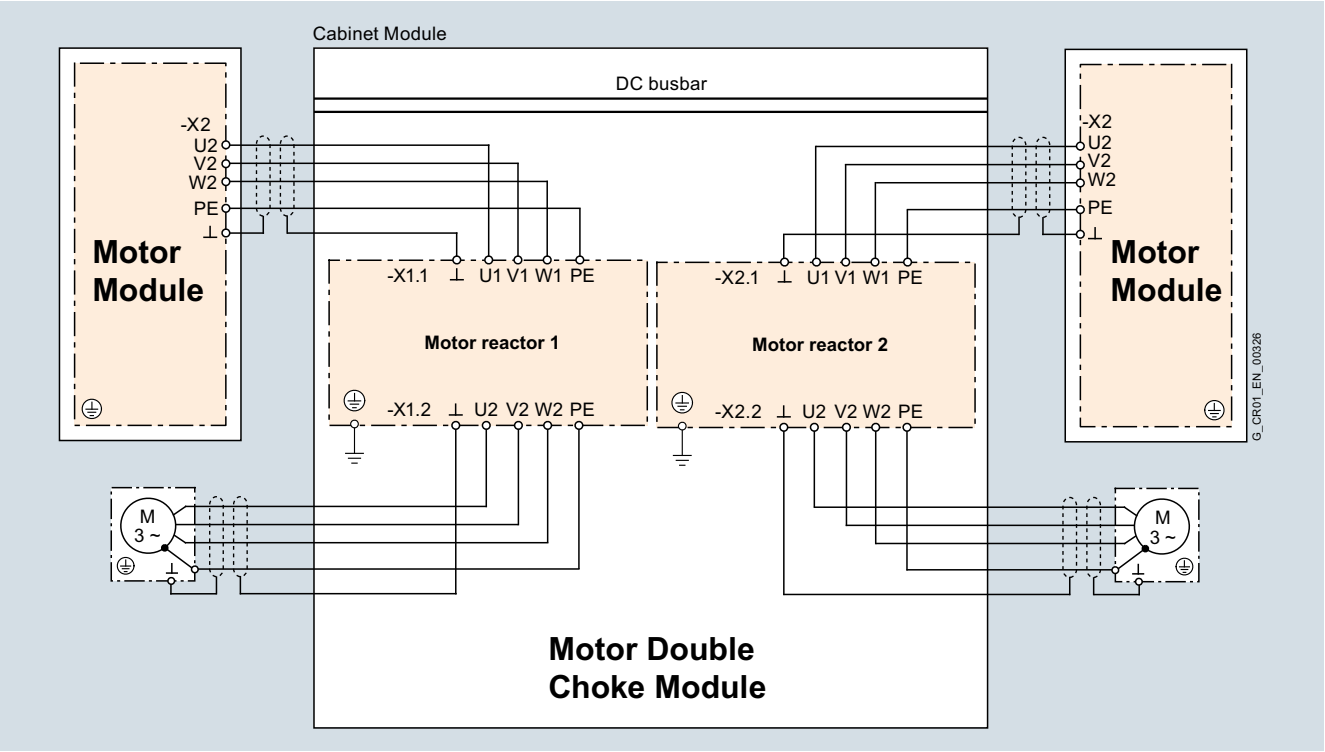
Motor reactors reduce the voltage stress on the motor windings by reducing the voltage gradients at the motor terminals that occur when motors are fed from drive converters. At the same time, the capacitive charge/discharge currents that occur at the converter output when long motor cables are used are 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.

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

Motor Double Choke Modules

Technical specifications

Line voltage 380 ... 480 V 3 A		Motor Double Choke Module Type	
		6SL3700-2AE36-1BA3	6SL3700-2AE38-4BA3
Type rating	kW	315	450
Number of reactors		2	2
Rated current $I_{rated\ E}$	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 Article No. with order code **B70** for Cranes industry version. [1]	Motor Module in chassis format Type
kW		
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".

Options

The table below lists the options available for Motor Double Choke Modules (for details, refer to the "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

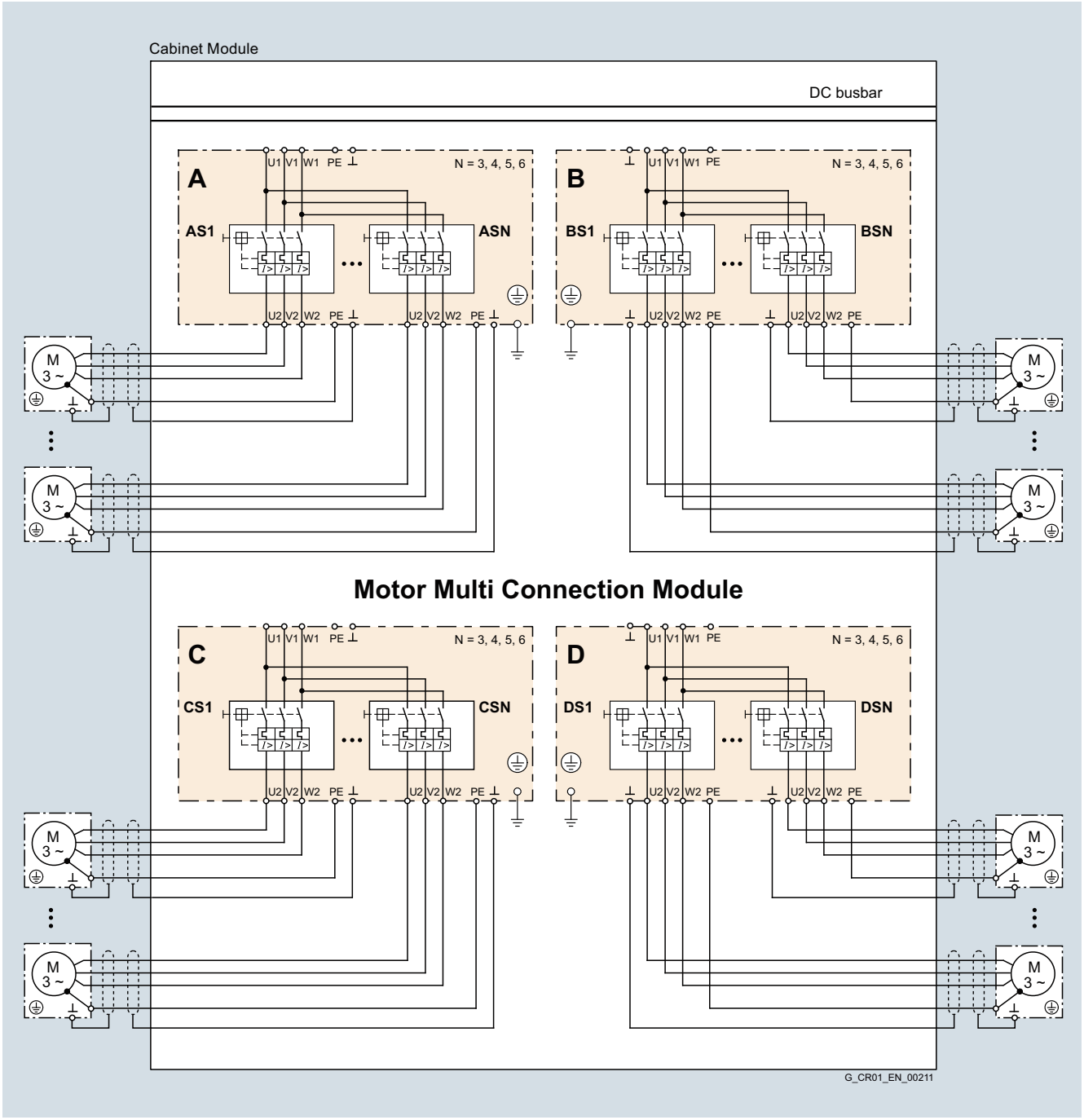
If the drive output of a gantry with drive motors is distributed over multiple axes to achieve a more compact design and enhanced motion, these motors can be operated cost-optimized in parallel with a converter with an appropriate total power rating. The Motor Multi Connection Modules are used to protect 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.

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 Article No. with order code **B70** for Cranes industry version. [1]	Option "Measuring instruments in control cabinet door"	Additional identification code -Z with order code
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".

Options

The table below lists the options available for Motor Multi Connection Modules (for details, refer to "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 × 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

Switch-Over Modules switch Motor Modules 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.

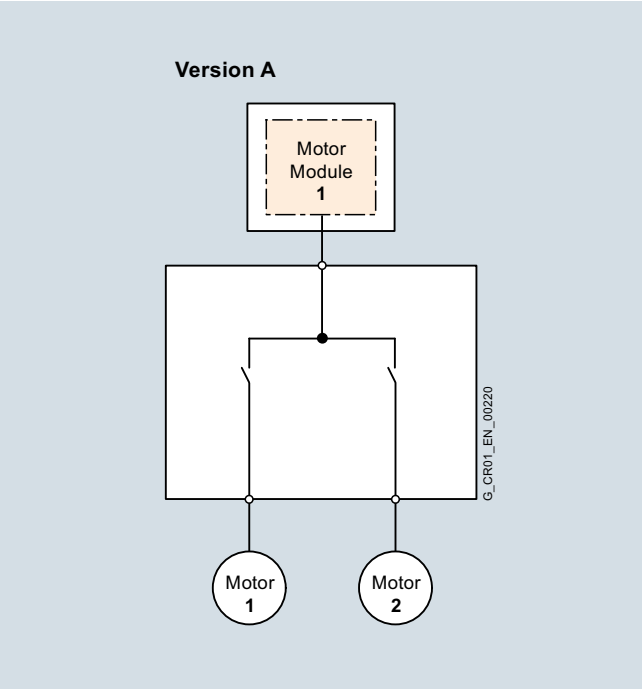
Design

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

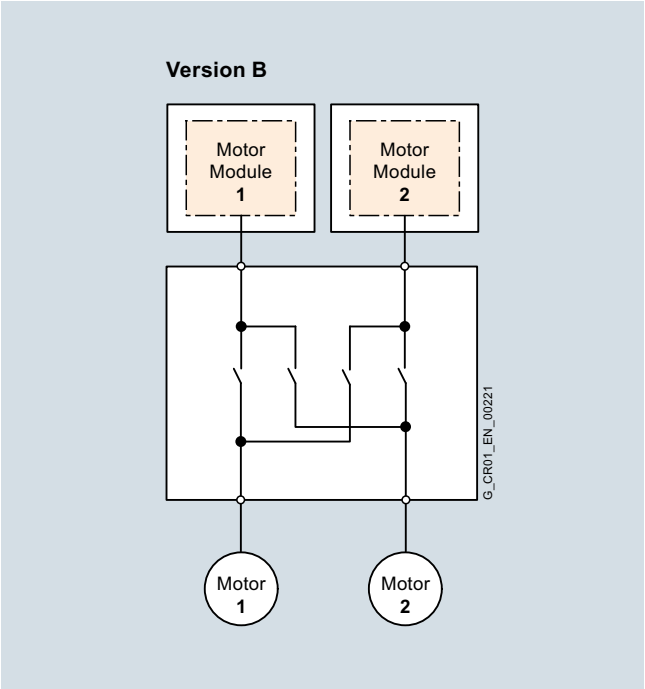


Implementation of version A with option **B80**:
2 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and a voltmeter (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage of the Motor Module.

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



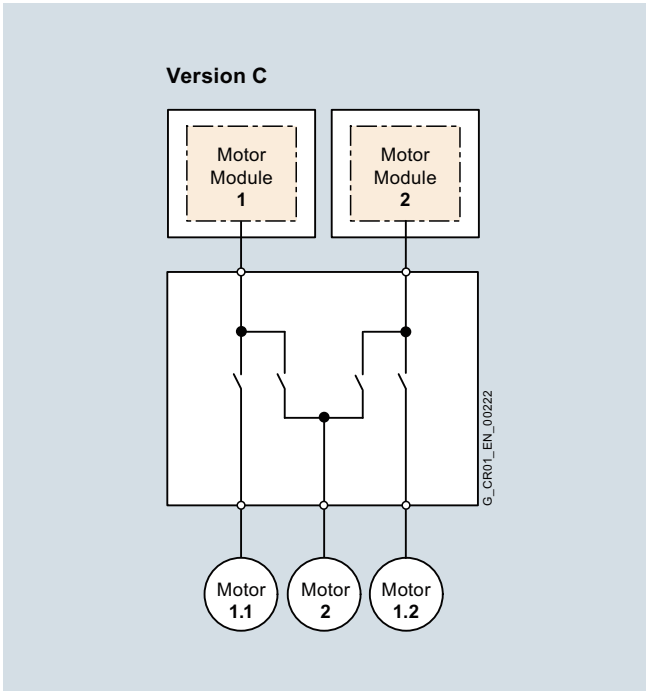
Implementation of version B with option **B80**:
2 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and 2 voltmeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage at the Motor Modules.

Design (continued)

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

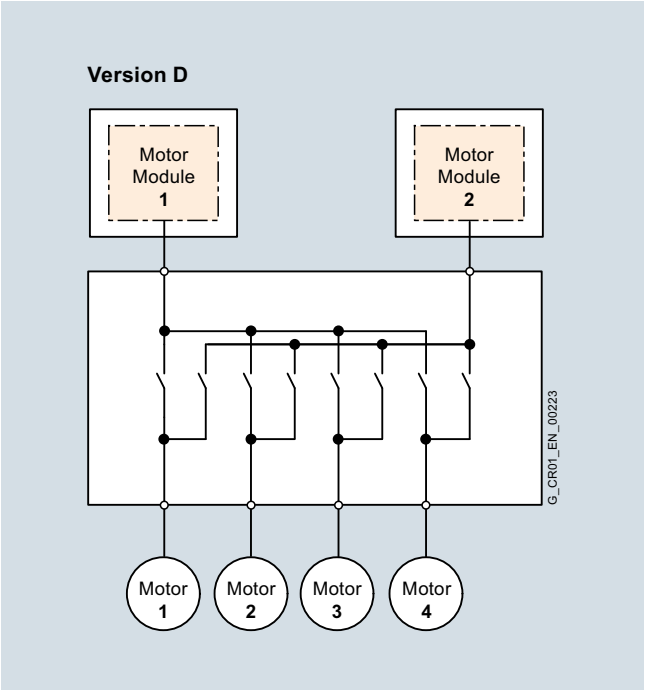


Implementation of version C with option **B80**:
3 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and 2 voltmeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage at the Motor Modules.

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



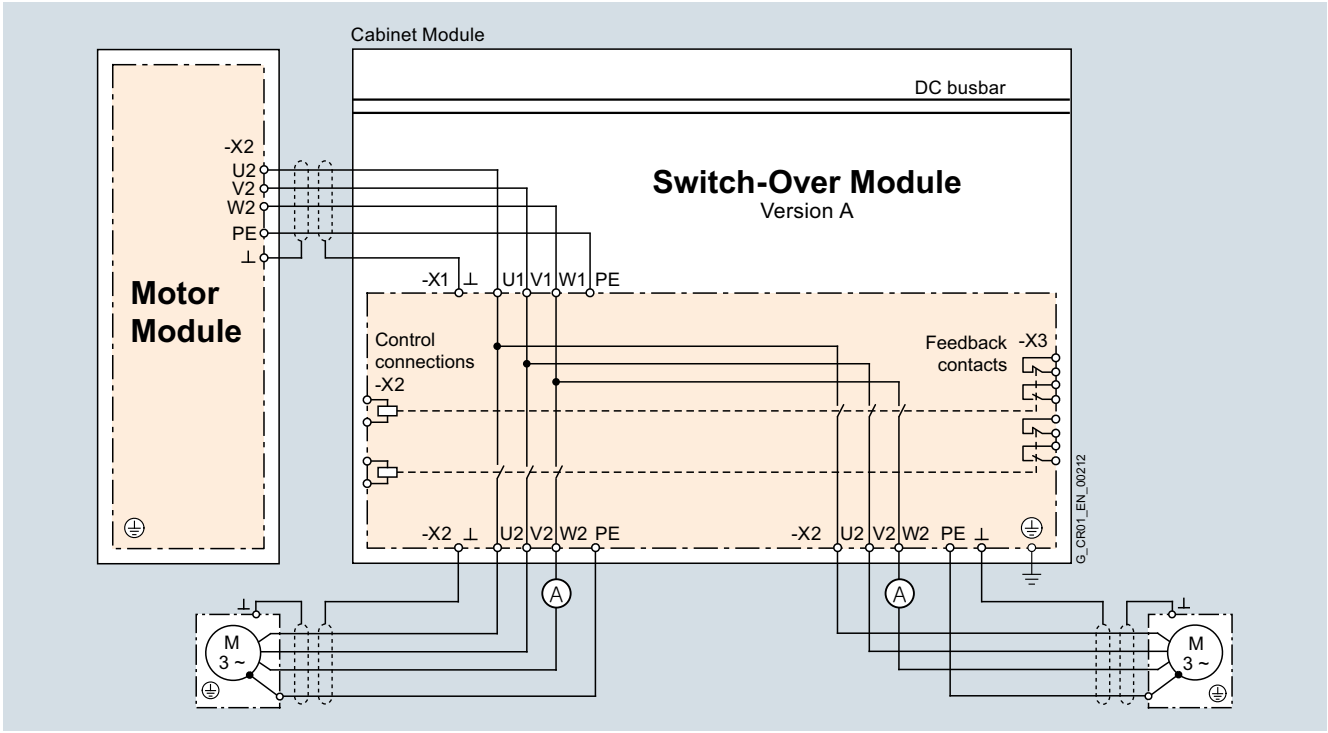
Implementation of version D with option **B80**:
2 ammeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the motor currents and 2 voltmeters (analog measuring instrument of moving-coil type, 240° scale) for indicating the output voltage at the Motor Modules.

The checkback contacts of the individual contactors are connected to terminals to support plant-specific interlocks.

Integration

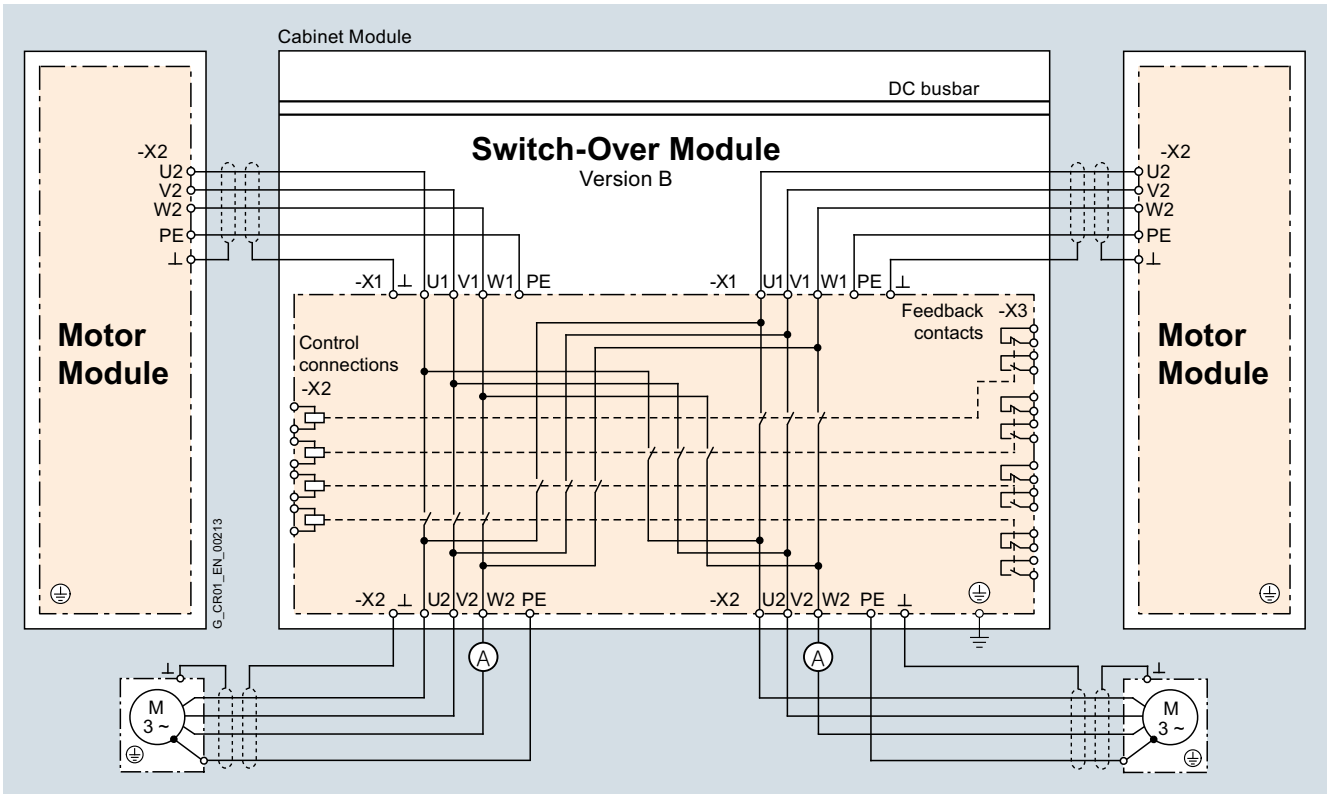
The motors and Motor Modules are connected to the Switch-Over Module in accordance with the grouping.

Version A



Connection example of a Switch-Over Module, Version A

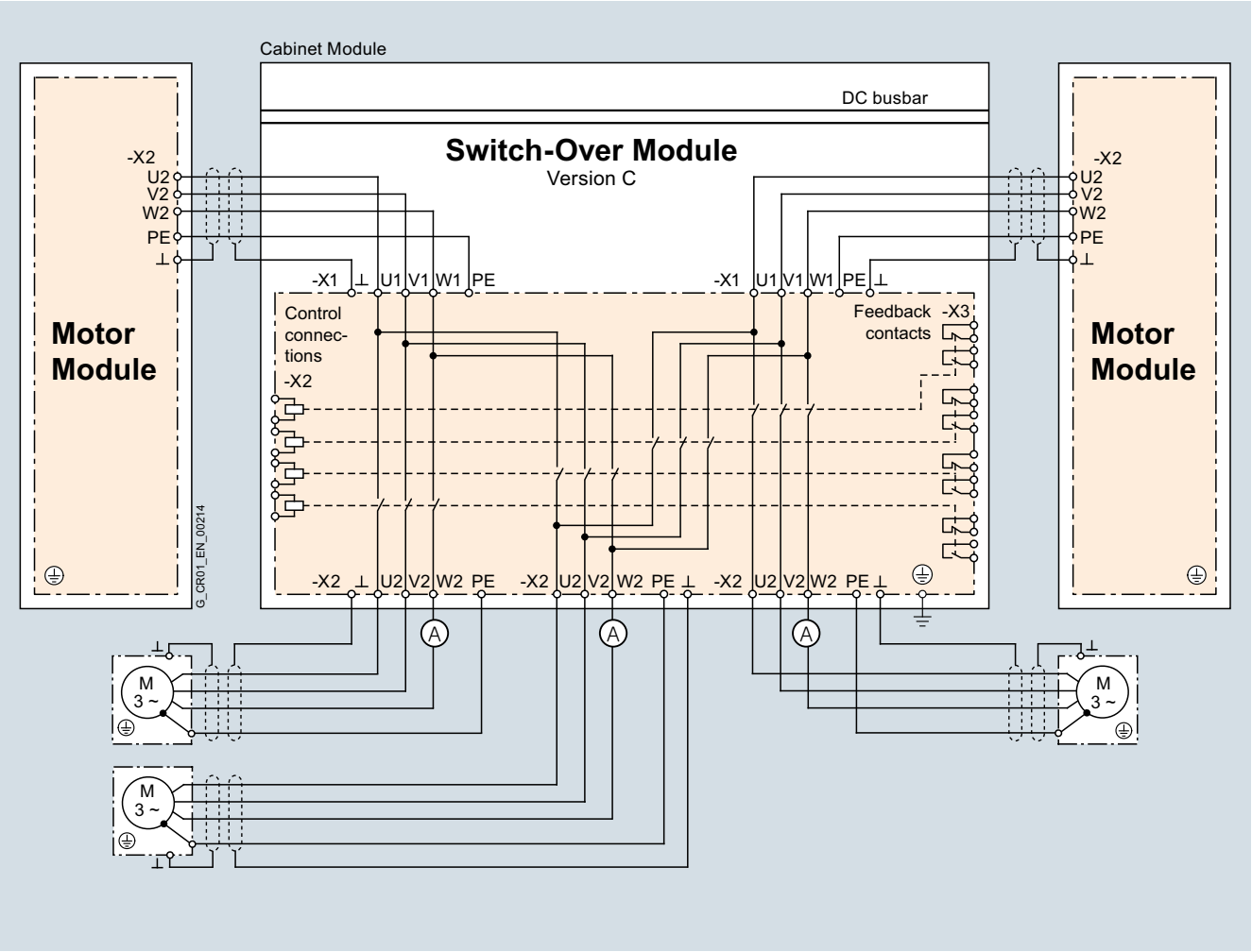
Version B



Connection example of a Switch-Over Module, Version B

Integration (continued)

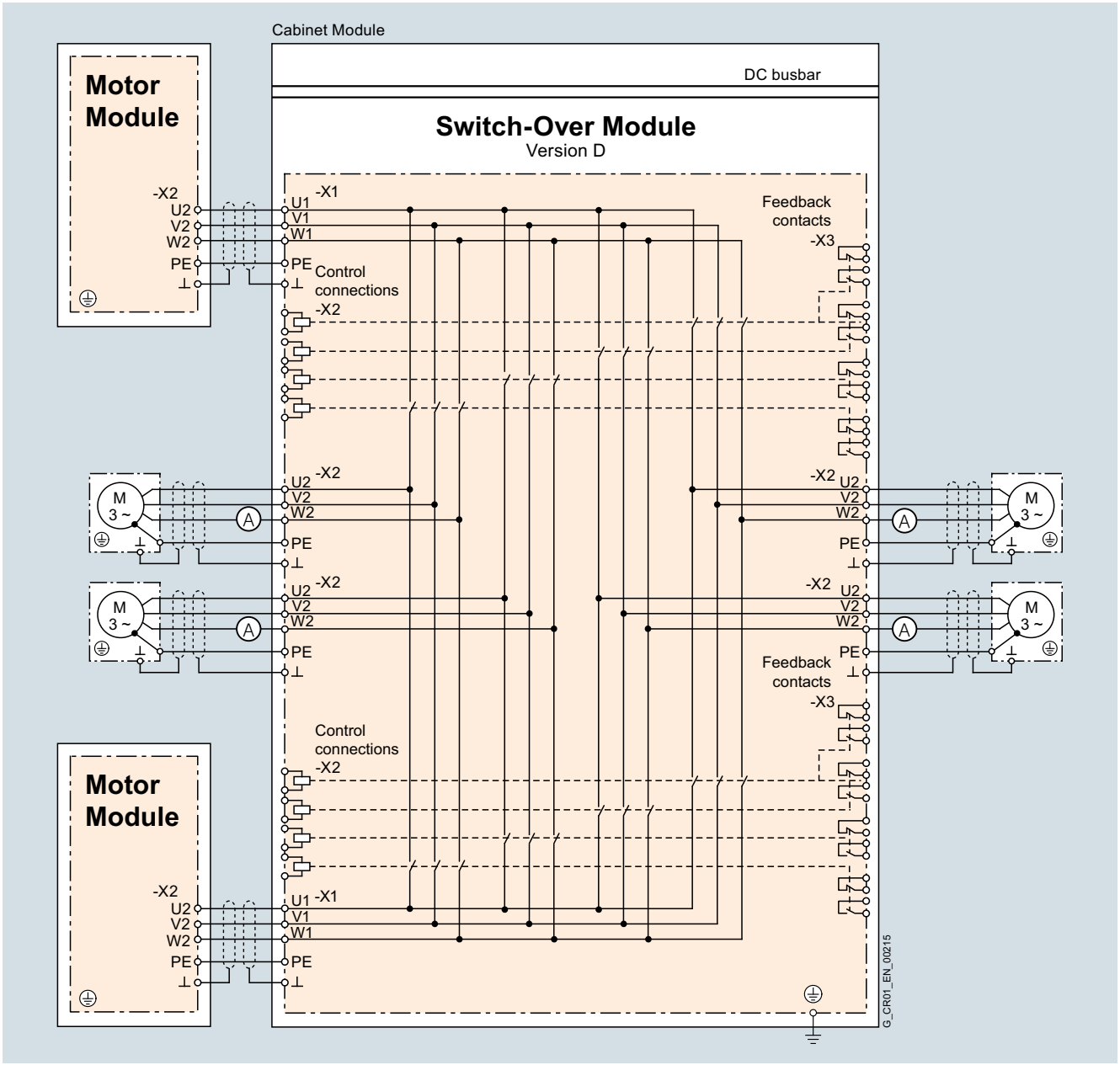
Version C



Connection example of a Switch-Over Module, Version C

Integration (continued)

Version D



Connection example of a Switch-Over Module, Version D

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 (continued)

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**

Selection and ordering data

Version	**Switch-Over Modules** Article No. with order code **B70** for Cranes industry version. [1]	Connectable Motor Modules Type	Type rating 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
	6SL3700-2FE41-4AA3-Z B70	6SL3720-1TE41-4AA3	800
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
	6SL3700-2FE41-4BA3-Z B70	6SL3720-1TE41-4AA3	800
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
	6SL3700-2FE41-4CA3-Z B70	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 × 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

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 DIN EN 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 (SIMEAS 7KG7500-0AA01-0AA0).

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 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.

B92 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.

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 detected using a temperature sensor (KTY84-130 or PTC).

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 detected using a temperature sensor (KTY84-130 or PTC).

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 detected using a temperature sensor (KTY84-130 or PTC).

K51 VSM10 Voltage Sensing Module

The VSM10 Voltage Sensing Module is used to acquire the voltage characteristic at the motor end.

K82 Terminal module for controlling the "Safe Torque Off" and "Safe Stop 1" safety functions

The terminal module is used to control the "Basic Safety Functions" over a wide voltage range from 24 to 240 V DC/AC. This means that the "STO" and "SS1" safety functions can be flexibly controlled from the signal voltages in the plant.

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, DIN EN ISO 13849-1 Category 3 (previously EN 954-1) as well as Performance Level (PL) d and IEC 61508 SIL 2.

These Safety Integrated functions of the SINAMICS S120 are generally certified by independent institutes. An up-to-date list of certified components is available on request from your local Siemens office.

Options (continued)

With option **K82**, the requirements specified in EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 (previously EN 954-1) as well as 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 following Safety Integrated functions are controlled using option **K82**:

- Safe Torque Off (STO)
- Safe Stop 1 (SS1) (time-controlled)

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.

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.

Options (continued)

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

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

The Cabinet Modules are designed in accordance with BGV A3 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_{rated} 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.

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.

Options (continued)

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**
• **T**ransport **U**nit				
• Serial number of transport unit				
• Position of Cabinet Module within transport unit from left to right				

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.

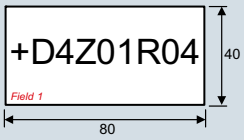
Y31 Label for plant identification, 1-line, 40 × 80 mm

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.



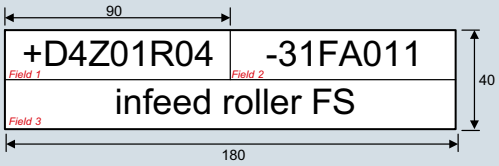
Y32 Label for plant identification, 2-line, 40 × 180 mm

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.



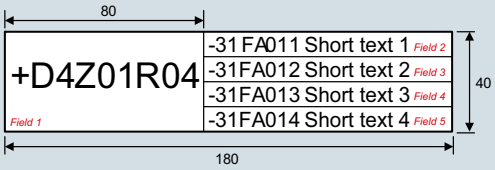
Y33 Label for plant identification, 4-line, 40 × 180 mm

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.

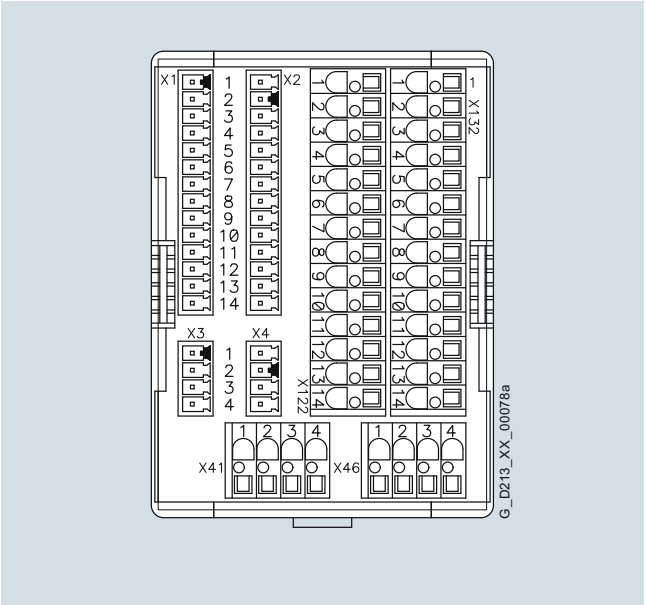
Dimensions H × W: 40 × 180 mm

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.



Overview



Customer terminal block -X55 represents the interface to the I/O devices and marshals a range of cabinet-internal signals to a central terminal block module mounted in the lower part of the cabinet.

It can be used with Motor Modules in chassis format.

Design

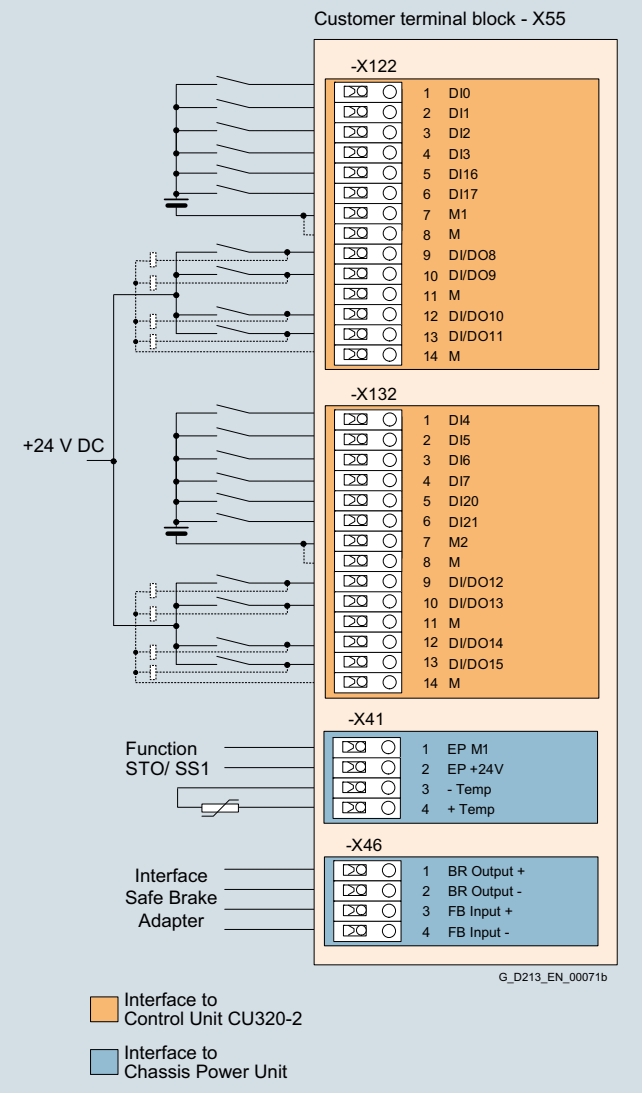
To connect signal cables on the customer side, terminal block -X55 includes terminals -X122, -X132, -X41 and -X46 (terminals -X1 to -X4 are used inside the cabinet and are not available). As a consequence, depending on the version (with/without option **K90**) the following digital inputs/outputs and/or signals are available:

The customer terminal block -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	✓	✓	–	–
-X46				
Connection Safe Brake Adapter	✓	✓	–	–

6

Design (continued)

Terminal assignment



Terminal assignment of customer terminal block -X55

Terminal block -X55-X122 digital inputs/outputs		
Terminal	Designation [1]	Technical specifications
1	DI 0	Voltage -30 ... +30 V DC Current consumption, typical: 9 mA at 24 V DC
2	DI 1	Electrical isolation: Terminal M1 is the reference potential
3	DI 2	Level (incl. ripple): • High signal level: 15 ... 30 V • Low signal level: -30 ... +5 V
4	DI 3	Input delay (typ.): • For 0 → 1: 50 µs • For 1 → 0: 150 µs
5	DI 16	
6	DI 17	
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 Current consumption, typical: 9 mA at 24 V DC
11	M	Level (incl. ripple): • High signal level: 15 ... 30 V • Low signal level: -30 ... +5 V
12	DI/DO 10	Fast inputs: [2] • DI/DO 8, 9, 10 and 11
13	DI/DO 11	Input delay (typ.): • For 0 → 1: 5 µs • For 1 → 0: 50 µs
14	M	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: 1.5 mm^2.

[1] DI: Digital input
DI/DO: bidirectional digital input/output
M: Electronic 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 V; load 48 Ω; High (1) = 90 % U_{out};
Low (0) = 10 % U_{out}.

Design (continued)

Terminal block -X55-X132 digital inputs/outputs		
Terminal	Designation [1]	Technical specifications
1	DI 4	Voltage -30 ... +30 V DC Current consumption, typical: 9 mA at 24 V DC Electrical isolation: Terminal M2 is the reference potential Level (incl. ripple): • High signal level: 15 ... 30 V • Low signal level: -30 ... +5 V Input delay (typ.): • For 0 → 1: 50 µs • For 1 → 0: 150 µs
2	DI 5	
3	DI 6	
4	DI 7	
5	DI 20	
6	DI 21	
7	M2	Reference potential for terminals 1 ... 6
8	M	Ground
9	DI/DO 12	As input: Voltage -30 ... +30 V DC Current consumption, typical: 9 mA at 24 V DC Level (incl. ripple): • High signal level: 15 ... 30 V • Low signal level: -30 ... +5 V Fast inputs: [2] • 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
10	DI/DO 13	
11	M	
12	DI/DO 14	
13	DI/DO 15	
14	M	

Max. connectable cross-section: 1.5 mm^2.

Terminal block -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 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
2	EP +24 V (enable pulses)	
3	-Temp	Temperature sensor connection for motor temperature sensing: KTY84-1C130, PTC, Pt100
4	+Temp	

Max. connectable cross-section: 2.5 mm^2.

Terminal block -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: 1.5 mm^2.

[1] DI: Digital input
DI/DO: bidirectional digital input/output
M: Electronic ground
M2: Ground reference.

[2] Can be used as measuring probe input or input for the external zero mark.

[3] Data for: U_{cc} = 24 V; load 48 W; High (1) = 90 % U_{out}; Low (0) = 10 % U_{out}.

Overview

The SIMOTRAS HD AC power controller is used for the open and closed-loop control of three-phase slip-ring rotor motors for cranes and hoisting gear.

SIMOTRAS HD is a fully-controlled digital, 3-phase thyristor controller in a compact design with stator phase control and electronic field reversal with ratings of between 20 and 580 kW for the open and closed-loop control of slip-ring rotor motors for cranes and hoisting gear.

All converters are equipped with a basic PMU operator panel in the door of the unit. The PMU can be used to perform all the adaptations, settings and measured value displays required for commissioning. The basic unit can also be operated via its serial service interface using a commercially available PC and suitable software. All device settings (e.g. controller parameters, limits, etc.) are stored in the device in a non-volatile memory.

Benefits

- **Compact design**
  with the open-loop control integrated in the drive
- **Favorably-priced solution in the retrofit area**
  by using slip-ring rotor motors that already exist in the plant or system

Application

- Hoisting, slewing, luffing, trolley and long travel gears as well as single and multi-motor drives
- The devices are ideally suited to crane modernization applications, because the existing components such as motors, resistors, cables, etc. can usually be reused.
- Devices are available in special versions for high ambient temperatures up to 65 °C.

Design

The SIMOTRAS HD device comprises:

- The power unit
- Basic electronics

Power unit

The power unit is a 3-phase thyristor AC power controller in a compact design. Two additional thyristor modules in the lateral branch of the power unit enable reversing of the rotating field, and therefore 4Q operation of the drive. Current transformers in 2 phases generate the actual current value for current control.

Basic electronics

The basic electronics contains the gating unit that activates the thyristors. It generates line-synchronized firing pulses. The control electronics is isolated from the line potential via firing pulse transformers.

All device settings (e.g. controller parameters, limits, etc.) are stored in the device in a non-volatile memory. Adjustment is performed digitally, via the operator panel on the device. The values are therefore easy to reproduce at any time.

Depending on the load conditions, the converter operates in motor mode (driving direction of rotating field, 1st and 3rd quadrant) or in braking mode with reversing current braking (2nd and 4th quadrant). Through omission of the conventional stator contactors, fast torque reversal is possible, with resulting high control dynamics.

Supplementary modules

See the Electronic options.

Function

Master switch signals

The incoming signals from the master switch, such as setpoint and control enable, are loaded.

- A master switch with setpoint potentiometer can be connected direct to the SIMOTRAS HD.
- A 4-stage master switch requires the CUD2 terminal expansion module for connection.

Ramp-function generator

The series-connected ramp-function generator with adjustable ramps forms the speed setpoint.

Speed controller

The speed controller with the subordinate current control circuit is connected down-circuit of the ramp-function generator and forms the actual control loop.

Start pulse

A start pulse is also generated so that the machine is activated in the hoisting direction of rotation immediately after power up. This prevents the load from dropping on start-up.

Sequencer

For switching through the rotor stages, a sequencer is installed that selects the planned stages speed-dependently and activates reversing.

Standstill monitoring

The integral zero-speed monitoring supports guided, electrical braking of the drive. For replacing the cable, e.g. in hoists, jog mode with creep speed is provided.

Operating states

The operating states are indicated in the device on a 5-digit, 7-segment display as well as the LEDs of the basic PMU operator panel.

Operating modes

The threshold for switchover between closed-loop and open-loop controlled operation can be defined in accordance with the control characteristic and set on the parameters of the device.

Parallel connection

To increase the performance, up to 6 devices can be connected in parallel. The terminal expansion option (CUD2) is required in this case for every device and (n-1) patch cable. Current splitting requires identical, separate parallel switching reactors for each SIMOTRAS device. The difference in reactor tolerances determines the current distribution. For operation without derating (current reduction), a tolerance of 5 % or better is recommended. Only devices with the same current ratings are permitted to be connected in parallel.

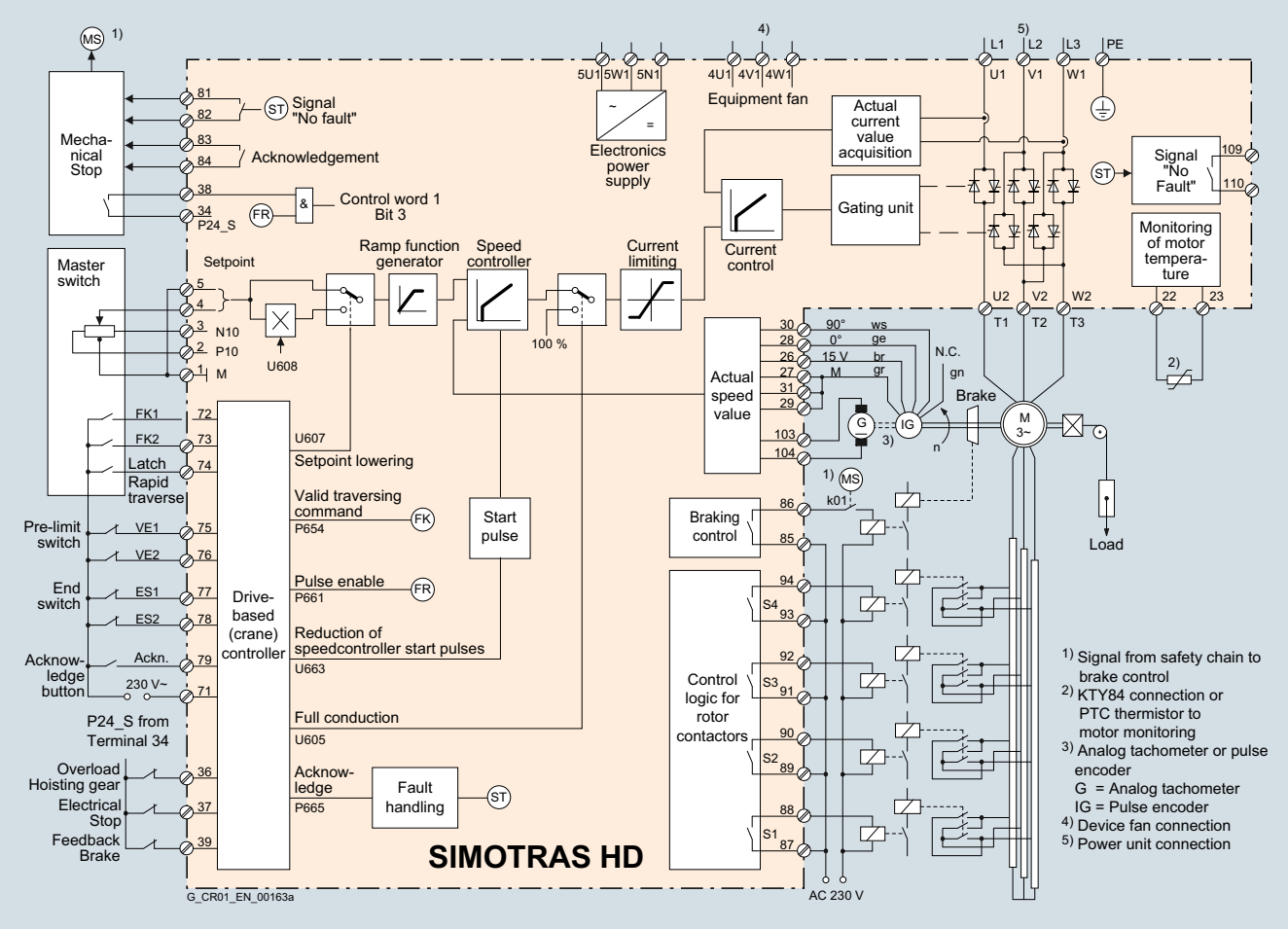
Integration

Crane technology

The drive-based (crane) control is integrated into the SIMOTRAS HD device. The SIMOTRAS HD device comprises:

- Power unit
- Electronics box with basic electronics

The drive-based (crane) control is designed to permit easy switchover between master switches with setpoint potentiometers and 4-stage master switches: The control functions can be specified by terminals.



Configuration

Notes on configuration

Rated current of the device I_{rated}

In crane operation, the motors are not operated continuously, but with variable load, at varying speeds, and with different ON durations. Under these conditions, it is sufficient when the rated current for the device I_{rated} is greater than the motor rated current. In intermittent duty with appropriate pauses in operation, the devices can carry twice the rated device current of I_{rated} greater than the rated motor current for 20 s. In intermittent duty with appropriate pauses in operation, the devices can carry twice the rated device current of I_{rated} for 20 s. This covers all the normal acceleration situations that occur with cranes. The SIMOTRAS HD devices can be operated continuously at the rated current for the device I_{rated}; the limit temperature for the thyristors will, however, be reached. Acceleration is not permitted from this operating state since the thyristors could be overloaded.

Rotor contactors

To ensure a reliable ramp-up from the closed-loop control characteristic to rated speed, it is recommended that 4 rotor contactors are used. Activation of the rotor contactors through contactor relays.

Permissible ON duration

Under unusual operating conditions, such as traversing with full load at extremely low speed for a long time, motors, resistors and SIMOTRAS HD must be dimensioned appropriately. When phase angle control is used, a higher stator current flows to achieve the necessary torque due to the reduced magnetization. The motors may become thermally overloaded, because the thermal power losses rise with the quadrant of the current. The resistors are overloaded when the closed-loop control characteristic is traversed for an extended period.

Rotor resistances

Since the speed is influenced with additional rotor resistors, the rotor performance is largely converted into heat in the external resistor. This ensures that excessive heating of the motor is avoided when traversing at low speed over long periods.

Emergency or safety limit switch

Due to the lack of stator contactors, the motor can no longer be galvanically isolated from the AC power controller, e.g. when an operational limit switch is actuated. If the controller is then not able to block the thyristors due to a device fault, this could result in an impermissible operating state.
It is therefore recommended that emergency or safety limit switches are used. These respond when the operational limit switch is passed and act on a line contactor or the crane switch.

Technical specifications

AC power controller in the basic version

Product designation		**SIMOTRAS HD AC power controller**					
Type		6SG7050-0EB60-0	6SG7052-0EB60-0	6SG7055-0EB60-0	6SG7060-0EB60-0	6SG7062-0EB60-0	6SG7065-0EB60-0
110 ... 500 V 3 AC, 60 ... 180 A							
Rated supply voltage Power unit	V	110 -10 % ... 500 + 10 % 3 AC					
Rated frequency	Hz	50/60 The devices automatically adjust to the frequency of the applied line voltage in a range from 45 ... 65 Hz.					
Rated current	A	60	78	98	112	142	180
Rated supply voltage Electronic power supply	V	380 (-25 %) ... 460 (+15 %) 2 AC I_{rated} = 1 A or 190 (25 %) ... 230 (+15 %) 1 AC I_{rated} = 2 A (-35 % for 1 min.)					
Phase fuse[1] 3 units	A/V	3NE1820-0 80/690	3NE1021-0 100/690	3NE10220-0 125/690	3NE1024-0 160/690	3NE1224-0 160/690	3NE1225-0 200/690
Rated supply voltage Fan	V	–	–	24 DC internal			
Overload possibility[2]		20 s duration: $I = 2 \times I_{rated}$ then 70 s duration: $I = I_{rated}$ then 60 s duration: I = 0 A (cycle duration 150 s)					
Power loss for rated current, approx.	W	272	306	386	439	500	630
Minimum load	A	3	6	6	6	7	7
Ambient temperature during operation at rated current	°C	0 ... 45 self-ventilation		0 ... 40 forced ventilation			
Upper limit temperature with current derating	°C	55		50			
Cooling air requirement	m^3/h	–		100			
Sound pressure level L_{pA} (1 m)	dB	–		40			
Storage and transport temperature	°C	-25 ... +70					
Installation altitude above sea level	m	≤ 1000 at rated current max. 3500 with reduced voltage and current					
Environmental class DIN IEC 60721-3-3		3K3					
Degree of protection DIN EN 60529		IP00	IP00	IP00	IP00	IP00	IP00
D400 device type		60 Mre	78 Mre	98 Mre	112 Mre	142 Mre	180 Mre
Dimensions		See dimensional drawings					
Weight, approx.	kg	16	16	16	16	17	17

[1] The fuses listed are not included with the device. The fuses listed are recommended fuses that must be ordered separately.

[2] It is permissible to operate the device without interruption with the rated connection current I_{rated}. This will cause the thyristors to reach their limit temperature. It is not possible to accelerate, i.e. increase the current from this operating state.

Technical specifications (continued)

Product designation		SIMOTRAS HD AC power controller					
Type		6SG7070-0EB60-0	6SG7072-0EB60-0	6SG7076-0EB60-0	6SG7080-0EB60-0	6SG7082-0EB60-0	6SG7085-0EB60-0
110 ... 500 V 3 AC, 225 ... 900 A							
Rated supply voltage Power unit	V	110 -10 % ... 500 + 10 % 3 AC					
Rated frequency	Hz	50/60 The devices automatically adjust to the frequency of the applied line voltage in a range from 45 ... 65 Hz.					
Rated current	A	225	285	360	525	680	900
Rated supply voltage Electronic power supply	V	380 (-25 %) ... 460 (+15 %) 2 AC I_{rated} = 1 A or 190 (-25 %) ... 230 (+15 %) 1 AC I_{rated} = 2 A (-35 % for 1 min.)					
Phase fuse[1] 3 units	A/V	3NE1227-0 250/690	3NE1331-0 350/690	3NE1332-0 400/690	3NE1435-0 560/690	3NE3340-8 900/690	6RY1702-0BA01[2] 1250/660
Rated supply voltage Fan	V	400 (± 15 %) 3 AC 50 Hz 460 (± 10 %) 3 AC 60 Hz				400 (± 10 %) 3 AC 50 Hz 460 (± 10 %) 3 AC 60 Hz	
Rated current Fan	A	0.24				1.1	
Overload possibility[3]		20 s duration: $I = 2 \times I_{rated}$ then 70 s duration: $I = I_{rated}$ then 60 s duration: I = 0 A (cycle duration 150 s)					
Power loss for rated current, approx.	W	839	1020	1300	1827	2890	3550
Minimum load	A	10	10	10	15	15	15
Ambient temperature during operation at rated current	°C	0 ... 40 forced ventilation					
Upper limit temperature with current derating	°C	50					
Cooling air requirement	m^3/h	570				1400	2400
Sound pressure level L_{pA} (1 m)	dB	73				88	
Storage and transport temperature	°C	-25 ... +70					
Installation altitude above sea level	m	≤ 1000 at rated current max. 3500 with reduced voltage and current					
Environmental class DIN IEC 60721-3-3		3K3					
Degree of protection DIN EN 60529		IP00	IP00	IP00	IP00	IP00	IP00
D400 device type		225 Mre	285 Mre	360 Mre	525 Mre	680 Mre	900 Mre
Dimensions		See dimensional drawings					
Weight, approx.	kg	30	30	30	45	85	137

1) The fuses listed are not included with the device. The fuses listed are recommended fuses that must be ordered separately.

2) Fuses included with device. No semiconductor fuses are necessary.

3) It is permissible to operate the device without interruption with the rated connection current I_{rated}. This will cause the thyristors to reach their limit temperature. It is not possible to accelerate, i.e. increase the current from this operating state.

Technical specifications (continued)

AC power controller in the special version

Product designation		SIMOTRAS HD AC power controller					
Type		6SG7050-0EB60-0-Z H78	6SG7052-0EB60-0-Z H78	6SG7055-0EB60-0-Z H78	6SG7060-0EB60-0-Z H78	6SG7062-0EB60-0-Z H78	6SG7065-0EB60-0-Z H78
110 ... 500 V 3 AC, 42 ... 125 A, ambient temperature 65 °C (option H78)							
Rated supply voltage Power unit	V	110 -10 % ... 500 + 10 % 3 AC					
Rated frequency	Hz	50/60 The devices automatically adjust to the frequency of the applied line voltage in a range from 45 ... 65 Hz.					
Rated current	A	42	55	70	80	100	125
Rated supply voltage Electronic power supply	V	380 (-25 %) ... 460 (+15 %) 2 AC I_{rated} = 1 A or 190 (-25 %) ... 230 (+15 %) 1 AC I_{rated} = 2 A (-35 % for 1 min.)					
Phase fuse[1] 3 units	A/V	3NE1820-0 80/690	3NE1021-0 100/690	3NE10220-0 125/690	3NE1024-0 160/690	3NE1224-0 160/690	3NE1225-0 200/690
Rated supply voltage Fan	V	–		24 DC internal			
Overload possibility[2]		20 s duration: $I = 2 \times I_{rated}$ then 70 s duration: $I = I_{rated}$ then 60 s duration: I = 0 A (cycle duration 150 s)					
Power loss for rated current, approx.	W	205	230	288	322	365	445
Minimum load	A	3	6	6	6	7	7
Ambient temperature during operation at rated current	°C	0 ... 65					
Cooling air requirement	m^3/h	–		100			
Sound pressure level L_{pA} (1 m)	dB	–		40			
Storage and transport temperature	°C	-25 ... +70					
Installation altitude above sea level	m	≤ 1000 at rated current max. 3500 with reduced voltage and current					
Environmental class DIN IEC 60721-3-3		3K3					
Degree of protection DIN EN 60529		IP00	IP00	IP00	IP00	IP00	IP00
D400 device type		60 Mre	78 Mre	98 Mre	112 Mre	142 Mre	180 Mre
Dimensions		See dimensional drawings					
Weight, approx.	kg	16	16	16	16	17	17

[1] The fuses listed are not included with the device. The fuses listed are recommended fuses that must be ordered separately.

[2] It is permissible to operate the device without interruption with the rated connection current I_{rated}. This will cause the thyristors to reach their limit temperature. It is not possible to accelerate, i.e. increase the current from this operating state.

Technical specifications (continued)

Product designation		**SIMOTRAS HD AC power controller**					
Type		6SG7070-0EB60-0-Z H78	6SG7072-0EB60-0-Z H78	6SG7076-0EB60-0-Z H78	6SG7080-0EB60-0-Z H78	6SG7082-0EB60-0-Z H78	6SG7085-0EB60-0-Z H78
110 ... 500 V 3 AC, 150 ... 700 A, ambient temperature 65 °C (option H78)							
Rated supply voltage Power unit	V	110 -10 % ... 500 + 10 % 3 AC					
Rated frequency	Hz	50/60 The devices automatically adjust to the frequency of the applied line voltage in a range from 45 ... 65 Hz.					
Rated current	A	150	200	250	365	475	700
Rated supply voltage Electronic power supply	V	380 (-25 %) ... 460 (+15 %) 2 AC I_{rated} = 1 A or 190 (-25 %) ... 230 (+15 %) 1 AC I_{rated} = 2 A (-35 % for 1 min.)					
Phase fuse[1] 3 units	A/V	3NE1227-0 250/690	3NE1331-0 350/690	3NE1332-0 400/690	3NE1435-0 560/690	3NE3340-8 900/690	6RY1702-0BA01[2] 1250/660
Rated supply voltage Fan	V	400 (± 15 %) 3 AC 50 Hz 460 (± 10 %) 3 AC 60 Hz				400 (± 10 %) 3 AC 50 Hz 460 (± 10 %) 3 AC 60 Hz	
Rated current Fan	A	0.24				1.1	
Overload possibility[3]		20 s duration: $I = 2 \times I_{rated}$ then 70 s duration: $I = I_{rated}$ then 60 s duration: I = 0 A (cycle duration 150 s)					
Power loss for rated current, approx.	W	595	731	895	1280	2146	2865
Minimum load	A	10	10	10	15	15	15
Ambient temperature during operation at rated current	°C	0 ... 65					
Cooling air requirement	m^3/h	570				1400	2400
Sound pressure level L_{pA} (1 m)	dB	73				88	
Storage and transport temperature	°C	-25 ... +70					
Installation altitude above sea level	m	≤ 1000 at rated current max. 3500 with reduced voltage and current					
Environmental class DIN IEC 60721-3-3		3K3					
Degree of protection DIN EN 60529		IP00	IP00	IP00	IP00	IP00	IP00
D400 device type		225 Mre	285 Mre	360 Mre	525 Mre	680 Mre	900 Mre
Dimensions		See dimensional drawings					
Weight, approx.	kg	30	30	30	45	85	137

Option **H78**:

Operation at an ambient temperature higher than +65 °C is not possible. The rated current, reduced compared to the standard version, must be maintained across the entire temperature range of 0 ... 65 °C.

1) The fuses listed are not included with the device. The fuses listed are recommended fuses that must be ordered separately.

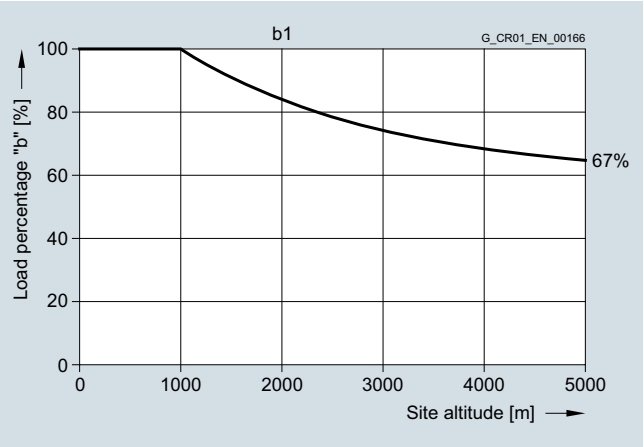
2) Fuses included with device. No semiconductor fuses are necessary.

3) It is permissible to operate the device without interruption with the rated connection current I_{rated}. This will cause the thyristors to reach their limit temperature. It is not possible to accelerate, i.e. increase the current from this operating state.

Technical specifications (continued)

Load values depending on the temperature of the coolant and installation altitude

Ambient or coolant temperature	Change in load values			
	Basic version		Special version (option **H78**)	
	Devices with self-ventilation	Devices with forced ventilation	Devices with self-ventilation	Devices with forced ventilation
+35 °C	0%	0%	0%	0%
+40 °C	0%	0%	0%	0%
+45 °C	0%	-5 %	0%	0%
+50° C	-6 %	-10 %	0%	0%
+55 °C	-12 %	Not permissible	0%	0%
+60 °C	Not permissible	Not permissible	0%	0%
+65 °C	Not permissible	Not permissible	0%	0%



Reduction factor for load values at installation altitudes above 1000 m

Selection and ordering data

Data position of Article No.	1	2	3	4	5	6	7		8	9	10	11	12		13	-Z	Order code
SIMOTRAS HD	**6**	**S**	**G**	■	■	■	■	-	■	■	■	■	■	-	**0**		
Basic version up to +40 °C or +45 °C																	
SIMOTRAS HD	**6**	**S**	**G**	■	■	■	■	-	■	■	■	■	■	-	**0**	**-Z**	**H78**
Special version up to +65 °C																	

Device version			
DC and AC power controllers for power control	**7**	**0**	
Rated current			
Basic version	Special version (option **H78**)		
60 A	42 A	**5**	**0**
78 A	55 A	**5**	**2**
98 A	70 A	**5**	**5**
112 A	80 A	**6**	**0**
142 A	100 A	**6**	**2**
180 A	125 A	**6**	**5**
225 A	150 A	**7**	**0**
285 A	200 A	**7**	**2**
360 A	250 A	**7**	**6**
525 A	365 A	**8**	**0**
680 A	475 A	**8**	**2**
900 A	700 A	**8**	**5**
Version			
Thyristor		**0**	
Rated voltage			
500 V		**E**	
Current transformer			
With current transformer		**B**	
Converter circuit			
4-quadrant device		**6**	**0**

Options

The SIMOTRAS HD converters can be ordered with the following options:

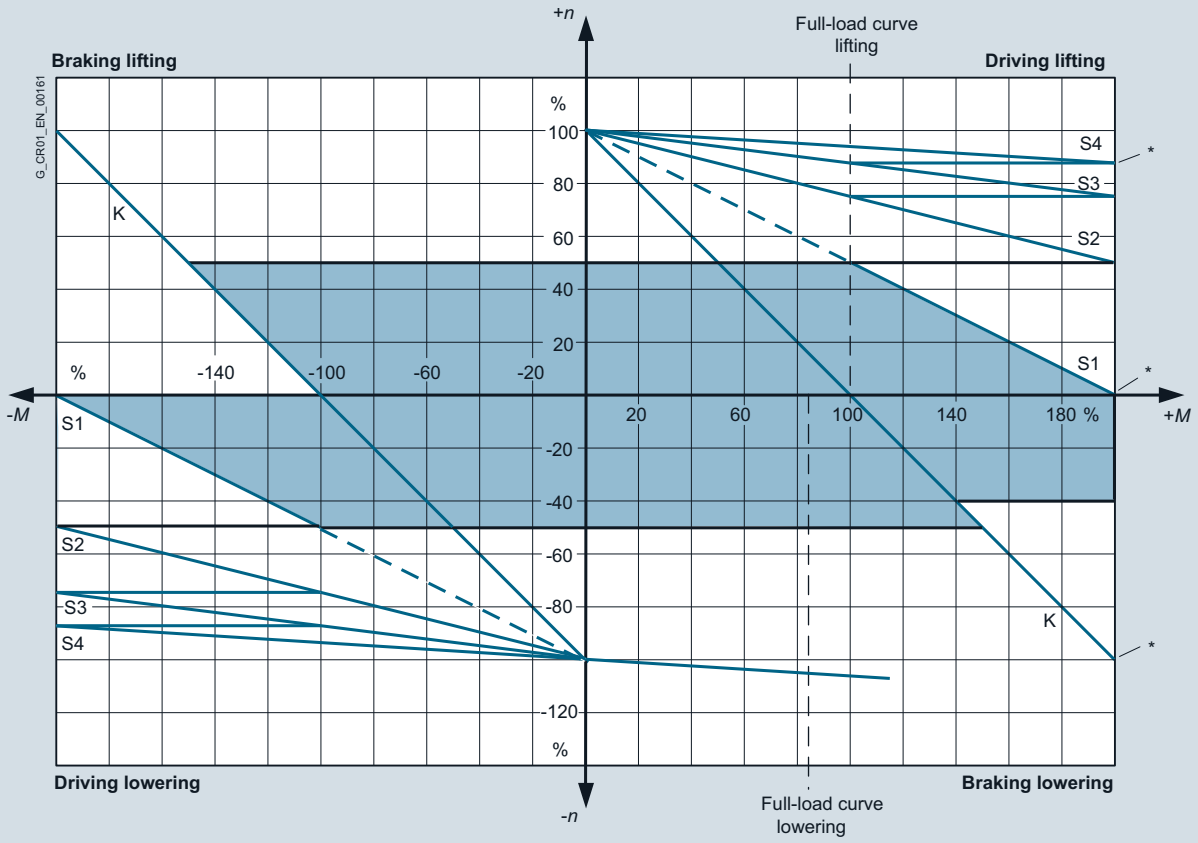
Description	Article No.	Order code
Operation of the SIMOTRAS HD devices at +65 °C ambient temperature		**H78**
SIMOTRAS HD Operating Instructions In printed form Languages: English	**6SG7000-0BA76**	**D76**
SIMOTRAS HD Operating Instructions and DriveMonitor commissioning tool On CD-ROM Languages: English, German	**6SG7000-0CD00**	**D64**

Operating Instructions in German are supplied with every device.

Characteristic curves

The speed changes steplessly in the control range when the master switch is operated. The crane driver only detects the end of the control range through latching of the master switch. Furthermore, the final stage is reached sub-synchronously or super-synchronously, depending on the load, by traversing the characteristics that are determined by the resistor increments. Current control is always operating to ensure that the set maximum torques are not exceeded. It goes without saying that the circuits are protected against reversal.

Control characteristics for hoists



SIMOTRAS HD control range

K — Characteristics for reversing mode (counter-current braking), i.e.
Delay lowering with pull-through loads or
Delay lifting when active reversing mode is required

S2, S3, S4 — Characteristics for controlled mode

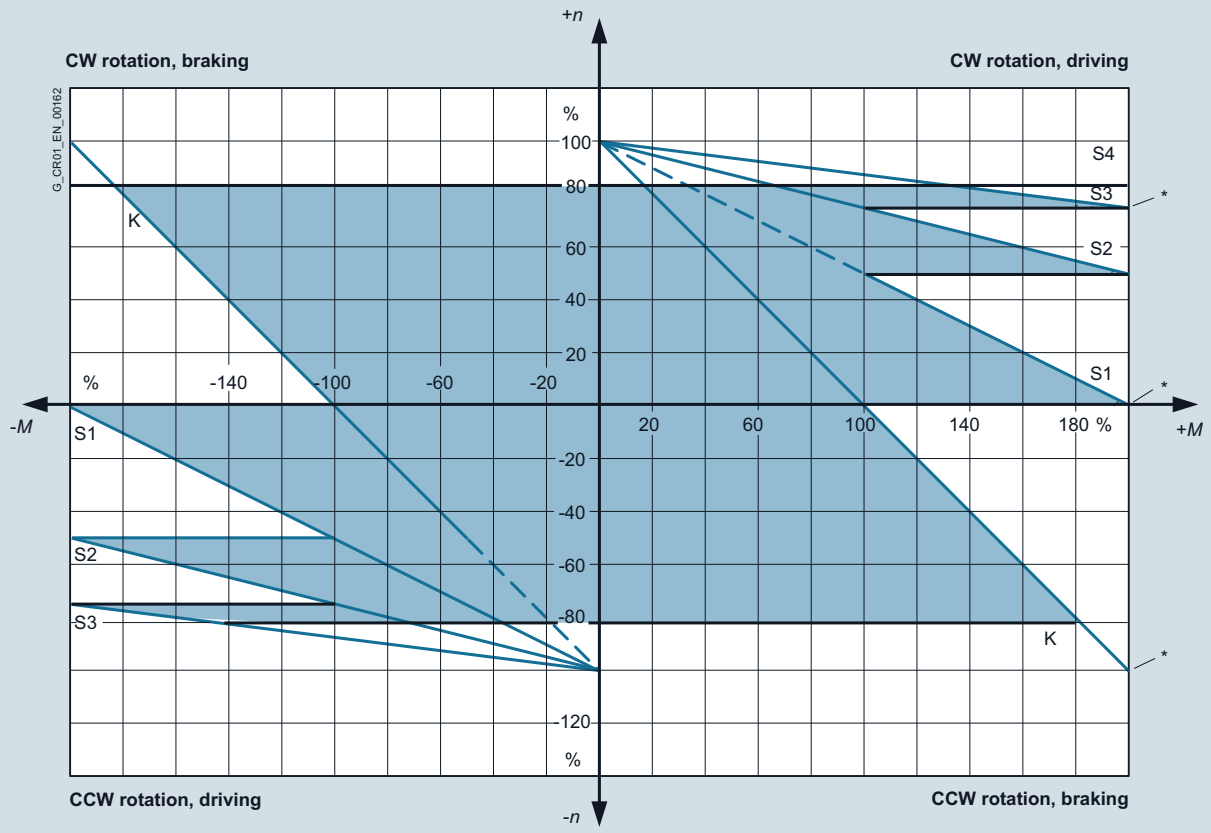
* — Use of current limiting (e.g. I_{max} = 2 x I_{rated})

Up to 4 rotor resistor switching stages can be provided. If less than 4 stages are implemented, the top stages (S3/S4) remain unused.

If the upper stages S3/S4 are not used, the over-synchronized speed increases in accordance with the parameterized characteristic on lowering. This must be taken into account when selecting overspeed protection. For this reason, a speed corresponding to the characteristic can also only be achieved during lifting.

Characteristic curves (continued)

Control characteristics for gantries

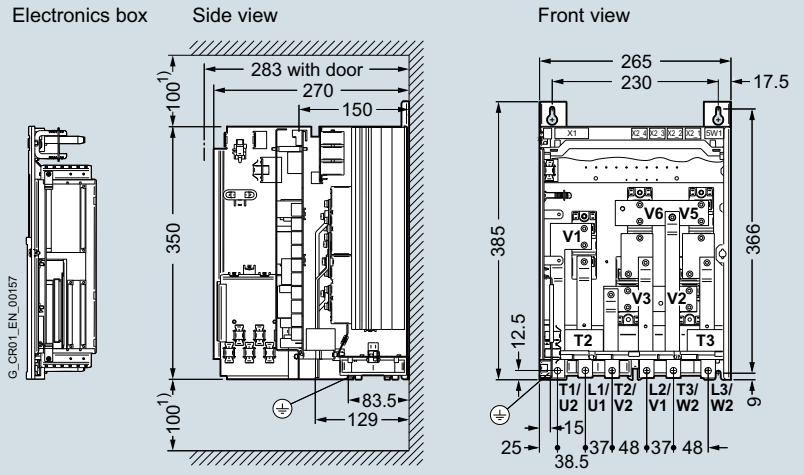


	SIMOTRAS HD control range
K	Characteristics for reversing mode (counter-current braking)
S3	Characteristics for controlled mode
*	Use of current limiting (e.g. I_{max} = 2 x I_{rated})

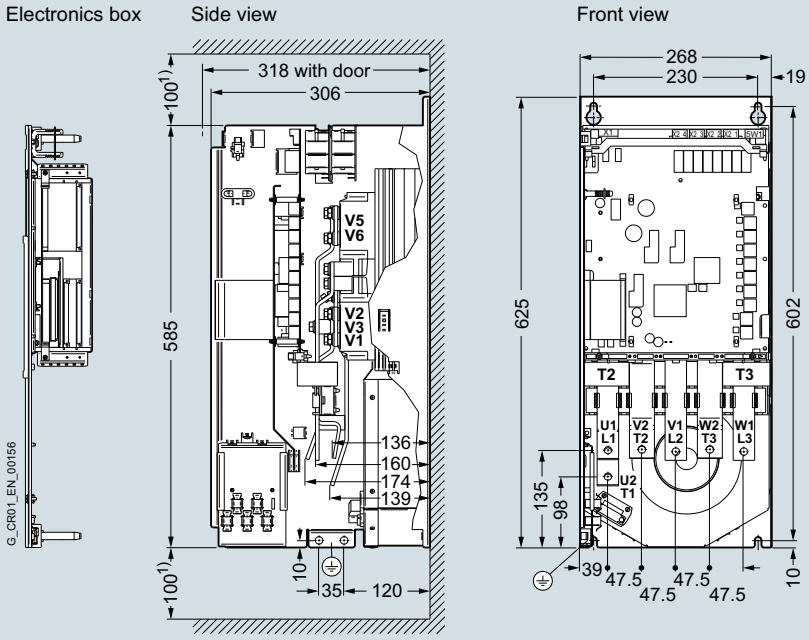
Up to 4 rotor resistor switching stages can be provided. If less than 4 stages are implemented, the top stages (S3/S4) remain unused.

Dimensional drawings

D400/60-180 Mre device type



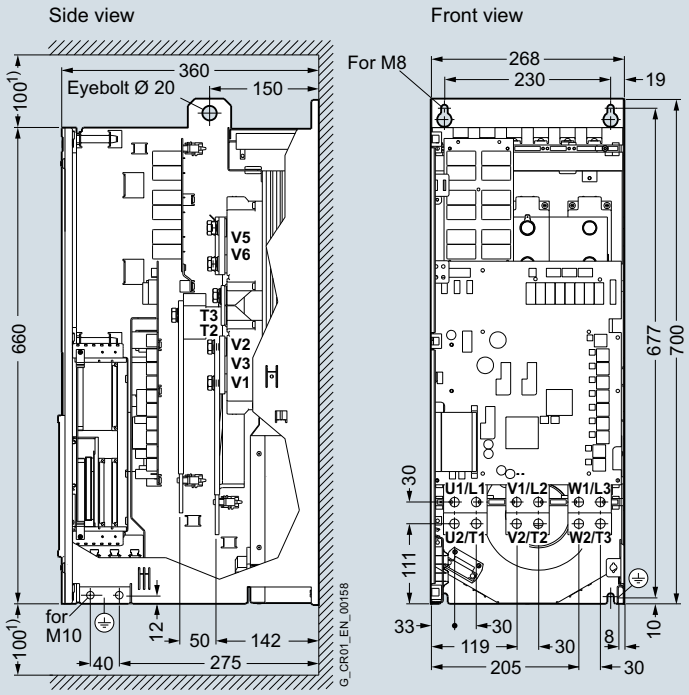
D400/225-360 Mre device type



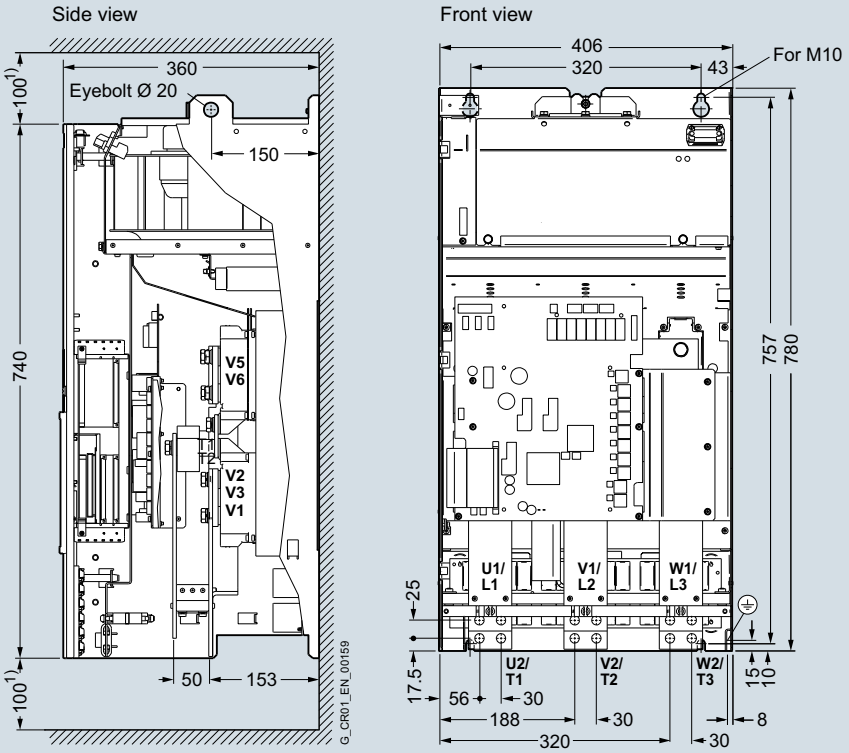
1) Minimum clearance for air circulation. An adequate flow of cooling air must be provided.

Dimensional drawings (continued)

D400/525 Mre device type



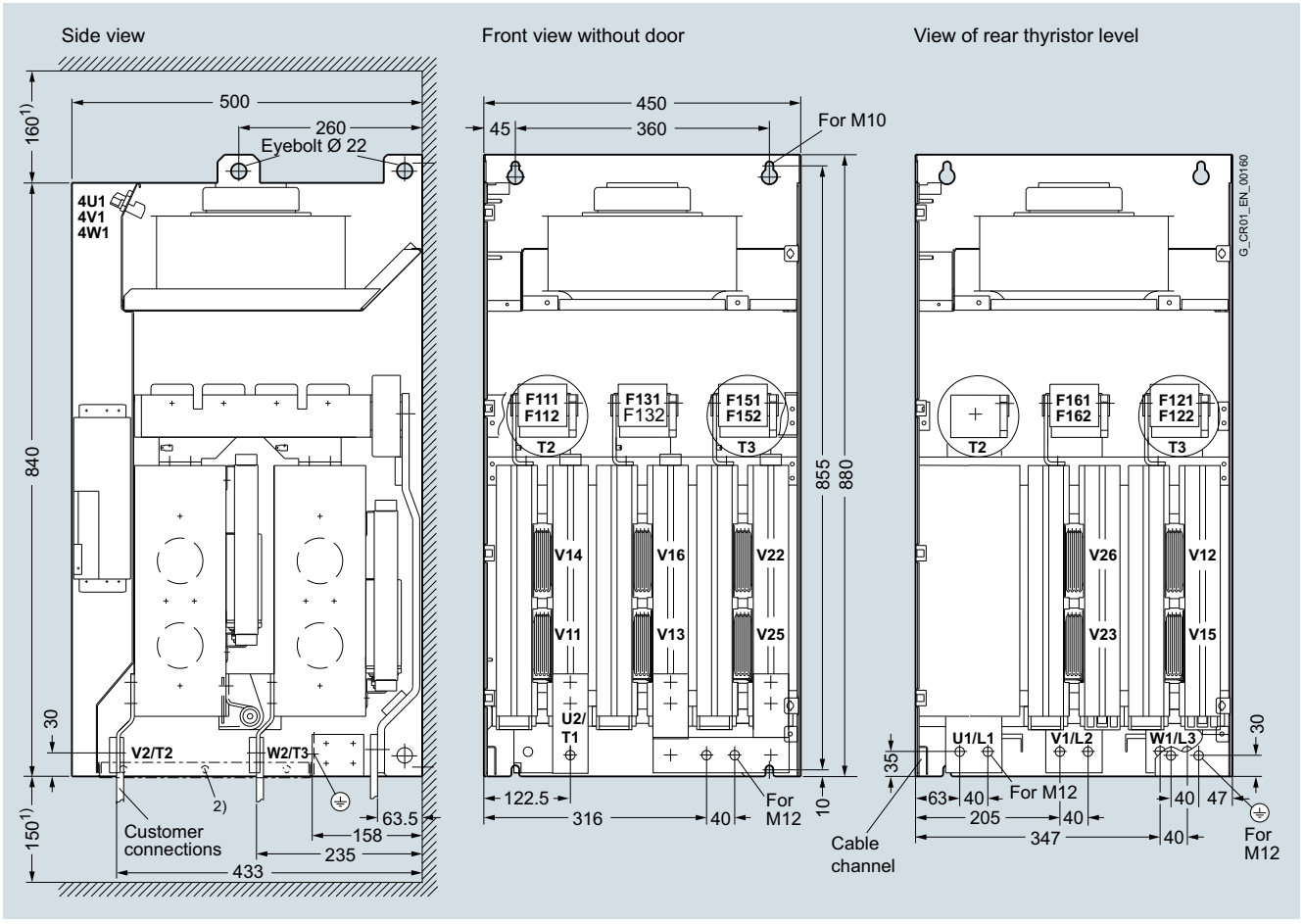
D400/680 Mre device type



1) Minimum clearance for air circulation. An adequate flow of cooling air must be provided.

Dimensional drawings (continued)

D400/900 Mre device type



1) Minimum clearance for air circulation, customer connection and fan replacement. An adequate flow of cooling air must be ensured.

2) Remove transport plate before commissioning by removing 6 M6 hexagon bolts.

More information

Reference to SIMOTRAS HE

SIMOTRAS HD is almost fully compatible with SIMOTRAS HE (6GA4625... series).

	SIMOTRAS HD	**SIMOTRAS HE**
Type	6SG70....-.....-0	6GA4625..-.....-.
Circuitry	Digital	Analog
Voltage range	110 ... 500 V 3 AC ±10 %	110 ... 500 V 3 AC ±10 %
Current range	42 ... 900 A	27 ... 1125 A
Isolated binary signals	8 inputs and 8 outputs	7 inputs and 8 outputs
Drive-related control available?	Yes	No
Do rotor contactors switch at zero current?	Yes	No
Are the devices interchangeable?	HE can be replaced with HD easily, taking the installation conditions into account. External activation of the HE must be adapted to the internal drive-based control of the HD!	HD can only be replaced with HE after careful inspection, possibly by external service providers. Additional equipment is necessary. Check the installation conditions!
Are the pulse generator evaluation, setpoint encoder, etc. standard?	Yes	No
Are freely connectable terminals and spare function blocks available for calculation and closed-loop control as well as for logic operations?	Yes	No
Is binary and analog terminal expansion possible?	Yes, via status display	No
CE marking present?	Yes	Yes

Overview

Electronics options are available for SIMOTRAS for expanding the interfaces available as standard.

The CUD2 terminal expansion module expands the SIMOTRAS HD with the necessary inputs/outputs for connecting a 4-stage master switch. A master switch with a setpoint potentiometer can be connected direct to the SIMOTRAS HD without a CUD2 terminal expansion module.

The CUD2 terminal expansion module is ordered separately and mounted on-site in the SIMOTRAS HD.

Selection and ordering data

Description	Article No.
Terminal expansion module CUD2	**6RX1700-0AK00**

Accessories

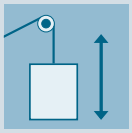
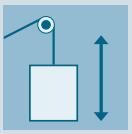
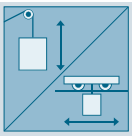
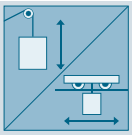
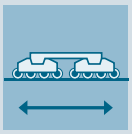
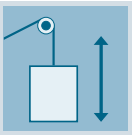
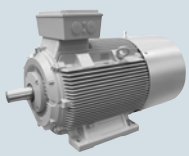
The following accessories are also available for SIMOTRAS HD:

Description	Article No.
Connecting cable between DriveMonitor and PC PMU (RS232) Length: 3 m	**9AK1012-1AA00**
SIMOTRAS HD Operating Instructions In printed form: • German • English	 **6SG7000-0BA00** **6SG7000-0BA76**
SIMOTRAS HD Operating Instructions and DriveMonitor commissioning tool On CD-ROM Languages: English, German	**6SG7000-0CD00**

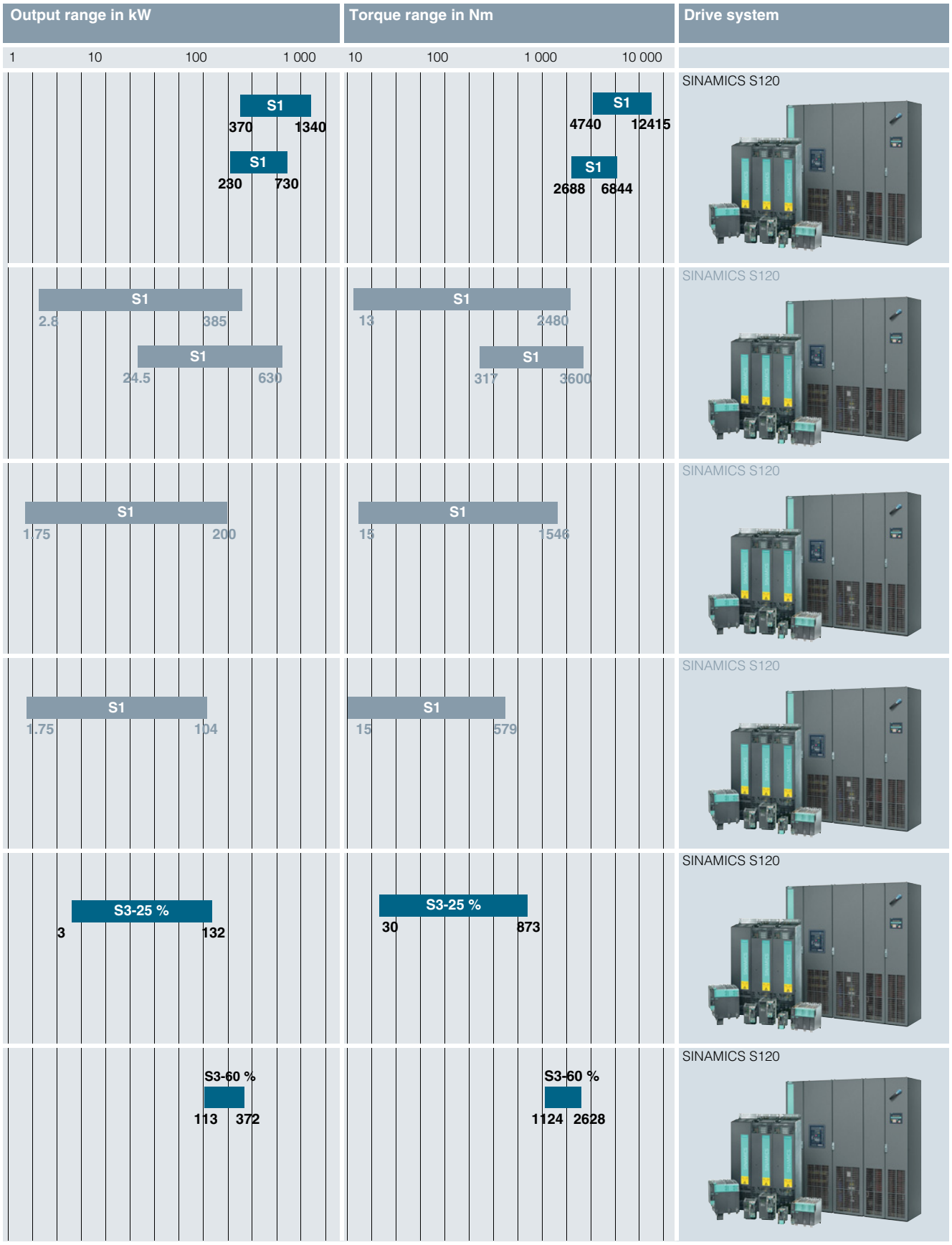
SIMOTICS motors for cranes

Type overview and rating data

Overview

Application	Motor type	Characteristics	Degree of protection	Cooling method	Shaft height	
	**SIMOTICS M-1PH8** 	Asynchronous motor without housing	IP23 IP55	Forced ventilation Forced ventilation	SH 355 SH 355	Page 7/12
	**SIMOTICS M-1PH8** 	Asynchronous motor without housing	IP55 IP23	Forced ventilation Forced ventilation	SH 80 – 280 SH 180 – 280	Catalog PM 21
	**SIMOTICS SD 1LE1** 	Asynchronous standard motor	IP55	Self-ventilated	SH 100 – 315	Catalog D 81.1
	**SIMOTICS SD 1LG4, 1LG6** 	Asynchronous standard motor	IP55	Self-ventilated	SH 100 – 280	Catalog D 81.1
	**SIMOTICS SD 1LP4, 1LP6** 	Asynchronous standard motor	IP55	Natural cooling	SH 132 S – 280 M	Page 7/26
	**SIMOTICS SD 1LG4, 1LG6** 	Asynchronous standard motor	IP55	Surface cooling with forced ventilation	SH 315 L	Page 7/59

Overview (continued)



7

Overview

Siemens has for many years been one of the leading manufacturers of crane motors. This type overview covers the current range of three-phase motors for use in cranes.
The technical specifications for hoisting motors 1PH8 of shaft height 355 (85 dB(A)), for gantry motors 1LP4, 1LP6 of shaft height 132-280 with fitted brake and for the hoisting motors 1LG4, 1LG6 of shaft height 315 with external fan you can find in this Catalog.

The technical specifications for the hoisting motors 1PH8 of shaft height 80-280 can be found in Catalog PM21, Chapter 5 SIMOTICS main motors. For the technical specifications for hoisting- and gantry motors 1LE1 of shaft height 100-315 and 1LG4, 1LG6 of shaft height 100-280 see Catalog D 81.1.

In addition to these motors, for high outputs in hoisting gear, SIMOTICS FD motors (1LM1/1LQ1/1LL1/1LP1, Catalog D 81.8) can be used as hoist motors in converter-fed drives.

The range of crane motors is aimed at crane manufacturers, system integrators, and crane operators. To make it easier to select motors, they are listed by speed and output (continuous and intermittent duty). The tables indicate the rated motor torques and the maximum permissible torques.

The asynchronous motors with the DURIGNIT 2000 winding insulation are suitable for use on the SINAMICS S120 drive system. Since the hoist motors in particular operate in a large field weakening range during converter operation, you must check – alongside the usual design criteria such as thermal load (rms torque) and maximum acceleration torque – whether the motor can still generate the required maximum torque in the field weakening range. A torque-speed diagram can be created to check this.

The requirements of the motors vary depending on the application conditions:

- Gantry cranes that are used in production halls are not usually directly subjected to climatic influences. The motors do not necessarily need high degrees of protection or special paint.
- Cranes located in seaports are often exposed to harsh weather, which means that special measures must be taken to protect the motors against corrosion as well as the ingress of dust and water.
- Cranes in steel works are often subject to very high ambient temperatures. The electrical and mechanical design (e.g. special bearings) must take this into account.

Application

Siemens crane motors are particularly suitable for crane operations under difficult conditions. These robust motors

- offer a high degree of protection and are particularly suitable for harsh operating conditions
- offer torque reserves that can handle high impulse loads
- are specially optimized for high-inertia drives with high torque

Both SIMOTICS SD and SIMOTICS M motors are used in crane applications.

SIMOTICS M are main motors which are used in crane applications primarily as hoist motors. With a power spectrum ranging from 2.8 kW to 1340 kW, they cover virtually every application. The compact asynchronous servo motors/main spindle motors are perfectly adapted to the SINAMICS S120 drive system.

The compact SIMOTICS SD asynchronous standard motors with cast-iron housing are particularly rugged and are, therefore, the first choice in crane applications.

Configuration

Motor dimensioning

When motors for crane drives are dimensioned (high-inertia drives), two criteria must be taken into account:

- The required maximum torque (starting torque)
- The rated output (thermal motor capacity)

When you check the torque, you check whether the motor can generate the required maximum torque (e.g. for acceleration). The maximum permissible torque is greater than the rated torque and is often specified as a multiple of the rated torque. An adequate safety margin from the stalling torque must be maintained.

When the output is dimensioned, the rated motor output is adjusted in accordance with the effective power requirements of the drive. The rated motor output depends on the motor temperature which, in turn, is influenced by the operating mode and the thermal behavior of the motor. The rating data of a motor differs for the various operating modes in accordance with EN 60034-1. The data is usually specified for one or more of the following operating modes:

- Continuous duty S1 (also corresponds to intermittent duty S3-100 %)
- Short-time duty S2
- Intermittent duty S3

Intermittent duties S4 and S5 vary to such an extent that accurate data can only be provided when certain additional conditions have been clearly defined.

The operating modes are defined in accordance with EN 60034-1.

Symbols used in formulae:

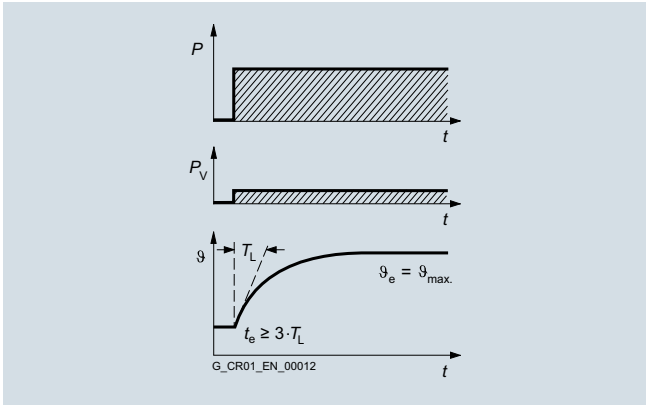
P	Load/specified motor output
P_V	Power loss of the motor
ϑ_e	Final temperature, steady-state temperature
ϑ_{max}	Max. winding temperature in respective operating mode
ϑ_{mean}	Mean winding temperature
t_e	Operating time
t_P	Idle time
t_S	Duty cycle duration
T_L	Thermal time constant of the motor (running)
T_{St}	Thermal time constant of the motor (stationary)

Configuration (continued)

Continuous duty (S1)

Definition

Operation with a constant load state, the duration of which is sufficient to attain thermal equilibrium.



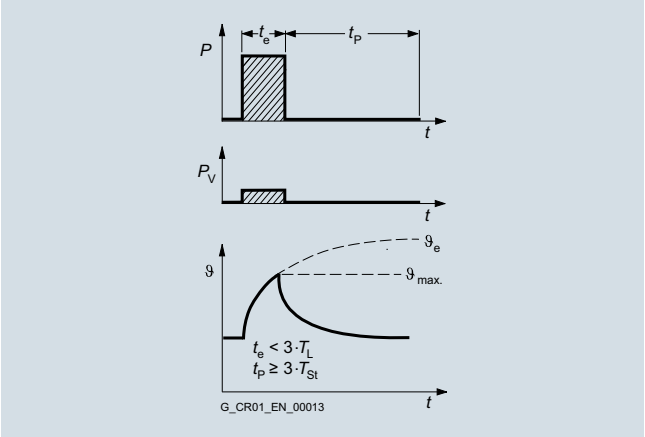
Explanation

The operating time t_e of the motor must be greater than 3 × T_L to ensure that thermal equilibrium is attained. The rated motor output for continuous duty must be designed such that the final temperature ϑ_e matches the permissible winding temperature. Start-up is deliberately discounted under the assumption that a single high-inertia start will not achieve the final temperature. The length of the subsequent idle time is insignificant. Caution is advised, however, when high-inertia starting is carried out on a warm machine or when a machine is started up several times in succession. Certain restrictions may apply or advice from a third party should be sought.

Short-time duty (S2)

Definition

Operation with a constant load state that, however, does not last long enough to attain thermal equilibrium, followed by idle time that lasts until the machine temperature differs from the coolant temperature by no more than 2 K.



Explanation

The operating time t_e must be less than 3 × T_L to ensure that the theoretical final temperature is not reached. The rated motor output and the operating time are harmonized in such a way that the maximum winding temperature ϑ_{max} does not exceed the permissible values. Here, too, start-up is deliberately discounted because it is assumed that the machine starts up cold and the start-up procedure is short with respect to the operating time t_e.

The rated motor output for short-time duty can be higher than for continuous duty, although the permissible operating time must also be specified. The shorter the operating time, the higher the rated output of the machine. Operating times of 10, 30, 60, and 90 minutes are recommended.

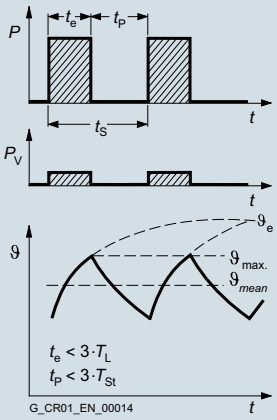
The subsequent idle time must be sufficiently long to ensure that the machine can cool back down to the ambient temperature (i.e. t_P is greater than or equal to 3 × T_{St}) because otherwise the maximum temperature will be exceeded the next time a similar duty cycle is carried out.

Configuration (continued)

Intermittent duty without the effect of the start-up process (S3)

Definition

Operation that involves a sequence of similar duty cycles, each with a constant-load period and idle time, whereby the starting current does not have a noticeable effect on the temperature rise (the duty cycle duration is generally short enough to ensure that thermal equilibrium is not attained).



Explanation

The operating time t_e must be less than $3 \times T_L$ to ensure that the theoretical final temperature ϑ_e is not reached. The subsequent idle time t_p, however, is also less than $3 \times T_{St}$, which means that the ambient temperature is no longer reached. A mean steady-state value ϑ_{mean} develops around which the temperature varies, but is below the theoretical final temperature ϑ_e.

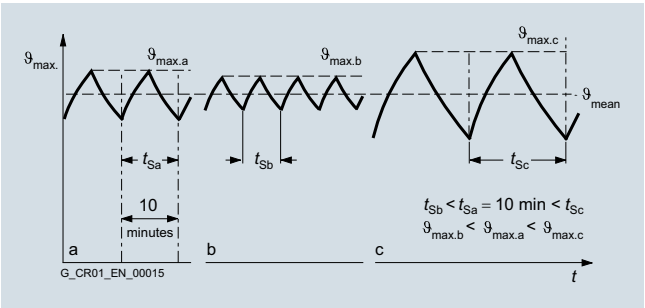
The rated motor output during intermittent duty is greater than during continuous duty. The time constants T_L and T_{St} may be different. This influences the rated output during intermittent duty and is taken into account in the S3 motor tables.

To determine the most suitable motor, therefore, a knowledge of the operating and idle times is required in addition to the required output during the operating time. They are specified by the duty cycle duration (total time) and the relative ON duration in % of the cycle duration. If no data has been provided for the duty cycle duration, 10 minutes apply in accordance with DIN EN 60034-1. The S3 motor tables are based on this. Values of 15, 25, 40, and 60 % are recommended for the cyclic duration factor.

Effect of varying duty cycle durations

The S3 rated output is designed in such a way that the temperature peaks ϑ_{max} match the permissible values with a 10 minute duty cycle duration (see "a" in diagram below). Shorter duty cycle durations are not critical because lower temperature peaks occur at the same mean winding temperature ϑ_{mean} (see "b" in diagram below). Since longer duty cycle durations result in higher temperature peaks (see "c" in diagram below) which, in turn, reduce the service life of the insulation, advice from a third party should be sought in this case.

In S3 duty, the start-up processes are not discounted; the relevant standard assumes that they do not have any significant influence on the temperature rise. Any number of duty cycles can be carried out per hour provided that this standard is fulfilled.



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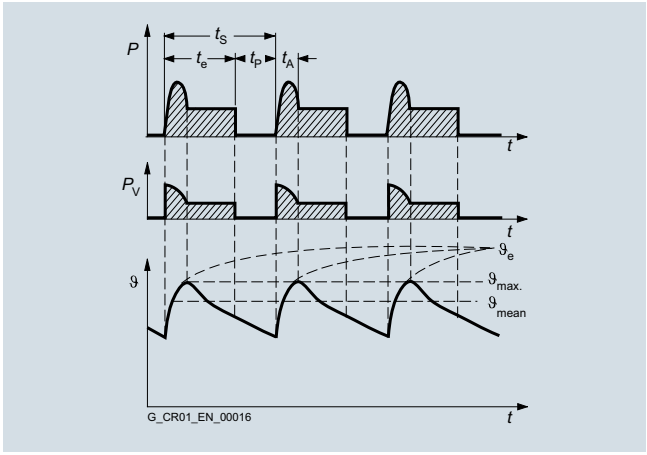
Configuration (continued)

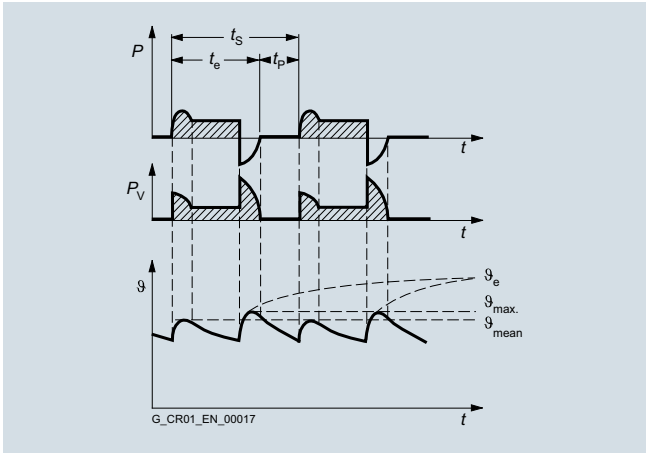
Intermittent duty with effect of the start-up process (S4)
Intermittent duty with effect of the start-up process and electrical braking (S5)

Definition

Operation that involves a sequence of similar duty cycles, each with a noticeable start-up time, a constant-load period, a period of rapid electrical braking (with S5), and idle time.



Intermittent duty S4



Intermittent duty S5

Explanation

These operating modes closely resemble S3 duty, except that the temperature rise caused by start-up and, in some cases, electrical braking are also included. This additional power loss depends on the acceleration torque and the time in which this occurs; in other words, it depends on the linear and rotating masses to be accelerated (kinetic energy). The masses that are moved, therefore, must be known. These are based on the moment of inertia referred to the motor shaft. How often and over what period of time the masses are subject to acceleration and braking procedures must also be known.

The more duty cycles performed by the crane drives every hour (e.g. short traveling distances or low hoisting heights), the greater the importance of the acceleration work for motor dimensioning purposes.

To accurately dimension a motor for duty cycles S4 and S5, therefore, the following information is required in addition to the steady-state output:

- Cyclic duration factor (CDF)
- External moment of inertia
- Acceleration or acceleration torque
- Accelerating time
- Number of working cycles per hour

General performance specifications for motors in S4/S5 duty are not possible because they always vary depending on the specific conditions under which the driven machine is operating (external moment of inertia) and the operating mode (working cycles, ON duration). Crane drives do not have a constant load across several working cycles but instead have a collective load.

Configuration (continued)

Calculating the rms value, ON duration

Actual duty can also be converted to a thermally equivalent S3 mode by means of "rms value calculation", which means that the S3 motor tables can be used again.

A torque diagram (duty cycle diagram) must be available when the calculation is performed (see diagrams below).

The value (assumed to be constant throughout the operating time) that would generate the same temperature rise as the actual torque is defined as the rms torque. The ON duration is the sum of operating times with respect to the total duty cycle duration.

If the individual traveling duty cycles are not the same (e.g. due to different loads or distances), all the different traveling cycles must be included in the rms value and ON duration calculation until they repeat themselves.

Differences in thermal behavior when the motor is running and when it is at a standstill are already taken into account with respect to the ON durations in the S3 tables. For this reason, M_{rms} must be calculated with respect to the operating time t_e and not to the duty cycle duration t_S.

To ensure that the rms value can be defined with sufficient accuracy, however, the operating phases during which the motor is not cooled as efficiently must be taken into account (e.g. during correction runs at low speeds and with naturally cooled motors).

Effects such as these can only be taken into account by the motor manufacturer.

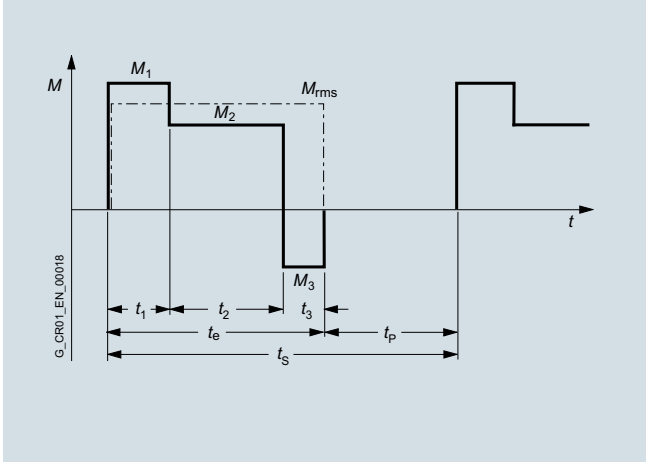
The operating conditions for hoist and traversing gears also vary enormously:

- The external moment of inertia with respect to the motor moment of inertia is usually greater in traversing gears than in hoist gears; in other words, the acceleration and braking work are more relevant for traversing gears than for hoists even when the number of duty cycles performed and the ON duration are the same.
- The steady-state torque (load torque) with respect to the rated motor torque is usually greater in hoists than in traversing gears (traveling resistance).
- The torque diagram for traversing gears does not take the direction of travel into account (without wind forces). The effect of the payload is minimal with high traversing gear weights; i.e. with handling cranes, it is repeated after each travel movement (after the second travel movement at the latest).
- The torque diagram for hoists is largely dependent on the load. The motor torques when the same load is hoisted and lowered are different (efficiency) and, in the case of handling cranes, a traveling duty cycle with a load is usually followed by a traveling duty cycle with empty load tackle (collective loading; see also FEM, Section I, Calculation Principles for Cranes); i.e. the cycle required for calculating the rms value is repeated after the fourth travel movement at the earliest.

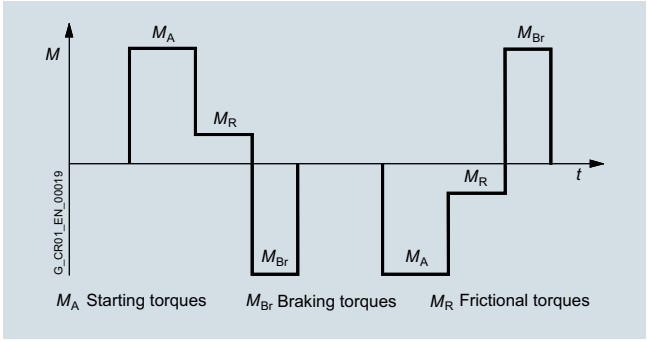
$$M_{rms} = \sqrt{\frac{\Sigma M^2 \times t}{t_e}}$$

$$ED = \frac{t_e \times 100}{t_S} \%$$

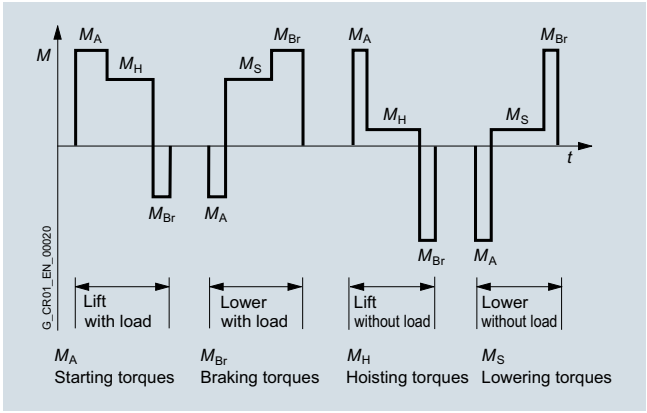
ED	ON time
M_{rms}	rms torque
M_1, M_2, M_3	Torques in travel diagram
t_1, t_2, t_3	Operating times of torques M_1, M_2, M_3
t_P	Idle time
t_e	Operating time of motor = $t_1 + t_2 + t_3$
t_S	Duty cycle duration = $t_e + t_P$



Torque diagram



Typical torque diagram for a gantry across one conveying cycle



Typical torque diagram for hoist across one conveying cycle

Technical specifications

Standards and specifications

The motors comply with the appropriate standards and regulations, especially those listed in the table below.

Title	IEC	DIN/EN
General specifications for rotating electrical machines	IEC 60034-1 IEC 60085	DIN EN 60034-1
General-purpose three-phase induction motors having standard dimensions and outputs	IEC 60072 mounting dimensions only	DIN EN 50347
Start-up characteristics for rotating electrical machines	IEC 60034-12	DIN EN 60034-12
Terminal designations and direction of rotation for rotating electrical machines	IEC 60034-8	DIN EN 60034-8
Designation for construction types, installation and terminal box position	IEC 60034-7	DIN EN 60034-7
Entry to terminal box	–	prDIN 42925 (08/99)
Built-in thermal protection	IEC 60034-11	–
Noise limit values for rotating electrical machines	IEC 60034-9	DIN EN 60034-9
IEC standard voltages	IEC 60038	DIN EN 60038
Cooling methods for rotating electrical machines	IEC 60034-6	DIN EN 60034-6
Mechanical vibrations for rotating electrical machines	IEC 60034-14	DIN EN 60034-14
Vibration limits	–	DIN ISO 10816
Degrees of protection of rotating electrical machines	IEC 60034-5	DIN EN 60034-5

Testing, quality assurance, acceptance inspection

Type testing is carried out for new machines. In series production, each motor is subjected to a routine test.

As part of quality assurance measures, the motors are subjected to in-process inspections.

Type test or routine test certificates can be issued upon request (must be specified in the order).

Inspection of motors by a customer or a customer's agent incurs additional expense because each motor will already have undergone standard testing. The inspection criteria must be specified in the order (fully clarified) as this is then used as a basis for calculating the overhead and billable costs.

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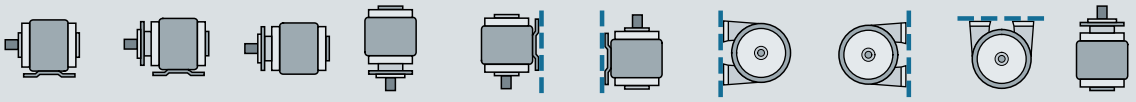
[1] DE is the motor's drive end with shaft. NDE is the motor's non-drive end.

Technical specifications (continued)

Types to EN 60034-7/IEC 60034-7

Hoisting gear motors are primarily used in construction types IM B3, IM B5, IM V1, and IM B35, although they can be supplied in other construction types (please inquire).

The individual sections in this catalog provide information about the listed available construction types of the various motor series.



EN 60034-7 Code I	IM B3	IM B35	IM B5	IM V1	IM V5	IM V6	IM B6	IM B7	IM B8	IM V3
EN 60034-7 Code II	IM 1001	IM 2001	IM 3001	IM 3011	IM 1011	IM 1031	IM1051	IM 1061	IM 1071	IM 3031

Insulation

The insulation system protects the winding against aggressive gases, vapors, dust, oil and increased air humidity. It can withstand the vibration stresses and ambient conditions that normally occur in hoisting operations.

Temperature classes

In EN 60034-1, the winding insulation (incl. impregnating material) is classified into temperature classes which are assigned specific overtemperatures.

The motor output specifications are uniformly based on a coolant temperature of 40 °C at an installation altitude of 1000 m above sea level for all insulation classes. The various sections in this catalog provide information about the permissible outputs under other ambient conditions.

Temperature limit in K according to temperature class

Temperature class	**B**	**F**	**H**
Temperature limit	80 K	105 K	125 K

Mechanical balance quality

Dynamic balancing

All rotors in hoisting gear motors are dynamically balanced with an inserted half featherkey. This corresponds to vibration severity grade A (normal). EN 60034-14 specifies the factory acceptance vibration test procedures and vibration limits for electrical machines. "Half-key balancing" (half featherkey = code H) is specified here based on ISO 8821.

Full-key balanced machines can also be shipped as special versions (please inquire).

Note for 1LP and 1LG three-phase squirrel-cage motors:

Low-vibration version B can be supplied to fulfill stricter requirements on smooth running. For converter-fed operation with frequencies greater than 60 Hz, special balancing is required for compliance with the specified limit values (plain text: maximum supply frequency/speed).

Vibration severity

The vibration severity is the r.m.s. value of the vibration velocity (frequency range from 10 to 1000 Hz).

A motor balanced in accordance with the relevant standard, however, may vibrate more strongly at the operating site.

This can be caused by the following factors:

- Unsuitable foundation
- Interference from the driven machine
- Components with a natural frequency that is almost identical to the frequency of the residual unbalance of the motor.

In cases such as these, each element in the system – not just the motor itself – needs to be checked.

The table below shows the limit values of electrical machines in accordance with EN 60034-14 Sept. 2004.

Limits (rms values) of max. vibration variables of vibration displacement *s*, vibration velocity *v* and acceleration *a* for the shaft height H

Vibration severity grade	Machine installation	Shaft height H in mm								
		56 < H ≤ 132			132 < H ≤ 280			H > 280		
		s_{rms} µm	v_{rms} mm/s	a_{rms} mm/s²	s_{rms} µm	v_{rms} mm/s	a_{rms} mm/s²	s_{rms} µm	v_{rms} mm/s	a_{rms} mm/s²
A	Free suspension	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
	Rigid clamping	21	1.3	2.0	29	1.8	2.8	37	2.3	3.6
B	Free suspension	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8
	Rigid clamping	–	–	–	14	0.9	1.4	24	1.5	2.4

The balancing type is stamped on the face of the DE[1)] shaft extension:

- F = Balancing with full featherkey
- H = Balancing with half featherkey
- N = Balancing without featherkey

1) DE is the motor's drive end with shaft. NDE is the motor's non-drive end.

Technical specifications (continued)

Bearings

All motors are equipped with rolling-contact bearings.

Motors equipped with cylindrical roller bearings are shipped with a rotor shipping brace to prevent brinelling in the DE[1] bearings during transportation and storage.

Shaft extensions

The squirrel-cage motors up to and including shaft height 160 have cylindrical shaft extensions. The motors are always supplied with a featherkey inserted in the shaft.

Coupling

The standard versions of hoisting gear motors are designed for coupling output. Pinion, chain, and belt outputs generate greater cantilever forces and bearing loads, which must be taken into account.

Motor protection

Hoisting gear motors are operated with a higher load factor in intermittent duty. If there is excessive power consumption, an undervoltage in the supply, an excessive ON duration, or excessive coolant temperatures or if the heat is not being dissipated adequately (speed of naturally cooled machines is too low), this can cause the temperature in the windings to rise and the motors to overheat. Direct and indirect measures can be taken to protect the motors from overheating. An adequate monitoring concept should take into account all the relevant factors.

In intermittent duty, devices that offer indirect protection (e.g. circuit-breakers, overload relays, or I^2t monitors) can only partly detect the causes of overheating.

The most reliable method is to detect excessively high temperatures directly at the point at which they occur (i.e. the machine windings). In this way, the effects of all possible causes can be detected by a single means.

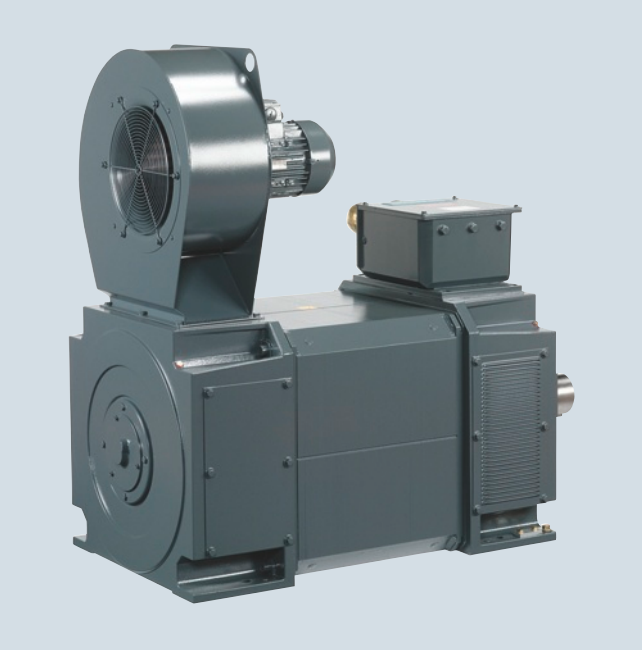
The resistance of the PTC thermistor detectors integrated in the windings increases significantly if the response temperature is exceeded. A tripping unit (Catalog LV1) detects this increase and uses a contact to intervene in the open-loop control. An additional detector loop for emitting a warning signal just below the shutdown temperature can also be used in process-critical production processes to allow working cycles that have already been started to be brought to an end.

It is recommended that KTY 84 temperature sensors be installed in converter-fed drives (the basic version of 1PH8 motors are equipped with these sensors as standard). This sensor is embedded in the winding head of the motor in the same manner as a PTC thermistor. The data is evaluated directly in the converter. Warning and shutdown response limits can be set. Since only one sensor can be evaluated in the converter, this motor protection method is only suitable in single-motor drives; PTC thermistors are recommended for drives with more than one motor (e.g crane traversing gears).

[1] DE is the motor's drive end with shaft. NDE is the motor's non-drive end.

1PH8 for SINAMICS S120 for cranes

Overview



1PH8 three-phase motor, shaft height 355

The innovations in the field of modern crane installations place higher and higher demands on compact asynchronous motors.

The compact asynchronous motor 1PH8 of shaft height 355 covers the increased performance requirements, e.g. for intermittent duty S3-40 % with up to 1.97 MW.

This motor serie is a converter solution which has been developed for use in conjunction with the SINAMICS S120 drive system. The 1PH8 asynchronous motors have the following features:

- Forced ventilated asynchronous motors with squirrel-cage rotor with IP55 degree of protection. The motors are ventilated as standard by a radial, externally mounted fan unit. With the "enhanced corrosion protection" option, the motors can also be installed outdoors.
- Forced ventilated asynchronous motors with squirrel-cage rotor with IP23 degree of protection. These motors are also ventilated as standard by a radial, externally mounted fan unit. These motors are particularly suitable for installation in power houses.

Benefits

- High power density with small motor dimensions
- Wide speed control ranges
- Speed down to zero without reducing the torque (constant torque characteristic)
- High rotational accuracy, even at the lowest speeds
- Fitted as standard with regreasing unit and insulated NDE bearing
- Optimized for converter-fed operation on SINAMICS
- Large selection of options

Technical specifications

Insulation of the stator winding according to EN 60034-1 (IEC 60034-1)	Utilization to temperature class 155 (F) for a coolant temperature of up to 40 °C
Cooling in accordance with EN 60034-6 (IEC 60034-6)	Radial fan NDE top mounted (intake from NDE)
Temperature monitoring	KTY 84 temperature sensor in the stator winding additional KTY 84 as spare
Motor supply voltage (for technical specifications, see the ventilation data and sound pressure level)	400 V 3 AC, 50/60 Hz 480 V 3 AC, 60 Hz
Type of construction according to EN 60034-7 (IEC 60034-7)	IM B3
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP23 or IP55
Shaft extension on the drive end according to DIN 748-3 (IEC 60072-1)	Feather key full or half-key balancing
Shaft and flange accuracy according to (IEC 60072-1)[1)]	Tolerance N (normal) Tolerance R (reduced)
Vibration severity according to Siemens/ EN 60034-14 (IEC 60034-14)	Level A (normal) Level R/A (reduced)
Sound pressure level according to DIN EN ISO 1680 Tolerance +3 dB	Sound pressure level 85 dB(A)
Maximum speeds	2800 rpm
External encoder systems	Incremental encoder HTL 1024 S/R POG 10 (Baumer-Hübner) Incremental encoder HTL 1024 S/R HOG 28 (Baumer-Hübner)
Connection	Terminal box NDE right or DE top
Paint finish	Standard paint finish, anthracite, RAL 7016
Options	Refer to Options and Selection and ordering data

S/R = signals/revolution

Notes:

The rated motor data is specified in the selection and ordering data for a nominal pulse frequency of 2.5 kHz.

[1)] Rotational accuracy of shaft extension, concentricity of spigot and shaft and perpendicularity of mounting face of flange to shaft.

Technical specifications (continued)

Motor version **Forced ventilation** (see 8th and 11th positions in the Article No.)	Fan motor: Current consumption at 400 V/50 Hz (± 10 %)	400 V/60 Hz (± 10 %)	460 V/60 Hz (± 10 %)	Direction of air-flow	Sound pressure level L_{pA} (1 m) Motor + external fan, rated load, tolerance +3 dB, nominal pulse frequency 2.5 kHz	Volume of air min.
	A	A	A		dB	m^3/s
1PH8 motors, shaft height 355						
1PH835.-7..1 (asynchronous version, external fan with noise level of 85 dB(A), IP55 degree of protection)	8.2	7.9	7.9	NDE → DE DE → NDE	85	1
1PH835.-7..4 (asynchronous version, external fan with noise level of 85 dB(A), IP23 degree of protection)	8.2	13.2[1]	10.9[2]	NDE → DE DE → NDE	85	1.3

Important note:

For 1PH8/SH 355/IP23/85 dB(A) motors, a special fan motor must be ordered using option **R60**/**R61** for operating the external fan on a supply voltage of 60 Hz (see Selection and ordering data/Article No. supplements).

Terminal box, max. connectable conductor cross sections

Terminal box type (see selection and ordering data for details)	Cable entry (power)	Cable entry (external signals)	Outer cable diameter, max.[3]	Number of main terminals	Cross section, max. per terminal	Current, max. per terminal[4]
			mm		mm^2	A
1PH8 motors, shaft height 355						
1XB7712-P01[5]	3 × M63 × 1.5	1 × M20 × 1.5 [6] 1 × M25 × 1.5 [7]	53	Phases: 3 × 4 M16 Grounding: 4 × M16	3 × 95	450
1XB7712-P03[5]	4 × M75 × 1.5	1 × M20 × 1.5 [6] 1 × M25 × 1.5 [7]	68	Phases: 3 × 4 M16 Grounding: 4 × M16	4 × 185	1150
1XB7820-P00	Not drilled	1 × M20 × 1.5 [6] 1 × M25 × 1.5 [7]	–	Phases: 2 × 3 × 4 M16 Grounding: 8 × M16	8 × 240	2100

.

1) Special fan for operation at 460 V/60 Hz (± 10 %), option: **R60** (see Selection and ordering data/Article No. supplements).

2) Special fan for operation at 400 V/60 Hz (± 10 %), option: **R61** (see Selection and ordering data/Article No. supplements).

3) Dependent on the design of the metric cable gland.

4) Current carrying capacity based on IEC 60364-5-52, routing type C.

5) For terminal box type 1XB7712-P.., depending on the standard, other cable entries (power) can be ordered using P options (see Selection and ordering data/Article No. supplements).

6) Mounted on left side of terminal box (viewed towards cable entries).

7) Mounted on right side of terminal box (viewed toward cable entries).

Selection and ordering data

SIMOTICS M-1PH8 asynchronous motors, shaft height 355, type of construction IM B3

Rated speed	Rated output	Rated torque	Rated current	Rated voltage	Rated frequency	Operating speed during field weakening,max.[1]	Max. speed[2]	Max. torque[3]	Max. current[4]	**1PH8 asynchronous motor** Forced ventilation, IP23 degree of protection
n_{rated}	P_{rated}	M_{rated}	I_{rated}	U_{rated}	f_{rated}	n_2	n_{max}	M_{max} at n_{rated}	I_{max}	
rpm	kW	Nm	A	V	Hz	rpm	rpm	Nm	A	Article No.
Supply voltage 480 V 3 AC, Active Line Module, Vector Control										
600	370	5889	530	500	30.4	1100	2800	12640	1310	**1PH8350-7■B40-■■■0**
	415	6605	590	500	30.5	1100	2800	12500	1280	**1PH8351-7■B40-■■■0**
	500	7958	700	500	30.5	1000	2800	15040	1490	**1PH8352-7■B40-■■■0**
	590	9391	810	500	30.5	1000	2800	17050	1630	**1PH8354-7■B40-■■■0**
	690	10983	940	500	30.5	900	2800	20690	1950	**1PH8356-7■B40-■■■0**
	780	12415	1060	500	30.5	900	2800	23650	2200	**1PH8358-7■B40-■■■0**
800	480	5730	680	500	40.4	1400	2800	12910	1850	**1PH8350-7■Q40-■■■0**
	530	6327	750	500	40.5	1400	2800	12830	1810	**1PH8351-7■Q40-■■■0**
	630	7521	870	500	40.5	1300	2800	15280	2050	**1PH8352-7■Q40-■■■0**
	750	8953	1040	500	40.4	1300	2800	19170	2480	**1PH8354-7■Q40-■■■0**
	860	10266	1180	500	40.4	1200	2800	22380	2830	**1PH8356-7■Q40-■■■0**
	960	11460	1300	500	40.5	1200	2800	23090	2860	**1PH8358-7■Q40-■■■0**
1000	600	5730	840	500	50.4	1500	2800	13470	2490	**1PH8350-7■C40-■■■0**
	670	6399	940	500	50.5	1500	2800	13380	2470	**1PH8351-7■C40-■■■0**
	780	7449	1080	500	50.5	1400	2800	14980	2540	**1PH8352-7■C40-■■■0**
	900	8595	1220	500	50.5	1300	2800	17230	2790	**1PH8354-7■C40-■■■0**
	1040	9932	1400	500	50.4	1200	2800	21370	3380	**1PH8356-7■C40-■■■0**
	1200	11460	1700	480	50.4	1200	2800	27150	4400	**1PH8358-7■C40-■■■0**
1350	670	4740	920	500	68	1700	2800	9990	2450	**1PH8350-7■D40-■■■0**
	750	5306	1040	500	68.1	1700	2800	9950	2400	**1PH8351-7■D40-■■■0**
	910	6437	1240	500	68	1700	2800	13910	3310	**1PH8352-7■D40-■■■0**
	1040	7357	1400	500	68	1400	2800	14180	3160	**1PH8354-7■D40-■■■0**
	1200	8489	1600	500	67.9	1400	2800	19150	4130	**1PH8356-7■D40-■■■0**
	1340	9479	1780	500	67.9	1400	2800	21870	4620	**1PH8358-7■D40-■■■0**

For versions, see Article No. supplements and options.

Overload factors for intermittent duty (S3) for 1PH835.-7..40-...0

Operating mode	S3-40 %	S3-60 %
Overload factor	1.47	1.23

Selection and ordering data (continued)

Motor type (repeated)	Max. torque[3]					Power factor	Magnetizing current	Efficiency	Moment of inertia	Weight, approx.	Terminal box
	M_{max} at 1000 rpm	1500 rpm	2000 rpm	2500 rpm	2800 rpm	cos φ	I_{μ}	η	J		
	Nm	Nm	Nm	Nm	Nm		A		kgm²	kg	Type
Supply voltage 480 V 3 AC, Active Line Module, Vector Control											
1PH8350-7.B4.-...	4840	2260	1320	870	580	0.85	194	0.946	14.74	2235	1XB7712-P01
1PH8351-7.B4.-...	4810	2260	1320	870	580	0.85	194	0.946	14.74	2235	1XB7712-P01
1PH8352-7.B4.-...	5770	2700	1570	1040	700	0.86	223	0.949	17.4	2560	1XB7712-P03
1PH8354-7.B4.-...	6550	3070	1790	1180	800	0.88	236	0.949	20.66	2889	1XB7712-P03
1PH8356-7.B4.-...	7930	3710	2160	1420	1000	0.88	285	0.952	24.22	3256	1XB7712-P03
1PH8358-7.B4.-...	9070	4240	2470	1630	1150	0.89	316	0.954	27.79	3629	1XB7712-P03
1PH8350-7.Q4.-...	8430	3890	2250	1470	1100	0.85	235	0.957	14.74	2235	1XB7712-P03
1PH8351-7.Q4.-...	8390	3880	2250	1470	1100	0.85	235	0.957	14.74	2235	1XB7712-P03
1PH8352-7.Q4.-...	9990	4610	2660	1740	1300	0.86	267	0.959	17.4	2560	1XB7712-P03
1PH8354-7.Q4.-...	12520	5770	3330	2170	1600	0.87	334	0.962	20.66	2889	1XB7712-P03
1PH8356-7.Q4.-...	14610	6730	3890	2540	1900	0.88	380	0.963	24.22	3256	1XB7820-P00
1PH8358-7.Q4.-...	15090	6980	4030	2640	1950	0.89	359	0.963	27.79	3629	1XB7820-P00
1PH8350-7.C4...	13470	6160	3540	2300	1850	0.85	294	0.962	14.74	2235	1XB7712-P03
1PH8351-7.C4...	13380	6140	3540	2300	1850	0.85	294	0.962	14.74	2235	1XB7712-P03
1PH8352-7.C4...	14980	6870	3950	2570	2070	0.87	302	0.963	17.4	2560	1XB7712-P03
1PH8354-7.C4...	17230	7910	4550	2970	2390	0.88	328	0.965	20.66	2889	1XB7820-P00
1PH8356-7.C4...	21370	9810	5640	3670	2960	0.88	410	0.967	24.22	3256	1XB7820-P00
1PH8358-7.C4...	27150	12430	7140	4650	3730	0.88	567	0.969	27.79	3629	1XB7820-P00
1PH8350-7.D4...	9990	8150	4670	3030	2430	0.86	235	0.965	14.74	2235	1XB7712-P03
1PH8351-7.D4...	9950	8120	4660	3030	2430	0.86	235	0.965	14.74	2235	1XB7712-P03
1PH8352-7.D4...	13910	11350	6500	4220	3390	0.87	338	0.969	17.4	2560	1XB7820-P00
1PH8354-7.D4...	14180	11570	6640	4320	3470	0.88	314	0.969	20.66	2889	1XB7820-P00
1PH8356-7.D4...	19150	15630	8960	5820	4680	0.88	433	0.972	24.22	3256	1XB7820-P00
1PH8358-7.D4...	21870	17840	10250	6660	5350	0.89	489	0.973	27.79	3629	1XB7820-P00

[1] n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P = P_{rated}$.

[2] n_{max}: Maximum speed that must not be exceeded.

[3] Maximum torque which is briefly available for dynamic operations (e.g. when accelerating).

[4] Maximum current which is briefly available for dynamic operations (e.g. when accelerating).

1PH8 for SINAMICS S120 for cranes – Degree of protection IP23

Selection and ordering data (continued)

Rated speed	Rated output	Rated torque	Rated current	Rated voltage	Rated frequency	Operating speed during field weakening, max.[1]	Max. speed[2]	Max. torque[3]	Max. current[4]	**1PH8 asynchronous motor** Forced ventilation, IP23 degree of protection
n_{rated}	P_{rated}	M_{rated}	I_{rated}	U_{rated}	f_{rated}	n_2	n_{max}	M_{max} at n_{rated}	I_{max}	
rpm	kW	Nm	A	V	Hz	rpm	rpm	Nm	A	Article No.
Supply voltage 690 V 3 AC, Active Line Module, Vector Control										
600	370	5889	380	690	30.5	1100	2800	12620	950	**1PH8350-7■H40-■■■0**
	415	6605	430	690	30.5	1100	2800	12490	930	**1PH8351-7■H40-■■■0**
	500	7958	510	690	30.5	1000	2800	14450	1040	**1PH8352-7■H40-■■■0**
	590	9391	590	690	30.5	1000	2800	17320	1200	**1PH8354-7■H40-■■■0**
	690	10983	680	690	30.5	900	2800	20800	1420	**1PH8356-7■H40-■■■0**
	780	12415	770	690	30.4	900	2800	24270	1630	**1PH8358-7■H40-■■■0**
800	480	5730	490	690	40.5	1400	2800	12600	1330	**1PH8350-7■K40-■■■0**
	530	6327	540	690	40.5	1400	2800	12530	1300	**1PH8351-7■K40-■■■0**
	630	7521	640	690	40.4	1300	2800	15760	1520	**1PH8352-7■K40-■■■0**
	750	8953	740	690	40.5	1300	2800	18080	1710	**1PH8354-7■K40-■■■0**
	860	10266	840	690	40.4	1200	2800	21500	1990	**1PH8356-7■K40-■■■0**
	960	11460	940	690	40.4	1200	2800	23550	2110	**1PH8358-7■K40-■■■0**
1000	600	5730	610	690	50.5	1500	2800	13570	1810	**1PH8350-7■U40-■■■0**
	670	6399	680	690	50.5	1500	2800	13480	1800	**1PH8351-7■U40-■■■0**
	780	7449	780	690	50.5	1400	2800	15390	1870	**1PH8352-7■U40-■■■0**
	900	8595	890	690	50.4	1300	2800	18240	2110	**1PH8354-7■U40-■■■0**
	1040	9932	1020	690	50.5	1200	2800	20940	2420	**1PH8356-7■U40-■■■0**
	1200	11460	1160	690	50.4	1200	2800	24680	2770	**1PH8358-7■U40-■■■0**
1350	670	4740	670	690	68.1	1700	2800	10260	1810	**1PH8350-7■V40-■■■0**
	750	5306	750	690	68.1	1700	2800	10230	1840	**1PH8351-7■V40-■■■0**
	910	6437	910	690	68	1700	2800	12720	2310	**1PH8352-7■V40-■■■0**
	1040	7357	1040	690	68.1	1400	2800	13890	2270	**1PH8354-7■V40-■■■0**
	1200	8489	1200	690	67.9	1400	2800	19270	3010	**1PH8356-7■V40-■■■0**
	1340	9479	1340	690	68	1400	2800	20360	3120	**1PH8358-7■V40-■■■0**

For versions, see Article No. supplements and options.

Overload factors for intermittent duty (S3) for 1PH835.-7..40-...0

Operating mode	S3-40 %	S3-60 %
Overload factor	1.47	1.23

Selection and ordering data (continued)

Motor type (repeated)	Max. torque[3]					Power factor	Magnetizing current	Efficiency	Moment of inertia	Weight, approx.	Terminal box
	M_{max} at 1000 rpm	1500 rpm	2000 rpm	2500 rpm	2800 rpm	cos φ	I_μ	η	J		
	Nm	Nm	Nm	Nm	Nm		A		kgm²	kg	Type
Supply voltage 690 V 3 AC, Active Line Module, Vector Control											
1PH8350-7.H4...	4830	2250	1310	860	580	0.85	139	0.947	14.74	2235	1XB7712-P01
1PH8351-7.H4...	4810	2250	1310	870	580	0.85	139	0.947	14.74	2235	1XB7712-P01
1PH8352-7.H4...	5570	2610	1530	1010	700	0.87	149	0.946	17.4	2560	1XB7712-P03
1PH8354-7.H4...	6650	3110	1810	1190	800	0.88	176	0.95	20.66	2889	1XB7712-P03
1PH8356-7.H4...	7980	3730	2170	1430	1000	0.88	209	0.953	24.22	3256	1XB7712-P03
1PH8358-7.H4...	9320	4360	2540	1670	1160	0.88	245	0.955	27.79	3629	1XB7712-P03
1PH8350-7.K4...	8240	3810	2200	1440	1120	0.86	162	0.956	14.74	2235	1XB7712-P03
1PH8351-7.K4...	8200	3800	2200	1440	1120	0.86	162	0.956	14.74	2235	1XB7712-P03
1PH8352-7.K4...	10300	4750	2740	1790	1320	0.86	207	0.959	17.4	2560	1XB7712-P03
1PH8354-7.K4...	11820	5460	3160	2060	1500	0.88	215	0.96	20.66	2889	1XB7712-P03
1PH8356-7.K4...	14040	6470	3730	2440	1850	0.88	249	0.962	24.22	3256	1XB7820-P00
1PH8358-7.K4...	15410	7130	4120	2700	2000	0.89	272	0.964	27.79	3629	1XB7820-P00
1PH8350-7.U4...	13570	6200	3550	2310	1850	0.85	216	0.962	14.74	2235	1XB7712-P03
1PH8351-7.U4...	13480	6180	3550	2310	1860	0.85	216	0.962	14.74	2235	1XB7712-P03
1PH8352-7.U4...	15390	7050	4050	2640	2120	0.86	232	0.964	17.4	2560	1XB7712-P03
1PH8354-7.U4...	18240	8360	4810	3130	2520	0.87	269	0.966	20.66	2889	1XB7712-P03
1PH8356-7.U4...	20940	9590	5510	3580	2880	0.88	283	0.967	24.22	3256	1XB7712-P03
1PH8358-7.U4...	24680	11330	6530	4250	3420	0.88	339	0.968	27.79	3629	1XB7820-P00
1PH8350-7.V4...	10260	8360	4790	3100	2490	0.86	178	0.966	14.74	2235	1XB7712-P03
1PH8351-7.V4...	10230	8340	4780	3100	2490	0.86	178	0.966	14.74	2235	1XB7712-P03
1PH8352-7.V4...	12720	10400	6000	3920	3150	0.87	208	0.967	17.4	2560	1XB7712-P03
1PH8354-7.V4...	13890	11330	6490	4220	3390	0.88	219	0.968	20.66	2889	1XB7712-P03
1PH8356-7.V4...	19270	15730	9020	5870	4710	0.88	317	0.972	24.22	3256	1XB7820-P00
1PH8358-7.V4...	20360	16620	9540	6200	4990	0.89	322	0.972	27.79	3629	1XB7820-P00

[1] n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P = P_{rated}$.

[2] n_{max}: Maximum speed that must not be exceeded.

[3] Maximum torque which is briefly available for dynamic operations (e.g. when accelerating).

[4] Maximum current which is briefly available for dynamic operations (e.g. when accelerating).

Selection and ordering data (continued)

SIMOTICS M-1PH8 asynchronous motors, shaft height 355, type of construction IM B3

Rated speed	Rated output	Rated torque	Rated current	Rated voltage	Rated frequency	Operating speed during field weakening, max.[1]	Max. speed[2]	Max. torque[3]	Max. current[4]	**1PH8 asynchronous motor** Forced ventilation, IP55 degree of protection
n_{rated}	P_{rated}	M_{rated}	I_{rated}	U_{rated}	f_{rated}	n_2	n_{max}	M_{max} at n_{rated}	I_{max}	
rpm	kW	Nm	A	V	Hz	rpm	rpm	Nm	A	Article No.
Supply voltage 480 V 3 AC, Active Line Module, Vector Control										
600	230	3661	350	500	30.3	1400	2800	12120	1260	**1PH8350-7■B10-■■■0**
	275	4377	410	500	30.3	1400	2800	14570	1440	**1PH8352-7■B10-■■■0**
	325	5173	475	500	30.3	1400	2800	16670	1590	**1PH8354-7■B10-■■■0**
	380	6048	550	500	30.3	1400	2800	20320	1920	**1PH8356-7■B10-■■■0**
	430	6844	620	500	30.2	1400	2800	23390	2180	**1PH8358-7■B10-■■■0**
800	300	3581	450	500	40.3	1400	2800	12500	1790	**1PH8350-7■Q10-■■■0**
	360	4298	530	500	40.3	1400	2800	14870	1990	**1PH8352-7■Q10-■■■0**
	420	5014	620	500	40.3	1400	2800	19960	2580	**1PH8354-7■Q10-■■■0**
	490	5849	720	500	40.2	1400	2800	22050	2790	**1PH8356-7■Q10-■■■0**
	565	6745	790	500	40.3	1400	2800	22770	2820	**1PH8358-7■Q10-■■■0**
1000	360	3438	540	500	50.3	1500	2800	13150	2430	**1PH8350-7■C10-■■■0**
	430	4107	620	500	50.3	1500	2800	14700	2490	**1PH8352-7■C10-■■■0**
	505	4823	720	500	50.3	1500	2800	16970	2750	**1PH8354-7■C10-■■■0**
	580	5539	830	500	50.3	1600	2800	21120	3340	**1PH8356-7■C10-■■■0**
	670	6399	1040	480	50.2	1600	2800	26910	4360	**1PH8358-7■C10-■■■0**
1350	380	2688	540	500	67.8	1800	2800	9840	2410	**1PH8350-7■D10-■■■0**
	460	3254	670	500	67.7	1800	2800	13690	3260	**1PH8352-7■D10-■■■0**
	550	3891	760	500	67.8	1700	2800	14050	3130	**1PH8354-7■D10-■■■0**
	630	4457	900	500	67.7	1700	2800	18980	4090	**1PH8356-7■D10-■■■0**
	730	5164	1040	500	67.7	1700	2800	21720	4590	**1PH8358-7■D10-■■■0**

For versions, see Article No. supplements and options.

Overload factors for intermittent duty (S3) for 1PH835.-7..10-...0

Operating mode	S3-40 %	S3-60 %
Overload factor	1.47	1.23

Selection and ordering data (continued)

Motor type (repeated)	Max. torque[3]					Power factor	Magnetizing current	Efficiency	Moment of inertia	Weight, approx.	Terminal box
	M_{max} at 1000 rpm	1500 rpm	2000 rpm	2500 rpm	2800 rpm	cos φ	I_μ	η	J		
	Nm	Nm	Nm	Nm	Nm		A		kgm²	kg	Type
Supply voltage 480 V 3 AC, Active Line Module, Vector Control											
1PH8350-7.B1...	4710	2220	1310	860	580	0.79	194	0.959	14.74	2235	1XB7712-P01
1PH8352-7.B1...	5640	2660	1560	1030	700	0.8	223	0.961	17.4	2560	1XB7712-P01
1PH8354-7.B1...	6450	3030	1780	1170	800	0.82	236	0.962	20.66	2889	1XB7712-P03
1PH8356-7.B1...	7840	3680	2150	1420	980	0.82	285	0.964	24.22	3256	1XB7712-P03
1PH8358-7.B1...	8990	4210	2460	1620	1100	0.82	316	0.965	27.79	3629	1XB7712-P03
1PH8350-7.Q1...	8210	3830	2230	1460	1050	0.8	235	0.964	14.74	2235	1XB7712-P03
1PH8352-7.Q1...	9750	4540	2640	1730	1250	0.81	267	0.966	17.40	2560	1XB7712-P03
1PH8354-7.Q1...	12960	5910	3390	2200	1690	0.8	334	0.967	20.66	2889	1XB7712-P03
1PH8356-7.Q1...	14420	6670	3860	2520	1850	0.81	380	0.968	24.22	3256	1XB7712-P03
1PH8358-7.Q1...	14930	6930	4020	2640	1890	0.84	359	0.969	27.79	3629	1XB7712-P03
1PH8350-7.C1...	13150	6070	3510	2290	1850	0.79	294	0.967	14.74	2235	1XB7712-P03
1PH8352-7.C1...	14700	6780	3910	2550	2060	0.82	302	0.969	17.40	2560	1XB7712-P03
1PH8354-7.C1...	16970	7830	4530	2960	2380	0.83	328	0.97	20.66	2889	1XB7712-P03
1PH8356-7.C1...	21120	9730	5610	3660	2950	0.82	410	0.971	24.22	3256	1XB7712-P03
1PH8358-7.C1...	26910	12360	7120	4640	3730	0.8	567	0.971	27.79	3629	1XB7712-P03
1PH8350-7.D1...	9840	8040	4620	3010	2420	0.83	235	0.97	14.74	2235	1XB7712-P03
1PH8352-7.D1...	13690	11180	6430	4190	3370	0.81	338	0.97	17.4	2560	1XB7712-P03
1PH8354-7.D1...	14050	11480	6620	4310	3470	0.85	314	0.972	20.66	2889	1XB7712-P03
1PH8356-7.D1...	18980	15500	8910	5800	4660	0.83	433	0.972	24.22	3256	1XB7712-P03
1PH8358-7.D1...	21720	17740	10220	6660	5360	0.83	489	0.972	27.79	3629	1XB7712-P03

[1] n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P = P_{rated}$.

[2] n_{max}: Maximum speed that must not be exceeded.

[3] Maximum torque which is briefly available for dynamic operations (e.g. when accelerating).

[4] Maximum current which is briefly available for dynamic operations (e.g. when accelerating).

1PH8 for SINAMICS S120 for cranes – Degree of protection IP55

Selection and ordering data (continued)

Rated speed	Rated output	Rated torque	Rated current	Rated voltage	Rated frequency	Operating speed during field weakening, max.[1]	Max. speed[2]	Max. torque[3]	Max. current[4]	**1PH8 asynchronous motor** Forced ventilation, IP55 degree of protection
n_{rated}	P_{rated}	M_{rated}	I_{rated}	U_{rated}	f_{rated}	n_2	n_{max}	M_{max} at n_{rated}	I_{max}	
rpm	kW	Nm	A	V	Hz	rpm	rpm	Nm	A	Article No.
Supply voltage 690 V 3 AC, Active Line Module, Vector Control										
600	230	3661	255	690	30.3	1400	2800	12090	910	**1PH8350-7■H10-■■■0**
	275	4377	295	690	30.3	1400	2800	13880	1000	**1PH8352-7■H10-■■■0**
	325	5173	345	690	30.3	1400	2800	16940	1170	**1PH8354-7■H10-■■■0**
	380	6048	400	690	30.3	1400	2800	20480	1400	**1PH8356-7■H10-■■■0**
	430	6844	455	690	30.2	1400	2800	24230	1630	**1PH8358-7■H10-■■■0**
800	300	3581	320	690	40.3	1400	2800	12180	1290	**1PH8350-7■K10-■■■0**
	360	4298	390	690	40.3	1400	2800	15360	1480	**1PH8352-7■K10-■■■0**
	420	5014	440	690	40.3	1400	2800	17590	1660	**1PH8354-7■K10-■■■0**
	490	5849	510	690	40.3	1400	2800	20960	1940	**1PH8356-7■K10-■■■0**
	565	6745	580	690	40.3	1400	2800	23360	2090	**1PH8358-7■K10-■■■0**
1000	360	3438	395	690	50.3	1500	2800	13240	1770	**1PH8350-7■U10-■■■0**
	430	4107	455	690	50.3	1500	2800	15110	1840	**1PH8352-7■U10-■■■0**
	505	4823	530	690	50.3	1500	2800	18280	2110	**1PH8354-7■U10-■■■0**
	580	5539	600	690	50.3	1600	2800	20510	2370	**1PH8356-7■U10-■■■0**
	670	6399	690	690	50.2	1600	2800	24570	2760	**1PH8358-7■U10-■■■0**
1350	380	2688	395	690	67.8	1800	2800	10200	1800	**1PH8350-7■V10-■■■0**
	460	3254	470	690	67.8	1800	2800	12290	2230	**1PH8352-7■V10-■■■0**
	550	3891	550	690	67.8	1700	2800	13660	2230	**1PH8354-7■V10-■■■0**
	630	4457	650	690	67.7	1700	2800	19140	2990	**1PH8356-7■V10-■■■0**
	730	5164	740	690	67.7	1700	2800	20270	3110	**1PH8358-7■V10-■■■0**

For versions, see Article No. supplements and options.

Overload factors for intermittent duty (S3) for 1PH835.-7..10-...0

Operating mode	S3-40 %	S3-60 %
Overload factor	1.47	1.23

Selection and ordering data (continued)

Motor type (repeated)	Max. torque[3]					Power factor	Magnetizing current	Efficiency	Moment of inertia	Weight, approx.	Terminal box
	M_{max} at 1000 rpm	1500 rpm	2000 rpm	2500 rpm	2800 rpm	cos φ	I_μ	η	J		
	Nm	Nm	Nm	Nm	Nm		A		kgm²	kg	Type
Supply voltage 690 V 3 AC, Active Line Module, Vector Control											
1PH8350-7.H1...	4690	2210	1300	860	580	0.79	139	0.959	14.74	2235	1XB7712-P01
1PH8352-7.H1...	5390	2550	1500	990	680	0.81	149	0.96	17.4	2560	1XB7712-P01
1PH8354-7.H1...	6550	3080	1810	1190	820	0.82	176	0.962	20.66	2889	1XB7712-P01
1PH8356-7.H1...	7890	3700	2160	1430	1000	0.82	209	0.964	24.22	3256	1XB7712-P01
1PH8358-7.H1...	9310	4350	2540	1670	1160	0.81	242	0.965	27.79	3629	1XB7712-P03
1PH8350-7.K1...	8010	3740	2180	1430	1000	0.8	162	0.965	14.74	2235	1XB7712-P01
1PH8352-7.K1...	10070	4670	2710	1780	1290	0.8	207	0.966	17.40	2560	1XB7712-P01
1PH8354-7.K1...	11560	5390	3140	2060	1490	0.82	215	0.969	20.66	2889	1XB7712-P03
1PH8356-7.K1...	13760	6400	3720	2440	1800	0.83	249	0.969	24.22	3256	1XB7712-P03
1PH8358-7.K1...	15290	7080	4100	2680	2010	0.84	272	0.969	27.79	3629	1XB7712-P03
1PH8350-7.U1...	13240	6110	3530	2310	1860	0.78	216	0.967	14.74	2235	1XB7712-P01
1PH8357-7.U1...	15110	6960	4010	2620	2110	0.81	232	0.968	17.40	2560	1XB7712-P01
1PH8354-7.U1...	18280	8430	4860	3180	2560	0.82	269	0.97	20.66	2889	1XB7712-P03
1PH8356-7.U1...	20510	9450	5450	3560	2860	0.83	283	0.971	24.22	3256	1XB7712-P03
1PH8358-7.U1...	24570	11310	6520	4250	3420	0.83	339	0.971	27.79	3629	1XB7712-P03
1PH8350-7.V1...	10200	8320	4780	3110	2500	0.83	178	0.97	14.74	2235	1XB7712-P01
1PH8352-7.V1...	12290	10040	5780	3760	3030	0.84	208	0.971	17.4	2560	1XB7712-P03
1PH8354-7.V1...	13660	11160	6420	4180	3360	0.86	219	0.972	20.66	2889	1XB7712-P03
1PH8356-7.V1...	19140	15630	8980	5840	4700	0.83	317	0.972	24.22	3256	1XB7712-P03
1PH8358-7.V1...	20270	16550	9510	6190	4970	0.85	322	0.973	27.79	3629	1XB7712-P03

1) n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P = P_{rated}$.

2) n_{max}: Maximum speed that must not be exceeded.

3) Maximum torque which is briefly available for dynamic operations (e.g. when accelerating).

4) Maximum current which is briefly available for dynamic operations (e.g. when accelerating).

Selection and ordering data (continued)

Position of the Article No.			1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16		
Shaft height 355			**1**	**P**	**H**	**8**	**3**	**5**	**.**	**–**	**7**	■	**.**	■	■	–	■	■	■	**0**	**–**	**Z**
Overall length[1]									**.**													
Asynchronous variant																						
Forced ventilation with noise value 85 dB											**7**											
Encoder systems for motors without **DRIVE-CLiQ interface**																						
Without encoder												**A**										
Prepared for encoder mounting systems[2]																						
Incremental encoder HTL 1024 S/R with solid shaft Mounting of incremental encoder POG 10 D 1024		Order code required: **H56**										**K**										
Incremental encoder HTL 1024 S/R with solid shaft Incremental encoder POG 10 supplied by customer		Order code required: **G80**										**K**										
Incremental encoder HTL 1024 S/R with hollow shaft Incremental encoder HOG 28 supplied by customer		Order code required: **H75**										**G**										
Rated speed (winding version)													**.**									
Cooling	**Degree of protection**																					
Forced ventilation	IP55													**1**								
Forced ventilation	IP23 (open-circuit cooling)													**4**								
Type																						
IM B3															**0**							
Shaft extension (DE)	**Balancing**																					
Featherkey	Full-key																**1**					
Featherkey	Half-key																**2**					
Bearings	**Vibration magnitude acc. to**	**Shaft and flange accuracy**[3]																				
Standard	A	N																**A**				
Standard	R/A	R																**B**				
Cable connection	(view of DE)																					
Terminal box	Cable infeed	External fan NDE with air inlet from NDE Air-flow direction NDE →																				
NDE right	Bottom	Top																	**U**			
		Left	Order code required: **G00**																**U**		**–**	**Z**
NDE left	Bottom	Top																	**V**			
		Right	Order code required: **G02**																**V**		**–**	**Z**
NDE top	Right	Left	Order code required: **G00**																**W**		**–**	**Z**
		Right	Order code required: **G02**																**W**		**–**	**Z**
DE top[4]	Right	Top[5]																	**X**			
		Left	Order code required: **G00**																**X**		**–**	**Z**
		Right	Order code required: **G02**																**X**		**–**	**Z**
Version status																						
Shaft height 355																				**0**		
Special versions Order No. supplement "-Z" with order code and plain text if required, see options.																					**–**	**Z**

[1] Not selectable. Determined by the choice of rated power.

[2] For more information on incremental encoders, visit www.baumerhuebner.com

[3] For definition, see 1PH8 Configuration Manual.

[4] Signal connection for 1PH835 NDE at bearing shield.

[5] Only possible for assignments with terminal box 1XB7712-P..

Options

Order code	Description
A08	Air flow monitoring 24 V DC
A31	Motor temperature monitoring through switch
A60	Motor protection through 3 × Pt100
A72	Bearing temperature monitoring with Pt100
G00	External fan NDE left (possible if 15th position of Article No. is U, W or X)
G02	External fan NDE right (possible if 15th position of Article No. is V, W or X)
G14	With air filter
G80	Mounting of a supplied POG 10 incremental encoder (possible if 9th position of Article No. is K)
H56	Mounting of a POG 10 DN 1024 incremental encoder (HTL 1024 S/R; possible if 9th position of Article No. is K)
H75	Mounting of a supplied HOG 28 incremental encoder (possible if 9th position of Article No. is G)
K12	Additional PTC thermistor chain for alarm and tripping
K16	Second shaft extension 120 mm × 210 mm (d × l; possible if 9th position of Article No. = "A" or "G")
K45	230 V standstill heating
K46	110 V standstill heating
K83	Terminal box rotated through +90° (possible if 15th position of Article No. is V or W)
K84	Terminal box rotated through -90° (possible if 15th position of Article No. is U or W)
K85	Terminal box rotated through +180°
L00	Terminal box 1XB7820 (cable entry plate undrilled) instead of terminal box 1XB7712
L12	Condensation water drain hole provided unsealed
L29	Enhanced corrosion protection (possible if 11th position of Article No. is 1)
L50	Adapter base for mounting a fan
P00	Cable entry plate undrilled (with terminal box 1XB7712 only)
P01	Cable entry plate 3 × M63 × 1.5 (only with terminal box 1XB7712)
P02	Cable entry plate 3 × M75 × 1.5 (only with terminal box 1XB7712)
P03	Cable entry plate 4 × M75 × 1.5 (only with terminal box 1XB7712)
P04	Cable entry plate 4 × M63 × 1.5 (only with terminal box 1XB7712)
P12	Cable entry plate 6 × M63 × 1.5 + 2 × M20 (only with terminal box 1XB7820)
P13	Cable entry plate 7 × M50 × 1.5 + 2 × M20 + 1 × M25 (only with terminal box 1XB7820)
P14	Cable entry plate 6 × M63 × 1.5 + 1 × M20 + 1 × M25 (only with terminal box 1XB7820)
P15	Cable entry plate 9 × M63 × 1.5 + 1 × M20 + 1 × M25 (only with terminal box 1XB7820)
P16	Cable entry plate 12 × M63 × 1.5 + 1 × M20 + 1 × M25 (only with terminal box 1XB7820)
Q00	Increased number of ground terminals in the terminal box (12 × M6 for 1XB771, 24 × M6 for 1XB7280)
R60	Special fan for operation at 460 V / 60 Hz (±10 %)
R61	Special fan for operation at 400 V / 60 Hz (±10 %)
Y84	Customer-specific information on rating plate (maximum 30 characters)[1)]
	Colors
–	Standard paint is anthracite RAL 7016
X01	Standard finish in RAL 9005 (black)
K24	Primer
K23	Special paint finish worldwide (anthracite RAL 7016)
K23+X..	Special paint finish worldwide in another color X.. (on request)

Order No. supplement "**-Z**" with order code and plain text, if required.

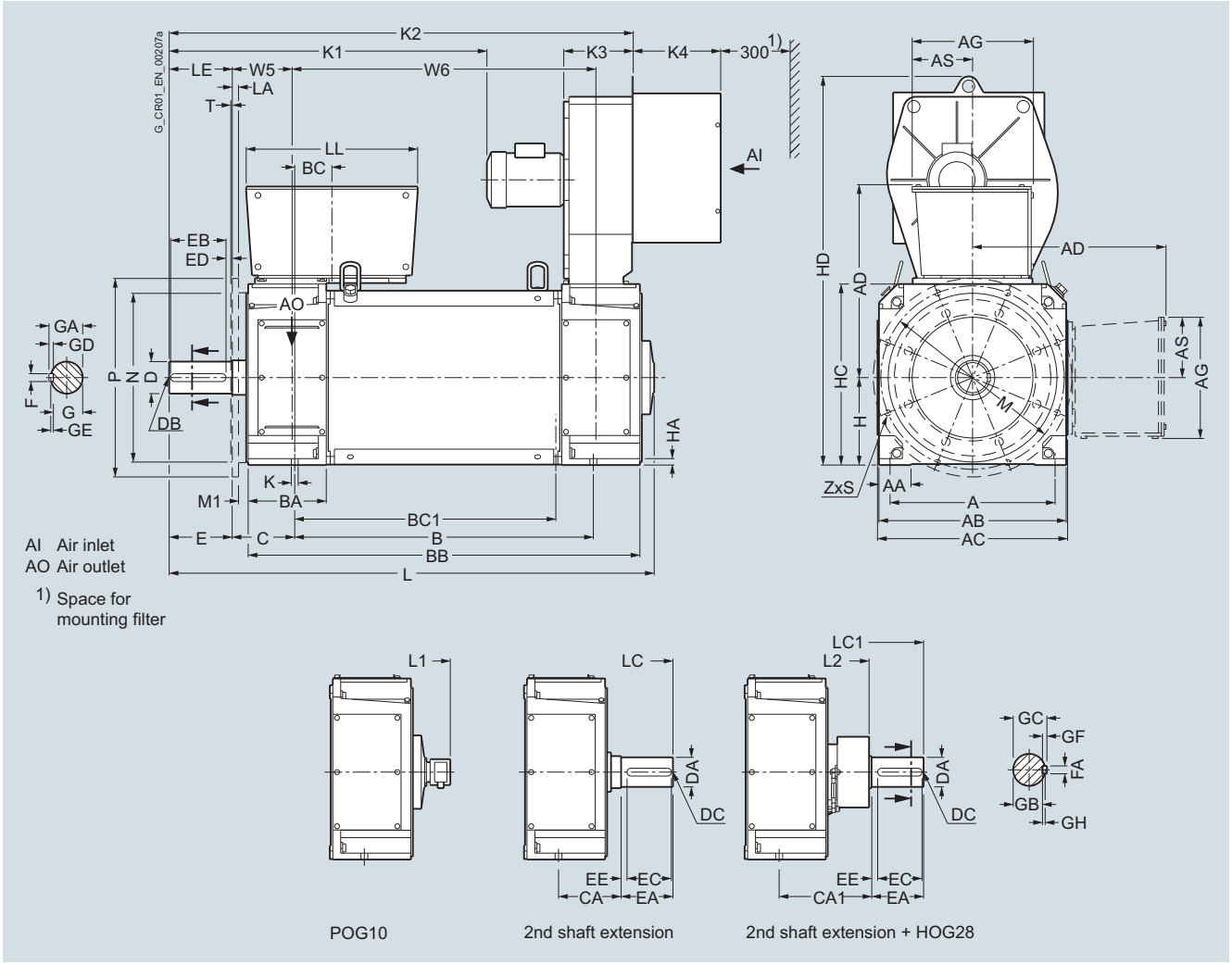
1) Specify plain text when ordering.

Options (continued)

Ordering example

Selection criteria	Requirement	Structure of the Article No.
Motor type	Asynchronous motor, shaft height 355, IP55 degree of protection, type of construction IM B3, noise level 85 dB(A), operating speed 800 rpm, Supply voltage 690 V 3 AC Intermittent duty S3-60 % Rated output 445 kW Rated torque 5312 Nm, Rated current 460 A, Terminal box type 1XB7712-P01	**1PH8352-7■K10-■■■0**
Encoder systems	Incremental encoder HTL 1024 S/R POG 10 (Baumer-Hübner), prepared for mounting	**1PH8352-7KK10-■■■0**
Shaft extension (DE)/balancing	Featherkey + full-key balancing	**1PH8352-7KK10-1■■0**
Bearings	Standard (A/N)	**1PH8352-7KK10-1A■0**
Terminal box	DE top, cable entry right	**1PH8352-7KK10-1AX0**
Special version	Mounting of a supplied pulse encoder with POG 10 mounting flange	**1PH8352-7KK10-1AX0-Z G80**
	230 V standstill heating	**1PH8352-7KK10-1AX0-Z G80+K45**
	Cable entry plate 4 × M75 × 1.5	**1PH8352-7KK10-1AX0-Z G80+K45+P03**
Complete ordering information for required version of motor		**1PH8352-7KK10-1AX0-Z G80+K45+P03**

Dimensional drawings



Shaft height	Dimensions to IEC																		
1PH8...	F	FA	G	GA	GB	GC	GD	GE	GF	GH	H	HA	HC	K	L	L1	L2	LC	LC1
350/351	32	32	119	137	114	127	18	11	18	11	355	26	735	Ø28	1523	1625	1644	1740	1861
352	32	32	119	137	114	127	18	11	18	11	355	26	735	Ø28	1613	1715	1734	1830	1951
354	32	32	119	137	114	127	18	11	18	11	355	26	735	Ø28	1723	1825	1844	1940	2061
356	32	32	119	137	114	127	18	11	18	11	355	26	735	Ø28	1843	1945	1964	2060	2181
358	32	32	119	137	114	127	18	11	18	11	355	26	735	Ø28	1963	2065	2084	2180	2301

Shaft height	Terminal box						Fan					Flange								
1PH8...	AD	AG	DE	BC	BC1	LL	K1	K2	K3	K4	HD	LA	LE	M	M1	N	P	S	T	Z
	1 XB7 820						**85 dB (A)**													
350/351	784	492	245	151	861	696	844	1438	282	355	1578	25	250	Ø740	40	Ø680	Ø800	Ø24	6	8
352	784	492	245	151	951	696	934	1528	282	355	1578	25	250	Ø740	40	Ø680	Ø800	Ø24	6	8
354	784	492	245	151	1061	696	1044	1638	282	355	1578	25	250	Ø740	40	Ø680	Ø800	Ø24	6	8
356	784	492	245	151	1181	696	1164	1758	282	355	1578	25	250	Ø740	40	Ø680	Ø800	Ø24	6	8
358	784	492	245	151	1301	696	1284	1878	282	355	1578	25	250	Ø740	40	Ø680	Ø800	Ø24	6	8
	1 XB7 712						**R60/R61 fan 60 Hz**													
350/351	640	377	201	–12	784	370	802	1438	282	355	1578									
352	640	377	201	–12	874	370	892	1528	282	355	1578									
354	640	377	201	–12	984	370	1002	1638	282	355	1578									
356	640	377	201	–12	1104	370	1122	1758	282	355	1578									
358	640	377	201	–12	1224	370	1242	1878	282	355	1578									

1LP4, 1LP6 with mounted spring-set brake

Overview

Three-phase asynchronous motor 1LP with fitted DC-excited spring-set brake

The naturally cooled crane motors of type 1LP4 and 1LP6 form a compact drive unit when combined with the mounted spring-set brake and are ideal for application as traversing motors. The DC-operated brake is designed as a holding brake, but is also capable of emergency shutdown braking operations at maximum motor speed. In the case of power failure, the brake is applied automatically by its spring force and brings the drive to a standstill.

Product range

The product range includes shaft heights 132 S to 280 M in the 5.5 to 132 kW power range for 4-pole motors, or in the 3 to 90 kW power range for 6-pole motors, for duty type S3-25 % in each case. As the table below shows, more than one type of brake can be fitted to a motor; this flexibility allows the user to tailor the drive unit – comprising the motor and brake – to the exact requirements of the crane manufacturer.

The motors can also be ordered without a brake. The same article numbers apply, but the article number supplements for the brake are excluded.

Motor shaft height	**Brake type**							
	KFB 10 100 Nm	KFB 16 160 Nm	KFB 25 250 Nm	KFB 30 300 Nm	KFB 40 400 Nm	KFB 63 630 Nm	KFB 100 1000 Nm	KFB 160 1600 Nm
132	✓							
160	✓	✓						
180	✓	✓	✓	✓	✓			
200		✓	✓	✓	✓			
225			✓	✓	✓	✓		
250			✓	✓	✓	✓	✓	✓
280					✓	✓	✓	✓

Technical specifications

Electrical design

Operating voltage

The crane brake motors are available for the following rated voltages:

- 400 V 3 AC, 50 Hz
- 460 V 3 AC, 50 Hz
- 500 V 3 AC, 50 Hz
- 690 V 3 AC, 50 Hz

The specifications change as follows for motors operating at a rated frequency of 60 Hz:

- Rated speed +20 %
- Rated power +15 %

The standard model of brake coil is supplied for connection to 207 V DC (see technical specifications for brakes).

Motor protection

The following protective equipment can be installed (see "Article number supplements and special versions"):

- 3 PTC thermistors for tripping
- 3 PTC thermistors for tripping and 3 PTC thermistors for alarm
- 1 KTY 84-130 temperature sensor for evaluation in the converter
- 3 bimetallic switches (Klixon) for tripping

Standstill heating

The motors can be fitted with a standstill heater. The heat outputs are as follows:

Motor shaft height	Heat output
	W
132 ... 160	100
180 ... 200	55
225 ... 250	92
280	109

For voltages, see "Article number supplements and special versions".

It is also possible to connect a voltage (which should equal approximately 4 to 10 % of the rated motor voltage) to stator terminals U1 and V1. 20 to 30 % of the rated motor current is normally sufficient to provide adequate heating.

Insulation

The motor windings are designed to comply with insulation class F.

Electric strength

See Catalog D 81.1.

Mechanical design

1LP4/1LP6 motors are naturally cooled units without fans. Depending on the shaft height, brakes with different torques can be built onto the motors. Housing and terminal box are made of gray cast iron. The brake itself does not have a separate terminal box; all the brake connections, whether coil, microswitch or heater, are taken to the motor terminal box.

Types of construction

The motors are available in types of construction IM B3, IM B35, IM V5, IM B5 and IM V1. Other types of construction are available on request.
The position of the condensate drain holes is determined by the type of construction.

Housing

The housing and terminal box of the motor are made of gray cast iron. The DE flange and the feet (bolted-on) can be supplied in GGG 40 as an option.

Degree of protection

The degree of protection of the standard motor models is IP55. IP56 is also available as an option. The water drain holes on motors with this degree of protection must be opened at regular intervals as part of the maintenance cycle to allow any condensate that has collected inside the motor to drain off.

Paint finish

The motors are coated as standard in a special finish RAL 7030 with a coat thickness of 180 µm. Other colors are available at additional cost. A further option is an offshore finish with a coat thickness of 220 µm.

Mounted equipment

Sensing equipment such as the POG 10 incremental encoder (made by Baumer Hübner) can be mounted on the motors. The brakes themselves can be supplied with an emergency manual release mechanism (see KFB spring-set brake for SIMOTICS SD 1LP4/1LP6, special versions "Emergency release with hand lever").

Technical specifications (continued)

Terminal box

On standard models, the terminal box is mounted on the top at the DE and is always the next size larger than on the basic models of the 1LG motor. The feet are cast on.

The terminal box can also be positioned on the left or right (as viewed from the DE), but this option is only possible on motors with bolted-on feet. If the motor is to have bolted-on feet and a terminal box positioned on top, options **K11** and **J22** must be selected in the order.

On motors with a brake, the terminal box is fitted at the NDE. The option **M64** must be specified additionally.

All connecting terminals for the motor and brake including auxiliaries are housed in the motor terminal box.

Motor shaft height	Terminal box	Clamping bolt	Conductor cross-section, max.	Entry hole[1]	Sealing range
			mm^2		mm
132, 160	GT320	M5	16	M40 × 1.5	19 to 28
180	GT421[2]	M5	16	M40 × 1.5	19 to 28
200	GT591	M6	25	M50 × 1.5	27 to 35
225	GT591	M8	35	M50 × 1.5	27 to 35
250, 280	GT591	M10	120	M63 × 1.5	32 to 42

Auxiliary terminal designations

Temperature sensor	Terminal designation
3 PTC thermistors for alarm	1TP1-1TP2
3 PTC thermistors for tripping	2TP1-2TP2
Bimetallic (NC contact)	2TP1-2TP2
Standstill heater (motor)	HE1-HE2
Brake coil DC	BA1-BA2
Brake coil AC	BD1-BD2
Standstill heater (brake)	BRHE1-BRHE2
Microswitch brake opened	BRS1-BRS3
Microswitch brake air gap monitoring	BRS1-BRS3

Shaft extension

Standard brake motors are designed with a cylindrical shaft extension.

Maximum speed

The maximum permissible speed is 3000 rpm.

Bearing

Motor shaft height	DE bearing	NDE bearing
132	6208 2ZC3	6208 2ZC3
160	6209 2ZC3	6209 2ZC3
180	6210 ZC3	6210 ZC3
200	6212 ZC3	6212 ZC3
225	6213 ZC3	6213 ZC3
250	6215 ZC3	6215 ZC3
280	6217 C3	6217 C3

[1] If the motor has been ordered with temperature sensor, an extra M20 × 1.5 hole is provided. If the motor has been ordered with heater, an extra M20 × 1.5 hole is provided.

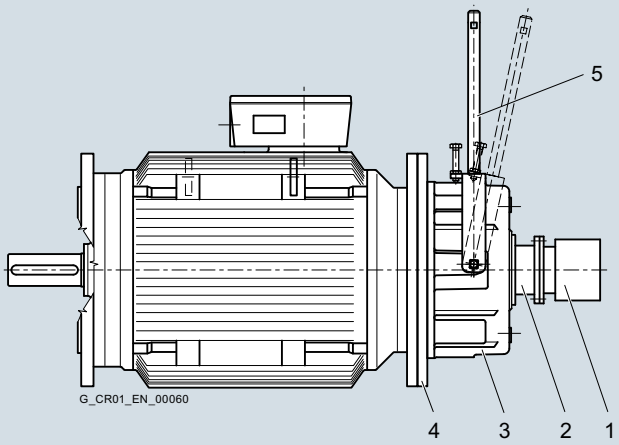
[2] Identical in construction to GK340.

Design

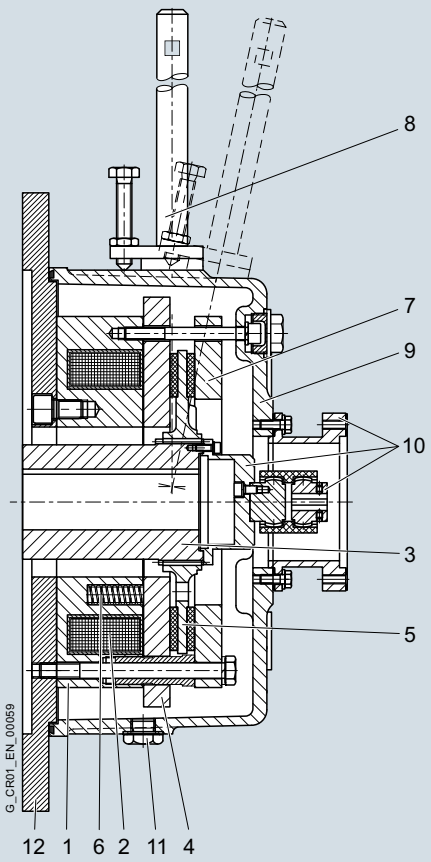
The electromagnetic double-disc spring-set brake KFB, see picture "KFB spring-set brake with manual lever", is intended to operate solely as a holding brake for this application. With the exception of emergency braking, it may only be operated as a dynamically loaded operational brake if it is appropriately dimensioned or after consultation with the manufacturer. It is a spring-loaded, electrically operated, double-disc brake, which operates when the power is switched off. When the coil (**2**) is energized with a DC voltage, the brake is released electromagnetically. If the coil (**2**) is de-energized, the springs (**6**) press the armature plate (**4**) axially against the friction-lining carrier (**5**) which in turn presses against the brake flange (**7**); this sequence provides the braking action. The brake is released when the coil (**2**) is energized. The magnetic field attracts the armature plate (**4**) towards the coil form (**1**), counteracting the spring pressure on the coil form. The air gap can be adjusted within a wide range, ensuring high availability of the brake. The motor and brake are coupled by means of a flange (**12**). Emergency brake release is possible by means of 2 emergency release screws – optionally with hand lever release.

As a result of the compact design with the enclosed coil form housing and appropriate sealing from the shaft, the brake has degree of protection IP67 when the housing is closed.

All the brake connections such as coil, microswitch, etc. are taken to the motor terminal box.



1 Rotary encoder POG10
2 Tacho bushing T2 with coupling and assembly components
3 KFB brake
4 IEC mounting flange
5 Hand lever for emergency release (option)



1 Coil form
2 Coil
3 Hub
4 Armature plate
5 Friction-lining carrier
6 Springs
7 Brake flange
8 Hand lever
9 Housing
10 Tacho assembly components
11 Service screw
12 Mounting flange

KFB spring-set brake with manual lever

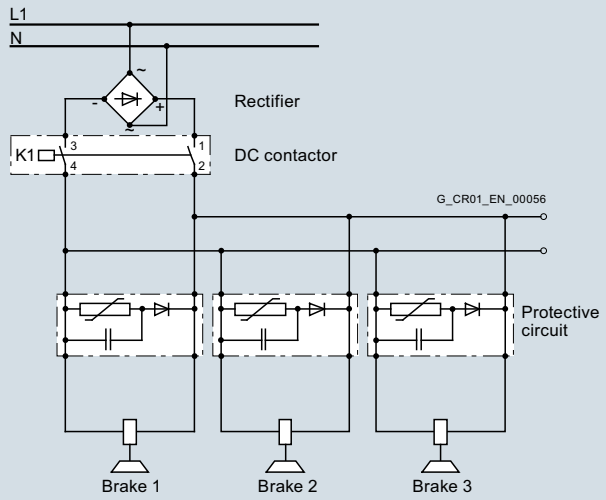
Design (continued)

Protective element

The brakes should be connected at the DC end, i.e. between the rectifier and coil (see circuit diagram below). This ensures a significantly shorter closing time than if the brake were connected at the AC end. A protective element (varistor + spark quenching) must be fitted in parallel to each brake coil. This protects the brake coil against excessively high de-energization voltages on the one hand, and the contactor contacts on the other. These protective elements must be installed close to the brake coils where possible, e.g. in the motor terminal box or in a distribution board on the subframes in the case of traversing gear. Protective elements PE-400/150/5 are directly available from the manufacturer[1)] under Article No. 008099300249.

Technical specifications

Protective element	
Connection voltage, max. (coil voltage)	400 V DC
Max. coil current	5 A
Max. energy absorption of one trip	150 J
Max. continuous output (average) of energy absorption	5 W
Trip peak at max. coil current	< 450 V
Ambient temperature	-40 ... +50 °C
Permissible cross section of connecting lead	0.2 ... 2.5 mm^2
Weight, approx.	0.2 kg
Degree of protection	IP20



Special versions

Emergency release with hand lever, option **J25**

In addition to brake release at zero current via 2 emergency release screws, it is also possible to release the brake by means of a hand lever permanently mounted on the brake housing. The lever is lockable.

Microswitch for "brake released" monitoring, option **J26**

The brake can be fitted with a microswitch for monitoring the "brake released" state. The contact is rated for:

- < 30 V DC, 5.0 A
- < 125 V DC, 0.5 A
- < 250 V AC, 5.0 A

Microswitch for air gap monitoring/wear, option **J24**

A 2nd microswitch can be fitted to monitor the "maximum air gap" function. Tripping of this contact indicates that full braking power is no longer available and the air gap must be adjusted immediately. The contact load rating is identical to that of the "brake released" microswitch.

Standstill heater, option **J27**

The installation of a heater can prevent the formation of condensate, e.g. caused by fluctuations in temperature and air humidity, inside the brake. This heater must not be switched on when the motor is operating. The heater is designed for a supply voltage of 230 V AC and a heat output of 40 W.

Encoder mounting, option **J28**/**J29**

An encoder (e.g. POG 10) can be mounted on the brake. Additional mounting components and other measures are required on the brake to fit an encoder.

Tacho socket T2 with coupling and mounting components is ordered with option **J28** (see section "Design").

If an encoder is to be fitted at a later date, the brake can be supplied prepared for encoder mounting. This is possible with option **J29**. Option **J29** does not include the coupling and mounting components.

It is also possible to retrofit an encoder by replacing the brake housing (the parts required, such as new housing, coupling, etc., can be ordered directly from the manufacturer[1)]) using the brake serial number as a reference).

Brake control unit BCU

A brake control unit (BCU) can also be used to supply and monitor the brake on single drives. For technical specifications, price, etc., please contact the manufacturer[1)] directly.

Rectifier in terminal box, option **C07**/**C01**

The brake motors can also be supplied with a bridge rectifier installed.

Note:

It must, however, be noted that the closing time for the brake can be a factor of 10 longer than the values specified in the tables (see section "Technical specifications" below) because it is connected at the AC current side.

Three-phase asynchronous motors 1LP4, 1LP6, 60 Hz variant

The motor types 1LP4 and 1LP6 are also available in a 60 Hz variant.

The following must be stated in addition to the Article No.:

- 400 VΔ 1LP....-.....**L5K**
- 460 VΔ 1LP....-.....**L5L**
- 500 VΔ 1LP....-.....**L5M**

Technical specifications on request.

1) PINTSCH BUBENZER GmbH
Werk Dinslaken
Hünxer Str. 149
D-46537 Dinslaken
Tel. +49 (0) 2064 / 602-0
Fax +49 (0) 2064 / 602-515

www.pintschbubenzer.de
E-mail: info@pintschbubenzer.de

Configuration

The following dimensioning parameters must be taken into account when a brake is selected:

Braking torque

On the assumption that the deceleration rate must be approximately equal to the acceleration rate, the braking torque should be calculated as follows:

$$M_{BR} = M_{Ja} \times \eta^2$$

M_{BR}	Braking torque of the mechanical brake
M_{Ja}	Accelerating torque for accelerating linear-motion and rotating masses

Accordingly, the braking torque of the mechanical brake must be approximately equal to the required maximum motor torque.

Braking energy on emergency trip

The braking energy for occasional emergency trips must be checked to ensure that it does not cause the brake to overheat. Please refer to table in section "Technical specifications" for permissible values. The braking energy produced for traversing gear can be calculated approximately with the following equation:

$$Q = \frac{I_{tot} \times n^2_{Br}}{182.4 \times 10^3} \times \frac{M_{Br}}{M_{Br} \pm M_L} \text{ [kJ]}$$

Q	Energy capability/braking energy in kJ
M_{Br}	Existing braking torque in Nm
M_L	Total of all load torques in Nm referred to the brake (motor) shaft
n_{Br}	Speed of brake (motor) shaft in rpm
I_{tot}	Total moment of inertia to be braked in kgm^2 reduced to the brake (motor) shaft
M_L	is positive if it supports braking (e.g. hoisting a load)
M_L	is negative if it counteracts braking (e.g. lowering a load)

The total moment of inertia I_{tot} is the sum of the individual moments of inertia of the plant components to be braked, reduced to the brake (motor) shaft, and the moment of inertia of the linear-motion masses. The equivalent mass inertia I_{Eqv} of a linear-motion mass m with velocity v, referred to the brake (motor) speed n_{Br}, is calculated as follows:

$$I_{Ers} = 91.2 \times m \times \left(\frac{v}{n_{Br}}\right)^2 \text{ [kgm}^2\text{]}$$

m	Mass of the linear-motion load in kg
v	Velocity of the linear-motion load in m/s
n_{Br}	Speed of brake (motor) shaft in rpm

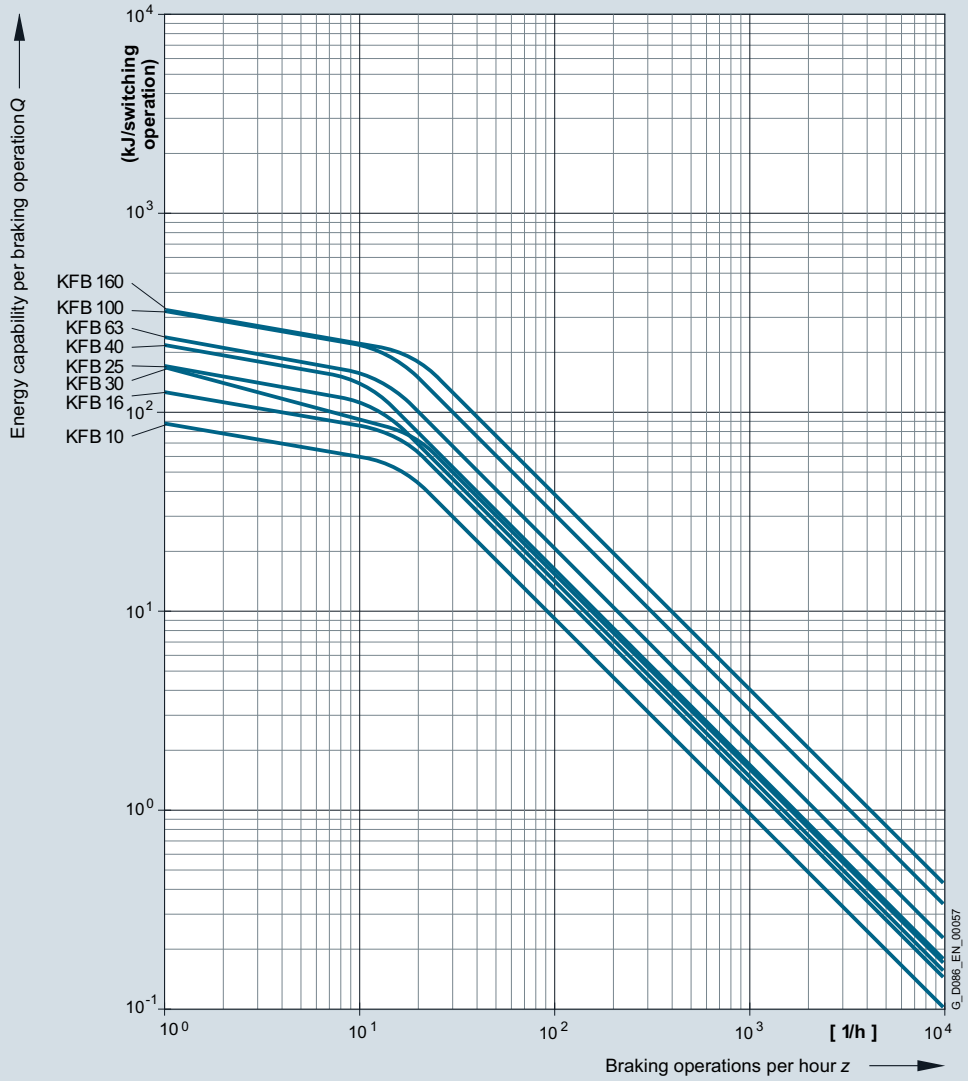
The velocity and/or speed to be entered here must equal the maximum values in normal operation. An increase in velocity resulting from wind forces may also need to be taken into account.

Configuration (continued)

Braking energy and energy capability

The brake must be capable of absorbing the heat produced by the occasional emergency braking operation. The maximum permissible energy capability *Q* is shown in the diagram below as a function of the number of switching operations.

The permissible energy capability *Q* for a single emergency trip can be found in the table in section "Technical specifications".



When the switching energy per braking operation and number of braking operations per hour are known, the brake size can be calculated.
Example:
Q = 35 kJ/switching operations and
z = 100 braking operations/hour
= brake KFB 160

Energy capability *Q*, braking speed *n* = 1500 rpm

Technical specifications

		KFB spring-set brakes							
		Type							
		KFB 10	KFB 16	KFB 25	KFB 30	KFB 40	KFB 63	KFB 100	KFB 160
Braking torque	Nm	100	160	250	300	400	630	1000	1600
Permissible speed	rpm	6000	6000	6000	6000	5500	4700	4000	3600
Rated voltage [1]	V DC	207	207	207	207	207	207	207	207
Rated output	W	100	118	160	154	188	206	316	340
Rated current	A	0.48	0.57	0.77	0.74	0.91	1	1.53	1.64
Moment of inertia	kgm^2	0.0017	0.0037	0.0048	0.0055	0.0068	0.017	0.036	0.05
Weight, approx.	kg	19	28	42	50	55	74	106	168
Energy capability Q									
• at n = 1500 rpm/z = 1	kJ	88	126	169	167	216	235	321	331
• at n = 1500 rpm/z = 100	kJ	8	11.7	12.6	13.8	14.5	18.4	27.1	34.8
Closing time t_1 [2]	ms	55	75	80	85	90	120	135	195
Release time t_2 [2]	ms	128	173	239	245	251	342	375	498

Q Energy capability per braking operation [kJ per switching operation]
n Speed [rpm]
z Braking operations per hour [1/h]
t_1 Closing time: Time from power OFF until 90 % of rated braking torque is reached
t_2 Release time: Time from power ON until 10 % of rated braking torque is reached
t Measured at 20 °C

The normal version of the brake is supplied for a coil voltage of 207 V DC. Voltages of 110 V DC and 180 V DC are also available at no extra cost (please state in plain text in the order). Other coil voltages on request.

[1] Rated voltage according to DIN IEC 38 with tolerances of +6 % and -10 % according to DIN VDE 0580.

[2] Switching time terms defined according to DIN VDE 0580, Closing time t_1 = Connection time t_1, Release time t_2 = Disconnection time t_2

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-15% or S2-30 min.											
132 S	1440	6.6	43.8	13.7	72	22.8	0.82	0.848	0.018	**1LP6130-4CA■■**	55
132 M	1440	9	59.7	18.3	98	30.4	0.83	0.855	0.023	**1LP6133-4CA■■**	62
160 M	1440	13.2	87.5	25.8	144	43	0.85	0.868	0.043	**1LP6163-4CA■■**	100
160 L	1440	18	119.5	34.5	196	57	0.85	0.886	0.055	**1LP6166-4CA■■**	114
180 M	1455	22.2	146	42	242	70	0.85	0.893	0.099	**1LP4183-4CA■■**	135
180 L	1455	26.4	173	50	286	83	0.85	0.900	0.12	**1LP4186-4CA■■**	150
180 L	1455	36	236	71	392	118	0.8	0.908	0.14	**1LP4188-4CA■■**	175
200 L	1455	36	236	67	392	112	0.86	0.907	0.19	**1LP4207-4CA■■**	195
200 L	1455	44	289	83	482	138	0.84	0.915	0.23	**1LP4208-4CA■■**	220
200 L	1458	54	354	102	596	170	0.83	0.916	0.29	**1LP4204-4CA■■**	280
225 S	1467	44	286	82	480	136	0.85	0.916	0.37	**1LP4220-4CA■■**	255
225 M	1467	54	352	97	582	162	0.87	0.925	0.45	**1LP4223-4CA■■**	290
225 M	1467	66	430	119	712	198	0.86	0.928	0.49	**1LP4228-4CA■■**	320
250 M	1474	66	427	120	710	200	0.86	0.927	0.69	**1LP4253-4CA■■**	375
250 M	1478	90	581	164	966	272	0.84	0.939	0.86	**1LP4258-4CA■■**	445
250 M	1478	108	698	195	1160	324	0.85	0.939	0.98	**1LP4254-4CA■■**	505
280 S	1482	90	580	164	964	272	0.84	0.938	1.2	**1LP4280-4CA■■**	515
280 M	1483	108	695	192	1158	320	0.86	0.941	1.4	**1LP4283-4CA■■**	560
280 M	1485	132	849	238	1414	396	0.85	0.945	1.71	**1LP4288-4CA■■**	660
280 M	1484	158	1017	294	1698	490	0.82	0.942	1.9	**1LP4284-4CA■■**	720

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-15% or S2-30 min.											
132 S	1440	6.6	43.8	13.7	72	22.8	0.82	0.848	0.018	**1LP6130-4CM8■**	55
132 M	1440	9	59.7	18.3	98	30.4	0.83	0.855	0.023	**1LP6133-4CM8■**	62
160 M	1440	13.2	87.5	25.8	144	43	0.85	0.868	0.043	**1LP6163-4CM8■**	100
160 L	1440	18	119.5	34.5	196	57	0.85	0.886	0.055	**1LP6166-4CM8■**	114
180 M	1455	22.2	146	42	242	70	0.85	0.893	0.099	**1LP6183-4CM8■**	150
180 L	1455	26.4	173	50	286	83	0.85	0.900	0.12	**1LP6186-4CM8■**	175
200 L	1455	36	236	67	392	112	0.86	0.907	0.19	**1LP6207-4CM8■**	220
200 L	1455	44	289	83	482	138	0.84	0.915	0.23	**1LP6208-4CM8■**	280
225 S	1467	44	286	82	480	136	0.85	0.916	0.37	**1LP6220-4CM8■**	290
225 M	1467	54	352	97	582	162	0.87	0.925	0.45	**1LP6223-4CM8■**	320
250 M	1474	66	427	120	710	200	0.86	0.927	0.69	**1LP6253-4CM8■**	445
250 M	1478	90	581	164	966	272	0.84	0.939	0.86	**1LP6258-4CM8■**	505
280 S	1482	90	580	164	964	272	0.84	0.938	1.2	**1LP6280-4CM8■**	560
280 M	1483	108	695	192	1158	320	0.86	0.941	1.4	**1LP6283-4CM8■**	660
280 M	1485	132	849	238	1414	396	0.85	0.945	1.71	**1LP6288-4CM8■**	720

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-25 % or S2-60 min.											
132 S	1455	5.5	36	11.4	72	22.8	0.81	0.860	0.018	**1LP6130-4CA■■**	55
132 M	1455	7.5	49	15.2	98	30.4	0.82	0.870	0.023	**1LP6133-4CA■■**	62
160 M	1460	11	72	21.5	144	43	0.84	0.885	0.043	**1LP6163-4CA■■**	100
160 L	1460	15	98	28.5	196	57	0.84	0.900	0.055	**1LP6166-4CA■■**	114
180 M	1465	18.5	121	35	242	70	0.84	0.904	0.099	**1LP4183-4CA■■**	135
180 L	1465	22	143	41.5	286	83	0.84	0.908	0.12	**1LP4186-4CA■■**	150
180 L	1465	30	196	59	392	118	0.8	0.917	0.14	**1LP4188-4CA■■**	175
200 L	1465	30	196	56	392	112	0.85	0.916	0.19	**1LP4207-4CA■■**	195
200 L	1465	37	241	69	482	138	0.84	0.925	0.23	**1LP4208-4CA■■**	220
200 L	1468	45	293	85	596	170	0.82	0.926	0.29	**1LP4204-4CA■■**	280
225 S	1475	37	240	68	480	136	0.85	0.922	0.37	**1LP4220-4CA■■**	255
225 M	1475	45	291	81	582	162	0.86	0.931	0.45	**1LP4223-4CA■■**	290
225 M	1475	55	356	99	712	198	0.86	0.934	0.49	**1LP4228-4CA■■**	320
250 M	1480	55	355	100	710	200	0.85	0.933	0.69	**1LP4253-4CA■■**	375
250 M	1482	75	483	136	966	272	0.85	0.944	0.86	**1LP4258-4CA■■**	445
250 M	1482	90	580	162	1160	324	0.85	0.943	0.98	**1LP4254-4CA■■**	505
280 S	1485	75	482	136	964	272	0.85	0.942	1.2	**1LP4280-4CA■■**	515
280 M	1485	90	579	160	1158	320	0.86	0.946	1.4	**1LP4283-4CA■■**	560
280 M	1488	110	707	198	1414	396	0.84	0.953	1.71	**1LP4288-4CA■■**	660
280 M	1486	132	849	245	1698	490	0.82	0.947	1.9	**1LP4284-4CA■■**	720

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page.

Note

With duty type S2 – 60 min., the output of motors in shaft heights132 and 160 is only 90 % of the specified values.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-25 % or S2-60 min.											
132 S	1455	5.5	36	11.4	72	22.8	0.81	0.860	0.018	**1LP6130-4CM8■**	55
132 M	1455	7.5	49	15.2	98	30.4	0.82	0.870	0.023	**1LP6133-4CM8■**	62
160 M	1460	11	72	21.5	144	43	0.84	0.885	0.043	**1LP6163-4CM8■**	100
160 L	1460	15	98	28.5	196	57	0.84	0.900	0.055	**1LP6166-4CM8■**	114
180 M	1465	18.5	121	35	242	70	0.84	0.904	0.099	**1LP6183-4CM8■**	150
180 L	1465	22	143	41.5	286	83	0.84	0.908	0.12	**1LP6186-4CM8■**	175
200 L	1465	30	196	56	392	112	0.85	0.916	0.19	**1LP6207-4CM8■**	220
200 L	1465	37	241	69	482	138	0.84	0.925	0.23	**1LP6208-4CM8■**	280
225 S	1475	37	240	68	480	136	0.85	0.922	0.37	**1LP6220-4CM8■**	290
225 M	1475	45	291	81	582	162	0.86	0.931	0.45	**1LP6223-4CM8■**	320
250 M	1480	55	355	100	710	200	0.85	0.933	0.69	**1LP6253-4CM8■**	445
250 M	1482	75	483	136	966	272	0.85	0.944	0.86	**1LP6258-4CM8■**	505
280 S	1485	75	482	136	964	272	0.85	0.942	1.2	**1LP6280-4CM8■**	560
280 M	1485	90	579	160	1158	320	0.86	0.946	1.4	**1LP6283-4CM8■**	660
280 M	1488	110	707	198	1414	396	0.84	0.953	1.71	**1LP6288-4CM8■**	720

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

Note

With duty type S2 – 60 min., the output of motors in shaft heights132 and 160 is only 90 % of the specified values.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-40 %											
132 S	1462	4.4	28.7	10	72	22.8	0.75	0.860	0.018	**1LP6130-4CA■■**	55
132 M	1462	6	39.2	13.2	98	30.4	0.76	0.870	0.023	**1LP6133-4CA■■**	62
160 M	1470	8.8	57.2	18	144	43	0.79	0.885	0.043	**1LP6163-4CA■■**	100
160 L	1470	12	78	24.5	196	57	0.79	0.900	0.055	**1LP6166-4CA■■**	114
180 M	1472	14.8	96	30	242	70	0.78	0.908	0.099	**1LP4183-4CA■■**	135
180 L	1472	17.6	114	35	286	83	0.8	0.910	0.12	**1LP4186-4CA■■**	150
180 L	1472	24	156	52	392	118	0.74	0.915	0.14	**1LP4188-4CA■■**	175
200 L	1472	24	156	47	392	112	0.81	0.914	0.19	**1LP4207-4CA■■**	195
200 L	1472	29	188	59	482	138	0.77	0.923	0.23	**1LP4208-4CA■■**	220
200 L	1474	36	233	73	596	170	0.77	0.924	0.29	**1LP4204-4CA■■**	280
225 S	1480	29	187	57	480	136	0.8	0.923	0.37	**1LP4220-4CA■■**	255
225 M	1480	36	232	68	582	162	0.82	0.932	0.45	**1LP4223-4CA■■**	290
225 M	1480	44	284	82	712	198	0.83	0.935	0.49	**1LP4228-4CA■■**	320
250 M	1486	44	282	82	710	200	0.83	0.935	0.69	**1LP4253-4CA■■**	375
250 M	1487	60	385	113	966	272	0.81	0.946	0.86	**1LP4258-4CA■■**	445
250 M	1487	72	462	135	1160	324	0.81	0.946	0.98	**1LP4254-4CA■■**	505
280 S	1489	60	385	116	964	272	0.79	0.944	1.2	**1LP4280-4CA■■**	515
280 M	1489	72	462	131	1158	320	0.84	0.947	1.4	**1LP4283-4CA■■**	560
280 M	1490	88	564	168	1414	396	0.79	0.954	1.71	**1LP4288-4CA■■**	660
280 M	1489	105	673	208	1698	490	0.77	0.947	1.9	**1LP4284-4CA■■**	720

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-40 %											
132 S	1462	4.4	28.7	10	72	22.8	0.75	0.860	0.018	**1LP6130-4CM8■**	55
132 M	1462	6	39.2	13.2	98	30.4	0.76	0.870	0.023	**1LP6133-4CM8■**	62
160 M	1470	8.8	57.2	18	144	43	0.79	0.885	0.043	**1LP6163-4CM8■**	100
160 L	1470	12	78	24.5	196	57	0.79	0.900	0.055	**1LP6166-4CM8■**	114
180 M	1472	14.8	96	30	242	70	0.78	0.908	0.099	**1LP6183-4CM8■**	150
180 L	1472	17.6	114	35	286	83	0.8	0.910	0.12	**1LP6186-4CM8■**	175
200 L	1472	24	156	47	392	112	0.81	0.914	0.19	**1LP6207-4CM8■**	220
200 L	1472	29	188	59	482	138	0.77	0.923	0.23	**1LP6208-4CM8■**	280
225 S	1480	29	187	57	480	136	0.8	0.923	0.37	**1LP6220-4CM8■**	290
225 M	1480	36	232	68	582	162	0.82	0.932	0.45	**1LP6223-4CM8■**	320
250 M	1486	44	282	82	710	200	0.83	0.935	0.69	**1LP6253-4CM8■**	445
250 M	1487	60	385	113	966	272	0.81	0.946	0.86	**1LP6258-4CM8■**	505
280 S	1489	60	385	116	964	272	0.79	0.944	1.2	**1LP6280-4CM8■**	560
280 M	1489	72	462	131	1158	320	0.84	0.947	1.4	**1LP6283-4CM8■**	660
280 M	1490	88	564	168	1414	396	0.79	0.954	1.71	**1LP6288-4CM8■**	720

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-60 %											
132 S	1475	3.3	21.4	8.3	72	22.8	0.68	0.855	0.018	**1LP6130-4CA■■**	55
132 M	1475	4.5	29.1	11	98	30.4	0.69	0.865	0.023	**1LP6133-4CA■■**	62
160 M	1480	6.6	42.6	14.5	144	43	0.75	0.880	0.043	**1LP6163-4CA■■**	100
160 L	1480	9	58	20	196	57	0.73	0.895	0.055	**1LP6166-4CA■■**	114
180 M	1480	11.1	72	25.5	242	70	0.69	0.905	0.099	**1LP4183-4CA■■**	135
180 L	1480	13.2	85	29	286	83	0.73	0.900	0.12	**1LP4186-4CA■■**	150
180 L	1480	18	116	44	392	118	0.66	0.905	0.14	**1LP4188-4CA■■**	175
200 L	1480	18	116	39.5	392	112	0.73	0.904	0.19	**1LP4207-4CA■■**	195
200 L	1480	22	142	51	482	138	0.68	0.913	0.23	**1LP4208-4CA■■**	220
200 L	1481	27	174	63	596	170	0.68	0.914	0.29	**1LP4204-4CA■■**	280
225 S	1485	22	141	46	480	136	0.75	0.919	0.37	**1LP4220-4CA■■**	255
225 M	1485	27	174	54	582	162	0.78	0.928	0.45	**1LP4223-4CA■■**	290
225 M	1485	33	212	65	712	198	0.79	0.931	0.49	**1LP4228-4CA■■**	320
250 M	1490	33	211	67	710	200	0.76	0.931	0.69	**1LP4253-4CA■■**	375
250 M	1490	45	288	93	966	272	0.74	0.942	0.86	**1LP4258-4CA■■**	445
250 M	1490	54	346	111	1160	324	0.75	0.942	0.98	**1LP4254-4CA■■**	505
280 S	1492	45	288	93	964	272	0.74	0.942	1.2	**1LP4280-4CA■■**	515
280 M	1492	54	346	104	1158	320	0.79	0.944	1.4	**1LP4283-4CA■■**	560
280 M	1492	66	422	141	1414	396	0.71	0.950	1.71	**1LP4288-4CA■■**	660
280 M	1491	79	506	175	1698	490	0.69	0.945	1.9	**1LP4284-4CA■■**	720

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-60 %											
132 S	1475	3.3	21.4	8.3	72	22.8	0.68	0.855	0.018	**1LP6130-4CM8■**	55
132 M	1475	4.5	29.1	11	98	30.4	0.69	0.865	0.023	**1LP6133-4CM8■**	62
160 M	1480	6.6	42.6	14.5	144	43	0.75	0.880	0.043	**1LP6163-4CM8■**	100
160 L	1480	9	58	20	196	57	0.73	0.895	0.055	**1LP6166-4CM8■**	114
180 M	1480	11.1	72	25.5	242	70	0.69	0.905	0.099	**1LP6183-4CM8■**	150
180 L	1480	13.2	85	29	286	83	0.73	0.900	0.12	**1LP6186-4CM8■**	175
200 L	1480	18	116	39.5	392	112	0.73	0.904	0.19	**1LP6207-4CM8■**	220
200 L	1480	22	142	51	482	138	0.68	0.913	0.23	**1LP6208-4CM8■**	280
225 S	1485	22	141	46	480	136	0.75	0.919	0.37	**1LP6220-4CM8■**	290
225 M	1485	27	174	54	582	162	0.78	0.928	0.45	**1LP6223-4CM8■**	320
250 M	1490	33	211	67	710	200	0.76	0.931	0.69	**1LP6253-4CM8■**	445
250 M	1490	45	288	93	966	272	0.74	0.942	0.86	**1LP6258-4CM8■**	505
280 S	1492	45	288	93	964	272	0.74	0.942	1.2	**1LP6280-4CM8■**	560
280 M	1492	54	346	104	1158	320	0.79	0.944	1.4	**1LP6283-4CM8■**	660
280 M	1492	66	422	141	1414	396	0.71	0.950	1.71	**1LP6288-4CM8■**	720

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-100 % or continuous duty S1											
132 S	1485	2	12.9	7.2	72	22.8	0.5	0.820	0.018	**1LP6130-4CA■■**	55
132 M	1485	2.8	18	9.2	98	30.4	0.53	0.830	0.023	**1LP6133-4CA■■**	62
160 M	1490	4.1	26.3	11.5	144	43	0.62	0.840	0.043	**1LP6163-4CA■■**	100
160 L	1490	5.6	35.9	15.5	196	57	0.61	0.860	0.055	**1LP6166-4CA■■**	114
180 M	1488	6.9	44.5	21	242	70	0.54	0.882	0.099	**1LP4183-4CA■■**	135
180 L	1488	8.2	52.7	23.5	286	83	0.57	0.888	0.12	**1LP4186-4CA■■**	150
180 L	1488	11.2	72	34	392	118	0.53	0.893	0.14	**1LP4188-4CA■■**	175
200 L	1488	11.2	72	31	392	112	0.58	0.892	0.19	**1LP4207-4CA■■**	195
200 L	1488	13.8	89	40	482	138	0.55	0.900	0.23	**1LP4208-4CA■■**	220
200 L	1488	16.8	108	49	596	170	0.55	0.901	0.29	**1LP4204-4CA■■**	280
225 S	1491	13.8	88	36	480	136	0.62	0.894	0.37	**1LP4220-4CA■■**	255
225 M	1491	16.8	108	42	582	162	0.64	0.899	0.45	**1LP4223-4CA■■**	290
225 M	1491	20	128	49	712	198	0.65	0.902	0.49	**1LP4228-4CA■■**	320
250 M	1495	20	128	52	710	200	0.62	0.902	0.69	**1LP4253-4CA■■**	375
250 M	1495	28	179	74	966	272	0.6	0.912	0.86	**1LP4258-4CA■■**	445
250 M	1495	34	217	88	1160	324	0.61	0.911	0.98	**1LP4254-4CA■■**	505
280 S	1496	28	179	75	964	272	0.59	0.910	1.2	**1LP4280-4CA■■**	515
280 M	1496	34	217	80	1158	320	0.67	0.913	1.4	**1LP4283-4CA■■**	560
280 M	1496	41	262	111	1414	396	0.58	0.919	1.71	**1LP4288-4CA■■**	660
280 M	1495	49	313	138	1698	490	0.56	0.913	1.9	**1LP4284-4CA■■**	720

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
4-pole, 1500 rpm											
Intermittent duty S3-100 % or continuous duty S1											
132 S	1485	2	12.9	7.2	72	22.8	0.5	0.820	0.018	**1LP6130-4CM8** ■	55
132 M	1485	2.8	18	9.2	98	30.4	0.53	0.830	0.023	**1LP6133-4CM8** ■	62
160 M	1490	4.1	26.3	11.5	144	43	0.62	0.840	0.043	**1LP6163-4CM8** ■	100
160 L	1490	5.6	35.9	15.5	196	57	0.61	0.860	0.055	**1LP6166-4CM8** ■	114
180 M	1488	6.9	44.5	21	242	70	0.54	0.882	0.099	**1LP6183-4CM8** ■	150
180 L	1488	8.2	52.7	23.5	286	83	0.57	0.888	0.12	**1LP6186-4CM8** ■	175
200 L	1488	11.2	72	31	392	112	0.58	0.892	0.19	**1LP6207-4CM8** ■	220
200 L	1488	13.8	89	40	482	138	0.55	0.900	0.23	**1LP6208-4CM8** ■	280
225 S	1491	13.8	88	36	480	136	0.62	0.894	0.37	**1LP6220-4CM8** ■	290
225 M	1491	16.8	108	42	582	162	0.64	0.899	0.45	**1LP6223-4CM8** ■	320
250 M	1495	20	128	52	710	200	0.62	0.902	0.69	**1LP6253-4CM8** ■	445
250 M	1495	28	179	74	966	272	0.6	0.912	0.86	**1LP6258-4CM8** ■	505
280 S	1496	28	179	75	964	272	0.59	0.910	1.2	**1LP6280-4CM8** ■	560
280 M	1496	34	217	80	1158	320	0.67	0.913	1.4	**1LP6283-4CM8** ■	660
280 M	1496	41	262	111	1414	396	0.58	0.919	1.71	**1LP6288-4CM8** ■	720

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-15% or S2-30 min.											
132 S	930	3.6	37	9.6	60	16	0.76	0.780	0.015	**1LP6130-6CA■■**	50
132 M	930	4.8	49.3	11.3	80	18.8	0.78	0.780	0.019	**1LP6133-6CA■■**	57
132 M	930	6.6	67.8	15.6	110	26	0.78	0.810	0.025	**1LP6134-6CA■■**	66
160 M	950	9	90.5	20.5	150	34	0.79	0.810	0.044	**1LP6163-6CA■■**	103
160 L	950	13.2	133	29.5	218	49	0.79	0.825	0.063	**1LP6166-6CA■■**	122
180 L	960	18	179	35.5	296	59	0.84	0.870	0.18	**1LP4186-6CA■■**	145
180 L	960	22	219	45	364	75	0.82	0.870	0.2	**1LP4188-6CA■■**	170
180 L	965	26	257	52	432	87	0.81	0.908	0.255	**1LP4184-6CA■■**	215
200 L	968	22	217	44	362	73	0.82	0.883	0.24	**1LP4206-6CA■■**	185
200 L	968	26	256	52	430	87	0.82	0.890	0.29	**1LP4207-6CA■■**	200
200 L	968	36	355	72	588	120	0.81	0.898	0.36	**1LP4208-6CA■■**	235
200 L	969	44	434	88	724	146	0.8	0.912	0.48	**1LP4204-6CA■■**	305
225 M	974	36	353	69	586	114	0.83	0.906	0.49	**1LP4223-6CA■■**	270
225 M	974	44	431	84	722	140	0.83	0.912	0.62	**1LP4228-6CA■■**	315
225 M	974	54	529	104	880	174	0.82	0.919	0.75	**1LP4224-6CA■■**	355
250 M	978	44	430	84	722	140	0.83	0.913	0.76	**1LP4253-6CA■■**	355
250 M	978	54	527	101	876	168	0.84	0.923	0.93	**1LP4258-6CA■■**	390
250 M	978	66	644	125	1070	208	0.83	0.926	1.07	**1LP4254-6CA■■**	440
280 S	982	54	525	100	872	166	0.86	0.915	1.1	**1LP4280-6CA■■**	455
280 M	983	66	642	120	1066	200	0.87	0.917	1.4	**1LP4283-6CA■■**	490
280 M	982	90	875	163	1454	272	0.86	0.931	1.65	**1LP4288-6CA■■**	550
280 M	982	108	1050	199	1746	332	0.85	0.935	1.94	**1LP4284-6CA■■**	660

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-15% or S2-30 min.											
132 S	930	3.6	37	9.6	60	16	0.76	0.780	0.015	**1LP6130-6CM8** ■	50
132 M	930	4.8	49.3	11.3	80	18.8	0.78	0.780	0.019	**1LP6133-6CM8** ■	57
132 M	930	6.6	67.8	15.6	110	26	0.78	0.810	0.025	**1LP6134-6CM8** ■	66
160 M	950	9	90.5	20.5	150	34	0.79	0.810	0.044	**1LP6163-6CM8** ■	103
160 L	950	13.2	133	29.5	218	49	0.79	0.825	0.063	**1LP6166-6CM8** ■	122
180 L	960	18	179	35.5	296	59	0.84	0.870	0.18	**1LP6186-6CM8** ■	170
180 L	960	22	219	45	364	75	0.82	0.870	0.2	**1LP6188-6CM8** ■	215
200 L	968	22	217	44	362	73	0.82	0.883	0.24	**1LP6206-6CM8** ■	200
200 L	968	26	256	52	430	87	0.82	0.890	0.29	**1LP6207-6CM8** ■	235
200 L	968	36	355	72	588	120	0.81	0.898	0.36	**1LP6208-6CM8** ■	305
225 M	974	36	353	69	586	114	0.83	0.906	0.49	**1LP6223-6CM8** ■	315
225 M	974	44	431	84	722	140	0.83	0.912	0.62	**1LP6228-6CM8** ■	355
250 M	978	44	430	84	722	140	0.83	0.913	0.76	**1LP6253-6CM8** ■	390
250 M	978	54	527	101	876	168	0.84	0.923	0.93	**1LP6258-6CM8** ■	440
280 S	982	54	525	100	872	166	0.86	0.915	1.1	**1LP6280-6CM8** ■	500
280 M	983	66	642	120	1066	200	0.87	0.917	1.4	**1LP6283-6CM8** ■	550
280 M	982	90	875	163	1454	272	0.86	0.931	1.65	**1LP6288-6CM8** ■	660

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-25 % or S2-60 min.											
132 S	950	3	30	8	60	16	0.76	0.790	0.015	**1LP6130-6CA■■**	50
132 M	950	4	40	9.4	80	18.8	0.76	0.805	0.019	**1LP6133-6CA■■**	57
132 M	950	5.5	55	13	110	26	0.76	0.830	0.025	**1LP6134-6CA■■**	66
160 M	960	7.5	75	17	150	34	0.74	0.860	0.044	**1LP6163-6CA■■**	103
160 L	960	11	109	24.5	218	49	0.74	0.875	0.063	**1LP6166-6CA■■**	122
180 L	970	15	148	29.5	296	59	0.83	0.889	0.18	**1LP4186-6CA■■**	145
180 L	970	18.5	182	37.5	364	75	0.8	0.896	0.2	**1LP4188-6CA■■**	170
180 L	975	22	216	43.5	432	87	0.8	0.912	0.255	**1LP4184-6CA■■**	215
200 L	975	18.5	181	36.5	362	73	0.81	0.898	0.24	**1LP4206-6CA■■**	185
200 L	975	22	215	43.5	430	87	0.81	0.903	0.29	**1LP4207-6CA■■**	200
200 L	975	30	294	60	588	120	0.8	0.909	0.36	**1LP4208-6CA■■**	235
200 L	976	37	362	73	724	146	0.8	0.919	0.48	**1LP4204-6CA■■**	305
225 M	978	30	293	57	586	114	0.83	0.918	0.49	**1LP4223-6CA■■**	270
225 M	978	37	361	70	722	140	0.83	0.922	0.62	**1LP4228-6CA■■**	315
225 M	978	45	440	87	880	174	0.81	0.927	0.75	**1LP4224-6CA■■**	355
250 M	982	37	361	70	722	140	0.83	0.923	0.76	**1LP4253-6CA■■**	355
250 M	982	45	438	84	876	168	0.83	0.933	0.93	**1LP4258-6CA■■**	390
250 M	982	55	535	104	1070	208	0.81	0.934	1.07	**1LP4254-6CA■■**	440
280 S	985	45	436	83	872	166	0.85	0.924	1.1	**1LP4280-6CA■■**	455
280 M	985	55	533	100	1066	200	0.86	0.927	1.4	**1LP4283-6CA■■**	490
280 M	985	75	727	136	1454	272	0.84	0.938	1.65	**1LP4288-6CA■■**	550
280 M	985	90	873	166	1746	332	0.83	0.940	1.94	**1LP4284-6CA■■**	660

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

Note

With duty type S2 – 60 min., the output of motors in shaft heights132 and 160 is only 90 % of the specified values.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-25 % or S2-60 min.											
132 S	950	3	30	8	60	16	0.76	0.790	0.015	**1LP6130-6CM8■**	50
132 M	950	4	40	9.4	80	18.8	0.76	0.805	0.019	**1LP6133-6CM8■**	57
132 M	950	5.5	55	13	110	26	0.76	0.830	0.025	**1LP6134-6CM8■**	66
160 M	960	7.5	75	17	150	34	0.74	0.860	0.044	**1LP6163-6CM8■**	103
160 L	960	11	109	24.5	218	49	0.74	0.875	0.063	**1LP6166-6CM8■**	122
180 L	970	15	148	29.5	296	59	0.83	0.889	0.18	**1LP6186-6CM8■**	170
180 L	970	18.5	182	37.5	364	75	0.8	0.896	0.2	**1LP6188-6CM8■**	215
200 L	975	18.5	181	36.5	362	73	0.81	0.898	0.24	**1LP6206-6CM8■**	200
200 L	975	22	215	43.5	430	87	0.81	0.903	0.29	**1LP6207-6CM8■**	235
200 L	975	30	294	60	588	120	0.8	0.909	0.36	**1LP6208-6CM8■**	305
225 M	978	30	293	57	586	114	0.83	0.918	0.49	**1LP6223-6CM8■**	315
225 M	978	37	361	70	722	140	0.83	0.922	0.62	**1LP6228-6CM8■**	355
250 M	982	37	361	70	722	140	0.83	0.923	0.76	**1LP6253-6CM8■**	390
250 M	982	45	438	84	876	168	0.83	0.933	0.93	**1LP6258-6CM8■**	440
280 S	985	45	436	83	872	166	0.85	0.924	1.1	**1LP6280-6CM8■**	500
280 M	985	55	533	100	1066	200	0.86	0.927	1.4	**1LP6283-6CM8■**	550
280 M	985	75	727	136	1454	272	0.84	0.938	1.65	**1LP6288-6CM8■**	660

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

Note

With duty type S2 – 60 min., the output of motors in shaft heights132 and 160 is only 90 % of the specified values.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-40 %											
132 S	960	2.4	23.9	7	60	16	0.65	0.800	0.015	**1LP6130-6CA■■**	50
132 M	960	3.2	31.8	8.3	80	18.8	0.72	0.780	0.019	**1LP6133-6CA■■**	57
132 M	960	4.4	43.8	11.4	110	26	0.68	0.840	0.025	**1LP6134-6CA■■**	66
160 M	970	6	59	15.5	150	34	0.66	0.860	0.044	**1LP6163-6CA■■**	103
160 L	970	8.8	86.5	22	218	49	0.67	0.880	0.063	**1LP6166-6CA■■**	122
180 L	981	12	118	24	296	59	0.81	0.895	0.18	**1LP4186-6CA■■**	145
180 L	981	14.8	144	32	364	75	0.77	0.873	0.2	**1LP4188-6CA■■**	170
180 L	984	17.6	171	37	432	87	0.76	0.920	0.255	**1LP4184-6CA■■**	215
200 L	980	14.8	144	31.5	362	73	0.76	0.899	0.24	**1LP4206-6CA■■**	185
200 L	980	17.6	172	36.5	430	87	0.77	0.905	0.29	**1LP4207-6CA■■**	200
200 L	980	24	234	52	588	120	0.75	0.910	0.36	**1LP4208-6CA■■**	235
200 L	981	29	282	63	724	146	0.74	0.920	0.48	**1LP4204-6CA■■**	305
225 M	984	24	233	46	586	114	0.82	0.920	0.49	**1LP4223-6CA■■**	270
225 M	984	29	281	56	722	140	0.81	0.926	0.62	**1LP4228-6CA■■**	315
225 M	984	36	349	70	880	174	0.8	0.929	0.75	**1LP4224-6CA■■**	355
250 M	986	29	281	58	722	140	0.78	0.928	0.76	**1LP4253-6CA■■**	355
250 M	986	36	349	70	876	168	0.8	0.938	0.93	**1LP4258-6CA■■**	390
250 M	986	44	426	86	1070	208	0.79	0.937	1.07	**1LP4254-6CA■■**	440
280 S	989	36	348	71	872	166	0.79	0.931	1.1	**1LP4280-6CA■■**	455
280 M	989	44	425	85	1066	200	0.81	0.932	1.4	**1LP4283-6CA■■**	490
280 M	989	60	579	116	1454	272	0.8	0.943	1.65	**1LP4288-6CA■■**	550
280 M	989	72	695	141	1746	332	0.79	0.945	1.94	**1LP4284-6CA■■**	660

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-40 %											
132 S	960	2.4	23.9	7	60	16	0.65	0.800	0.015	**1LP6130-6CM8** ■	50
132 M	960	3.2	31.8	8.3	80	18.8	0.72	0.780	0.019	**1LP6133-6CM8** ■	57
132 M	960	4.4	43.8	11.4	110	26	0.68	0.840	0.025	**1LP6134-6CM8** ■	66
160 M	970	6	59	15.5	150	34	0.66	0.860	0.044	**1LP6163-6CM8** ■	103
160 L	970	8.8	86.5	22	218	49	0.67	0.880	0.063	**1LP6166-6CM8** ■	122
180 L	981	12	118	24	296	59	0.81	0.895	0.18	**1LP6186-6CM8** ■	170
180 L	981	14.8	144	32	364	75	0.77	0.873	0.2	**1LP6188-6CM8** ■	215
200 L	980	14.8	144	31.5	362	73	0.76	0.899	0.24	**1LP6206-6CM8** ■	200
200 L	980	17.6	172	36.5	430	87	0.77	0.905	0.29	**1LP6207-6CM8** ■	235
200 L	980	24	234	52	588	120	0.75	0.910	0.36	**1LP6208-6CM8** ■	305
225 M	984	24	233	46	586	114	0.82	0.920	0.49	**1LP6223-6CM8** ■	315
225 M	984	29	281	56	722	140	0.81	0.926	0.62	**1LP6228-6CM8** ■	355
250 M	986	29	281	58	722	140	0.78	0.928	0.76	**1LP6253-6CM8** ■	390
250 M	986	36	349	70	876	168	0.8	0.938	0.93	**1LP6258-6CM8** ■	440
280 S	989	36	348	71	872	166	0.79	0.931	1.1	**1LP6280-6CM8** ■	500
280 M	989	44	425	85	1066	200	0.81	0.932	1.4	**1LP6283-6CM8** ■	550
280 M	989	60	579	116	1454	272	0.8	0.943	1.65	**1LP6288-6CM8** ■	660

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-60 %											
132 S	975	1.8	17.6	6.3	60	16	0.55	0.800	0.015	**1LP6130-6CA■■**	50
132 M	975	2.4	23.5	7.3	80	18.8	0.62	0.770	0.019	**1LP6133-6CA■■**	57
132 M	975	3.3	32.3	9.8	110	26	0.62	0.810	0.025	**1LP6134-6CA■■**	66
160 M	980	4.5	44	13	150	34	0.6	0.850	0.044	**1LP6163-6CA■■**	103
160 L	980	6.6	64.3	18.8	218	49	0.59	0.880	0.063	**1LP6166-6CA■■**	122
180 L	984	9	88	20	296	59	0.73	0.896	0.18	**1LP4186-6CA■■**	145
180 L	984	11.1	108	26	364	75	0.7	0.870	0.2	**1LP4188-6CA■■**	170
180 L	986	13.2	128	30	432	87	0.7	0.915	0.255	**1LP4184-6CA■■**	215
200 L	986	11.1	108	26	362	73	0.7	0.897	0.24	**1LP4206-6CA■■**	185
200 L	986	13.2	128	29	430	87	0.73	0.904	0.29	**1LP4207-6CA■■**	200
200 L	986	18	174	43	588	120	0.68	0.905	0.36	**1LP4208-6CA■■**	235
200 L	986	22	213	52	724	146	0.67	0.914	0.48	**1LP4204-6CA■■**	305
225 M	988	18	174	37	586	114	0.77	0.922	0.49	**1LP4223-6CA■■**	270
225 M	988	22	213	46	722	140	0.75	0.925	0.62	**1LP4228-6CA■■**	315
225 M	988	27	261	57	880	174	0.74	0.925	0.75	**1LP4224-6CA■■**	355
250 M	990	22	212	47	722	140	0.73	0.926	0.76	**1LP4253-6CA■■**	355
250 M	990	27	260	57	876	168	0.74	0.936	0.93	**1LP4258-6CA■■**	390
250 M	990	33	318	70	1070	208	0.73	0.933	1.07	**1LP4254-6CA■■**	440
280 S	992	27	260	56	872	166	0.76	0.925	1.1	**1LP4280-6CA■■**	455
280 M	992	33	318	68	1066	200	0.75	0.934	1.4	**1LP4283-6CA■■**	490
280 M	992	45	433	92	1454	272	0.76	0.940	1.65	**1LP4288-6CA■■**	550
280 M	992	54	520	113	1746	332	0.74	0.946	1.94	**1LP4284-6CA■■**	660

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3, IM V5		**0**	**–**
IM B5, IM V1		**1**	**–**
IM B35		**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-60 %											
132 S	975	1.8	17.6	6.3	60	16	0.55	0.800	0.015	**1LP6130-6CM8** ■	50
132 M	975	2.4	23.5	7.3	80	18.8	0.62	0.770	0.019	**1LP6133-6CM8** ■	57
132 M	975	3.3	32.3	9.8	110	26	0.62	0.810	0.025	**1LP6134-6CM8** ■	66
160 M	980	4.5	44	13	150	34	0.6	0.850	0.044	**1LP6163-6CM8** ■	103
160 L	980	6.6	64.3	18.8	218	49	0.59	0.880	0.063	**1LP6166-6CM8** ■	122
180 L	984	9	88	20	296	59	0.73	0.896	0.18	**1LP6186-6CM8** ■	170
180 L	984	11.1	108	26	364	75	0.7	0.870	0.2	**1LP6188-6CM8** ■	215
200 L	986	11.1	108	26	362	73	0.7	0.897	0.24	**1LP6206-6CM8** ■	200
200 L	986	13.2	128	29	430	87	0.73	0.904	0.29	**1LP6207-6CM8** ■	235
200 L	986	18	174	43	588	120	0.68	0.905	0.36	**1LP6208-6CM8** ■	305
225 M	988	18	174	37	586	114	0.77	0.922	0.49	**1LP6223-6CM8** ■	315
225 M	988	22	213	46	722	140	0.75	0.925	0.62	**1LP6228-6CM8** ■	355
250 M	990	22	212	47	722	140	0.73	0.926	0.76	**1LP6253-6CM8** ■	390
250 M	990	27	260	57	876	168	0.74	0.936	0.93	**1LP6258-6CM8** ■	440
280 S	992	27	260	56	872	166	0.76	0.925	1.1	**1LP6280-6CM8** ■	500
280 M	992	33	318	68	1066	200	0.75	0.934	1.4	**1LP6283-6CM8** ■	550
280 M	992	45	433	92	1454	272	0.76	0.940	1.65	**1LP6288-6CM8** ■	660

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

1LP4, 1LP6 SH 132 S - 280 M with mounted spring-set brake

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-100 % or continuous duty S1											
132 S	988	1.1	10.6	5.7	60	16	0.45	0.680	0.015	**1LP6130-6CA■■**	50
132 M	988	1.5	14.5	6.4	80	18.8	0.48	0.720	0.019	**1LP6133-6CA■■**	57
132 M	988	2	19.3	8.5	110	26	0.46	0.780	0.025	**1LP6134-6CA■■**	66
160 M	988	2.8	27	11	150	34	0.46	0.820	0.044	**1LP6163-6CA■■**	103
160 L	988	4.1	39.6	15.5	218	49	0.46	0.850	0.063	**1LP6166-6CA■■**	122
180 L	990	5.6	54	16	296	59	0.62	0.820	0.18	**1LP4186-6CA■■**	145
180 L	990	6.9	67	21	364	75	0.56	0.850	0.2	**1LP4188-6CA■■**	170
180 L	991	8.2	79	24.5	432	87	0.58	0.880	0.255	**1LP4184-6CA■■**	215
200 L	991	6.9	66.5	20	362	73	0.58	0.870	0.24	**1LP4206-6CA■■**	185
200 L	991	8.2	79	23	430	87	0.59	0.880	0.29	**1LP4207-6CA■■**	200
200 L	991	11.2	108	34	588	120	0.55	0.880	0.36	**1LP4208-6CA■■**	235
200 L	991	13.8	133	41	724	146	0.54	0.900	0.48	**1LP4204-6CA■■**	305
225 M	993	11.2	108	28.5	586	114	0.63	0.908	0.49	**1LP4223-6CA■■**	270
225 M	993	13.8	133	35	722	140	0.63	0.910	0.62	**1LP4228-6CA■■**	315
225 M	993	16.8	162	43.5	880	174	0.62	0.907	0.75	**1LP4224-6CA■■**	355
250 M	994	13.8	133	35	722	140	0.63	0.915	0.76	**1LP4253-6CA■■**	355
250 M	994	16.8	161	42	876	168	0.63	0.920	0.93	**1LP4258-6CA■■**	390
250 M	994	20	192	52	1070	208	0.61	0.925	1.07	**1LP4254-6CA■■**	440
280 S	995	16.8	161	43	872	166	0.62	0.914	1.1	**1LP4280-6CA■■**	455
280 M	995	20	192	52	1066	200	0.61	0.920	1.4	**1LP4283-6CA■■**	490
280 M	995	28	269	71	1454	272	0.63	0.916	1.65	**1LP4288-6CA■■**	550
280 M	995	34	326	86	1746	332	0.62	0.930	1.94	**1LP4284-6CA■■**	660

		Order code
Voltage		
400 VΔ, 50 Hz	**9**	**L5G**
460 VΔ, 50 Hz	**9**	**L5H**
500 VΔ, 50 Hz	**9**	**L5J**
Type		
IM B3, IM V5	**0**	**–**
IM B5, IM V1	**1**	**–**
IM B35	**6**	**–**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Shaft height	Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Torque, max.[1]	Current, max.[2]	Power factor	Efficiency	Moment of inertia	**1LP asynchronous motor** Natural cooling for voltage of 690 V Y, 50 Hz	Weight, approx. (without brake)
SH	n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	cos φ	η	J		
	rpm	kW	Nm	A	Nm	A			kgm²	Article No.	kg
6-pole, 1000 rpm											
Intermittent duty S3-100 % or continuous duty S1											
132 S	988	1.1	10.6	5.7	60	16	0.45	0.680	0.015	**1LP6130-6CM8** ■	50
132 M	988	1.5	14.5	6.4	80	18.8	0.48	0.720	0.019	**1LP6133-6CM8** ■	57
132 M	988	2	19.3	8.5	110	26	0.46	0.780	0.025	**1LP6134-6CM8** ■	66
160 M	988	2.8	27	11	150	34	0.46	0.820	0.044	**1LP6163-6CM8** ■	103
160 L	988	4.1	39.6	15.5	218	49	0.46	0.850	0.063	**1LP6166-6CM8** ■	122
180 L	990	5.6	54	16	296	59	0.62	0.820	0.18	**1LP6186-6CM8** ■	170
180 L	990	6.9	67	21	364	75	0.56	0.850	0.2	**1LP6188-6CM8** ■	215
200 L	991	6.9	66.5	20	362	73	0.58	0.870	0.24	**1LP6206-6CM8** ■	200
200 L	991	8.2	79	23	430	87	0.59	0.880	0.29	**1LP6207-6CM8** ■	235
200 L	991	11.2	108	34	588	120	0.55	0.880	0.36	**1LP6208-6CM8** ■	305
225 M	993	11.2	108	28.5	586	114	0.63	0.908	0.49	**1LP6223-6CM8** ■	315
225 M	993	13.8	133	35	722	140	0.63	0.910	0.62	**1LP6228-6CM8** ■	355
250 M	994	13.8	133	35	722	140	0.63	0.915	0.76	**1LP6253-6CM8** ■	390
250 M	994	16.8	161	42	876	168	0.63	0.920	0.93	**1LP6258-6CM8** ■	440
280 S	995	16.8	161	43	872	166	0.62	0.914	1.1	**1LP6280-6CM8** ■	500
280 M	995	20	192	52	1066	200	0.61	0.920	1.4	**1LP6283-6CM8** ■	550
280 M	995	28	269	71	1454	272	0.63	0.916	1.65	**1LP6288-6CM8** ■	660

Type	
IM B3, IM V5	**0**
IM B5, IM V1	**1**
IM B35	**6**

For inertia mass and weight of brakes, see technical specifications for KFB spring-set brake for SIMOTICS SD 1LP4, 1LP6.

For ordering example, see Page 7/55.

[1] Maximum torque that is available for converter-fed operation.

[2] Maximum current that is available for converter-fed operation.

Options

Options or order codes (supplement "-Z" is required)

Order code	Special motor versions
A11	Motor protection through PTC thermistor with 3 embedded temperature sensors for tripping
A12	Motor protection through PTC thermistor with 6 embedded temperature sensors for tripping and alarm
A23	Motor temperature detection with embedded temperature sensor KTY 84-130
A31	3 bimetallic switches (Klixon) for tripping
K45	Standstill heating for 230 V
K46	Standstill heating for 115 V
L27	Insulated bearing cartridge
B02	Acceptance test certificate 3.1 according to EN 10204
C23	Temperature class F, used acc. to B, coolant temperature 50 °C, derating approx. 8 %
C25	Temperature class F, used acc. to B, coolant temperature 60 °C, derating approx. 18 %
K09	Terminal box on RHS
K10	Terminal box on LHS
M64	Terminal box at NDE (needed for motor with brake)
K11	Bolted-on feet
J22	Foot made of GGG 40, only in conjunction with K11 or K09 / K10
K52	IP56 degree of protection (non-heavy-sea)
K55	Cable entry, maximum configuration
J05	All cable glands EMC
K83	Rotation of the terminal box through 90°, entry from DE
K84	Rotation of the terminal box through 90°, entry from NDE
K85	Rotation of terminal box through 180°
J20	Flange end shield made of GGG 40
M65	Standard shaft made of stainless steel
M91	Special "Offshore" finish in RAL 7030, stone gray, coat thickness 220 µm
Y54 • and special finish RAL ….	Special finish in other standard RAL colors: RAL 1015, 1019, 2003, 2004, 3007, 5007, 5009, 5010, 5012, 5015, 5017, 5018, 5019, 6019, 7000, 7004, 7011, 7016, 7022, 7033
K31	Second rating plate, supplied separately packed
Y73	Customized cable entries (plain text is required)
Y80 • and identification code	Extra rating plate or rating plate with different data

- This order code only determines the price of the version – additional plain text is required.

Article No. supplement "-Z" with order code and plain text, if required.

Options (continued)

Order code	Special brake versions
J18	Mounting of pulse encoder POG 10 DN 1024 I on the brake (possible only in conjunction with J28, option includes the encoder)
J30	Mounting of brake KFB 10
J31	Mounting of brake KFB 16
J32	Mounting of brake KFB 25
J33	Mounting of brake KFB 30
J34	Mounting of brake KFB 40
J35	Mounting of brake KFB 63
J36	Mounting of brake KFB 100
J37	Mounting of brake KFB 160
C01	Brake supply voltage 400 V AC (equivalent to DC = 180 V) with half-wave rectifier in the terminal box
J25	Hand lever release for brake
J26	Microswitch "brake released"
J24	Microswitch "air-gap monitoring"
J27	230 V brake standstill heating
J28	Brake with components for mounting encoder POG 10 (T2)
J29	Brake prepared for mounting encoder POG 10 (T1)
G80	Mounting of rotary pulse encoder POG 10 DN 1024 I on motor without fan (without fitted brake)
C07	Brake supply voltage 230 V AC (equivalent to DC = 207 V) with bridge rectifier in the terminal box

Non-standard brake coil voltage on request.

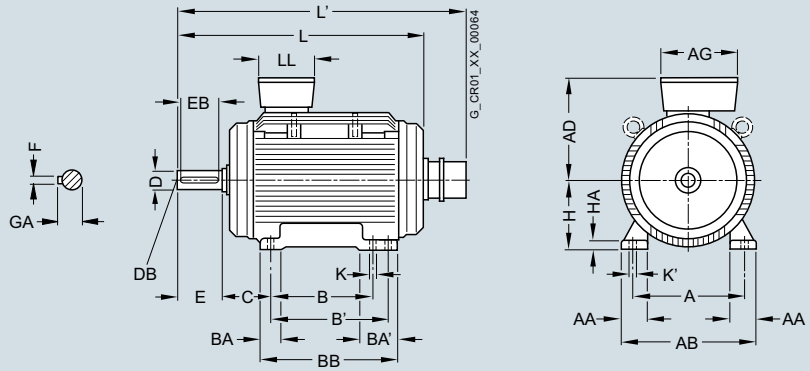
Ordering example

Selection criteria	Requirement	Structure of the Article No.
Motor type	Brake motor without external fan, degree of protection IP55, gray cast-iron model	**1LP4■■■-■■■■■**
Shaft height	180 M	**1LP4183-■■■■■**
No. of poles/speed	4-pole	**1LP4183-4■■■■**
Version	Crane version	**1LP4183-4CA■■**
Voltage/frequency	400 VΔ, 50 Hz	**1LP4183-4CA9■** **L5G**
Type of construction	IM B5	**1LP4183-4CA91** **L5G**
Special version	Motor protection through PTC thermistor with 6 embedded temperature sensors for tripping and alarm	**1LP4183-4CA91-Z** **L5G+A12**
	Standstill heating for 230 V	**1LP4183-4CA91-Z** **L5G+A12+K45**
	Mounting of brake KFB 25	**1LP4183-4CA91-Z** **L5G+A12+K45+J32**
	Hand lever release for brake	**1LP4183-4CA91-Z** **L5G+A12+K45+J32+J25**
	Microswitch "brake released"	**1LP4183-4CA91-Z** **L5G+A12+K45+J32+J25+J26**
	230 V brake standstill heating	**1LP4183-4CA91-Z** **L5G+A12+K45+J32+J25+J26+J27**
	Brake with components for mounting encoder POG 10 (T2)	**1LP4183-4CA91-Z** **L5G+A12+K45+J32+J25+J26+J27+J28**
Complete ordering information for required version of brake motor		**1LP4183-4CA91-Z** **L5G+A12+K45+J32+J25+J26+J27+J28**

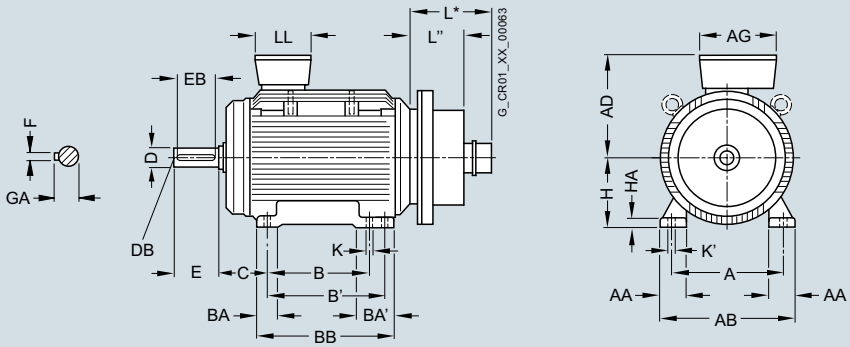
Dimensional drawings

1LP4 and 1LP6, type of construction IM B3

With POG 10 pulse encoder



With brake and with POG 10 pulse encoder



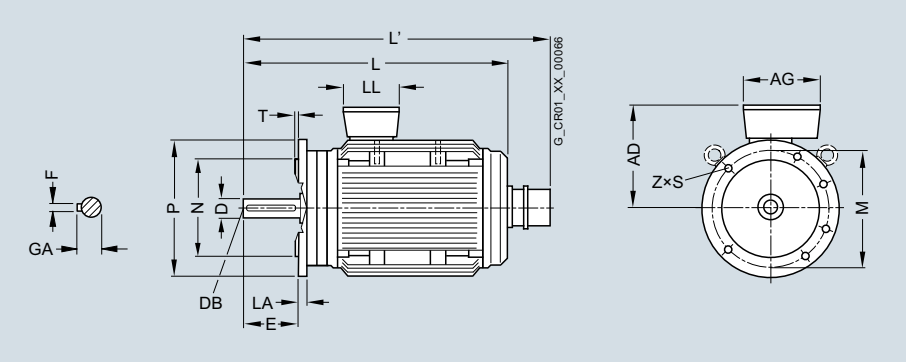
For motor			Dimensions in mm																	
Shaft height	Type	No. of poles	A	AA	AB	AD	AG	B	B'	BA	BA'	BB	C	H	HA	K	K'	L [1]	L [1]	LL
132 S	1LP6130	4, 6	216	53	256	228	208	140		49	–	180	89	132	15	12	16	397	582	178
132 M	1LP6133	4, 6	216	53	256	228	208	178		49	–	218	89	132	15	12	16	397	582	178
	1LP6134	6																397	582	
160 M	1LP6163	4, 6	254	60	300	256	208	210		57	–	256	108	160	18	15	19	529	714	178
160 L	1LP6166	4, 6	254	60	300	256	208	254		57	–	300	108	160	18	15	19	529	714	178
180 M	1LP4183, 1LP6183	4	279	65	339	310	266	241		70	111	328	121	180	20	15	19	562	714	197
180 L	1LP4186, 1LP6186	4, 6	279	65	339	310	266	241	279	70	111	328	121	180	20	15	19	562	714	197
	1LP4188, 1LP6188	4, 6																613	765	
	1LP4184	6																643	795	
200 L	1LP4206, 1LP6206	6	318	70	378	375	319	305		80	80	355	133	200	25	19	25	617	764	233
	1LP4207, 1LP6207	4, 6																617	764	
	1LP4208, 1LP6208	4, 6																617	764	
	1LP4204	4, 6																734	881	
225 S	1LP4220, 1LP6220	4	356	80	436	410	300	286		85	110	361	149	225	34	19	25	670	830	236
225 M	1LP4223, 1LP6223	4, 6	356	80	436	410	300	286	311	85	110	361	149	225	34	19	25	670	830	236
	1LP4228, 1LP6228	4, 6																730	890	
	1LP4224	6																780	910	
250 M	1LP4253, 1LP6253	4, 6	406	100	490	500	380	349		100	100	409	168	250	40	24	30	764	930	307
	1LP4258, 1LP6258	6																764	930	
	1LP4258, 1LP6258	4																834	1000	
	1LP4254	4, 6																834	1000	
280 S	1LP4280, 1LP6280	4, 6	457	100	540	540	380	368		100	151	479	190	280	40	24	30	830	1005	307
280 M	1LP4283, 1LP6283	4, 6	457	100	540	540	380	368	419	100	151	479	190	280	40	24	30	830	1005	307
	1LP4288, 1LP6288	6																830	1005	
	1LP4288, 1LP6288	4																940	1115	
	1LP4284	6																940	1115	
	1LP4284	4																990	1165	

[1] Dimensions L and L' on request for 1LP6 motors, shaft heights 180 M to 280 M.

Dimensional drawings (continued)

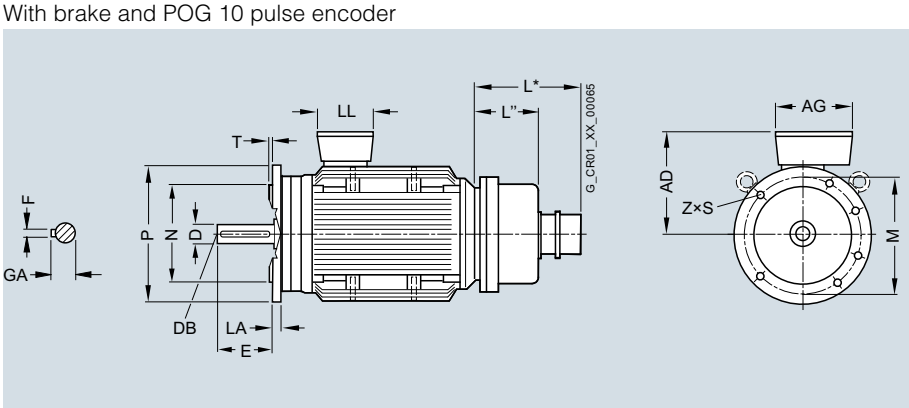
1LP4 and 1LP6, type of construction IM B5

With POG 10 pulse encoder



Brake mounting	
Brake	L'' with brake mm
KFB 10	Max. 150
KFB 16	Max. 175
KFB 25	Max. 180
KFB 30	Max. 180
KFB 40	Max. 185
KFB 63	Max. 200
KFB 100	Max. 215
KFB 160	Max. 230

With brake and POG 10 pulse encoder

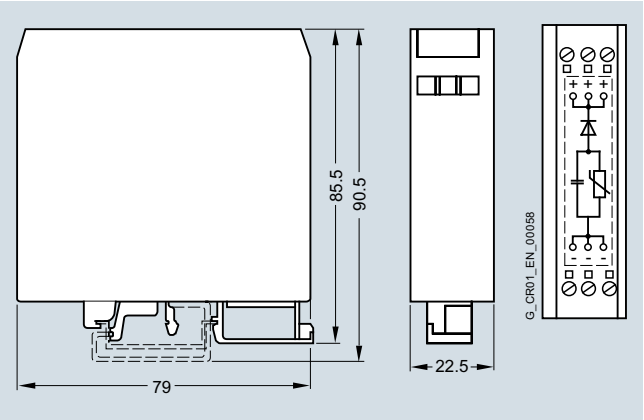


Brake mounting + POG 10	
Brake	L* with brake + POG 10 mm
KFB 10	Max. 315
KFB 16	Max. 330
KFB 25	Max. 345
KFB 30	Max. 345
KFB 40	Max. 355
KFB 63	Max. 370
KFB 100	Max. 385
KFB 160	Max. 400

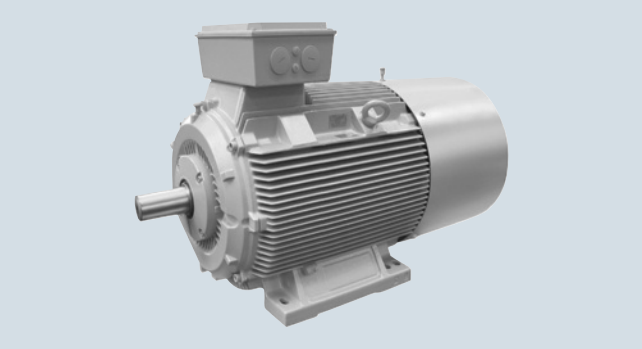
For motor			DE shaft extension						Flange dimensions						
Shaft height	Type	No. of poles	D	DB	E	EB	F	GA	LA	M	N	P	S	T	Z
132 S	1LP6130	4, 6	38	M12	80	70	10	41	12	265	230	300	14.5	4	4
132 M	1LP6133	4, 6	38	M12	80	70	10	41	12	265	230	300	14.5	4	4
	1LP6134	6													
160 M	1LP6163	4, 6	42	M16	110	90	12	45	13	300	250	350	18.5	5	4
160 L	1LP6166	4, 6	42	M16	110	90	12	45	13	300	250	350	18.5	5	4
180 M	1LP4183, 1LP6183	4	48	M16	110	100	14	51.5	13	300	250	350	18.5	5	4
180 L	1LP4186, 1LP6186	4, 6	48	M16	110	100	14	51.5	13	300	250	350	18.5	5	4
	1LP4188, 1LP6188	4, 6													
	1LP4184	6													
200 L	1LP4206, 1LP6206	6	55	M20	110	100	16	59	15	350	300	400	18.5	5	4
	1LP4207, 1LP6207	4, 6													
	1LP4208, 1LP6208	4, 6													
	1LP4204	4, 6													
225 S	1LP4220, 1LP6220	4	60	M20	140	125	18	64	16	400	350	450	18.5	5	8
225 M	1LP4223, 1LP6223	4, 6	60	M20	140	125	18	64	16	400	350	450	18.5	5	8
	1LP4228, 1LP6228	4, 6													
	1LP4224	6													
250 M	1LP4253, 1LP6253	4, 6	65	M20	140	125	18	69	18	500	450	550	18.5	5	8
	1LP4258, 1LP6258	6													
	1LP4258, 1LP6258	4													
	1LP4254	4, 6													
280 S	1LP4280, 1LP6280	4, 6	75	M20	140	125	20	79.5	18	500	450	550	18.5	5	8
280 M	1LP4283, 1LP6283	4, 6	75	M20	140	125	20	79.5	18	500	450	550	18.5	5	8
	1LP4288, 1LP6288	6													
	1LP4288, 1LP6288	4													
	1LP4284,	6													
	1LP4284	4													

Dimensional drawings (continued)

Protective element



Overview



The separately ventilated three-phase motors 1LG4 of shaft height 315 are especially suitable for use as hoist motors in medium-output drives. The axially mounted external fan means that the motors can operate for long periods with rated torque at low speeds, an operating characteristic required, for example, for the hoisting gear of trestle or assembly cranes.

Product range

Motor type	Number of poles	Winding utilization factor	Power	Rated speed	Power	Rated speed	Power	Rated speed
			50 Hz	50 Hz	69 Hz	69 Hz	87 Hz	87 Hz
			S1/kW	rpm	S1/kW	rpm	S1/kW	rpm
1LG4316-6	6	F	117	987	150	1367	181	1726
1LG4317-6	6	F	141	987	180	1367	219	1726
1LG4318-6	6	F	171	987	219	1367	265	1726
1LG4314-6	6	F	214	987	274	1367	332	1726
1LG4316-8	8	F	101	736	129	1022	156	1291
1LG4317-8	8	F	123	736	157	1022	191	1291
1LG4318-8	8	F	148	736	189	1022	229	1291
1LG4314-8	8	F	179	736	229	1022	277	1291

Encoder mounting

The following encoders can be mounted – between the motor NDE and the external fan – (HOG 10 DN 1024 I encoders are installed on cranes):

- HOG 10 D.....
- HOG 10 D..... with centrifugal switch FSL
- HOG 10 D..... with centrifugal switch ESL (on request)

The connections of the encoder and centrifugal switch (if applicable) are taken to an auxiliary terminal box. As a result, the fan unit does not need to be disassembled when the encoder cables are connected on the system.

The table below shows an overview of the available motor outputs.

Technical specifications

The maximum permissible field-weakening speed is 2600 rpm for all the variants listed above.

The following rated voltages are available:

- 400 V 3 AC
- 460 V 3 AC
- 500 V 3 AC
- 690 V 3 AC (special insulation!)

The standard version of the external fan motor is designed for

- 50 Hz 3 AC 220 – 240 VΔ/380 – 420 VY, 2.0/1.15 A
- 60 Hz 3 AC 440 – 480 VY, 1.05 A

Other rated voltages can be ordered with order code **Y81** and plain text.

We recommend that the external fan motor is ordered with a standstill heater for outdoor installations. Cables for the external fan motors must always enter from below. The fan cowl can be turned accordingly.
The motors are available in types of construction IM B3 and IM B35.

The electrical data of the motors for intermittent duty S3 plus the relevant planning data can be found in the selection and ordering data.
The special models normally required for cranes are the only options listed under "Article number supplements and special versions". For further options, see Catalog D 81.1.

The basic version of the 1LG4 motor without an external fan is described in Catalog D 81.1.

1LG4, 1LG6 SH 315 L with external fan

Selection and ordering data

Rated speed	Rated output	Rated torque	Rated current (at 400 V)	Max. torque[1]	Max. current[2]	Moment of inertia	**1LG asynchronous motor** Surface cooling with external fan, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz	Weight, approx. (without brake)
n_{rated}	P_{rated}	M_{rated}	I_{rated}	M_{max}	I_{max}	J		
rpm	kW	Nm	A	Nm	A	kgm²	Article No.	kg
6-pole, 1000 rpm, 50 Hz								
Intermittent duty S3-25 %								
979	169	1648	298	2264	426	3.2	**1LG4316-6CA■■**	925
	204	1990	360	2728	510	4	**1LG4317-6CA■■**	1015
	248	2419	440	3308	618	4.7	**1LG4318-6CA■■**	1215
	310	3024	550	4140	765	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-40 %								
983	147	1428	260	2264	426	3.2	**1LG4316-6CA■■**	925
	177	1719	312	2728	510	4	**1LG4317-6CA■■**	1015
	215	2089	380	3308	618	4.7	**1LG4318-6CA■■**	1215
	269	2613	478	4140	765	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-60 %								
985	131	1270	232	2264	426	3.2	**1LG4316-6CA■■**	925
	158	1532	278	2728	510	4	**1LG4317-6CA■■**	1015
	191	1852	340	3308	618	4.7	**1LG4318-6CA■■**	1215
	239	2317	428	4140	765	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-100 % or continuous duty S1								
987	117	1132	210	2264	426	3.2	**1LG4316-6CA■■**	925
	141	1364	252	2728	510	4	**1LG4317-6CA■■**	1015
	171	1654	305	3308	618	4.7	**1LG4318-6CA■■**	1215
	214	2070	386	4140	765	5.5	**1LG4314-6CA■■**	1435

		Order code
Voltage		
400 VΔ, 50 Hz	**9**	**L5G**
460 VΔ, 50 Hz	**9**	**L5H**
500 VΔ, 50 Hz	**9**	**L5J**
Type		
IM B3	**0**	**–**
IM B35	**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with forced ventilation, for voltage of 690 V Y, 50 Hz Article No.	Weight, approx. (without brake) kg
6-pole, 1000 rpm, 50 Hz								
Intermittent duty S3-25 %								
979	169	1648	298	2264	426	3.2	**1LG6316-6CM8** ■	1045
	204	1990	360	2728	510	4	**1LG6317-6CM8** ■	1215
	248	2419	440	3308	618	4.7	**1LG6318-6CM8** ■	1280
Intermittent duty S3-40 %								
983	147	1428	260	2264	426	3.2	**1LG6316-6CM8** ■	1045
	177	1719	312	2728	510	4	**1LG6317-6CM8** ■	1215
	215	2089	380	3308	618	4.7	**1LG6318-6CM8** ■	1280
Intermittent duty S3-60 %								
985	131	1270	232	2264	426	3.2	**1LG6316-6CM8** ■	1045
	158	1532	278	2728	510	4	**1LG6317-6CM8** ■	1215
	191	1852	340	3308	618	4.7	**1LG6318-6CM8** ■	1280
Intermittent duty S3-100 % or continuous duty S1								
987	117	1132	210	2264	426	3.2	**1LG6316-6CM8** ■	1045
	141	1364	252	2728	510	4	**1LG6317-6CM8** ■	1215
	171	1654	305	3308	618	4.7	**1LG6318-6CM8** ■	1280

Type	
IM B3	**0**
IM B35	**6**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

1LG4, 1LG6 SH 315 L with external fan

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with external fan, for voltages of 400 VΔ, 50 Hz 460 VΔ, 50 Hz 500 VΔ, 50 Hz Article No.	Weight, approx. (without brake) kg
8-pole, 750 rpm, 50 Hz								
Intermittent duty S3-25 %								
727	146	1918	275	2622	390	3.1	**1LG4316-8CB■■**	900
	178	2338	334	3192	468	3.9	**1LG4317-8CB■■**	1055
	215	2824	402	3840	562	4.5	**1LG4318-8CB■■**	1135
	259	3402	465	4646	655	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-40 %								
731	127	1659	236	2622	390	3.1	**1LG4316-8CB■■**	900
	155	2025	286	3192	468	3.9	**1LG4317-8CB■■**	1055
	186	2430	342	3840	562	4.5	**1LG4318-8CB■■**	1135
	225	2939	353	4646	655	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-60 %								
734	113	1470	207	2622	390	3.1	**1LG4316-8CB■■**	900
	139	1809	255	3192	468	3.9	**1LG4317-8CB■■**	1055
	166	2160	303	3840	562	4.5	**1LG4318-8CB■■**	1135
	202	2628	353	4646	655	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-100 % or continuous duty S1								
736	101	1311	187	2622	390	3.1	**1LG4316-8CB■■**	900
	123	1596	227	3192	468	3.9	**1LG4317-8CB■■**	1055
	148	1920	272	3840	562	4.5	**1LG4318-8CB■■**	1135
	179	2323	320	4646	655	5.5	**1LG4314-8CB■■**	1415

			Order code
Voltage			
400 VΔ, 50 Hz	**9**		**L5G**
460 VΔ, 50 Hz	**9**		**L5H**
500 VΔ, 50 Hz	**9**		**L5J**
Type			
IM B3		**0**	**–**
IM B35		**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with forced ventilation, for voltage of 690 V Y, 50 Hz Article No.	Weight, approx. (without brake) kg
8-pole, 750 rpm, 50 Hz								
Intermittent duty S3-25 %								
727	146	1918	275	2622	390	3.1	**1LG6316-8CM8** ■	1040
	178	2338	334	3192	468	3.9	**1LG6317-8CM8** ■	1135
	215	2824	402	3840	562	4.5	**1LG6318-8CM8** ■	1305
Intermittent duty S3-40 %								
731	127	1659	236	2622	390	3.1	**1LG6316-8CM8** ■	1040
	155	2025	286	3192	468	3.9	**1LG6317-8CM8** ■	1135
	186	2430	342	3840	562	4.5	**1LG6318-8CM8** ■	1305
Intermittent duty S3-60 %								
734	113	1470	207	2622	390	3.1	**1LG6316-8CM8** ■	1040
	139	1809	255	3192	468	3.9	**1LG6317-8CM8** ■	1135
	166	2160	303	3840	562	4.5	**1LG6318-8CM8** ■	1305
Intermittent duty S3-100 % or continuous duty S1								
736	101	1311	187	2622	390	3.1	**1LG6316-8CM8** ■	1040
	123	1596	227	3192	468	3.9	**1LG6317-8CM8** ■	1135
	148	1920	272	3840	562	4.5	**1LG6318-8CM8** ■	1305

Type	
IM B3	**0**
IM B35	**6**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

1LG4, 1LG6 SH 315 L with external fan

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with external fan, for voltages of 400 VΔ, 69 Hz 460 VΔ, 69 Hz 500 VΔ, 69 Hz Article No.	Weight, approx. (without brake) kg
6-pole, 1380 rpm, 69 Hz								
Intermittent duty S3-25 %								
1356	218	1535	388	2096	536	3.2	**1LG4316-6CA■■**	925
	261	1838	455	2514	655	4	**1LG4317-6CA■■**	1015
	318	2240	554	3060	788	4.7	**1LG4318-6CA■■**	1215
	397	2796	695	3828	990	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-40 %								
1361	189	1326	335	2096	536	3.2	**1LG4316-6CA■■**	925
	227	1593	396	2514	655	4	**1LG4317-6CA■■**	1015
	276	1937	477	3060	788	4.7	**1LG4318-6CA■■**	1215
	345	2421	598	3828	990	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-60 %								
1365	168	1175	298	2096	536	3.2	**1LG4316-6CA■■**	925
	202	1413	353	2514	655	4	**1LG4317-6CA■■**	1015
	245	1714	424	3060	788	4.7	**1LG4318-6CA■■**	1215
	307	2148	535	3828	990	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-100 % or continuous duty S1								
1367	150	1048	268	2096	536	3.2	**1LG4316-6CA■■**	925
	180	1257	316	2514	655	4	**1LG4317-6CA■■**	1015
	219	1530	388	3060	788	4.7	**1LG4318-6CA■■**	1215
	274	1914	476	3828	990	5.5	**1LG4314-6CA■■**	1435

			Order code
Voltage			
400 VΔ, 69 Hz	**9**		**L5N**
460 VΔ, 69 Hz	**9**		**L5P**
500 VΔ, 69 Hz	**9**		**L5Q**
Type			
IM B3		**0**	**–**
IM B35		**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with forced ventilation, for voltage of 690 V Y, 69 Hz Article No.	Weight, approx. (without brake) kg
6-pole, 1380 rpm, 69 Hz								
Intermittent duty S3-25 %								
1356	218	1535	388	2096	536	3.2	**1LG6316-6CM■■**	1045
	261	1838	455	2514	655	4	**1LG6317-6CM■■**	1215
	318	2240	554	3060	788	4.7	**1LG6318-6CM■■**	1280
Intermittent duty S3-40 %								
1361	189	1326	335	2096	536	3.2	**1LG6316-6CM■■**	1045
	227	1593	396	2514	655	4	**1LG6317-6CM■■**	1215
	276	1937	477	3060	788	4.7	**1LG6318-6CM■■**	1280
Intermittent duty S3-60 %								
1365	168	1175	298	2096	536	3.2	**1LG6316-6CM■■**	1045
	202	1413	353	2514	655	4	**1LG6317-6CM■■**	1215
	245	1714	424	3060	788	4.7	**1LG6318-6CM■■**	1280
Intermittent duty S3-100 % or continuous duty S1								
1367	150	1048	268	2096	536	3.2	**1LG6316-6CM■■**	1045
	180	1257	316	2514	655	4	**1LG6317-6CM■■**	1215
	219	1530	388	3060	788	4.7	**1LG6318-6CM■■**	1280

			Order code
Voltage			
690 V Y, 69 Hz	**9**		**L5W**
Type			
IM B3		**0**	–
IM B35		**6**	–

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

1LG4, 1LG6 SH 315 L with external fan

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with external fan, for voltages of 400 VΔ, 69 Hz 460 VΔ, 69 Hz 500 VΔ, 69 Hz Article No.	Weight, approx. (without brake) kg
8-pole, 1035 rpm, 69 Hz								
Intermittent duty S3-25 %								
1009	187	1770	351	2410	490	3.1	**1LG4316-8CB■■**	900
	228	2158	418	2934	585	3.9	**1LG4317-8CB■■**	1055
	274	2593	502	3532	700	4.5	**1LG4318-8CB■■**	1135
	332	3142	600	4280	846	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-40 %								
1015	162	1524	300	2410	490	3.1	**1LG4316-8CB■■**	900
	198	1863	357	2934	585	3.9	**1LG4317-8CB■■**	1055
	238	2239	427	3532	700	4.5	**1LG4318-8CB■■**	1135
	288	2710	512	4280	846	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-60 %								
1019	144	1350	266	2410	490	3.1	**1LG4316-8CB■■**	900
	176	1649	315	2934	585	3.9	**1LG4317-8CB■■**	1055
	212	1987	378	3532	700	4.5	**1LG4318-8CB■■**	1135
	256	2399	455	4280	846	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-100 % or continuous duty S1								
1022	129	1205	239	2410	490	3.1	**1LG4316-8CB■■**	900
	157	1467	280	2934	585	3.9	**1LG4317-8CB■■**	1055
	189	1766	336	3532	700	4.5	**1LG4318-8CB■■**	1135
	229	2140	408	4280	846	5.5	**1LG4314-8CB■■**	1415

			Order code
Voltage			
400 VΔ, 69 Hz	**9**		**L5N**
460 VΔ, 69 Hz	**9**		**L5P**
500 VΔ, 69 Hz	**9**		**L5Q**
Type			
IM B3		**0**	**–**
IM B35		**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with forced ventilation, for voltage of 690 V Y, 50 Hz Article No.	Weight, approx. (without brake) kg
8-pole, 1035 rpm, 69 Hz								
Intermittent duty S3-25 %								
1009	187	1770	351	2410	490	3.1	**1LG6316-8CM■■**	1040
	228	2158	418	2934	585	3.9	**1LG6317-8CM■■**	1135
	274	2593	502	3532	700	4.5	**1LG6318-8CM■■**	1305
Intermittent duty S3-40 %								
1015	162	1524	300	2410	490	3.1	**1LG6316-8CM■■**	1040
	198	1863	357	2934	585	3.9	**1LG6317-8CM■■**	1135
	238	2239	427	3532	700	4.5	**1LG6318-8CM■■**	1305
Intermittent duty S3-60 %								
1019	144	1350	266	2410	490	3.1	**1LG6316-8CM■■**	1040
	176	1649	315	2934	585	3.9	**1LG6317-8CM■■**	1135
	212	1987	378	3532	700	4.5	**1LG6318-8CM■■**	1305
Intermittent duty S3-100 % or continuous duty S1								
1022	129	1205	239	2410	490	3.1	**1LG6316-8CM■■**	1040
	157	1467	280	2934	585	3.9	**1LG6317-8CM■■**	1135
	189	1766	336	3532	700	4.5	**1LG6318-8CM■■**	1305

			Order code
Voltage			
690 V Y, 69 Hz	**9**		**L5W**
Type			
IM B3		**0**	–
IM B35		**6**	–

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with external fan, for voltages of 400 VΔ, 87 Hz 460 VΔ, 87 Hz 500 VΔ, 87 Hz Article No.	Weight, approx. (without brake) kg
6-pole, 1740 rpm, 87 Hz								
Intermittent duty S3-25 %								
1714	262	1460	461	2002	646	3.2	**1LG4316-6CA■■**	925
	318	1772	548	2424	782	4	**1LG4317-6CA■■**	1015
	384	2140	665	2932	932	4.7	**1LG4318-6CA■■**	1215
	481	2680	848	3674	1195	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-40 %								
1721	228	1265	397	2002	646	3.2	**1LG4316-6CA■■**	925
	276	1532	469	2424	782	4	**1LG4317-6CA■■**	1015
	334	1853	572	2932	932	4.7	**1LG4318-6CA■■**	1215
	418	2319	728	3674	1195	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-60 %								
1724	203	1124	355	2002	646	3.2	**1LG4316-6CA■■**	925
	245	1357	420	2424	782	4	**1LG4317-6CA■■**	1015
	297	1645	509	2932	932	4.7	**1LG4318-6CA■■**	1215
	372	2061	648	3674	1195	5.5	**1LG4314-6CA■■**	1435
Intermittent duty S3-100 % or continuous duty S1								
1726	181	1001	318	2002	646	3.2	**1LG4316-6CA■■**	925
	219	1212	380	2424	782	4	**1LG4317-6CA■■**	1015
	265	1466	454	2932	932	4.7	**1LG4318-6CA■■**	1215
	332	1837	580	3674	1195	5.5	**1LG4314-6CA■■**	1435

			Order code
Voltage			
400 VΔ, 87 Hz	**9**		**L5R**
460 VΔ, 87 Hz	**9**		**L5S**
500 VΔ, 87 Hz	**9**		**L5T**
Type			
IM B3		**0**	**–**
IM B35		**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with forced ventilation, for voltage of 690 V Y, 87 Hz Article No.	Weight, approx. (without brake) kg
6-pole, 1740 rpm, 87 Hz								
Intermittent duty S3-25 %								
1714	262	1460	461	2002	646	3.2	**1LG6316-6CM■■**	1045
	318	1772	548	2424	782	4	**1LG6317-6CM■■**	1215
	384	2140	665	2932	932	4.7	**1LG6318-6CM■■**	1280
Intermittent duty S3-40 %								
1721	228	1265	397	2002	646	3.2	**1LG6316-6CM■■**	1045
	276	1532	469	2424	782	4	**1LG6317-6CM■■**	1215
	334	1853	572	2932	932	4.7	**1LG6318-6CM■■**	1280
Intermittent duty S3-60 %								
1724	203	1124	355	2002	646	3.2	**1LG6316-6CM■■**	1045
	245	1357	420	2424	782	4	**1LG6317-6CM■■**	1215
	297	1645	509	2932	932	4.7	**1LG6318-6CM■■**	1280
Intermittent duty S3-100 % or continuous duty S1								
1726	181	1001	318	2002	646	3.2	**1LG6316-6CM■■**	1045
	219	1212	380	2424	782	4	**1LG6317-6CM■■**	1215
	265	1466	454	2932	932	4.7	**1LG6318-6CM■■**	1280

			Order code
Voltage			
690 V Y, 87 Hz	**9**		**L5X**
Type			
IM B3		**0**	**–**
IM B35		**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

1LG4, 1LG6 SH 315 L with external fan

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with external fan, for voltages of 400 VΔ, 69 Hz 460 VΔ, 69 Hz 500 VΔ, 69 Hz Article No.	Weight, approx. (without brake) kg
8-pole, 1035 rpm, 69 Hz								
Intermittent duty S3-25 %								
1275	226	1693	412	2308	578	3.1	**1LG4316-8CB■■**	900
	277	2075	508	2826	735	3.9	**1LG4317-8CB■■**	1055
	332	2487	609	3388	855	4.5	**1LG4318-8CB■■**	1135
	402	3011	712	4098	1005	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-40 %								
1282	196	1460	351	2308	578	3.1	**1LG4316-8CB■■**	900
	241	1795	434	2826	735	3.9	**1LG4317-8CB■■**	1055
	288	2145	522	3388	855	4.5	**1LG4318-8CB■■**	1135
	349	2600	610	4098	1005	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-60 %								
1287	175	1299	315	2308	578	3.1	**1LG4316-8CB■■**	900
	214	1588	383	2826	735	3.9	**1LG4317-8CB■■**	1055
	256	1900	460	3388	855	4.5	**1LG4318-8CB■■**	1135
	310	2300	538	4098	1005	5.5	**1LG4314-8CB■■**	1415
Intermittent duty S3-100 % or continuous duty S1								
1291	156	1154	280	2308	578	3.1	**1LG4316-8CB■■**	900
	191	1413	340	2826	735	3.9	**1LG4317-8CB■■**	1055
	229	1694	410	3388	855	4.5	**1LG4318-8CB■■**	1135
	277	2049	478	4098	1005	5.5	**1LG4314-8CB■■**	1415

		Order code
Voltage		
400 VΔ, 69 Hz	**9**	**L5R**
460 VΔ, 69 Hz	**9**	**L5S**
500 VΔ, 69 Hz	**9**	**L5T**
Type		
IM B3	**0**	**–**
IM B35	**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Selection and ordering data (continued)

Rated speed n_{rated} rpm	Rated output P_{rated} kW	Rated torque M_{rated} Nm	Rated current (at 400 V) I_{rated} A	Max. torque[1] M_{max} Nm	Max. current[2] I_{max} A	Moment of inertia J kgm²	**1LG asynchronous motor** Surface cooling with forced ventilation, for voltage of 690 V Y, 87 Hz Article No.	Weight, approx. (without brake) kg
8-pole, 1035 rpm, 87 Hz								
Intermittent duty S3-25 %								
1275	226	1693	412	2308	578	3.1	**1LG6316-8CM■■**	1040
	277	2075	508	2826	735	3.9	**1LG6317-8CM■■**	1135
	332	2487	609	3388	855	4.5	**1LG6318-8CM■■**	1305
Intermittent duty S3-40 %								
1282	196	1460	351	2308	578	3.1	**1LG6316-8CM■■**	1040
	241	1795	434	2826	735	3.9	**1LG6317-8CM■■**	1135
	288	2145	522	3388	855	4.5	**1LG6318-8CM■■**	1305
Intermittent duty S3-60 %								
1287	175	1299	315	2308	578	3.1	**1LG6316-8CM■■**	1040
	214	1588	383	2826	735	3.9	**1LG6317-8CM■■**	1135
	256	1900	460	3388	855	4.5	**1LG6318-8CM■■**	1305
Intermittent duty S3-100 % or continuous duty S1								
1291	156	1154	280	2308	578	3.1	**1LG6316-8CM■■**	1040
	191	1413	340	2826	735	3.9	**1LG6317-8CM■■**	1135
	229	1694	410	3388	855	4.5	**1LG6318-8CM■■**	1305

			Order code
Voltage			
690 V Y, 87 Hz	**9**		**L5X**
Type			
IM B3		**0**	**–**
IM B35		**6**	**–**

For ordering example, see Page 7/73.

[1] Maximum torque that is available for converter-fed operation.
[2] Maximum current that is available for converter-fed operation.

Options

Options or order codes (supplement "-Z" is required)

Order code	Description
A11	Motor protection through PTC thermistor with 3 embedded temperature sensors for tripping
A12	Motor protection through PTC thermistor with 6 embedded temperature sensors for tripping and alarm
A23	Motor temperature detection with embedded temperature sensor KTY 84-130
J15	Mounting of rotary pulse encoder HOG 10 DN 1024 I, terminal box moisture protection
J16	Mounting of rotary pulse encoder HOG 10 DN 1024 I, terminal box dust protection
K45	Standstill heating for 230 V
K46	Standstill heating for 115 V
L27	Insulated bearing cartridge
Y54 • and special finish RAL ….	Special finish in other standard RAL colors: RAL 1015, 1019, 2003, 2004, 3007, 5007, 5009, 5010, 5012, 5015, 5017, 5018, 5019, 6019, 7000, 7004, 7011, 7016, 7022, 7033
K26	Special finish in RAL 7030, stone gray, coat thickness 90 µm
M91	Special "Offshore" finish in RAL 7030, stone gray, coat thickness 220 µm
Y73 • and identification code	Non-standard cable entry holes, specify size and number in plain text
K09	Terminal box on RHS
K10	Terminal box on LHS
K83	Rotation of the terminal box through 90°, entry from DE
K84	Rotation of the terminal box through 90°, entry from NDE
K85	Rotation of terminal box through 180°
K31	Second rating plate, supplied separately packed
Y74	Mounting of rotary pulse encoder HOG 10 DN 1024 I + FSL (speed ... rpm), terminal box moisture protection
Y76	Mounting of rotary pulse encoder HOG 10 DN 1024 I + FSL (speed ... rpm) terminal box dust protection
Y80 • and identification code	Extra rating plate or rating plate with different data
Y81 • and identification code	Non-standard voltage and/or frequency of the external fan motor, standstill heating
Y82 • and identification code	Extra rating plate with identification code

- This order code only determines the price of the version – additional plain text is required.

Order No. supplement "-Z" with order code and plain text, if required.

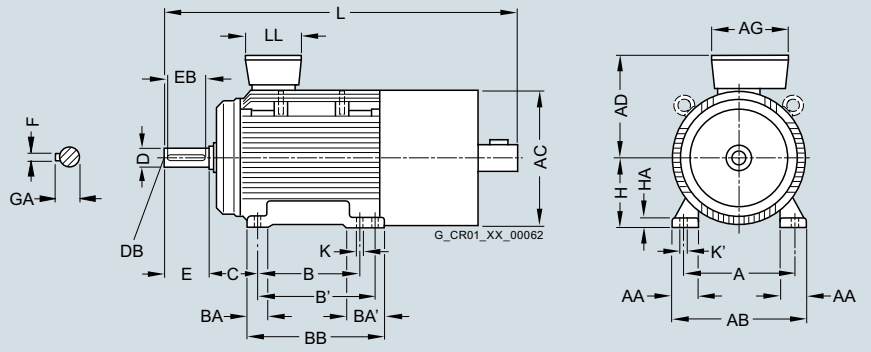
Options (continued)

Ordering example

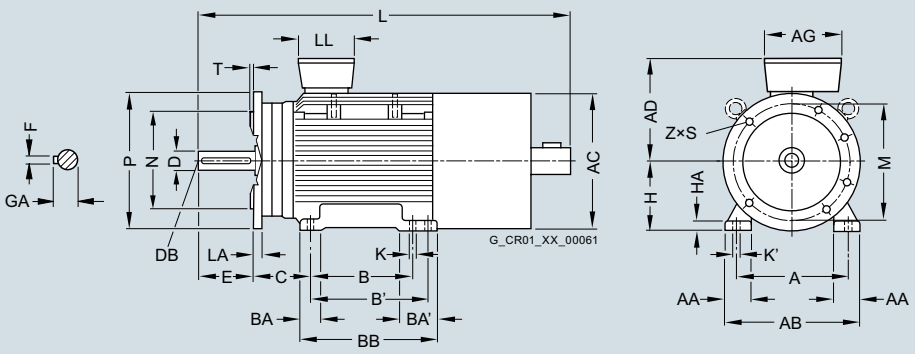
Selection criteria	Requirement	Structure of the Article No.
Motor type	Standard motor with improved efficiency, IP55 degree of protection, cast-iron version	**1LG4■■■-■■■■■**
Shaft height	315 L	**1LG4316-■■■■■**
No. of poles/speed	6-pole	**1LG4316-6■■■■**
Version	Crane version	**1LG4316-6CA■■**
Voltage/frequency	400 VΔ, 50 Hz	**1LG4316-6CA9■** **L5G**
Type	IM B3	**1LG4316-6CA90** **L5G**
Special version	Motor temperature detection with embedded temperature sensor KTY 84-130	**1LG4316-6CA90-Z** **L5G+A23**
	Standstill heating for 230 V	**1LG4316-6CA90-Z** **L5G+A23+K45**
	Mounting of rotary pulse encoder HOG 10 DN 1024 I + FSL (speed ... rpm) terminal box dust protection	**1LG4316-6CA90-Z** **L5G+A23+K45+Y76**
Complete ordering information for required version of hoist motor		**1LG4316-6CA90-Z** **L5G+A23+K45+Y76**

Dimensional drawings

1LG4/1LG6, type of construction IM B3



1LG4/1LG6, type of construction IM B35

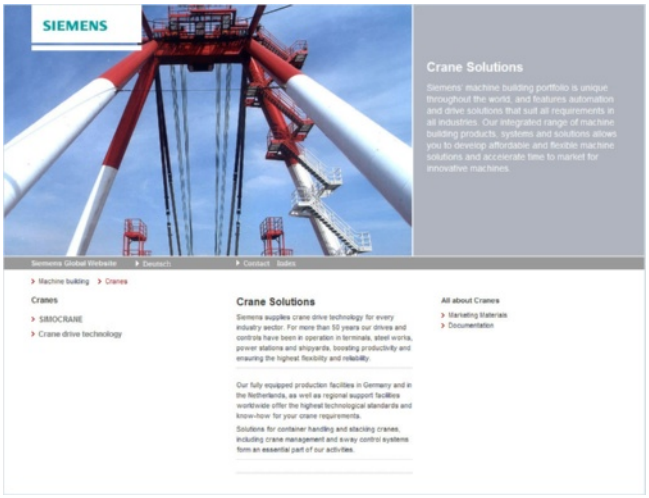


For motor		Dimensions designation acc. to IEC																	
Type	No. of poles	A	AA	AB	AD	AG	B	B'	BA	BA'	BB	C	H	HA	K	K'	L	AC	LL
1LG4316	6, 8	508	120	610	495	379	457	508	125	176	578	216	315	50	28	35	1522	610	307
1LG6316	6, 8																		
1LG4317	6, 8	508	120	610	495	379	457	508	125	176	578	216	315	50	28	35	1522	610	307
1LG6317	6																1662		
1LG6317	8																1522		
1LG4318	6	508	120	610	495	379	457	508	155	250	666	216	315	30	28	35	1662	610	307
1LG4318	8								125	176	578			50			1522		
1LG6318	6								155	250	666			30			1662		
1LG6318	8								125	176	578			50			1662		
1LG4314	6, 8	508	120	610	495	379	457	508	155	250	666	216	315	30	28	35	1749	610	307

For motor		DE shaft extension						Flange dimensions						
Type	No. of poles	D	DB	E	EB	F	GA	LA	M	N	P	S	T	Z
1LG4316	6, 8	80	M20	170	140	22	85	22	600	550	660	24	6	8
1LG6316	6, 8													
1LG4317	6, 8	80	M20	170	140	22	85	22	600	550	660	24	6	8
1LG6317	6, 8													
1LG4318	6, 8	80	M20	170	140	22	85	22	600	550	660	24	6	8
1LG6318	6, 8													
1LG4314	6, 8	80	M20	170	140	22	85	22	600	550	660	24	6	8

Services and documentation

Overview



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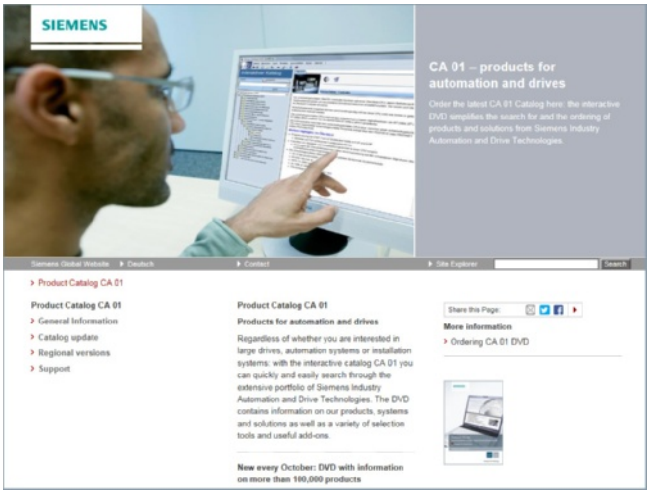

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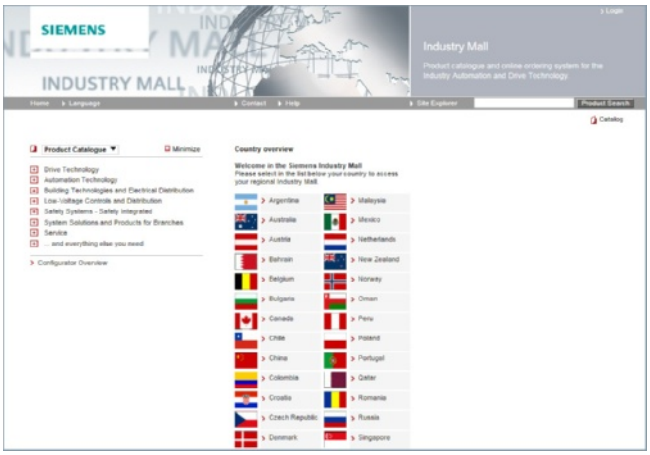

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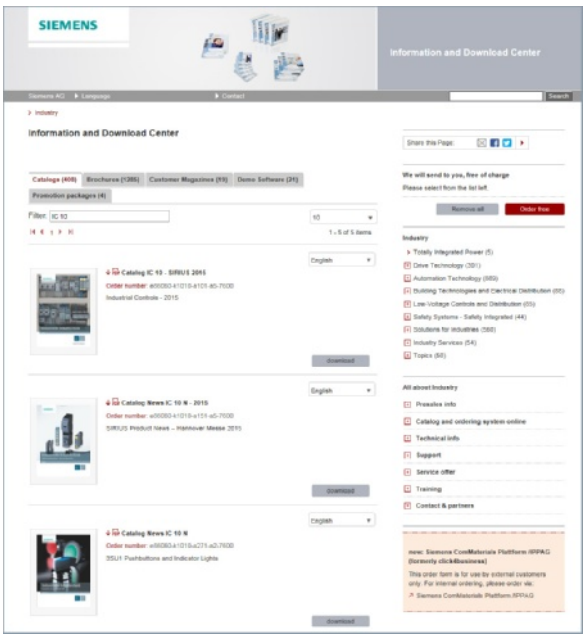

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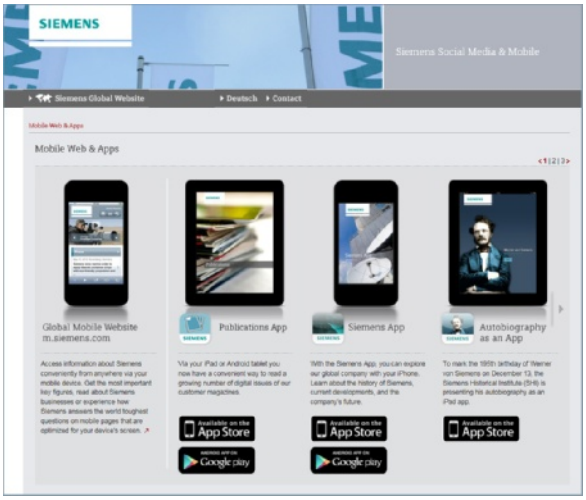

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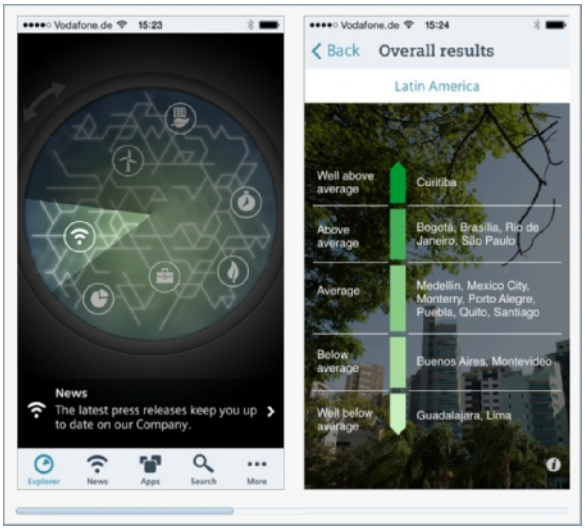

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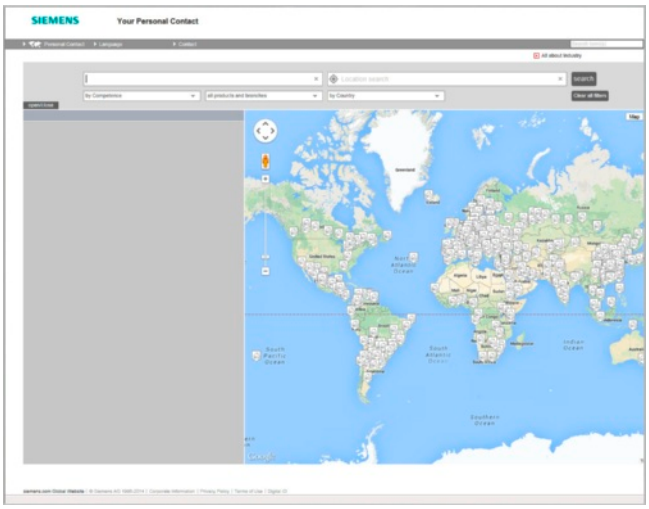

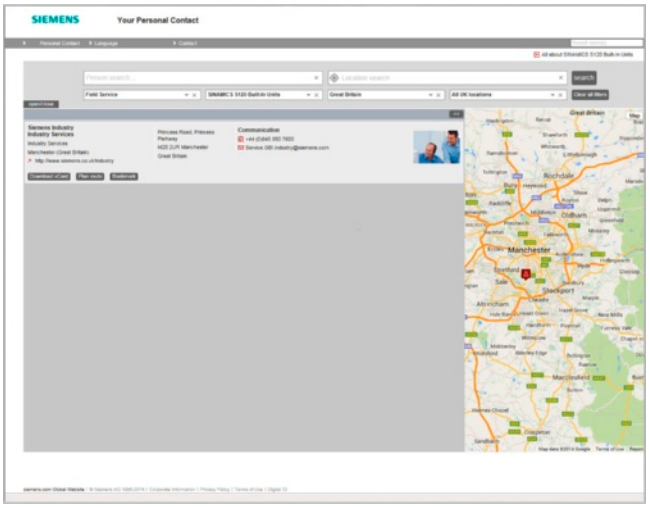

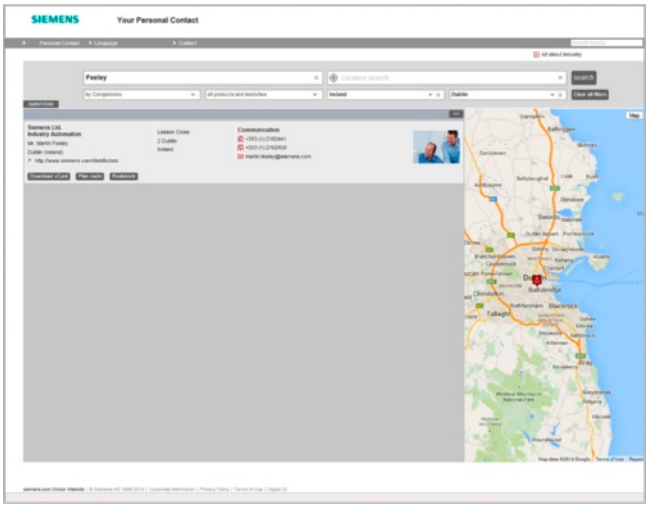

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8

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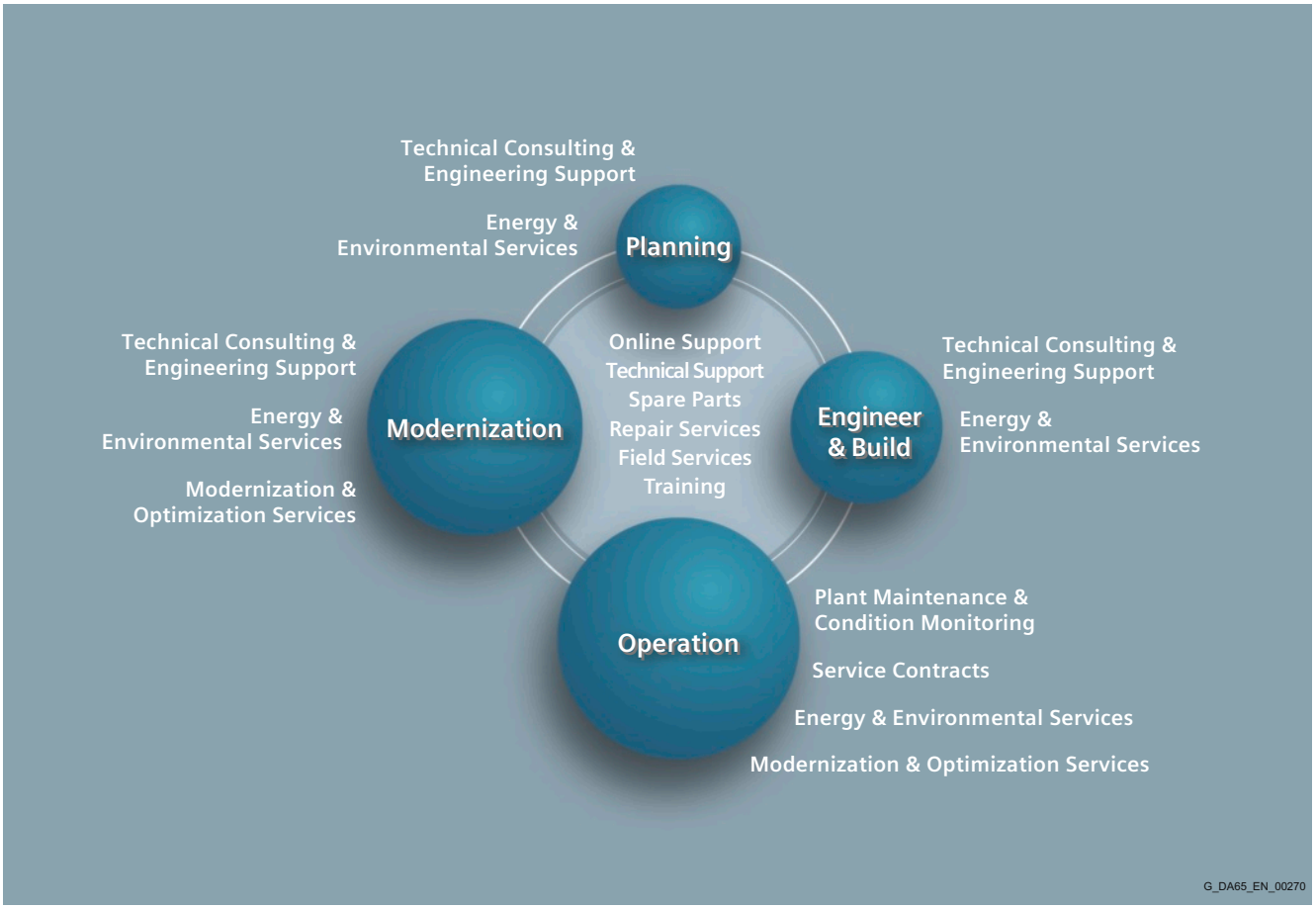

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8

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Industry Services for the entire life cycle

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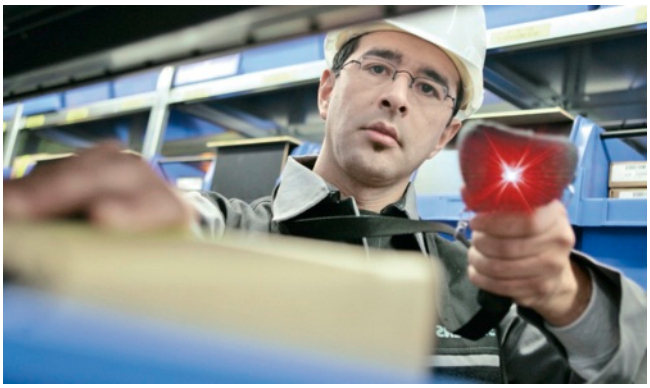

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Repair Services

Reliable electrical and electronic equipment is crucial for operating continuous processes. That is why it is essential that motors and converters always undergo highly specialized repair and maintenance. Siemens offers complete customer and repair services – on site and in repair centers – as well as technical emergency services worldwide. The repair services include all measures necessary to quickly restore the functionality of defective units. In addition, services such as spare parts logistics, spare parts storage and rapid manufacturing are available to plant operators in all verticals. With a global network of certified repair shops operated by Siemens as well as third parties, Siemens handles the maintenance and overhaul of motors, converters, and other devices as an authorized service partner.

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Field Services

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Technical Consulting & Engineering Support

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http://support.automation.siemens.com/WW/view/en/16605680

Energy & Environmental Services

Efficient energy use and resource conservation – these top sustainability concerns pay off – both for the environment and for companies. Siemens offers integrated solutions that unlock all technical and organizational potential for successful environmental management. Customized consulting services are aimed at sustainably lowering the cost of energy and environmental protection and thus increasing plant efficiency and availability. The experts provide support in the conceptual design and implementation of systematic solutions in energy and environmental management, enabling maximum energy efficiency and optimized water consumption throughout the entire company. Improved data transparency makes it possible to identify savings potential, reduce emissions, optimize production processes, and thereby noticeably cut costs.

http://support.automation.siemens.com/WW/view/en/42350774

Industry Services for the entire life cycle

Modernization & Optimization Services

High machine availability, expanded functionality and selective energy savings – in all industries, these are decisive factors for increasing productivity and lowering costs. Whether a company wants to modernize individual machines, optimize drive systems, or upgrade entire plants, Siemens' experts support the projects from planning to commissioning.

Expert consulting and project management with solution responsibility lead to security and make it possible to specifically identify savings potential in production. This secures investments over the long term and increases economic efficiency in operation.

http://support.automation.siemens.com/WW/view/en/66005532

Plant Maintenance & Condition Monitoring

Modern industrial plants are complex and highly automated. They must operate efficiently in order to ensure the company's competitive strength. In addition, the steadily increasing networking of machines and plants require consistent security concepts. Maintenance and status monitoring as well as the implementation of integrated security concepts by Siemens' experts support optimum plant use and avoid downtime. The services include maintenance management as well as consulting on maintenance concepts, including the complete handling and execution of the necessary measures. Complete solutions also cover remote services, including analysis, remote diagnosis, and remote monitoring. These are based on the Siemens Remote Services platform with certified IT security.

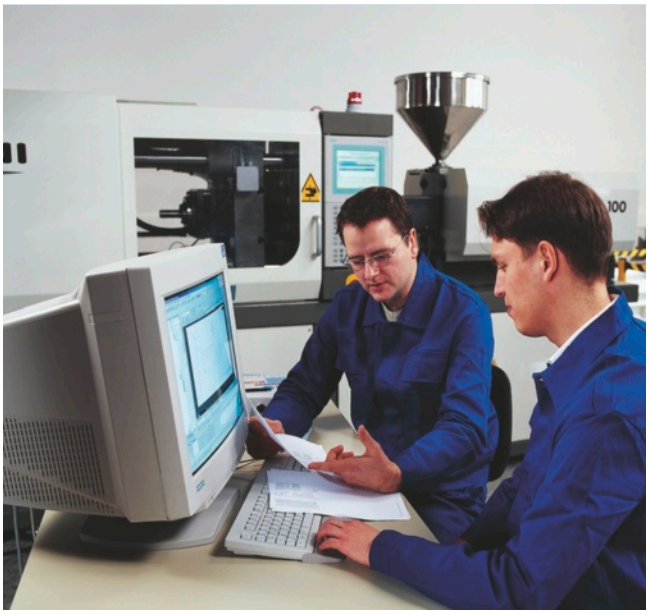
http://support.automation.siemens.com/WW/view/en/59456862

Service Contracts

Making maintenance costs calculable, reducing interfaces, speeding up response times, and unburdening the company's resources – the reduced downtimes that these measures achieve increase the productivity of a plant. Service contracts from Siemens make maintenance and repairs more cost-effective and efficient. The service packages include local and remote maintenance for a system or product group in automation and drive technology. Whether you need extended service periods, defined response times, or special maintenance intervals, the services are compiled individually and according to need. They can be adjusted flexibly at any time and used independently of each other. The expertise of Siemens' specialists and the capabilities of remote maintenance thus ensure reliable and fast maintenance processes throughout a plant's entire lifecycle.

http://support.automation.siemens.com/WW/view/en/65961857

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 teleservice. 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

SITRAIN

Overview

Faster and more applicable know-how: Hands-on training from the manufacturer

Siemens Industry Training provides you with comprehensive support in solving your tasks.

Training by the market leader in the industry enables you to make independent decisions with confidence. Especially where the optimum and efficient use of products and plants are concerned. You can eliminate deficiencies in existing plants, and exclude expensive faulty planning right from the beginning.

First-class know-how directly pays for itself: In shorter commissioning times, high-quality end products, faster troubleshooting and reduced downtimes. In other words, increased profits and lower costs.

Achieve more with Siemens Industry Training

- Shorter times for commissioning, maintenance and servicing
- Optimized production operations
- Reliable configuration and commissioning
- Minimization of plant downtimes
- Flexible plant adaptation to market requirements
- Compliance with quality standards in production
- Increased employee satisfaction and motivation
- Shorter familiarization times following changes in technology and staff

Siemens Industry Training is characterized by

Top trainers

Our trainers are skilled teachers with direct practical experience. Course developers have close contact with product development, and directly pass on their knowledge to the trainers.

Practical relevance

The practical experience of our trainers enables them to teach theory effectively. We also place the highest emphasis on practical exercises, which make up to half of the course time. You can therefore immediately implement your new knowledge in practice. We train you methodically on state-of-the-art training equipment. This training approach will give you all the confidence you need.

Wide variety

With a total of about 300 local attendance courses, we train the complete range of products from Siemens Industry as well as interaction of the products in systems.

Customized training

We are only a short distance away. You can find us at more than 50 locations in Germany, and in 62 countries worldwide. You wish to have individual training instead of one of our 300 courses? Our solution: We will provide a program tailored exactly to your personal requirements. Training can be carried out in our Training Centers or at your company location.

The right mixture: Blended learning

"Blended learning" is a combination of various training media and sequences. For example, a participant based course in a Training Center can be optimally supplemented by a self-teach program as preparation or follow-up. Additional effect: Reduced traveling costs and periods of absence.

More information

Contact

Visit our Internet site at:
http://www.siemens.nl/training/cranes

or let us advise you personally. You can request our latest training catalog from:

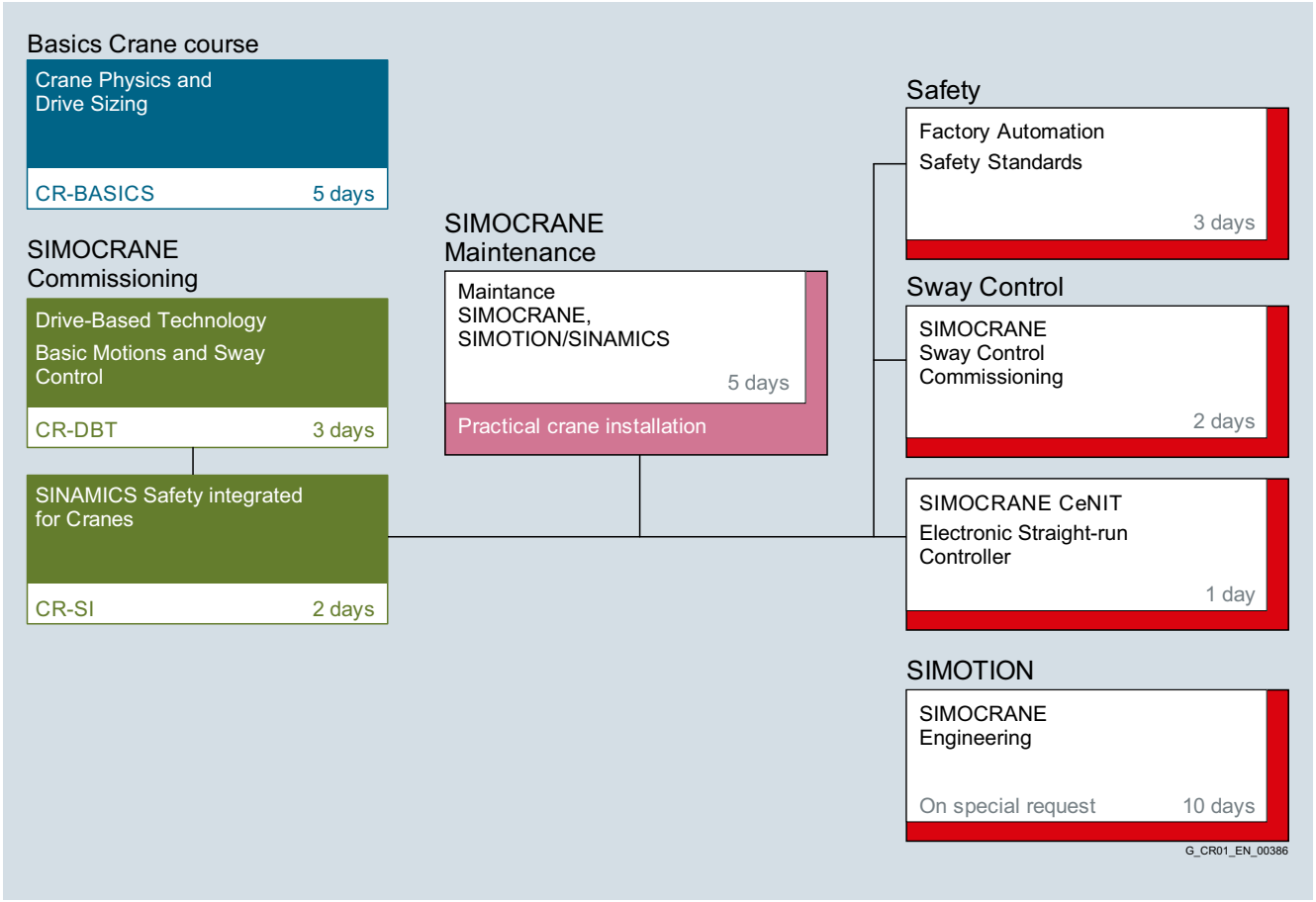
Siemens Training NL

phone: +31 (70) 333-3900

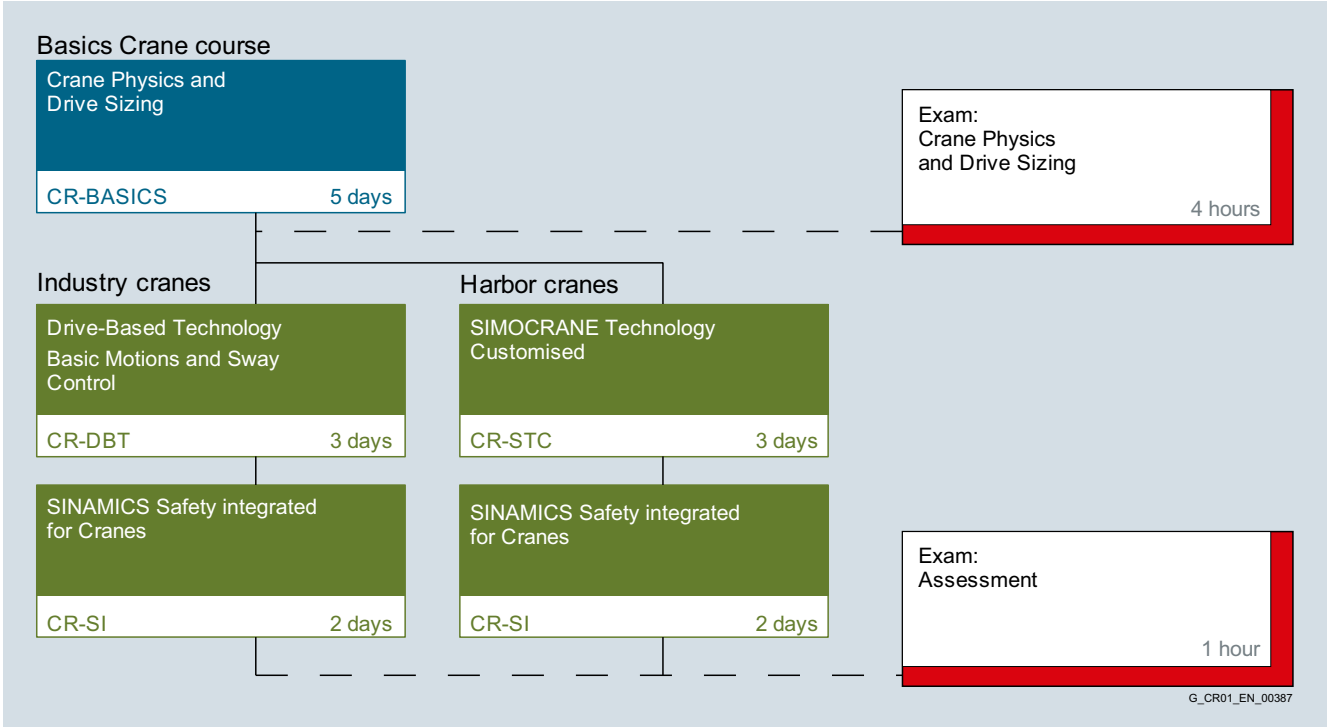
e-mail: siemens.training.nl@siemens.com

Overview

Cranes training courses



Training solution partner



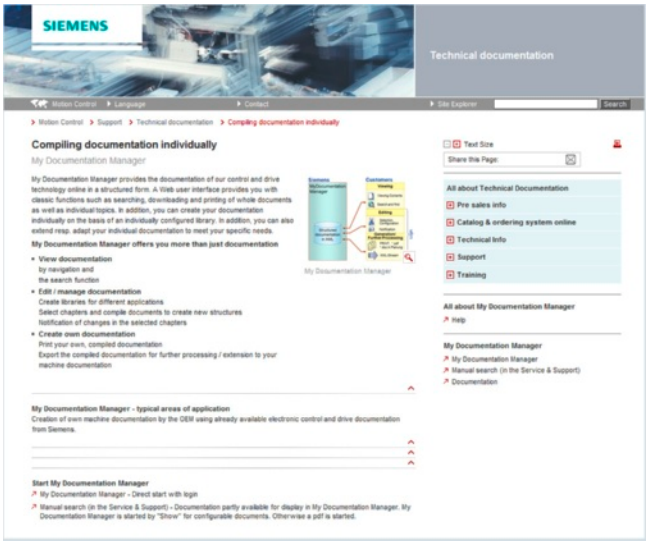
Overview

Spares on Web – Identification of spare parts on the Internet

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

Overview



My Documentation Manager – Customizing information

My Documentation Manager offers all Motion Control customers an innovation with extended usability: Machine manufacturers and end customers are not only able to assemble their own customized technical documents for a specific product or system, they can also generate complete libraries with individually configured contents. The content that matches your topic can be found from the full range of documentation stored under Service & Support using the operator interface and assembled using drag & drop into application-based libraries, generated and even combined with your own documentation. The self-generated collections can be saved in the commonly used RTF and PDF formats or even in XML format.

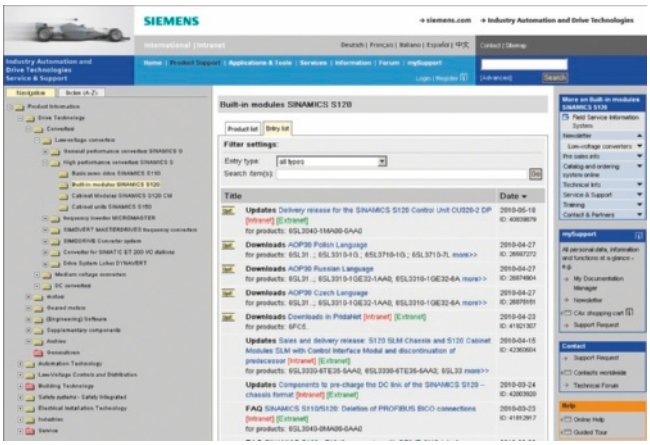
You must register for configuring and generating/managing (the existing login can be used, e.g. Industry Mall
www.siemens.com/industrymall

Benefits

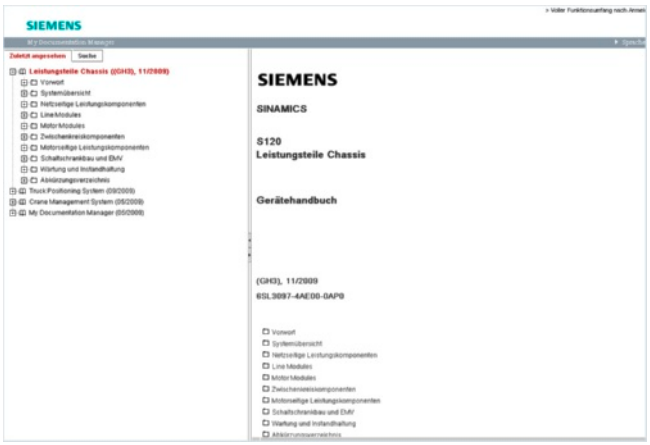
- Display
  View, print or download standard documents or personalized documents
- Configure
  Transfer standard documents or parts of them to personalized documents
- Generate/Manage
  Produce and manage personalized documents in the formats PDF, RTF or XML

Design

My Documentation Manager is the web-based system to generate personalized documentation based on standard documents. It is part of the Service & Support Portal.



Search in the Service & Support portal



Document in My Documentation Manager

Function

Opening My Documentation Manager

My Documentation Manager opens in two ways

- Search in the Service & Support portal
  www.siemens.com/automation/service&support
  The appropriate manuals are designated by "configurable". My Documentation Manager opens by clicking on "Display and configure". The selected document is displayed as the current document.
- Using the direct link from the Service & Support portal
  www.automation.siemens.com/docconf/
  After logon/registration, the online help is displayed as current document.

More information

You can find more information on the Internet at
www.siemens.com/mdm

General 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.

Comprehensive documentation is available for SIMOTION and the SINAMICS S120 drive system, including the Operating Manual, Programming Manual or Configuration Manual, as well as the Commissioning Manual.

Information is available in the following formats:

- Paper version, printed copy
- PDF file available on Internet as DOConWEB application with 'search all documents' function
  http://www.siemens.com/automation/doconweb

You can find additional information on the Internet at:
www.siemens.com/motioncontrol/docu

Information and documentation relating to SIMOTION are available in the form of:

- Windows Help in conjunction with the SCOUT engineering system
- Documents/documentation at:
  https://support.industry.siemens.com/cs

→ Manuals → (enter search term) SIMOTION

Application

Explanations for the manuals:

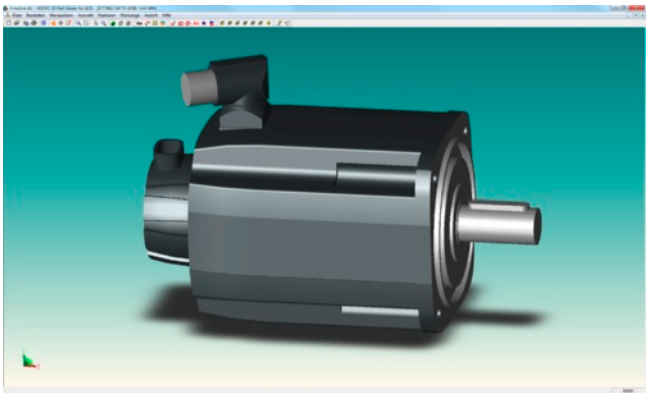
- **Operating Instructions**
  contain all the information needed for the installation and for the electrical connection of the components, information about commissioning and a description of the converter functions.
  Phases of use: Control cabinet construction, commissioning, operation, maintenance and servicing.
- **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**
  describes all parameters, function diagrams and faults/alarms for the product/system as well as their meaning 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/diagnostics.
- **Function Manual**
  contains all the relevant information about individual drive functions.
  Phases of use: Commissioning of components that have already been connected, configuration of system functions.

Selection and ordering data

Description	Article No.
General documentation	
DOConCD	**6FC5398-0AC10-1YA2**
SINUMERIK 828D/840D sl SINAMICS S120 SIMOTICS motors SIMATIC	
User, manufacturer and service documentation on DVD-ROM Curretn version: 06/2015	
Languages: English, German	
• Delivery of current version	**6FC5298-0CD00-0YG0**
• Update service	**6FC5298-0CD00-0YG2**
EMC Design Guidelines	
SIMOTICS, SIMOTION, SINAMICS, SINUMERIK	
• Chinese Simplified	**6FC5297-0AD30-0RP3**
• German	**6FC5297-0AD30-0AP3**
• English	**6FC5297-0AD30-0BP3**
• French	**6FC5297-0AD30-0DP3**
• Italian	**6FC5297-0AD30-0CP3**
• Japanese	**6FC5297-0AD30-0TP3**
• Spanish	**6FC5297-0AD30-0EP3**

Overview

CAD CREATOR – Dimensional drawing and 2D/3D CAD generator



Thanks to the user-friendly operator interface of the CAD CREATOR, it is easy to configure controls, drives and motors. With the support of the CAD CREATOR, product-specific dimension drawings and 2D/3D CAD models can be created quickly. The CAD CREATOR assists the machine manufacturer's designers, drafting engineers and project engineers.

Selection and ordering data

Description	Article No.
CAD CREATOR Dimensional drawing and 2D/3D CAD generator on DVD-ROM English, French, German, Italian, Spanish	**6SL3075-0AA00-0AG0**

More information

The CAD CREATOR is available on DVD-ROM and as an Internet application.

Additional information is available on the Internet at www.siemens.com/cadcreator

Benefits

- Provision of dimension drawings as 2D/3D CAD models in mm and inches
- Display of 2D/3D CAD models and dimension drawings on integrated viewers
- With the online version, 3D models and dimension drawings can also be displayed in the form of a downloadable PDF
- Support for all general geometry interfaces STEP, IGES, Parasolid, SAT, VDA, and for special interfaces such as Ideas, NX, Solid Edge, Pro/Engineer, Autocad, Inventor, Mechanical Desktop, Catia and Solidworks
- Multi-language operator interface in English, French, German, Italian and Spanish, and direct Help (English, German)
- Dimension drawings and 2D/3D CAD models for:
- Motors
  - 1FT6/1FT7/1FK7 synchronous motors
  - 1FE1 built-in synchronous motors
  - 1FW3 torque motors
  - 1FW6 built-in torque motors
  - 1FT6/1FT7/1FK7 geared motors
  - 1PH8 synchronous/asynchronous motors
  - 1PH7/1PH4/1PL6/1PM4/1PM6 asynchronous motors
  - 2SP1 motor spindles
  - 1FN3, 1FN6 linear motors
- SINAMICS S110, SINAMICS S120
  - Control Units
  - Power Modules (Blocksize/Chassis/Combi)
  - Line Modules (Booksize/Chassis)
  - Line-side components
  - Motor Modules (Booksize/Chassis)
  - DC link components
  - Supplementary system components
  - Load-side power components
  - Encoder system connection
  - Connection system MOTION-CONNECT
- SINUMERIK
  - CNC controls
  - Operator components for CNC controls
- SIMOTION
  - SIMOTION D
  - SIMOTION C

The CAD CREATOR offers a variety of options for configuring, but also different methods for searching for a product:

- According to Article No.
- According to technical description

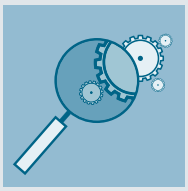
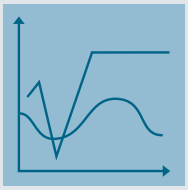
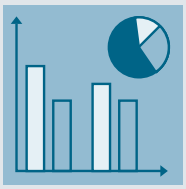
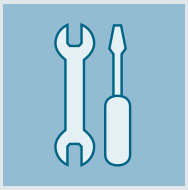
After successful configuration of the product, the dimensional drawings and models are displayed with the integrated viewers and made available for export.

Notes

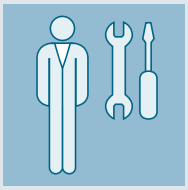
Appendix

Functions of the Crane Management System

Overview

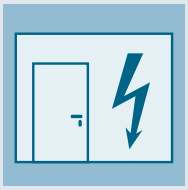
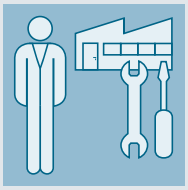
Function	Symbol	Description of functions
Status display		• Graphical visualization of crane, components and subsystems • Settings of operating parameters for crane operation
Condition monitoring		• Recording of highly dynamic operating variables • Monitoring of limit values
Error diagnostics		• Alarm/event 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

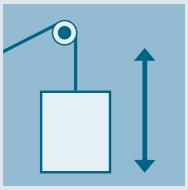
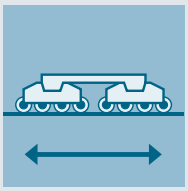
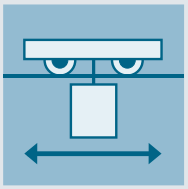
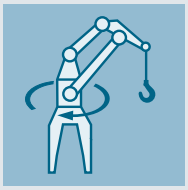
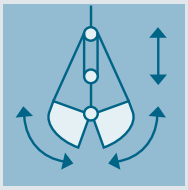
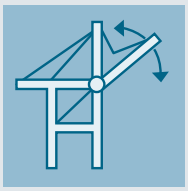
Function		Description of functions
Crane driver		• Crane driver directly on the crane • Restricted operator authorizations in crane management system
Crane driver (remote)		• Crane driver at remote control desk • Restricted operator authorizations in crane management system
Maintenance technician		• 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
Remote service		• Maintenance or service technician for crane systems with remote-access • System specialist with remote-access

Installation locations

Overview

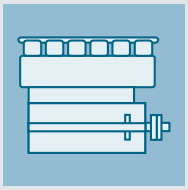
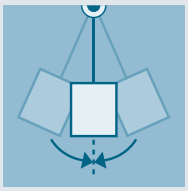
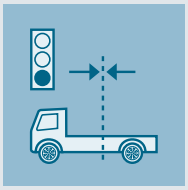
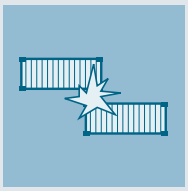
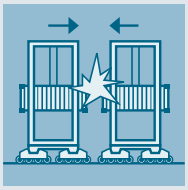
Function	Symbol	Description of functions
Electrical room		• Installation location for the complete drive and control technology on a crane
Crane driver cabin		• Moveable or permanently installed crane driver cabin
Maintenance building		• Building/location of service and maintenance technician at a terminal
Administration center		• Terminal administration • Central control room with logistics systems • Central server landscape and IT administration

Overview

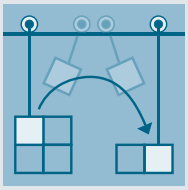
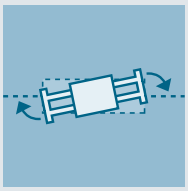
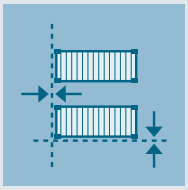
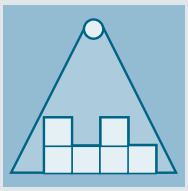
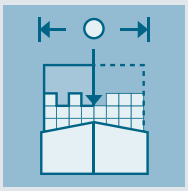
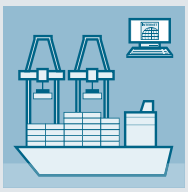
Function	Symbol	Description of functions
Hoist		• Hoisting axis for container cranes
Gantry		• Gantry axis for cranes of different types
Trolley		• Traversing axis for the trolley of cranes of different types
Slewing gear		• Slewing gear axis for slewing luffing cranes and similar types
Grab		• Holding and closing gear for grab cranes
Boom		• Drive axis for the crane boom-hoist for STS or ship unloading cranes
AGV		• Automatic guided vehicle

Extended technological functions and products

Overview

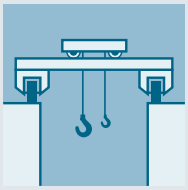
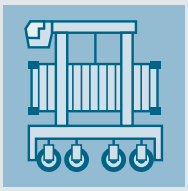
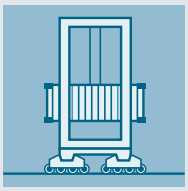
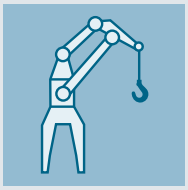
Function	Symbol	Description of functions
SIMOCRANE ECO Technology		• Fuel saving power management software for combustion engine and alternator power machinery
SIMOCRANE Sway Control Systems		• Automatic sway control for cranes of different types
SIMOCRANE Truck Positioning		• Positioning system for 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 SIMOCRANE products Truck Positioning and the SIMOCRANE Sway Control System
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

Overview (continued)

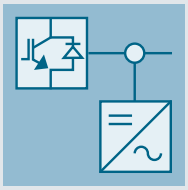
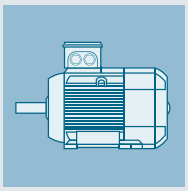
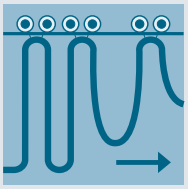
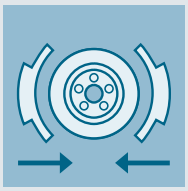
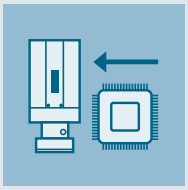
Function	Symbol	Description of functions
Automatic travel		• Automatic or semi-automatic loading and unloading for container cranes • This function is derived from a function of "SIMOCRANE Sway Control Systems"
On-the-fly unloading		• On-the-fly unloading of bulk material to grab cranes
Skew control		• Automatic control of the load angle on a ship to shore crane (STS) • The presence of the corresponding mechanical components is a pre-requisite for this function • This function is derived from a function of "SIMOCRANE Sway Control Systems"
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 • Pre-requisite 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

Crane types

Overview

Function	Symbol	Description of functions
Ladle crane		• Ladle crane in steelworks
Straddle carrier		• Mobile transport crane in container terminals
RTG (ECO RTG)		• **R**ubber **T**ired **G**antry • Mobile, rubber-tired stacking crane • ECO RTG • Energy-efficient and diesel-powered RTG with hybrid drive system and reload function
GSU		• **G**rab **S**hip **U**nloader • Grab ship unloading crane for handling bulk material in the harbor area
STS		• **S**hip **T**o **S**hore crane • Container handling in the harbor area • Cargo handling between ship and terminal
RMG		• **R**ail **M**ounted **G**antry • 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

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 electri-cally supplied cranes
Brake		• Brakes for the different drive axes of a crane
Refurbishment		• Service for the modernization and conversion of older crane systems
CeSAR		• Controller-supported Sway Control System

Overview

Many of the products in this catalog comply with UL or CSA requirements and are labeled with the corresponding approval designation.

All of the 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 are used for their intended purpose. In other cases, the vendor of these products is responsible for arranging that new certificates are issued.

UL: Underwriters Laboratories (independent public testing institution in North America)

Test symbol:

- **UL** for end products, tested by UL in accordance with the UL standard
- **cUL** for end products, tested by UL in accordance with the CSA standard
- **cULus** for end products, tested by UL in accordance with the UL and CSA standards
- **UR** for mounting parts in end products, tested by UL in accordance with the UL standard
- **cUR** for mounting parts in end products, tested by UL in accordance with the CSA standard
- **cURus** for mounting parts in end products, tested by UL in accordance with the UL and CSA standards

Test standards:

- SIMOTION: Standard UL 508
- SINAMICS: Standard UL 508C
- Motors: Standard UL 547

Product category/file No.:

- SIMOTION: E164110
- SINAMICS: E192450
- Motors: E93429

TUV: TUV Rheinland of North America Inc. Independent public testing institution in North America National recognized testing laboratory (NRTL)

Test symbol:

- cTUVus Tested by TUV in accordance with the UL and CSA standards

CSA: Canadian Standard Association Independent public testing institution in Canada

Test symbol:

- CSA Tested by CSA in accordance with the CSA standard

Test standard:

- Standard CAN/CSA-C22.2/No. 0-M91/No. 14-05/No. 142-M1987

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 delivery can be found in the readme file supplied with the relevant product(s).

License types

Siemens Industry Automation & Drive Technologies 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.

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 Industry Automation & Drive Technologies 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 www.siemens.com/automation/salesmaterial-as/catalog/en/terms_of_trade_en.pdf

Explanation of the raw material/metal surcharges[1]

Surcharge calculation

To compensate for variations in the price of the raw materials silver, copper, aluminum, lead, gold, dysprosium[2] and/or neodym[2], 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.

The surcharges are calculated in accordance with the following criteria:

- Basic official price of the raw material
  Basic official price from the day prior to receipt of the order or prior to release order (daily price) for[3]
  - Silver (sales price, processed)
  - Gold (sales price, processed)

  and for[4]
  - Copper (lower DEL notation + 1 %)
  - Aluminum (aluminum in cables)
  - Lead (lead in cables)
- Metal factor of the products
  Certain products are displayed with a metal factor. The metal factor determines the official price (for those raw materials concerned) as of which the metal surcharges are applied and the calculation method used (weight or percentage method). An exact explanation is given below.

Structure of the metal factor

The metal factor consists of several digits; the first digit indicates whether the percentage method of calculation refers to the list price or a possible discounted price (customer net price) (L = list price / N = customer net price).

The remaining digits indicate the method of calculation used for the respective raw material. If no surcharge is added for a raw material, a "-" is used.

1st digit	List or customer net price using the percentage method
2nd digit	for silver (AG)
3rd digit	for copper (CU)
4th digit	for aluminum (AL)
5th digit	for lead (PB)
6th digit	for gold (AU)
7th digit	for dysprosium (Dy)[2]
8th digit	for neodym (Nd)[2]

Weight method

The weight method uses the basic official price, the daily price and the raw material weight. In order to calculate the surcharge, the basic official price must be subtracted from the daily price. The difference is then multiplied by the raw material weight.

The basic official price can be found in the table below using the number (1 to 9) of the respective digit of the metal factor. The raw material weight can be found in the respective product descriptions.

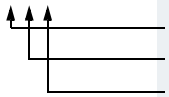
Percentage method

Use of the percentage method is indicated by the letters A-Z at the respective digit of the metal factor.

The surcharge is increased - dependent on the deviation of the daily price compared with the basic official price - using the percentage method in "steps" and consequently offers surcharges that remain constant within the framework of this "step range". A higher percentage rate is charged for each new step. The respective percentage level can be found in the table below.

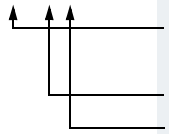
Metal factor examples

L E A – – – – –



Basis for % surcharge: List price
Silver Basis 150 €, Step 50 €, 0.5 %
Copper Basis 150 €, Step 50 €, 0.1 %
No surcharge for aluminum
No surcharge for lead
No surcharge for gold
No surcharge for dysprosium
No surcharge for neodym

N – A 6 – – – –



Basis for % surcharge: Customer net price
No surcharge for silver
Copper Basis 150 €, Step 50 €, 0.1 %
Aluminum acc. to weight, basic offic. price 225 €
No surcharge for lead
No surcharge for gold
No surcharge for dysprosium
No surcharge for neodym

– – 3 – – – – –

No basis necessary
No surcharge for silver
Copper acc. to weight, basic official price 150 €
No surcharge for aluminum
No surcharge for lead
No surcharge for gold
No surcharge for dysprosium
No surcharge for neodym

1. Refer to the separate explanation on the next page regarding the raw materials dysprosium and neodym (= rare earths).
2. For a different method of calculation, refer to the separate explanation for these raw materials on the next page.
3. Source: Umicore, Hanau (www.metalsmanagement.umicore.com).
4. Source: German Trade Association for Cables and Conductors (www.kabelverband.org).

Explanation of the raw material/metal surcharges for dysprosium and neodym (rare earths)

Surcharge calculation

To compensate for variations in the price of the raw materials silver[1)], copper[1)], aluminum[1)], lead[1)], gold[1)], dysprosium and/or neodym, surcharges are calculated on a daily basis using the so-called metal factor for products containing these raw materials. The surcharge for dysprosium and neodym is calculated as a supplement to the price of a product if the basic official price of the raw material in question is exceeded.

The surcharge is calculated in accordance with the following criteria:

- Basic official price of the raw material[2)]
  Three-month basic average price (see below) in the period before the quarter in which the order was received or the release order took place (= average official price) for
  - dysprosium (Dy metal, 99 % min. FOB China; USD/kg)
  - neodym (Nd metal, 99 % min. FOB China; USD/kg)
- Metal factor of the products
  Certain products are displayed with a metal factor. The metal factor indicates (for those raw materials concerned) the basic official price as of which the surcharges for dysprosium and neodym are calculated using the weight method. An exact explanation of the metal factor is given below.

Three-month average price

The prices of rare earths vary according to the foreign currency, and there is no freely accessible stock exchange listing. This makes it more difficult for all parties involved to monitor changes in price. In order to avoid continuous adjustment of the surcharges, but to still ensure fair, transparent pricing, an average price is calculated over a three-month period using the average monthly foreign exchange rate from USD to EUR (source: European Central Bank). Since not all facts are immediately available at the start of each month, a one-month buffer is allowed before the new average price applies.

Examples of calculation of the average official price:

Period for calculation of the average price:	Period during which the order/release order is effected and the average price applies:
Sep 2012 - Nov 2012	Q1 in 2013 (Jan - Mar)
Dec 2012 - Feb 2013	Q2 in 2013 (Apr - Jun)
Mar 2013 - May 2013	Q3 in 2013 (Jul - Sep)
Jun 2013 - Aug 2013	Q4 in 2013 (Oct - Dec)

Structure of the metal factor

The metal factor consists of several digits; the first digit is not relevant to the calculation of dysprosium and neodym.

The remaining digits indicate the method of calculation used for the respective raw material. If no surcharge is added for a raw material, a "-" is used.

1st digit	List or customer net price using the percentage method
2nd digit	for silver (AG)[1)]
3rd digit	for copper (CU)[1)]
4th digit	for aluminum (AL)[1)]
5th digit	for lead (PB)[1)]
6th digit	for gold (AU)[1)]
7th digit	for dysprosium (Dy)
8th digit	for neodym (Nd)

Weight method

The weight method uses the basic official price, the average price and the raw material weight. In order to calculate the surcharge, the basic official price must be subtracted from the average price. The difference is then multiplied by the raw material weight.

The basic official price can be found in the table below using the number (1 to 9) of the respective digit of the metal factor. Your Sales contact can inform you of the raw material weight.

Metal factor examples

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1	No basis necessary
2	No surcharge for silver
3	No surcharge for copper
4	No surcharge for aluminum
5	No surcharge for lead
6	No surcharge for gold
7	Dysprosium acc. to weight, basic official price 300 €
8	Neodym acc. to weight, basic official price 50 €

1. For a different method of calculation, refer to the separate explanation for these raw materials on the previous page.
2. Source: Asian Metal Ltd (www.asianmetal.com)

Values of the metal factor

Percentage method	Basic official price in €	Step range in €	% surcharge 1st step Price in €	% surcharge 2nd step Price in €	% surcharge 3rd step Price in €	% surcharge 4th step Price in €	% surcharge per additional step
			150.01 - 200.00	200.01 - 250.00	250.01 - 300.00	300.01 - 350.00	
A	150	50	0.1	0.2	0.3	0.4	0.1
B	150	50	0.2	0.4	0.6	0.8	0.2
C	150	50	0.3	0.6	0.9	1.2	0.3
D	150	50	0.4	0.8	1.2	1.6	0.4
E	150	50	0.5	1.0	1.5	2.0	0.5
F	150	50	0.6	1.2	1.8	2.4	0.6
G	150	50	1.0	2.0	3.0	4.0	1.0
H	150	50	1.2	2.4	3.6	4.8	1.2
I	150	50	1.6	3.2	4.8	6.4	1.6
J	150	50	1.8	3.6	5.4	7.2	1.8
			175.01 - 225.00	225.01 - 275.00	275.01 - 325.00	325.01 - 375.00	
O	175	50	0.1	0.2	0.3	0.4	0.1
P	175	50	0.2	0.4	0.6	0.8	0.2
R	175	50	0.5	1.0	1.5	2.0	0.5
			225.01 - 275.00	275.01 - 325.00	325.01 - 375.00	375.01 - 425.00	
S	225	50	0.2	0.4	0.6	0.8	0.2
U	225	50	1.0	2.0	3.0	4.0	1.0
V	225	50	1.0	1.5	2.0	3.0	1.0
W	225	50	1.2	2.5	3.5	4.5	1.0
			150.01 - 175.00	175.01 - 200.00	200.01 - 225.00	225.01 - 250.00	
Y	150	25	0.3	0.6	0.9	1.2	0.3
			400.01 - 425.00	425.01 - 450.00	450.01 - 475.00	475.01 - 500.00	
Z	400	25	0.1	0.2	0.3	0.4	0.1
	Price basis (1st digit)						
L	Calculation based on the list price						
N	Calculation based on the customer net price (discounted list price)						
Weight method	**Basic official price in €**						
1	50	Calculation based on raw material weight					
2	100						
3	150						
4	175						
5	200						
6	225						
7	300						
8	400						
9	555						
Miscellaneous							
-	No metal surcharge						

1. General Provisions

By using this catalog you can acquire hardware and software products described therein from Siemens AG subject to the following Terms and Conditions of Sale and Delivery (hereinafter referred to as "T&C"). Please note that the scope, the quality and the conditions for supplies and services, including software products, by any Siemens entity having a registered office outside Germany, shall be subject exclusively to the General Terms and Conditions of the respective Siemens entity. The following T&C apply exclusively for orders placed with Siemens Aktiengesellschaft, Germany.

1.1 For customers with a seat or registered office in Germany

For customers with a seat or registered office in Germany, the following applies subordinate to the T&C:

- the "General Terms of Payment"[1)] and,
- for software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or Registered Office in Germany"[1)] and,
- for other supplies and services, the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry"[1)].

1.2 For customers with a seat or registered office outside Germany

For customers with a seat or registered office outside Germany, the following applies subordinate to the T&C:

- the "General Terms of Payment"[1)] and,
- for software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or Registered Office outside of Germany"[1)] and
- for other supplies and/or services, the "General Conditions for Supplies of Siemens Industry for Customers with a Seat or Registered Office outside of Germany"[1)].

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 charget 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.

The metal factor of a product indicates the basic official price (for those raw materials concerned) as of which the surcharges on the price of the product are applied, and with what method of calculation.

An exact explanation of the metal factor can be downloaded at:

www.siemens.com/automation/salesmaterial-as/catalog/en/terms_of_trade_en.pdf

To calculate the surcharge (except in the cases of dysprosium and neodym), the official price from the day 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).

3. Additional Terms and Conditions

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.

Insofar as there are no remarks on the individual pages of this catalog - especially with regard to data, dimensions and weights given - these are subject to change without prior notice.

4. Export regulations

We shall not be obligated to fulfill any agreement if such fulfillment is prevented by any impediments arising out of national or international foreign trade or customs requirements or any embargoes and/or other sanctions.

Export of goods listed in this catalog may be subject to licensing requirements. We will indicate in the delivery details whether licenses are required under German, European and US export lists. Goods labeled with "AL" not equal to "N" are subject to European or German export authorization when being exported out of the EU. Goods labeled with "ECCN" not equal to "N" are subject to US re-export authorization.

The export indications can be viewed in advance in the description of the respective goods on the Industry Mall, our online catalog system. Only the export labels "AL" and "ECCN" indicated on order confirmations, delivery notes and invoices are authoritative.

Even without a label, or with label "AL:N" or "ECCN:N", authorization may be required i .a. due to the final disposition and intended use of goods.

If you transfer goods (hardware and/or software and/or technology as well as corresponding documentation, regardless of the mode of provision) delivered by us or works and services (including all kinds of technical support) performed by us to a third party worldwide, you must comply with all applicable national and international (re-)export control regulations.

If required for the purpose of conducting export control checks, you (upon request by us) shall promptly provide us with all information pertaining to the particular end customer, final disposition and intended use of goods delivered by us respectively works and services provided by us, as well as to any export control restrictions existing in this relation.

The products listed in this catalog may be subject to European/German and/or US export regulations. Any export requiring approval is therefore subject to authorization by the relevant authorities.

Errors excepted and subject to change without prior notice.

1) The text of the Terms and Conditions of Siemens AG can be downloaded at
www.siemens.com/automation/salesmaterial-as/catalog/en/terms_of_trade_en.pdf

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Digital Factory, Process Industries and Drives and Low-Voltage Power Distribution

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