SIEMENS

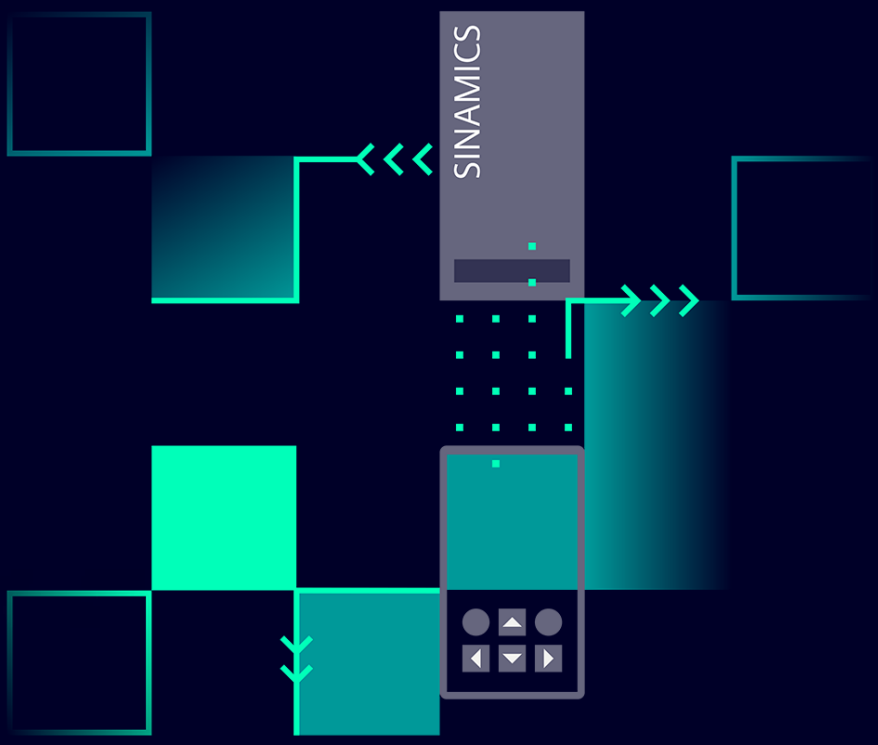
MOTION CONTROL DRIVES

SINAMICS
Drive Software

siemens.com/d99

Catalog
D 99

Edition
April
2024



Related catalogs

Motion Control Drives D 32
SINAMICS S210 Servo Drive System

PDF (E86060-K5532-A101-A9-7600)

Motion Control Drives D 36.1
SINAMICS G220 built-in and wall-mounted units

PDF (E86060-K5536-A111-A1-7600)

Motion Control Drives D 37.1
SINAMICS S200 Servo drive system

PDF (E86060-K5537-A111-A2-7600)

SiePortal
Information and Ordering Platform
on the Internet

sieportal.siemens.com

SIEMENS

Catalog
D 99

Edition
April
2024

Combining the real and digital worlds ...
Transformation

MOTION CONTROL

SINAMICS Drive Software

siemens.com/d99

Dear Customer,

We are happy to present you with the new PDF version of the Catalog D 99 · April 2024.

The catalog provides a comprehensive overview of the SINAMICS Drive Software. The SINAMICS Drive Software allows modular enhancement of the functionality of SINAMICS drives to fulfill the needs of industrial applications.

The products listed in this Catalog are also included in SiePortal.
Please contact your local Siemens office for additional information.

Up-to-date information about SINAMICS Drive Software is available online at www.siemens.com/sinamics-drive-software

You can access SiePortal on the internet at: https://sieportal.siemens.com

Your personal contact will be glad to receive your suggestions and recommendations for improvement. You can find your representative in our personal contacts database at www.siemens.com/automation-contact

We hope that you will often enjoy using the new Catalog D 99 · April 2024 as a selection and ordering reference document and wish you every success with our products and solutions.

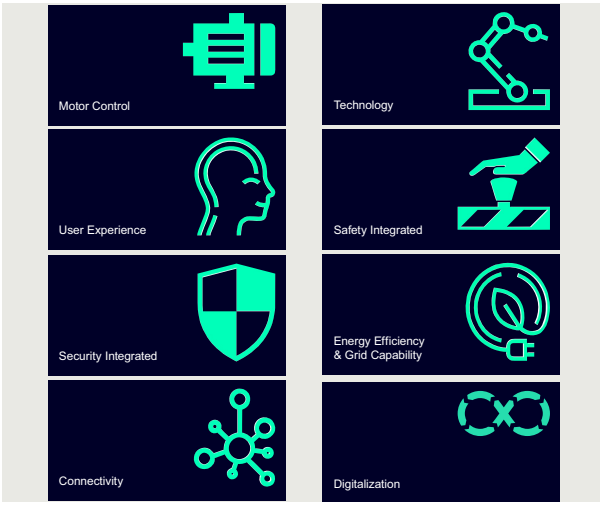
With kind regards

Frank Golüke
Vice President
General Motion Control
Siemens AG, Digital Industries, Motion Control

SINAMICS

SINAMICS Drive Software

Motion Control



Catalog D 99 · April 2024

Refer to SiePortal for current updates of this catalog:
sieportal.siemens.com

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

Digitalization in drive technology

From the digital world to the real world

siemens.com/digital-drives

Increase your transparency and productivity by digitalizing your drive technology

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

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

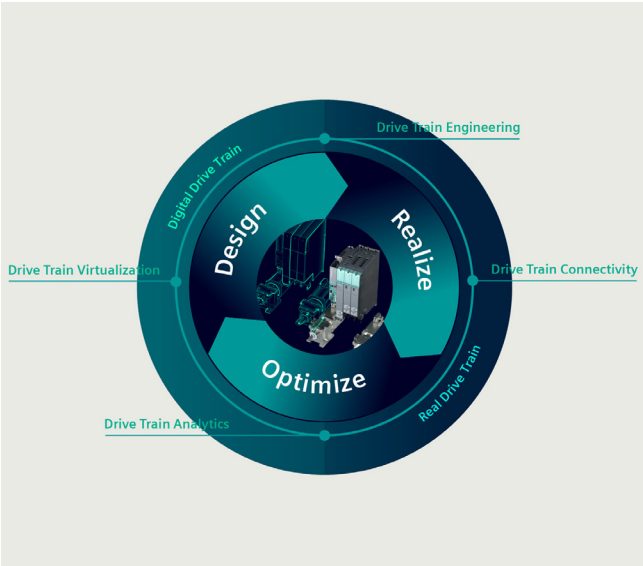
The digitalization portfolio for the drive train spans over the complete life cycle – from the design phase to realization and optimization – in the digital and the real world.

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

These solutions enable you to gain a better understanding of processes, states and utilization. The health status of the drive train can be monitored and analyzing drive data enables an early detection of anomalies and reduces downtimes.

This way, availability and productivity of machines and plants can be increased and the actual maintenance demand can be identified. Furthermore, data-based business models and service offerings are facilitated.

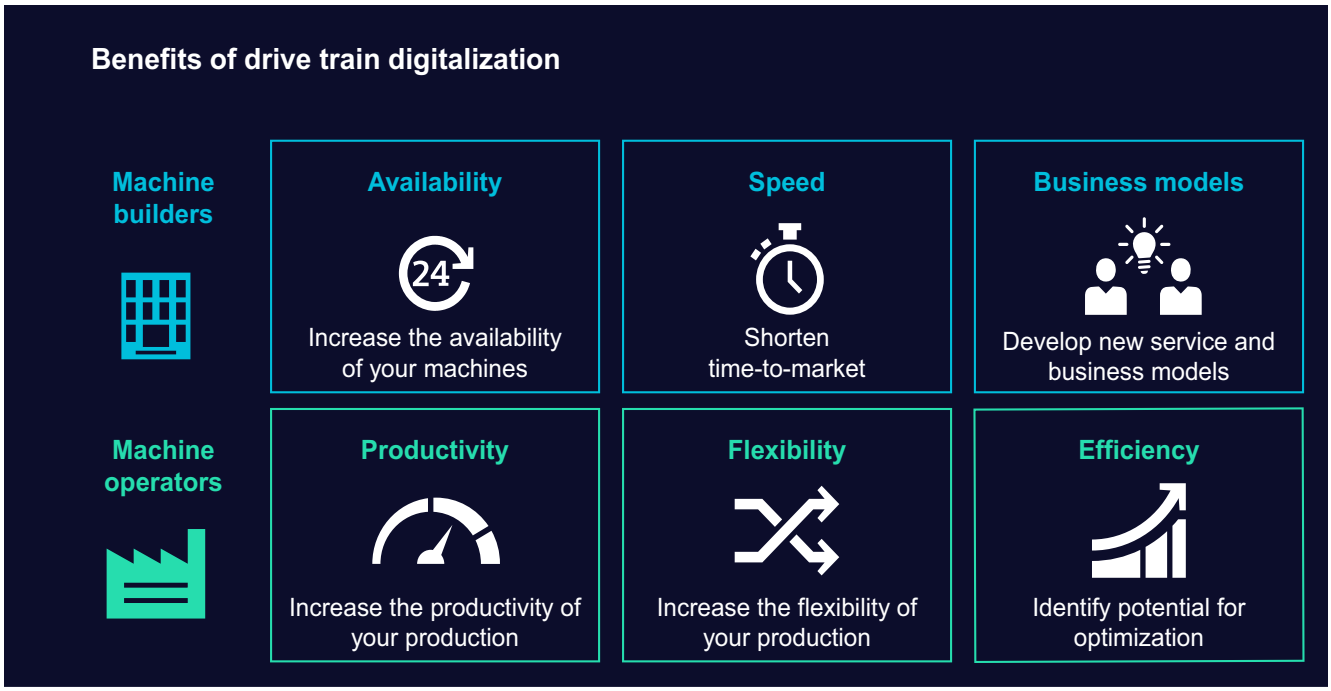
Our digitalization portfolio covers all phases of the life cycle: from the design phase to realization and optimization. It covers the digital and the real drive train.



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

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

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



Benefits for machine and plant builders

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

Benefits for machine and plant operators

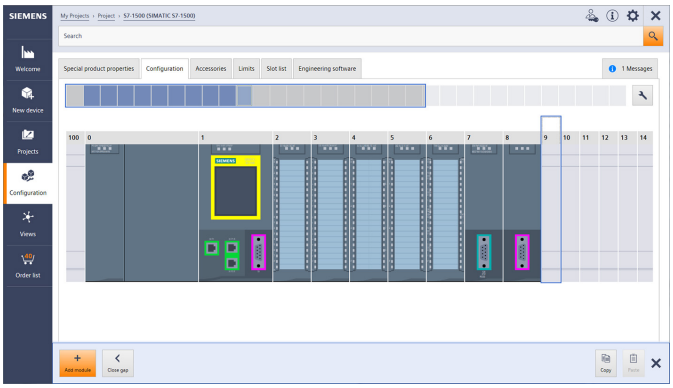
- Increased availability and productivity of production, fewer unscheduled downtimes – through the early detection of deviations and emerging risks thanks to digital drive monitoring
- More flexible production down to batch size 1 – through more effective use of knowledge from existing production lines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

siemens.com/digital-drives

TIA Selection Tool – quick, easy, smart configuration

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

Do you always need the optimum configuration for planning your project?
For your application we offer the TIA Selection Tool to support all project planners, beginners and experts alike.
No detailed portfolio knowledge is necessary.
TIA Selection Tool is available for download as a free desktop version or a cloud variant.



Your Advantages

Quick

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

Easy

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

Smart

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

The TIA Selection Tool is a completely paperless solution.
Download it now:
www.siemens.com/tst

For more information, scan the QR code

Sustainability @Siemens

Transforming the everyday to create a better tomorrow.

For more information, see www.siemens.com/sustainabililty-figures

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

Mission & strategy

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

Technology with aim and purpose

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

Our contribution

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

Sustainability facts

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

Overview

SINAMICS Drive Software – The right function for every application

SINAMICS Drive Software ensures that our SINAMICS frequency converters operate smoothly and reliably.

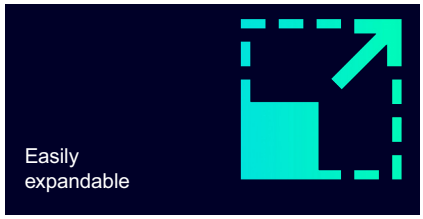
It offers comprehensive functionality, is easily expandable and enables the greatest possible flexibility for a wide range of applications.

Comprehensive functionality

The software enables highly accurate and dynamic control of different types of motors.

Integrated functions help to reduce energy consumption. The software protects the converter against overload and ensures high availability. Furthermore, positioning tasks as well as logic and technology functions can be taken over directly by the drive.

The Safety Integrated functions ensure maximum safety for operating and maintenance personnel. The special requirements of industries and applications e. g. pumps, fans and conveyor technology are met by specific functions.



Easily expandable

Most of the SINAMICS Drive Software functionality is already included in the basic scope of our frequency converters.

However, the scope of performance can be further increased via additional SINAMICS Drive Software options.

These options allow the use of special added value or expansion functions.

For example, the SINAMICS Safety Integrated Extended option provides additional safety functions compared to the basic version.

Greatest flexibility

The additional SINAMICS Drive Software options can easily be ordered together with the SINAMICS frequency converter.

You do not know which options you need at the beginning?
No problem, besides options that can be ordered directly at the time of purchase, some options can also be ordered later.

Before purchasing, you can test the SINAMICS Drive Software options free of charge for a limited time (trial license concept).

Overview

Motor Control Functions

Basic – but most important!
From standard pump and fan applications to high-end drives with complex multi-axis servo applications:
Motor control with SINAMICS drives is always perfect.
A wide variety of motor technologies and performance levels with optimal settings for all applications can be controlled. Just the perfect control for your task!

Technology Functions

The SINAMICS drives' range of applications is significantly expanded by the Technology Functions.
From logic to positioning and more – everything on board!

User Experience

An excellent user experience is given throughout the whole engineering chain as well as throughout the whole drives portfolio due to consistent Ethernet-based interfaces, communication protocols (wired or wireless) as well as up to date browser technologies.

All of the converter functions have been designed so that they can be handled in the same way from an engineering perspective, irrespective of the selected drive type. Knowledge gained can therefore be reused easily and efficiently.

www.siemens.com/engineering-tools

Safety Integrated Functions

SINAMICS drives offer comprehensive and integrated safety functions.
These act significantly faster than conventional designs. As a consequence, Safety Integrated further increases the safety of a machine.

www.siemens.com/safety-drives

Security Integrated Functions

Keep systems and data safe with Security Integrated.

With the new Security Integrated functions, we are hardening SINAMICS drives and therefore also your machines against cyber attacks from the outside (available for SINAMICS S200, SINAMICS S210 (New), SINAMICS G220).

www.siemens.com/industrial-cybersecurity

Energy Efficiency and Grid Capability Functions

Energy is valuable and should be used as efficiently as possible.
SINAMICS drives offer integrated functions for energy efficiency and naturally also support PROFIenergy.

www.siemens.com/drives-energy-efficiency

Connectivity Functions

Consistent openness today and tomorrow.

SINAMICS offers a comprehensive range of communication options for engineering, exchanging data between drives – and naturally for exchanging data with higher level automation systems.

www.siemens.com/profinet

Digitalization in drive technology

Getting started in drive technology digitalization is very easy. We offer suitable digitalization solutions for low-voltage motors and low-voltage converters for every phase in the life cycle of a machine or plant. Our portfolio extends from the digital to the real drive train. Thanks to continuous integration, it is possible to start today in one area with little effort – and use the information acquired elsewhere tomorrow.

www.siemens.com/digital-drives

More information

Further information about SINAMICS Drive Software is available on the internet at:
www.siemens.com/sinamics-drive-software

Notes

2

Overview

Motor Control Functions				
Motor Control Functions Control philosophy				
Drives	**SINAMICS S** Multi-axis			
	SINAMICS G			**SINAMICS S** Single-axis
Control mode	**Vector Control**			**Servo Control**
	Standard Drive Control • Pumps, fans and compressors with flow characteristic • Blasting technology • Mills, mixers, kneaders, crushers, agitators • Horizontal conveyor technology • Basic spindles	**Dynamic Drive Control** • Demanding applications with high utilization of the motor/converter • Pumps and compressors with displacement machines • Extruders • Centrifuges • Vertical conveyor technology	**Expert Mode** • All applications • All setting options are available	• Special closed-loop control for highest dynamics servo motor applications • Especially important for machine tool applications
Required data	Rated speed and rated current	Rated speed, rated current and rated power	Depending on commissioning routine	Depending on commissioning routine
Focus	Easy & fast commissioning for the untrained user	Simplified commissioning for most applications	Maximum performance for the expert user	Maximum performance for the expert user

Motor control modes

The control methods are the core of the entire converter firmware. They are responsible for optimum movement of the connected motor and the attached machines.
The better the control functions, the faster, better and more smoothly the machine operates, thereby significantly enhancing the quality of the production output.

Open loop control

The U/f open-loop control characteristic is the simplest way to control an induction motor.
Several different characteristics, e. g. linear or parabolic, can be configured.
In addition, basic functions like slip compensation, voltage boost or resonance damping are supported.

Universal closed-loop control (Vector Control)

The vector control emulates the motor as precisely as possible to obtain the best results regarding control precision and control quality.
For most applications and motors, the closed-loop vector control is the perfect choice. It is optimized for both Siemens and 3rd party motors.
Unknown motors – regardless of the technology (induction, synchronous reluctance, permanent magnet synchronous) – can be identified and commissioned easily.

The vector control is characterized by features like

- Best speed accuracy
- Best speed ripple
- Best torque accuracy
- Best torque ripple
- Optimized for control with or without encoder

Closed-loop control for highest dynamics (Servo Control)

In the servo control mode, the connected motor is emulated in a vector model based on its equivalent circuit diagram data. Consequently, the servo control constitutes a field-oriented control. In contrast to vector control, the vector model is optimized according to other criteria in servo control.
In favor of achieving a high dynamic performance, a small deterioration in the control accuracy and control quality is accepted.

Special features of the servo control include

- Maximum computing speed
- Shortest sampling times
- Maximum dynamic performance
- High output frequencies
- Preferably used with permanent magnet synchronous motors with encoder for the appropriate dynamic performance

General control loop structures

Both servo and vector control share some common used control-loop structures:

- Extended brake control. It allows complex brake controls, such as for motor holding brakes and service brakes.
- Setpoint channel. It is the link between the setpoint source and the motor control. The converter has a special feature that supports simultaneous input of two setpoints. Generation and subsequent modification of the total setpoint (influencing the direction, skip frequency, up/down ramp) take place in the setpoint channel.
- Command sources. Different sources of command usually result from the requirements to operate a drive from different places (on-site/remote), in different situations (standard/emergency mode) and/or different operating. The BICC binector connector technology allows SINAMICS to configure and combine the command and setpoint sources completely individually.
- Limiters or limits are used to constrain input and/or output variables as appropriate to the connected machine; this means that not all positioning variables are used over their full range but are limited judiciously to enhance the safety and quality of the production process.
- Pulse frequency & modulation.
  Several different pulse frequencies possible to adjust the drive to the application including asynchronous pulse frequencies to minimize derating and mechanical resonances.
  In addition, wobbling is available to generate a more pleasant acoustic experience.

Overview

The software option SINAMICS Motor Control Extended for SINAMICS G220 enables high-performance encoderless closed-loop control of synchronous reluctance motors from standstill, by enabling pulse technique at very low speeds.

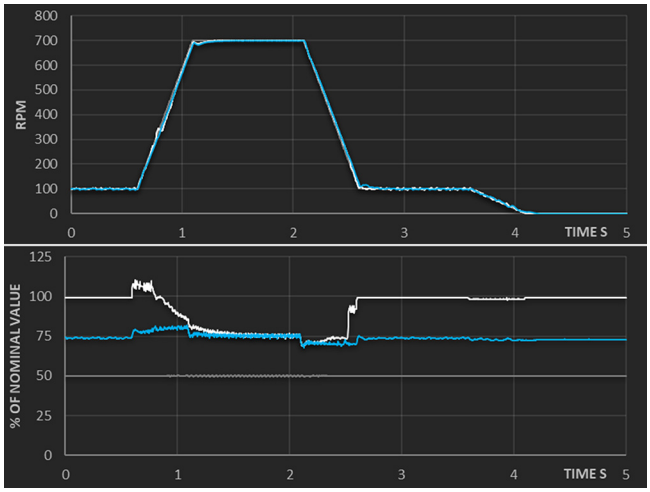
Main benefits

- Reduces commissioning time and effort (less configuration, tuning and wiring)
- Saves energy due to permanent operation in closed-loop vector control
- Saves cost for encoder, cable, installation, spares, etc.
- Allows continuous operation at near zero speeds including torque control
- Improves system stability and robustness
- Improves drive dynamic performance
- Improves reliability and availability by reducing system complexity

Example 1: Low speeds, robustness and energy efficiency

The following diagram shows a measured load cycle. In the low speed range, the software option Motor Control Extended leads to significant reduced currents and therefore increased energy efficiency. Also, continuous operation with high loads is possible near zero speed.

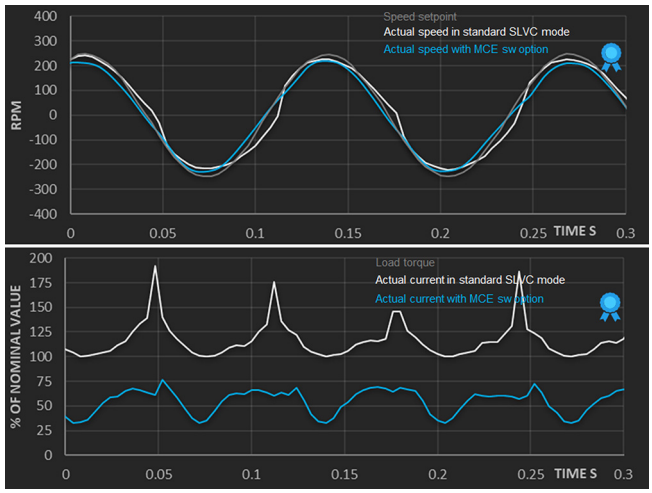
When medium speeds are reached (in diagram: rectangle), the control switches from the pulse technique to standard sensorless vector control.



Example 2: Dynamic behavior

In the following measurement, a sinusoidal signal was used to demonstrate the dynamic performance of the pulse technique. The sinusoidal signal is reproduced perfectly with the pulse technique while maintaining a relatively low current compared to the standard sensorless control near zero speed. For higher sinusoidal frequencies, the standard control would not be able to work.

This shows perfectly that with the software option Motor Control Extended, also high dynamic applications that need fast reaction times at low speeds without ramps are possible.



In which cases should the Motor Control Extended software option be used?

With synchronous reluctance motor drive

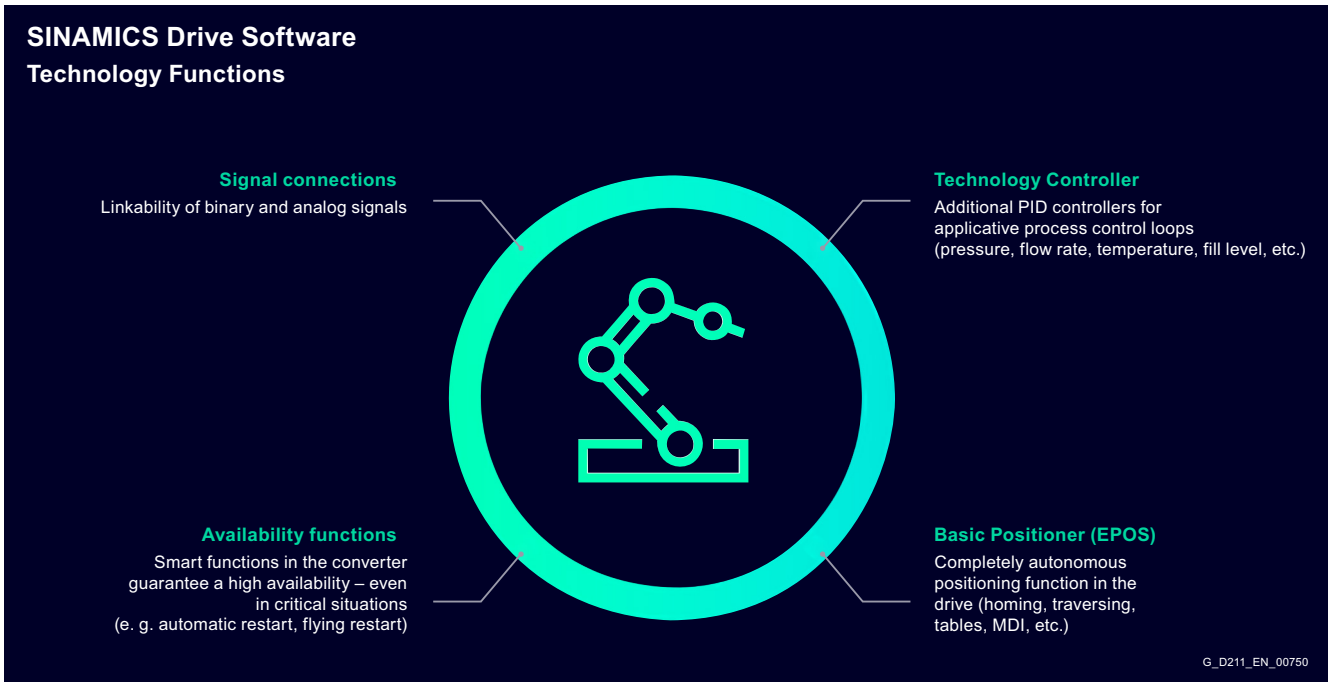
- the application requires frequent or long or even permanent operation at very low speeds during operation cycle and/or precise torque control from 0 rpm is required (e. g. winders, mixers, extruders).
- If the load peak at start is difficult to predict or changes dynamically and/or positioning in the application is required (e. g. logistics, cranes, hoists).
- If the drive dynamic performance is critical, requiring operation with no or very short ramps in closed-loop (e. g. servo pumps).
- If the motor works in harsh conditions or it is impossible to use an encoder (dust, heavy vibrations, mechanical restrictions) (e. g. heavy industry).

SD card

Selection and ordering data

Description	Article No.
Delivery with SD card, 8 GB	
Motor Control Extended (license)	**6SL5970-0AA00-0AA0-Z H01**
With firmware V6.2 and Motor Control Extended (license)	**6SL4170-1GC00-0AA0-Z H01**
Delivery in electronic form, eCOL (without SD card)	**6SL5977-0AA00-1DA0**
Motor Control Extended (license)	

Overview



Signal connections

Create new functions by intelligently interconnecting sub-functions. Signal Connect gives you the flexibility you need to configure customized solutions to meet your needs.

Basic Positioner

The basic positioner provides powerful and precise positioning functions. Due to its flexibility and adaptability, the basic positioner (EPOS) can be used for a wide range of positioning tasks.
The functions are easy to use during both commissioning and operation, and the comprehensive monitoring functions are very powerful.
As a consequence, many applications can be implemented without having to use external position controls.

Technology Controller

The technology controller is implemented as a PID controller for performing all kinds of process control tasks.
It can be used to control the line pressure, fill level, temperature, flow or tension control, or load balancing etc.

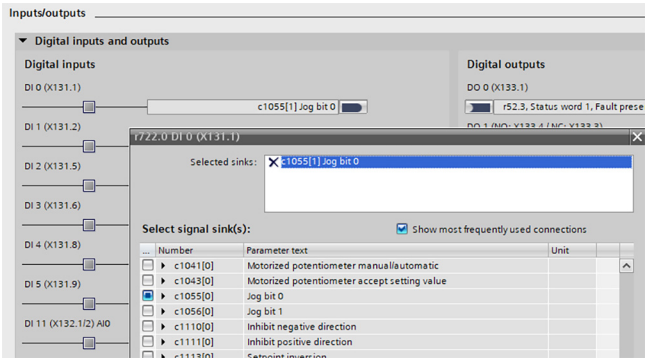
Availability functions

Smart functions in the converter guarantee a high availability – even in critical situations. These functions are e. g. automatic restart, flying restart, kinetic buffering, overvoltage limitation, keep running mode and emergency operation mode.

Overview

Signal interconnection

The SINAMICS drive system allows input and output signals of different SINAMICS Drive Software functions to be interconnected with one another. In addition to setting parameters, the ability to interconnect signals is an additional option of adapting SINAMICS Drive Software functions to address the particular application. Signal connection enables flexible adaptation of SINAMICS to a wide range of the customer requirements.



Technology Controller

The integrated technology controller in SINAMICS Drive Software enables precise control of process variables such as pressure, temperature, level and flow. With a wide range of additional functions, the technology controller offers an optimum solution for your individual requirements:

Setpoint specification: Flexible selection between analog value and fixed setpoint in order to achieve the desired objective precisely.

Setpoint channel: With functions such as scaling, ramp-function generator and filter, you have full control over the desired setpoint.

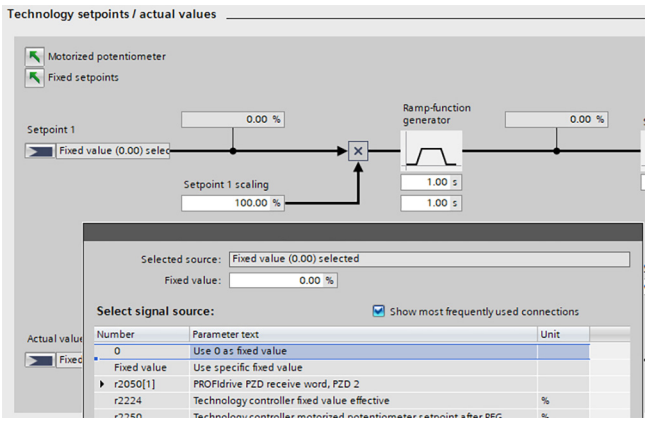
Actual value channel: Use filtering, limiting and signal conditioning for precise acquisition and processing of the actual value.

PID controller: Optimize the performance of your control system by individually setting the D component, blocking the I component and adjusting the control sense.

Enabling and limiting the controller output: Control the output of the controller as required and set individual limits to ensure the stability of your processes.

Fault reaction: Our PID controller reacts to errors that occur, ensuring reliable and safe control of your process parameters.

The technology controller not only offers precision, but also user-friendliness and adaptability. Rely on proven technology for optimum results in your applications!



Availability functions

The following smart functions are available to increase availability:

Automatic restart:

Use the powerful automatic restart function in the SINAMICS drive system to ensure a reliable and automatic restart. This innovative function enables seamless power recovery, especially after a power failure.

Any faults that occur are automatically acknowledged and the drive restarts automatically. This functionality goes beyond mains faults and can be used flexibly for any fault shutdowns. The automatic restart function therefore offers a comprehensive solution for critical situations.

Thanks to its adaptability and reliability, this function minimizes downtimes and increases the overall availability of the drive system.

Flying restart:

Experience the impressive "flying restart" function – an intelligent solution that allows your motor module to seamlessly switch to a motor that may already be rotating after it has been switched on. This advanced function can be activated both in operation with and without an encoder and offers maximum application versatility.

A practical example illustrates the performance of this function: After a power failure, a fan drive can be quickly synchronized with the running fan motor again thanks to the "flying restart" function. This enables operation to be resumed as quickly as possible and significantly minimizes downtimes.

Integrate the "flying restart" function into your drive systems and benefit from reliable, flexible and efficient motor control – exactly when it matters.

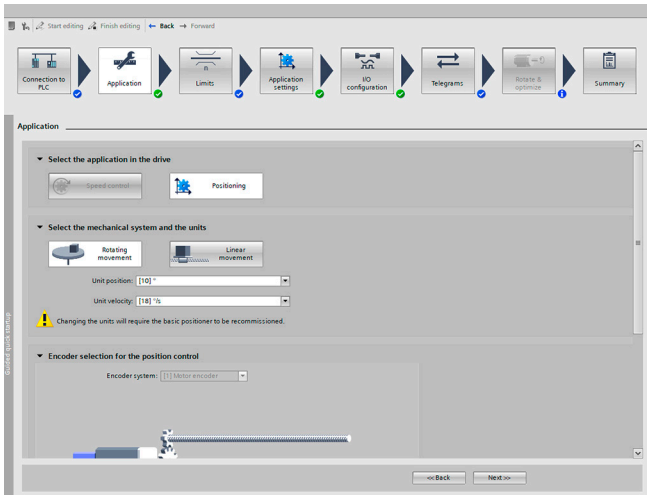
3

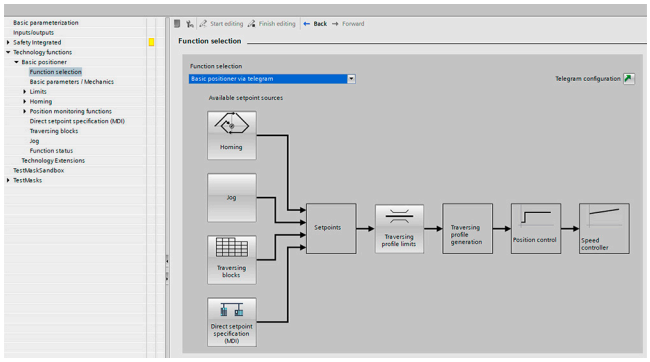
Overview

SINAMICS drives offer an integrated positioning function for controlling the position of the axis and can therefore solve straightforward and simple motion control tasks with the drive without additional external technological effort.
In this way, linear or rotary axes can be positioned in the machine or system component – absolute or relative positioning is possible.

The integrated positioning function is offered as a technology function as basic positioner (EPOS).

The EPOS in SINAMICS drives – solves extensive positioning tasks independently, without a high-end PLC controller.





The EPOS basic positioner in the SINAMICS drive system provides powerful and precise positioning functions. Due to its flexibility with the adaptability, the basic positioner can be used for a wide range of positioning tasks.

The functions are easy to handle, both during commissioning with the support of the physical unit and during operation, and are also characterized by comprehensive monitoring functions.

Many applications can be carried out without external position controllers.

The basic positioner is used to position linear and rotary axes (modulo) in absolute/relative terms with rotary motor encoder.

User-friendly configuring with guided quick startup and commissioning, including control panel (operation using PC) and diagnostics, are possible with the SINAMICS Startdrive commissioning tools.

In addition to extremely flexible positioning functions, the basic positionier offers a high degree of user-friendliness and reliability thanks to integral monitoring and compensation functions.

Different operating modes and their functionality increase flexibility and plant productivity, for example, by means of "on-the-fly" and bumpless correction of the motion control.

Preconfigured PROFIdrive positioning telegrams are available which, when selected, automatically establish the internal "connection" to the basic positioner.

In addition, the SIMATIC PLC also provides a BasicPosControl technology object for control of the basic positioner (EPOS) with Siemens telegrams.

Overview

Functionality of the basic positioner (EPOS)

Lower-level closed-loop position control with the following essential components

- Position actual value sensing (including the lower-level measuring probe evaluation and reference mark search)
- Position controller (including limits, adaptation and pre-control calculation)
- Monitoring functions (standstill, positioning and dynamic following error monitoring)

Mechanical system

- Backlash compensation
- Modulo offset

Limitations

- Speed/acceleration/delay/jerk limitation
- Software limit switches (traversing range limitation by means of position setpoint evaluation)
- Hardware limit switches (traversing range limitation using hardware limit switch evaluation)

Referencing or adjustment

- Set reference point (for an axis at standstill)
- Active homing (separate mode including reversing cam functionality, automatic reversal of direction, homing to "output cam and encoder zero mark" or only "encoder zero mark" or "external zero mark (BERO)")
- Passive homing (seamless referencing possible during "normal" traversing with the aid of the measuring input evaluation; general evaluation, e.g. of a BERO. Subordinate function for the modes "jog", "direct setpoint input/MDI" and "traversing blocks")
- Absolute encoder alignment

Traversing block mode

- 64 traversing blocks for
  - SINAMICS S210 (New)
- 32 traversing blocks for
  - SINAMICS S200, PROFINET version
- Positioning using traversing blocks that can be stored in the drive unit including continuation conditions and specific jobs for a previously homed axis
- Configuring traversing blocks using the traversing block editor in the relevant commissioning tool of the SINAMICS converter family
- A traversing block contains the following information:
  - Job number and job (e.g. positioning, waiting, GOTO block jump, setting of binary outputs, travel to fixed stop)
  - Motion parameters (target position, velocity, override for acceleration and deceleration)
  - Mode (e.g.: hide block, continuation conditions such as "Continue_with_stop", "Continue_flying" and "Continue_-externally using high-speed measuring inputs")
  - Job parameters (e.g. wait time, block step conditions)

Direct setpoint specification (MDI) mode

- Positioning (absolute, relative) and setting-up (endless closed-loop position control) using direct setpoint inputs (e.g. via the PLC using telegram)
- It is always possible to influence the motion parameters during traversing (on-the-fly setpoint acceptance) as well as for on-the-fly changes between the setup and positioning modes.
- The direct setpoint specification mode (MDI) can also be used in the relative positioning or setup mode if the axis is not referenced. This means that on-the-fly synchronization and re-referencing can be carried out using "flying referencing".

Jog mode

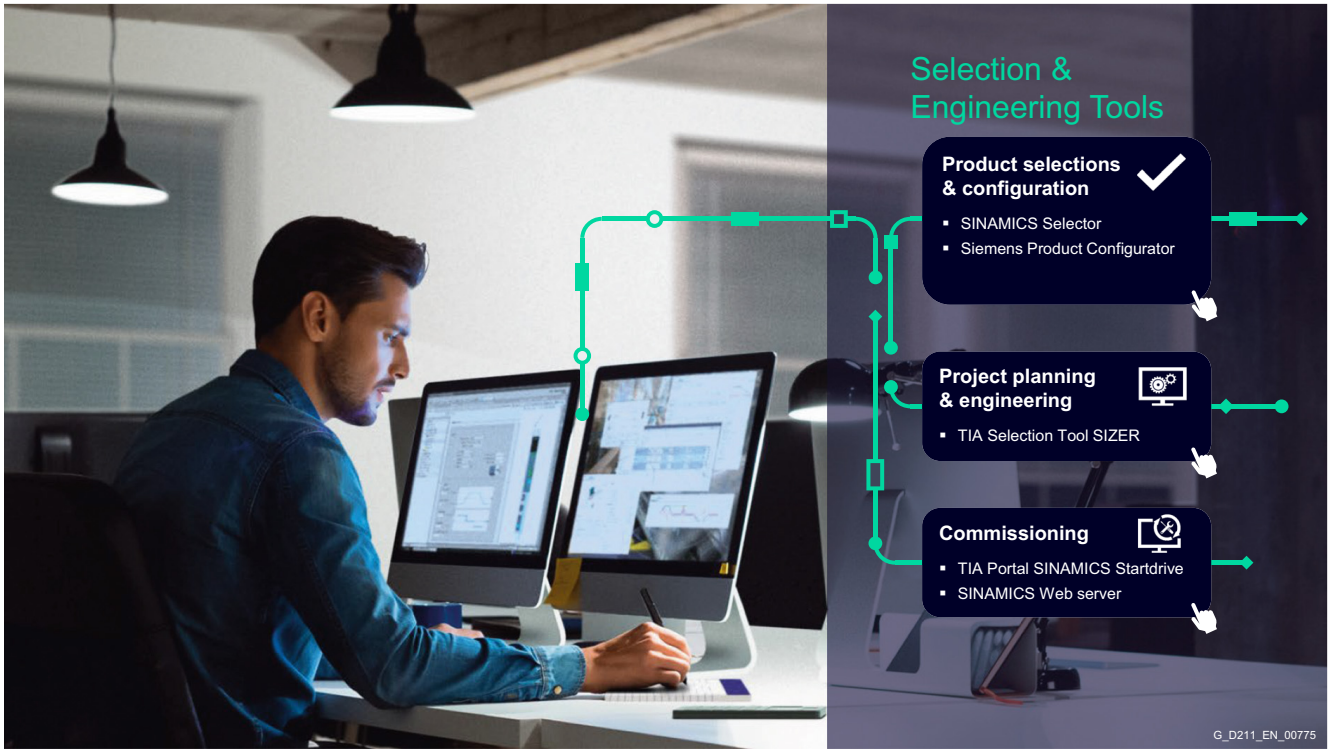
- Closed-loop position controlled traversing of the axis with "endless position controlled" or "jog incremental" modes (traverse through a "step width"), which can be toggled between

Overview

Efficient selection, engineering, diagnostic and service tools of converters and motors

Simple or complex: Siemens offers professional tools for configuring drive components or engineering drive systems and solutions. The digital guidance spans from product selection and configuration to specific engineering of drive systems.

An excellent user experience is given throughout the whole engineering chain as well as throughout the whole drives portfolio due to consistent Ethernet-based interfaces, communication protocols (wired or wireless) as well as up to date browser technologies.



Overview

SINAMICS Selector app: Your guide to frequency converters

Finding the right frequency converter for your application can be a challenge. But SINAMICS Selector app makes your selection process quick and easy – reducing it to just a few clicks.
As an app, the digital guide is accessible even on the go.
It helps you navigate the comprehensive range of SINAMICS converters and guides you reliably to the one that matches your application.

Drive selection on the go: benefits at a glance

SINAMICS Selector app is designed to help you find the right frequency converter easily and quickly. To ensure that the app is accessible to everyone, we prioritized a clear structure and functional design. In addition, the selection process consists of only five steps. In this way, SINAMICS Selector app offers a smart, swift and smooth path to select and purchase your converter.

You will find free downloads for Android and iOS here:
www.siemens.com/sinamics-selector

Siemens Product Configurator

Overview

The Siemens Product Configurator helps you to configure the optimum drive technology products for a number of applications. The product portfolio comprises the full drive technology range of gearbox, motor, converter and connection system as well as corresponding controller with suitable software license. The intuitive user interface in conjunction with product-specific preliminary selectors makes it simple, fast and efficient to configure products. The result is a bill of materials with extensive documentation consisting of technical data sheets, motor characteristic curves, 2D dimensional drawings / 3D CAD models, EPLAN macros and much more. You can order the products directly by transferring the bill of materials to the shopping cart of SiePortal.

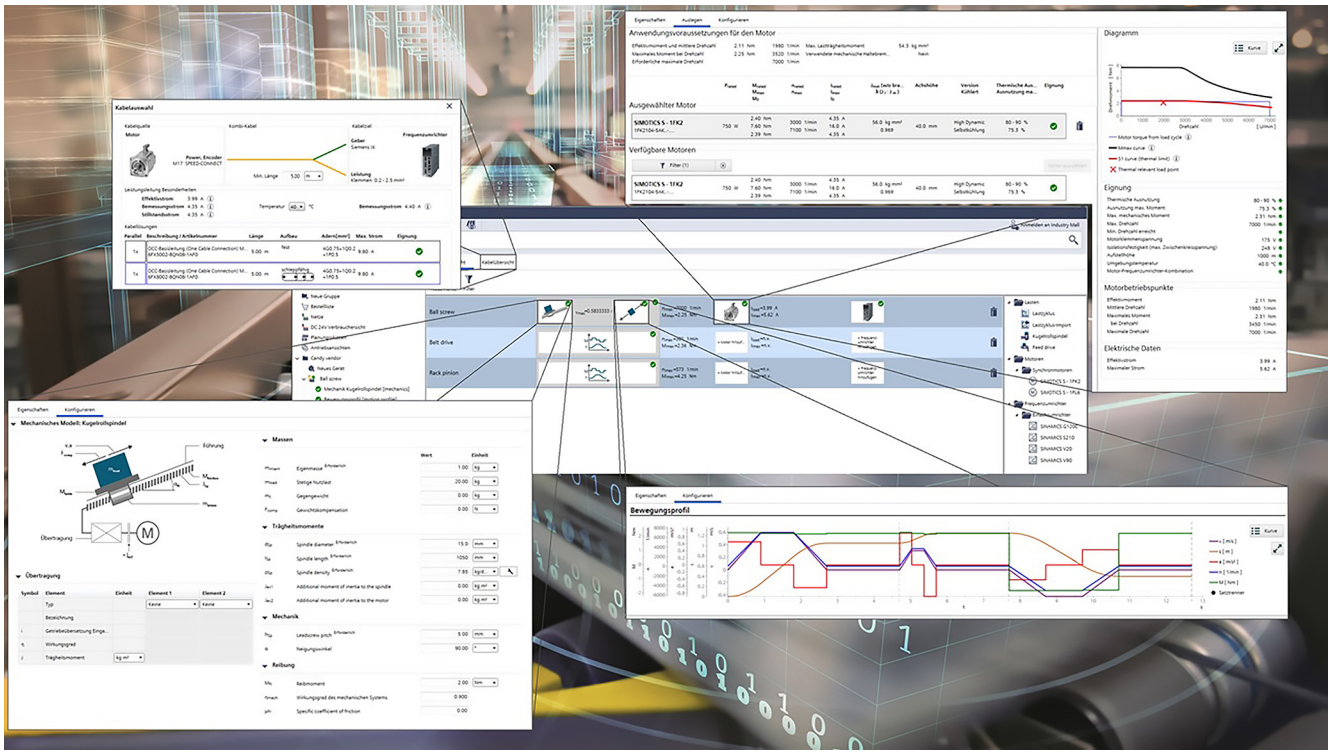
Siemens Product Configurator at a glance

- Quick and easy configuration of drive products and associated components – gearboxes, motors, converters, controllers, connection systems
- Extensive documentation for all products and components, such as
  - Data sheets in up to 12 languages
  - Motor characteristic curves
  - 2D dimensional drawings / 3D CAD models in different formats
  - Terminal box drawing and terminal connection diagram
  - Certificates
  - EPLAN macros
- Ability to order products directly through SiePortal

Access to the Siemens Product Configurator

The Siemens Product Configurator can be accessed without the need for registration or logging in:
www.siemens.com/spc

Overview



Selection guide and configurator for automation technology

Error-free configuration without expert knowledge through intelligent configurators and selection wizards. Desktop and cloud versions enable cross-team collaboration with maximum flexibility.

There are two versions of the TIA Selection Tool:

- One for downloading and execution on Microsoft Windows PCs (from Microsoft Windows 10)
- One for running from the cloud, which is launched from mobile devices directly in the browser (we recommend Safari, Chrome and Firefox)

Projects stored in the cloud can be edited with both tools. This makes it possible to work on-the-go using a tablet, at home on a PC – and vice versa, or together with colleagues and customers.

In order to use the full functionality, we recommended setting up a SiePortal account for both cases. This gives you access to prices and enables you to save your projects to our cloud.

You can find additional information about the TIA Selection Tool at:
www.siemens.com/tia-selection-tool

Drive dimensioning in the TIA Selection Tool

Application-specific requirements can be determined using drive technology dimensioning in the TIA Selection Tool. This can include motors, gearboxes and converters. The tool supports the configuration and dimensioning of control functions with an open and closed control loop. The technical documentation with features of the technical drive system, as well as a product list for ordering via SiePortal can also be compiled.

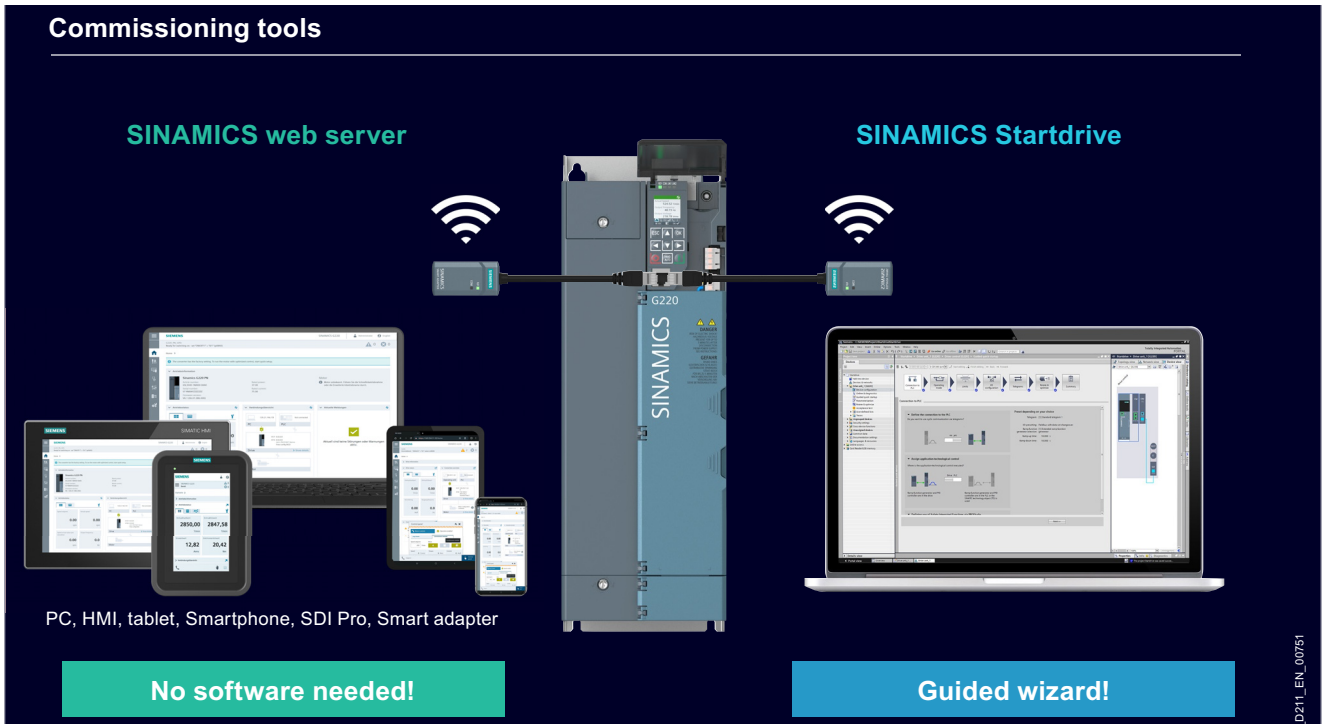
You can find more information on the SIZER for Siemens Drives engineering tool at
https://support.industry.siemens.com/cs/ww/en/ps/13434/dl

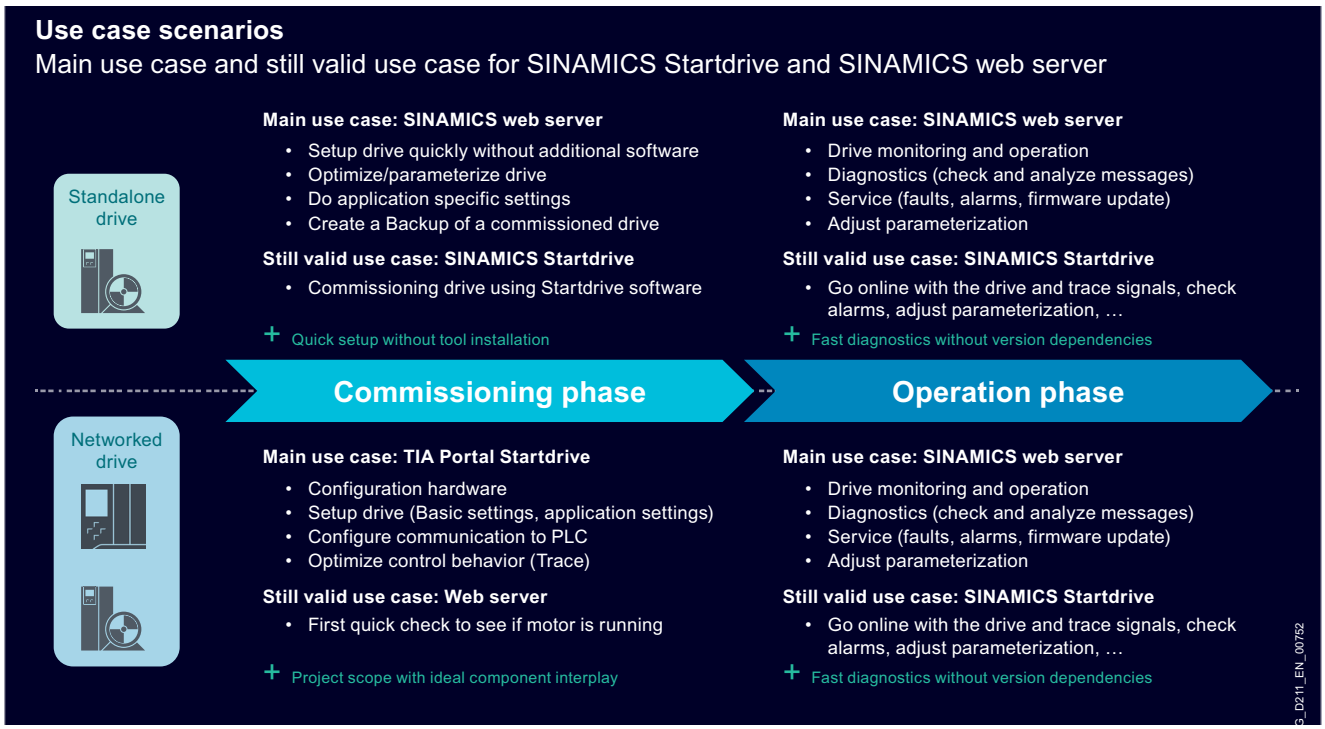
Commissioning tools

Overview

Good user experience is the core feature of the commissioning tool set based on the two pillars SINAMICS web server and SINAMICS Startdrive.

A consistent operating philosophy throughout the whole portfolio is represented within SINAMICS web server and SINAMICS Startdrive as well as the interexchange of data between these two commissioning tools. A consistent use of Ethernet-based interfaces and protocols is rounding up the commissioning scenario no matter if users prefer a wired or wireless connection to the SINAMICS drives.

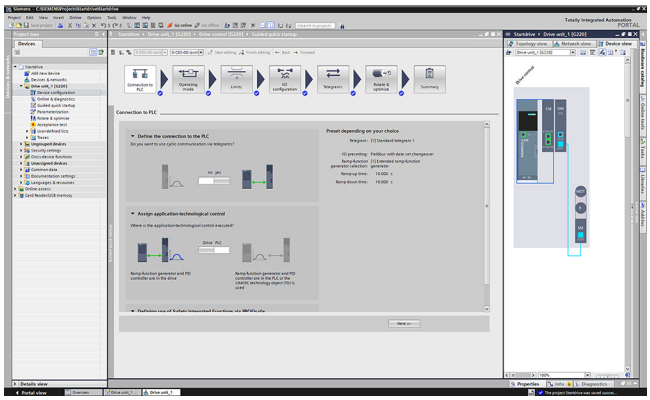




Overview

SINAMICS Startdrive is integrated in the TIA Portal and is a tool for the configuration, commissioning and diagnostics of the SINAMICS family of converters.

The SINAMICS Startdrive commissioning tool has been optimized with regard to user friendliness and consistent use of the TIA Portal benefits of a common working environment for PLC, HMI and drives. Time-saving and guided step-by-step commissioning with maximum flexibility is complemented by user-friendly graphic function views for all drive functions, including functional safety (Safety Integrated) and drive-based technology functions (e.g. EPOS). The automatic message display, the powerful real-time trace and the context-sensitive online help make converter diagnostics very easy.



The software packages based on the TIA Portal are harmonized with each other and offer important benefits, the main advantage being a shared project storage. The TIA Portal enables simple integration of SINAMICS converters in your automation solution. Thanks to the standardization of operator actions and the integration in general TIA Portal operating concepts (e.g. UMAC, Openness) as well as standard TIA Portal functions (e.g. Undo/Redo), familiarization is easy both for drive experts as well as SIMATIC users. Special focus is placed on the interaction between SIMATIC and SINAMICS, especially when connecting the SINAMICS drives to SIMATIC technology objects.

Integration

Supported frequency converters

SINAMICS Startdrive Basic enables complete commissioning, diagnostics, parameterization, optimization and connection to the PLC for the following SINAMICS converters integrated in SINAMICS Startdrive:

- SINAMICS G120, G120C, G120D, G120P
- SINAMICS G115D
- SINAMICS G130, G150
- SINAMICS G220 (as of V18 SP2) *)
- SINAMICS S120 1), S150
- SINAMICS S200 (as of V18 SP2)
- SINAMICS S210 and SINAMICS S210 (New) (as of V18 SP1)
- SINAMICS MV

SINAMICS Startdrive Advanced

With SINAMICS Startdrive Advanced (available as of V15) you benefit from powerful engineering functions that save you considerable time and ultimately costs.

- Safety acceptance test:
  - Guided acceptance test wizard for all drive-based Safety Integrated functions
  - Automatic and safety function-specific generation of traces to analyze the machine behavior
  - Generation of an acceptance report as Excel file (xlsx format, can also be used with OpenOffice)
  - Safety Activation Test
- Improved optimization options in the drive: Extended measuring functions (available for CU320-2 PN/DP and CU310-2 PN as of V5.2 SP3, SINAMICS S210 (New) as of V6.1 and SINAMICS S200 as of V6.2), long-term trace
- Also contains all Startdrive Basic functions
- Only license key required, no additional installation

*New in V19 *)*

Startdrive Basic V19 *)

- Support of the shared device functionality for SINAMICS S210, S120, G220 *) for separate control of the drives by separate controllers
- Improvement of the library function for individual drive objects in the multi-axis system
- Integration of the decentralised SINAMICS S120M drives
- Integration of the drive version V6.3 for SINAMICS S200 and SINAMICS S210 (New):
  - Introduction of the positioning function EPOS for SINAMICS S210 (New)

Startdrive Advanced V19 *)

- Long-term trace functionality for CU320-2 PN/DP and CU310-2 PN-based drive units

*) For SINAMICS G220 please install SINAMICS Startdrive V18 SP2 Update 1 till SINAMICS Startdrive V19 SP1 is available. More information are available on the internet at
https://support.industry.siemens.com/cs/document/109827567
www.siemens.com/startdrive

1) Includes SINAMICS S220 Smart Line Modules booksize format as of SINAMICS Startdrive V17 Update 1.

4

Integration

Installation versions

SINAMICS Startdrive can be installed as an optional package to SIMATIC STEP 7 or as a stand-alone application (without SIMATIC STEP 7).

System requirements

The following table shows the recommended hardware and system equipment for the operation of SINAMICS Startdrive.

Hardware	Recommendation
Computer	As of SIMATIC FIELD PG M6 Comfort (or comparable PC)
Processor	Intel Core i5-8400H (2.5 ... 4.2 GHz; 4 cores + hyper-threading; 8 MB Smart Cache)
RAM	16 GB or more (32 GB for large projects)
Hard disk	SSD with at least 50 GB available memory
Screen resolution	15.6" Full HD display (1920 × 1080 or larger)
Operating systems	• **Microsoft Windows 10 (64 bit)** - Windows 10 Professional Version 22H2 - Windows 10 Enterprise 21H2, 22H2 - Windows 10 Enterprise 2016 LTSC - Windows 10 Enterprise 2019 LTSC - Windows 10 Enterprise 2021 LTSC • **Microsoft Windows 11 (64 bit)** - Windows 11 Home Version 21H2, 22H2 - Windows 11 Professional Version 21H2, 22H2 - Windows 11 Enterprise 21H2, 22H2 • **Microsoft Windows Server (64 bit)** - Windows Server 2016 Standard (full installation) - Windows Server 2019 Standard (full installation) - Windows Server 2022 Standard (full installation)

Compatibility with other products

- SINAMICS Startdrive V19 operates with STEP 7, WinCC and Scout TIA V19 in one framework
- SINAMICS Startdrive V19 can be installed on the same computer in parallel with other versions of SINAMICS Startdrive V12 to V18
- SINAMICS Startdrive can be installed on the same computer as SINAMICS MICROMASTER STARTER

Supported virtualization platforms

SINAMICS Startdrive can be installed in a virtual machine. For this purpose, one of the following virtualization platforms in the specified version or a newer version can be used:

- VMware vSphere Hypervisor (ESXi) 6.7
- VMware Workstation 15.5.0
- VMware Player 15.5.0
- Microsoft Hyper-V Server 2019

Supported safety programs

The following safety programs have been tested with SINAMICS Startdrive V19:

- Virus scanners:
  - Symantec Endpoint Protection 14.6
  - Trend Micro OfficeScan 14.0
  - McAfee Endpoint Security (ENS) 10.6 and 10.7
  - Microsoft Defender
  - Qihoo 360 "Safe Guard 12.1" + "Virus Scanner"
- Encryption software:
  - Microsoft Bitlocker
- Host-based Intrusion Detection System
  - McAfee Application Control 8.3.3

Selection and ordering data

Description	Article No.
SINAMICS Startdrive Basic V19 commissioning tool *) Single license and certificate of license English, French, German, Italian, Spanish, Chinese Simplified	
• Software download (email address required for delivery)	**6SL3072-4KA02-0XG0**
SINAMICS Startdrive Advanced V19 commissioning tool *) License key (floating license) English, French, German, Italian, Spanish, Chinese Simplified	
• On DVD-ROM with license key on USB flash drive	**6SL3072-4KA02-0XA5**
• Software download incl. license key (email address required for delivery)	**6SL3072-4KA02-0XG5**
Upgrade SINAMICS Startdrive Advanced V15 ... V18 to V19	
• On DVD-ROM with license key on USB flash drive	**6SL3072-4KA02-0XE5**
• Software download incl. license key (email address required for delivery)	**6SL3072-4KA02-0XK5**
Software Update Service with SINAMICS Startdrive Advanced in the TIA Portal Delivery is performed according to the number of ordered SUS products (e.g. 10 upgrade license keys (floating license) with 10 DVD-ROMs, 10 USB flash drives, etc.)	
• On DVD-ROM with upgrade license key on USB flash drive	**6SL3072-4AA02-0XL8**
• Software download incl. license key (email address required for delivery)	**6SL3072-4AA02-0XY8**
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.	
	Recommended accessories For communication between the drive unit and the programming device or PC
SINAMICS Smart Adapter	**6SL4950-0AJ00-0AA0**
• Wi-Fi solution for the next generation of SINAMICS converters SINAMICS S200 [1], SINAMICS S210 (New) [1] and SINAMICS G220	

More information

The SINAMICS Startdrive Basic commissioning tool is available free on the internet at
www.siemens.com/startdrive

*) For SINAMICS G220 please install SINAMICS Startdrive V18 SP2 Update 1 till SINAMICS Startdrive V19 SP1 is available. More information are available on the internet at
https://support.industry.siemens.com/cs/document/109827567
www.siemens.com/startdrive

[1] Release for SINAMICS S200 and SINAMICS S210 (New) available soon.

Overview

Support for migration from SINAMICS S210 TIA projects

To update TIA projects with existing SINAMICS S210 and firmware V5.x to SINAMICS S210 (New) with firmware V6.x, the SINAMICS Migration Tool is on hand, offering a convenient way to replace the converters.

Migration tends to take place automatically in offline mode. Parameter assignment and drive networking remain unchanged.

Only the security settings (incl. Safety Integrated) need to be manually set, for the purpose of protecting the project.

The SINAMICS Migration Tool requires the TIA Portal V18 SP1 or higher.

https://support.industry.siemens.com/cs/document/109822030

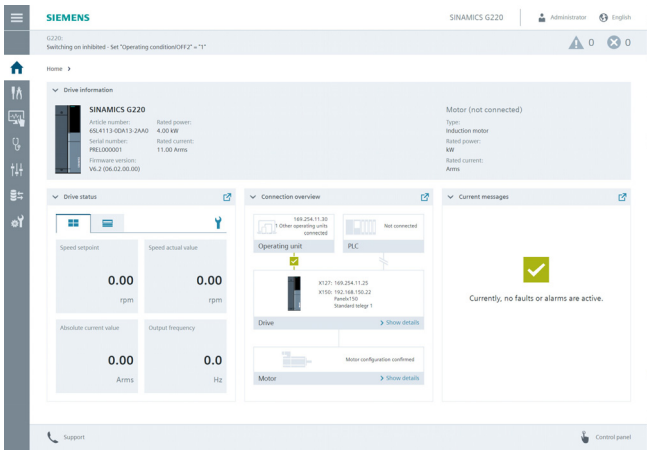
Overview

Web server for efficient commissioning, diagnostics, maintenance and operator control and monitoring, any time, from anywhere

Thanks to the web server, the SINAMICS next generation portfolio offers an efficient commissioning, diagnostics, maintenance option as well as operation and monitoring functions. The user is supported by a help function and additional links to specific product information, downloads, FAQs and manuals.
The web server provides access to a multi-faceted range of new options for commissioning or parameter assignment, drive diagnostics, remote maintenance as well as operator control and monitoring for any networked PC with a web browser or for tablets and smartphones (via a separate WLAN access point, such as SINAMICS Smart Adapter.
The following gives an idea of the functionality offered by the SINAMICS G220 as an example.

The start screen offers a quick overview of the state of the drive

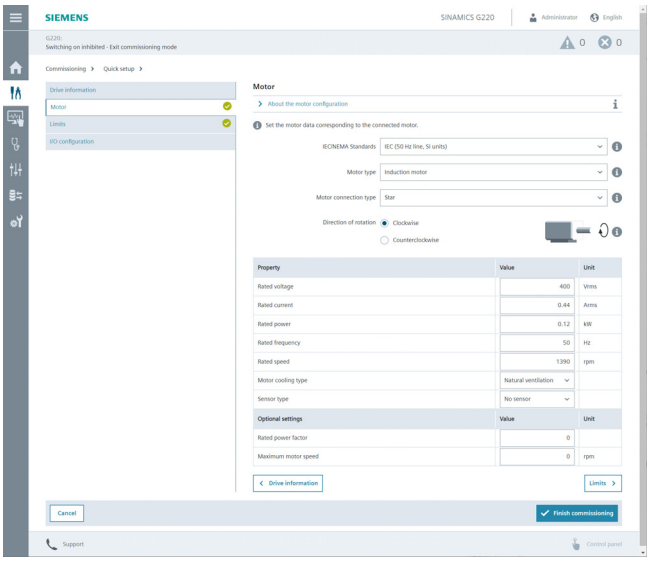
- Drive type, connected motor as well as the article number and installed firmware
- Important drive parameters show the operating state (can be configured)
- The connection overview provides information about the status of the connections (operating unit - converter - motor)
- Overview of all pending fault and warning messages



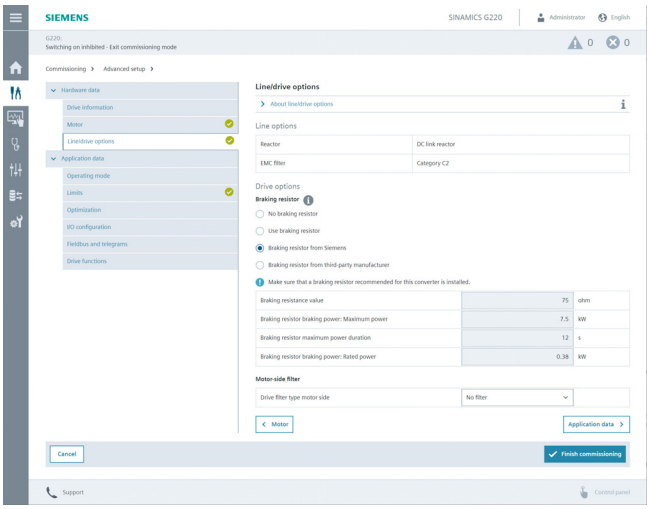
Start screen of the web server integrated into SINAMICS G220

Commissioning

- In the quick commissioning, the most important drive characteristics are defined, e.g. motor data, limit values and the configuration of the inputs and outputs. If an motor-side filter is installed, the extended commissioning has to be used.
- In the extended commissioning, drive options and functions are defined to suit your application. The extended commissioning includes all the settings of the quick commissioning as well as additional options and functions.
- Safety Integrated commissioning guides you through the commissioning of the Safety Integrated functions of the converter.



Quick commissioning with open dialog showing the set motor data

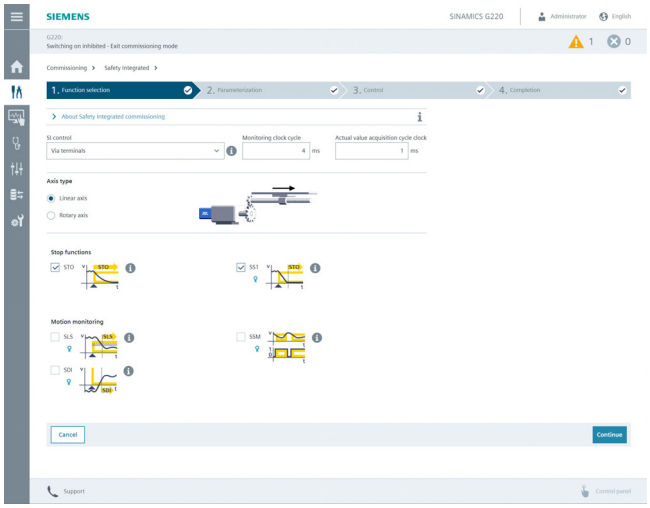


Extended commissioning with open dialog for the line/drive options

Note

Integrated web server is part of the next generation converters such as SINAMICS S200, S210 (New) and G220, and its functionality may differ from the web server accessible via Smart Access Modules offered for the rest of the frequency converters from SINAMICS family.

Overview

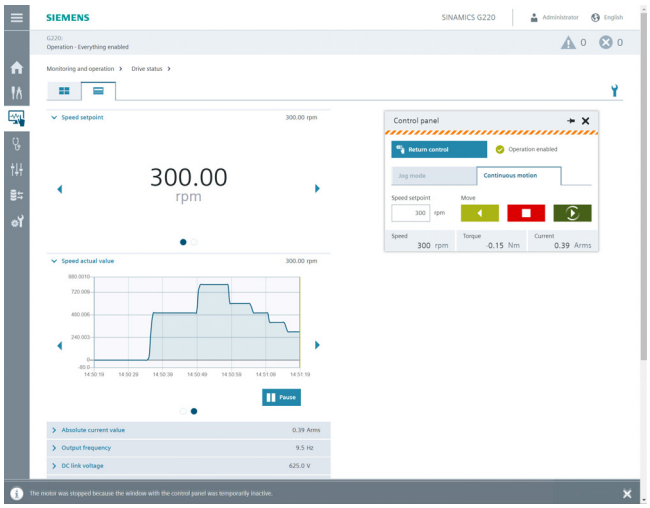


Safety Integrated assistant

Operator control and monitoring

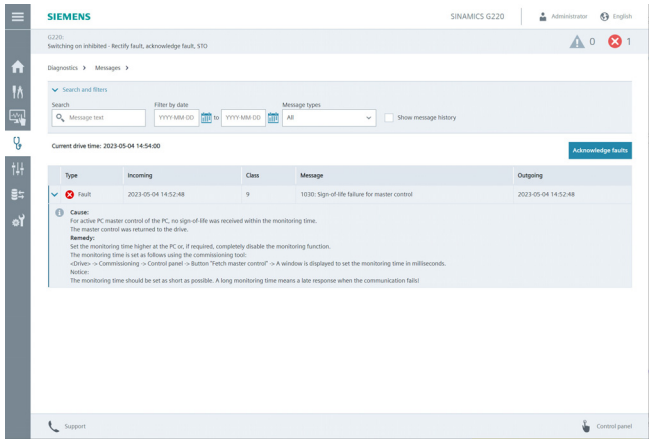
- Configurable drive status with value or trend display
- Status of the digital inputs
- Drive traversing via the control panel, which can be freely positioned on the screen

Diagnostics



Operator control and monitoring of the drive with the help of the drive status and control panel

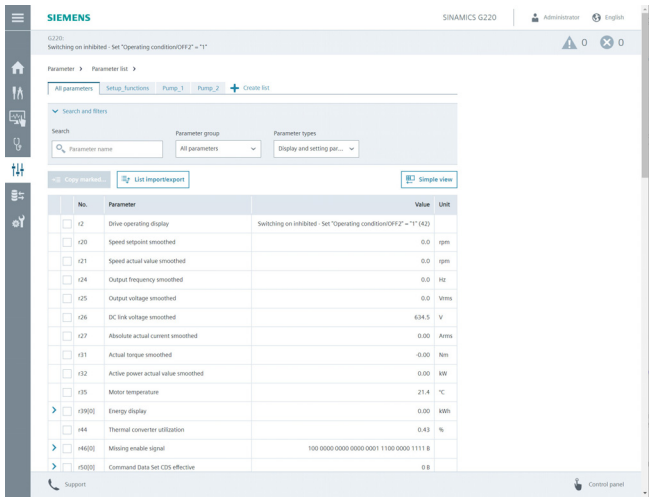
- Evaluation of warnings and fault messages
- Evaluation of system events (diagnostic buffer)
- Analysis of the safety status
- Connection overview, diagnostics of the drive communication and control and status words



Alarm view with convenient search and filter functions

Service and maintenance functions

- Monitor and adjust drive parameters
- Convenient creation and management of signal interconnections
- Create, import and export user-specific parameter lists
- Back up and restore the drive configuration
- Perform firmware update, also via the network
- Manage software licenses
- Configure basic settings for the drive and web server (e.g. date and time of the drive)
- Configure and manage user accounts and access controls (UMAC)



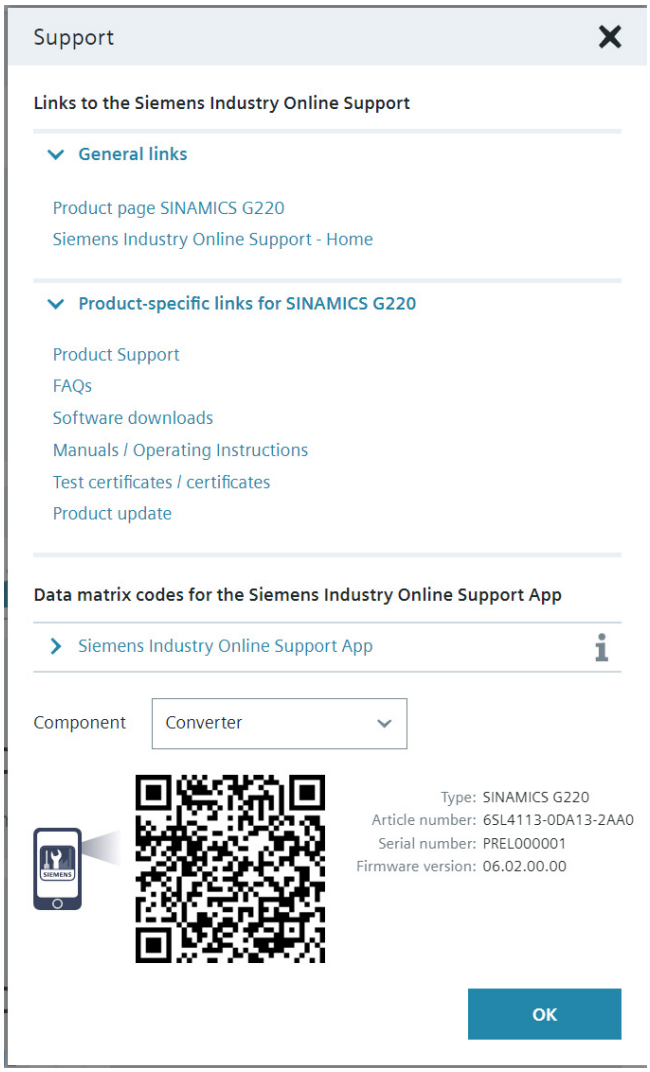
Parameter list for quick access to drive parameters, also via user-defined parameter lists

4

Overview

Support

- Operator support with comprehensive information about the drive and user interface
- Easy access to product information such as FAQs, software downloads, manuals and certificates
- When storing the html documentation on the drive memory card, the user manual can be accessed in a context-sensitive manner from the user interface



Support dialog for quick access to product-specific information

Benefits

Simple and fast commissioning

- Installation of additional commissioning software is not required.
  Tools required for the commissioning are ready to use via the integrated web server.
- Standard pages to set thresholds and onboard inputs
- Guided parameterization of Safety Integrated functions
- Extensive online help with context-sensitive access to the Operating Instructions (memory card required)

Shorter machine downtimes

- Quick overview of the current configuration and the state of the drive
- Efficient diagnostics and maintenance
- Understandable diagnostic information and messages, including the causes of issues and possible remedies, are displayed in plain text in multiple languages
- Context-sensitive help with optional access to the web-based device documentation provides quick help with questions about drive functions

Convenient service and maintenance functions

- Quick backup and restoration of the drive data
- Convenient firmware update, also via the network
- Convenient access to drive parameters and their signal interconnections
- User-defined parameter lists that focus on what matters
- Easy and efficient handling of the parameter list by using search functions and filters (e.g. parameter groups, parameter types)
- Easy exchange with operating personnel by importing/exporting user-defined parameter lists.
- User-defined parameter lists can be exchanged between the SINAMICS Startdrive and the web server.

Direct language selection

- English, French, German, Italian, Spanish, Chinese Simplified

Accessibility

- Via all LAN or PROFINET interfaces
- Use of mobile devices (e.g. notebooks/tablets and smartphones) via WLAN e.g. with SINAMICS Smart Adapter [1] or a separate access point
- Access to the web server via PCs/notebooks, SIMATIC HMI (> 10”), smartphones/tablets with a Chromium-based internet browser

Access security

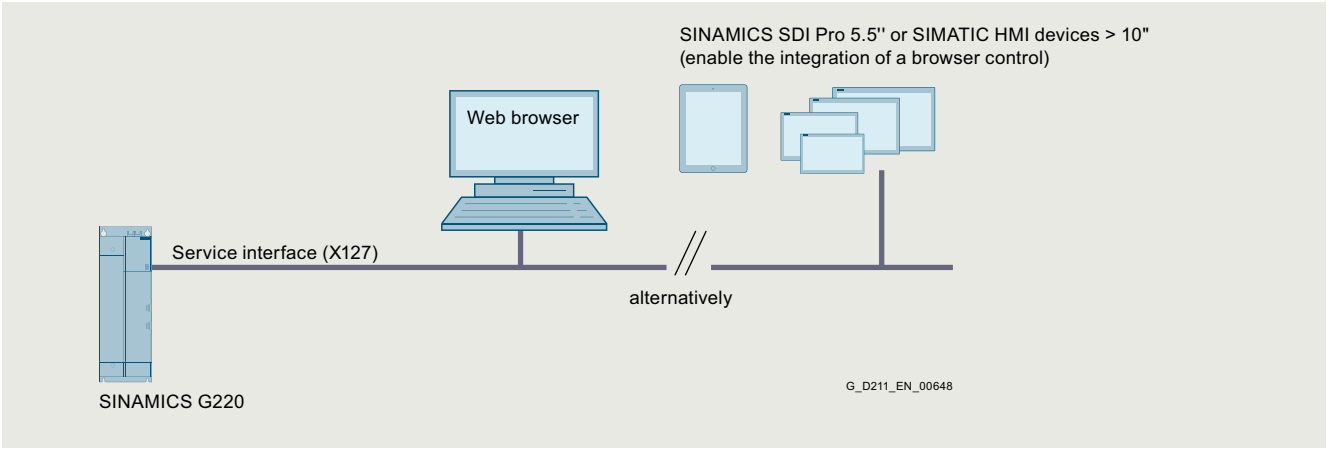
- Protection against unauthorized access to the drive functions and data
- Convenient user administration that supports a roles concept
- Easy set-up and management of user accounts

Application

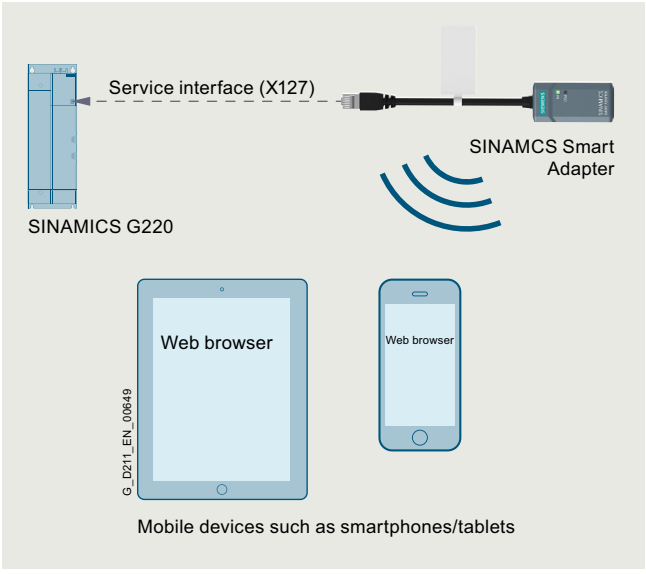
The web server is ideal for applications not requiring any special commissioning software or version dependencies. Commissioning, diagnostics and maintenance as well as operator control and monitoring are possible both locally and remotely, provided appropriate security measures are applied.

[1] SINAMICS Smart Adapter available soon.

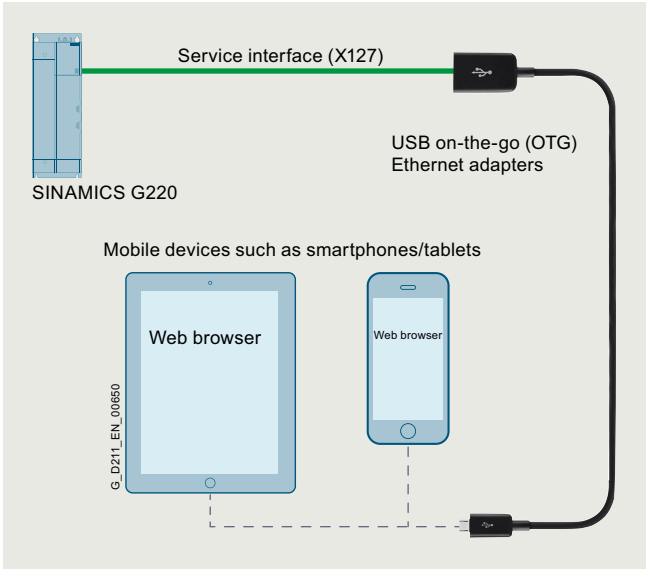
Integration



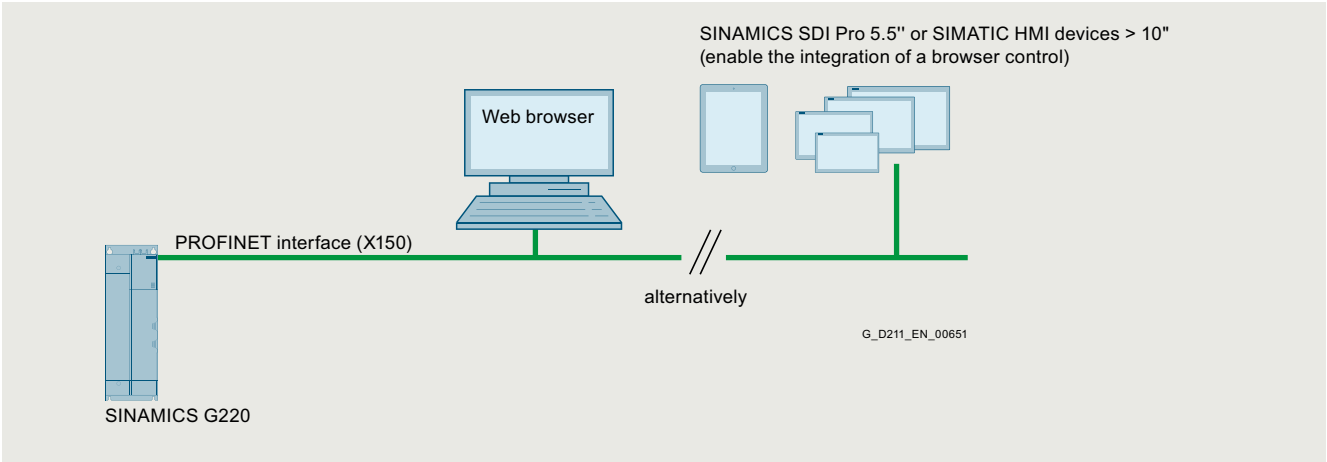
Integration of the SINAMICS web server based on the example of a SINAMICS G220 and the service interface (X127)[1)]



Wireless access to the web server via the service interface (X127) of the SINAMICS G220 with the help of the SINAMICS Smart Adapter [1)]



Access to the web server via the service interface (X127) of the SINAMICS G220 with the help of a USB on-the-go (OTG) Ethernet adapter



Integration of the SINAMICS web server based on the example of a SINAMICS G220 and the PROFINET interface (X150) as connected web client (e.g. PC, SIMATIC HMI etc.) [1)]

[1)] SINAMICS Smart Adapter and SINAMICS SDI Pro 5.5" available soon.

4

Overview

SINAMICS Smart Adapter

SINAMICS Smart Adapter is a Wi-Fi solution for engineering, service and maintenance tasks for the next generation of SINAMICS converters SINAMICS S200 [1], SINAMICS S210 (New) [1] and SINAMICS G220. The adapter is designed to be plugged into and powered from the service interface (X127) on the converter.

Benefits

- Wireless access to the converter-integrated web server via mobile users device
- Wireless access with SINAMICS Startdrive to the SINAMICS converters
- Portable and compact Wi-Fi solution for engineering, service and maintenance tasks for the next generation of SINAMICS converters SINAMICS S200 [1], SINAMICS S210 (New) [1] and SINAMICS G220
- Advanced security technology
- Plug and Play interface for easy connectivity
- User friendly

Application

SINAMICS Smart Adapter is used in general industrial applications as an engineering solution for quick commissioning and service.

The adapter is especially valuable in areas, which are difficult to access due to their mechanical mounting locations. The use of SINAMICS Smart Adapter avoids cable clutter and tripping points during commissioning and service tasks and therefore prevents from occasional accidents.

Function

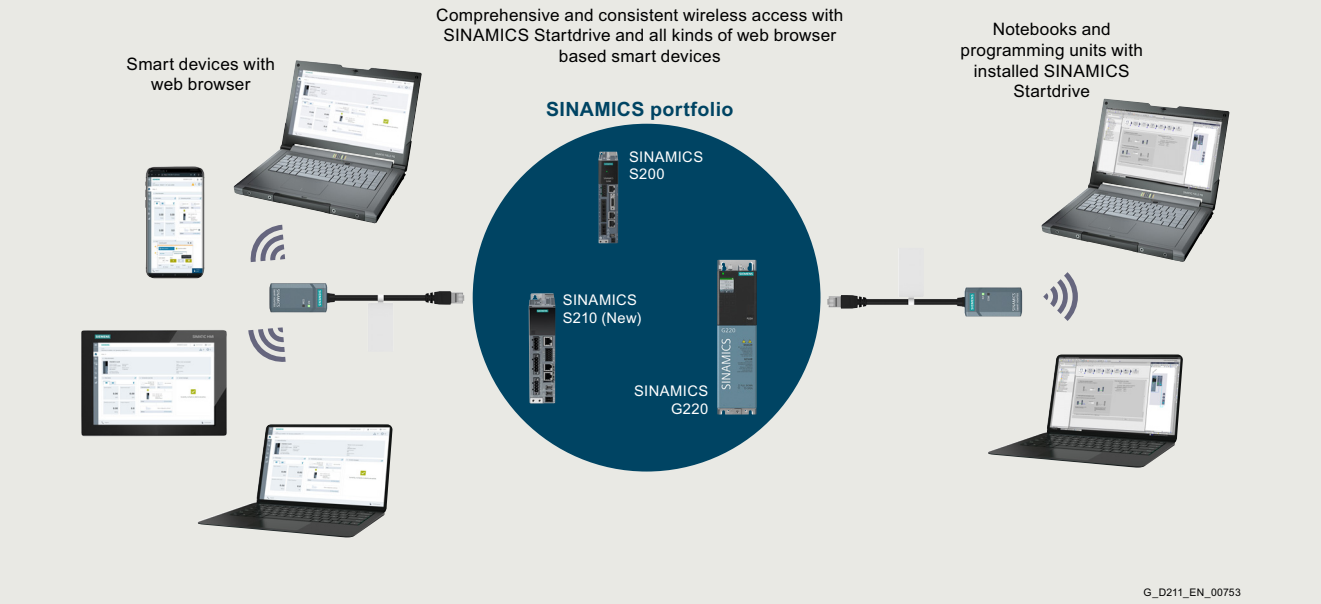
- Easy and quick service and commissioning via a wireless solution using the converter-integrated web server
- Interface that is suitable for the next generation of SINAMICS converters SINAMICS S200 [1], SINAMICS S210 (New) [1] and SINAMICS G220 and allows power supply of SINAMICS Smart Adapter directly from the converter.
- Advanced security with WPA3 protocol

Selection and ordering data

Description	Article No.
SINAMICS Smart Adapter [1] Wi-Fi solution for the next generation of SINAMICS converters SINAMICS S200 [1], SINAMICS S210 (New) [1] and SINAMICS G220	**6SL4950-0AJ00-0AA0**

[1] Release for SINAMICS S200 and SINAMICS S210 (New) available soon.

Integration



Wireless access with SINAMICS Startdrive via Smart Adapter

Technical specifications

	SINAMICS Smart Adapter 6SL4950-0AJ00-0AA0
Supported operating systems	Apple iOS (from 12.2), Android, Microsoft Windows, Mac OS (from 10.15)
Recommended browsers	Google Chrome (from 69.0), Microsoft Edge (from 80.0), Safari, Opera (from 56.0)
Ambient temperature	
• During storage and transport	-40 °C ... +70 °C (-40 ... +158 °F)
• During operation	-10 °C ... +40 °C (-40 ... +104 °F)
Humidity	< 95%, without condensation
Rated voltage	24 V DC
Wireless technology and frequency range [1]	
• At 2.4G:	Wi-Fi 2400 MHz ... 2483.5 MHz
• At 5G:	Wi-Fi 5150 MHz ... 5250 MHz
Wireless modulation type	
• At 2.4G:	802.11 b/g/n
• At 5G:	802.11 a/n
Maximum output power (EIRP)	
• At 2.4G:	17.66 dBm
• At 5G:	14.50 dBm
Type of modulation	DSSS (DBPSK, DQPSK, CCK), OFDM (BPSK, QPSK, 16QAM, 64QAM)
Maximum wireless communication distance	50 m (164 ft)
Maximum antenna gain	
• At 2.4G:	1.2 dBi
• At 5G:	1.6 dBi
Maximum radio frequency output power	
• At 2.4G:	18 dBm
• At 5G:	15 dBm
Degree of protection	IP20/UL Open Type
Dimensions	
• Width	30 mm (1.18 in)
• Height	200 mm (7.87 in)
• Depth	18 mm (0.71 in)
Weight, approx.	0.032 kg (0.071 lb)
Compliance with standards	CE, UKCA, UL, CRC, IMDA, NBTC, KCC, NCC, ICASA, SDPPI, UkrCEPRO, JRF, RED, FCC, IC, WPC, ANATEL, TRA, MIC, SRRC, RCM, ENACOM, SUBTEL, MTC, SDOC, MOC

[1] The actual frequency range may vary depending upon market.

Overview

SINAMICS SDI Pro 5.5"

The SINAMICS SDI Pro 5.5" represents a powerful and user-friendly Operator Panel for SINAMICS G220, SINAMICS S200[1] and SINAMICS S210 (New)[1]. The SDI Pro supports both newcomers and drive experts. Thanks to its touch interface and high-contrast 5.5" color display, it goes hand-in-glove for commissioning, diagnostics, operator control and monitoring as well as on-site maintenance and servicing of converters.

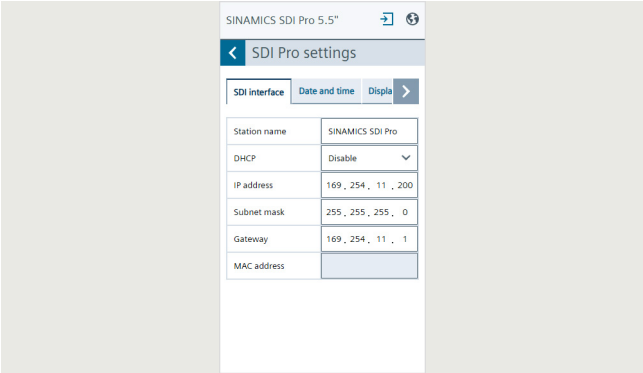
The user interface to the converter is provided by the converter's built-in web server. The technology of the SDI Pro grants full access to the functionality of the web server.
The supported web server functions pertaining to each converter can be found here:

- SINAMICS G220 ⇒ For more information on web server functions, see SINAMICS web server for SINAMICS G220.
- SINAMICS S200[1] ⇒ For more information on web server functions, see SINAMICS web server for SINAMICS S200.
- SINAMICS S210 (New)[1]⇒ For more information on web server functions, see SINAMICS web server for SINAMICS S210 (New).

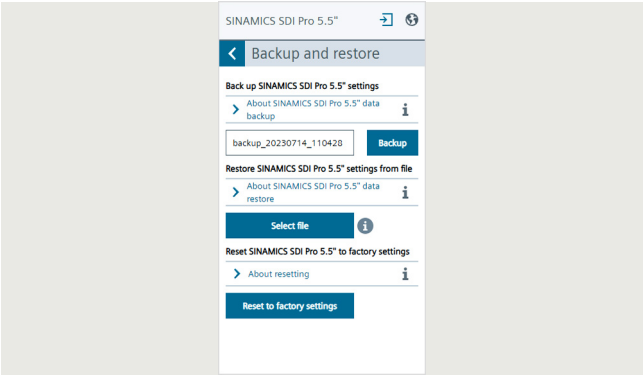
In addition, the SDI Pro offers its own configuration interface with the following settings options:

- SDI Pro main menu

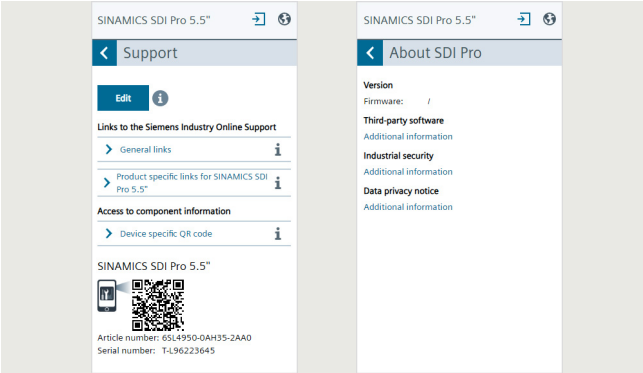
- Set the SDI Pro system settings such as user interface language, real-time clock, interface settings, display settings, change background image of the home screen



- Back up and restore the SDI Pro device settings



- Access product-specific information (e.g. manuals, downloads, FAQs) and information on SDI Pro (e.g. currently installed firmware version, security notifications)



The additional available options in the form of the SINAMICS SDI Pro 5.5" handheld kit and SINAMICS SDI Pro 5.5" door mounting kit extend the operating range of the device. With the SDI Pro 5.5" handheld kit, the device can be equipped with a rubber oversheath for mobile use. The SINAMICS SDI Pro 5.5" door mounting kit enables the SINAMICS SDI Pro to be installed in control cabinet doors.

[1] Release for SINAMICS S200 and SINAMICS S210 (New) available soon.

Selection and ordering data

Description	Article No.
SINAMICS SDI Pro 5.5" [2) 4) 5)] for use with SINAMICS G220 SINAMICS S200[1)] SINAMICS S210 (New)[1)] Operating languages: German, English, French, Italian, Spanish, Chinese Simplified	**6SL4950-0AH35-2AA0**
Accessories	
SINAMICS SDI Pro 5.5" handheld kit [2) 5)] for use with the SINAMICS SDI Pro 5.5" Included in the scope of delivery: • Handheld housing • Ethernet connecting cable Length 3 m (9.84 ft), can be used to connect a SINAMICS SDI Pro 5.5" with a converter	**6SL4950-0AH65-0AA0**
SINAMICS SDI Pro 5.5" door mounting kit [2) 5)] for mounting a SINAMICS SDI Pro 5.5" in control cabinet doors with metal thicknesses of 1 ... 3 mm (0.04 ... 0.12 in) Degree of protection IP55 Included in the scope of delivery: • Fixing accessories	**6SL4950-0AH55-0AA0**
SINAMICS IP55 panel mounting frame [5)] for SINAMICS G220 Included in the scope of delivery: • Ethernet connecting cable, length approx. 15 cm (5.91 in)	**6SL4950-0AH75-0AA0**
IE TP Cord RJ45/RJ45 [3)] Patch cable, available fully assembled • With 4 x 2 cores for 10/100/1000 Mbps Ethernet • Small cable diameter • Cat6$_A$ (4 x 2) of the ISO/IEC 11801 and EN 50173 international cabling standards	
0.3 m	**6XV1870-3QE30**
0.5 m	**6XV1870-3QE50**
1 m	**6XV1870-3QH10**
2 m	**6XV1870-3QH20**
3 m	**6XV1870-3QH30**
4 m	**6XV1870-3QH40**
6 m	**6XV1870-3QH60**
10 m	**6XV1870-3QN10**
15 m	**6XV1870-3QN15**
20 m	**6XV1870-3QN20**
25 m	**6XV1870-3QN25**
30 m	**6XV1870-3QN30**

1) For information on updates to the SINAMICS SDI Pro 5.5", see www.siemens.com/sinamics-sdi-pro-dlThe Ethernet connection cable to connect the SDI Pro to the service interface of the converter (X127) or the PROFINET interface (X150) must be ordered separately.
To use the operator panel without an additional power supply at the service interface of the converter (X127; point-to-point connection), an 8-wire RJ45 Ethernet cable is required. Pre-assembled cables can be ordered as an accessory.

2) For applications where the space behind the SINAMICS SDI Pro 5.5" is very limited, a cable with angled connectors can be used. Such cables can be purchased from HARTING under the order number 09 48 858 5745 050. For information on HARTING cables visit www.harting.com.

3) Release for SINAMICS S200 and SINAMICS S210 (New) available soon.

4) Available soon.

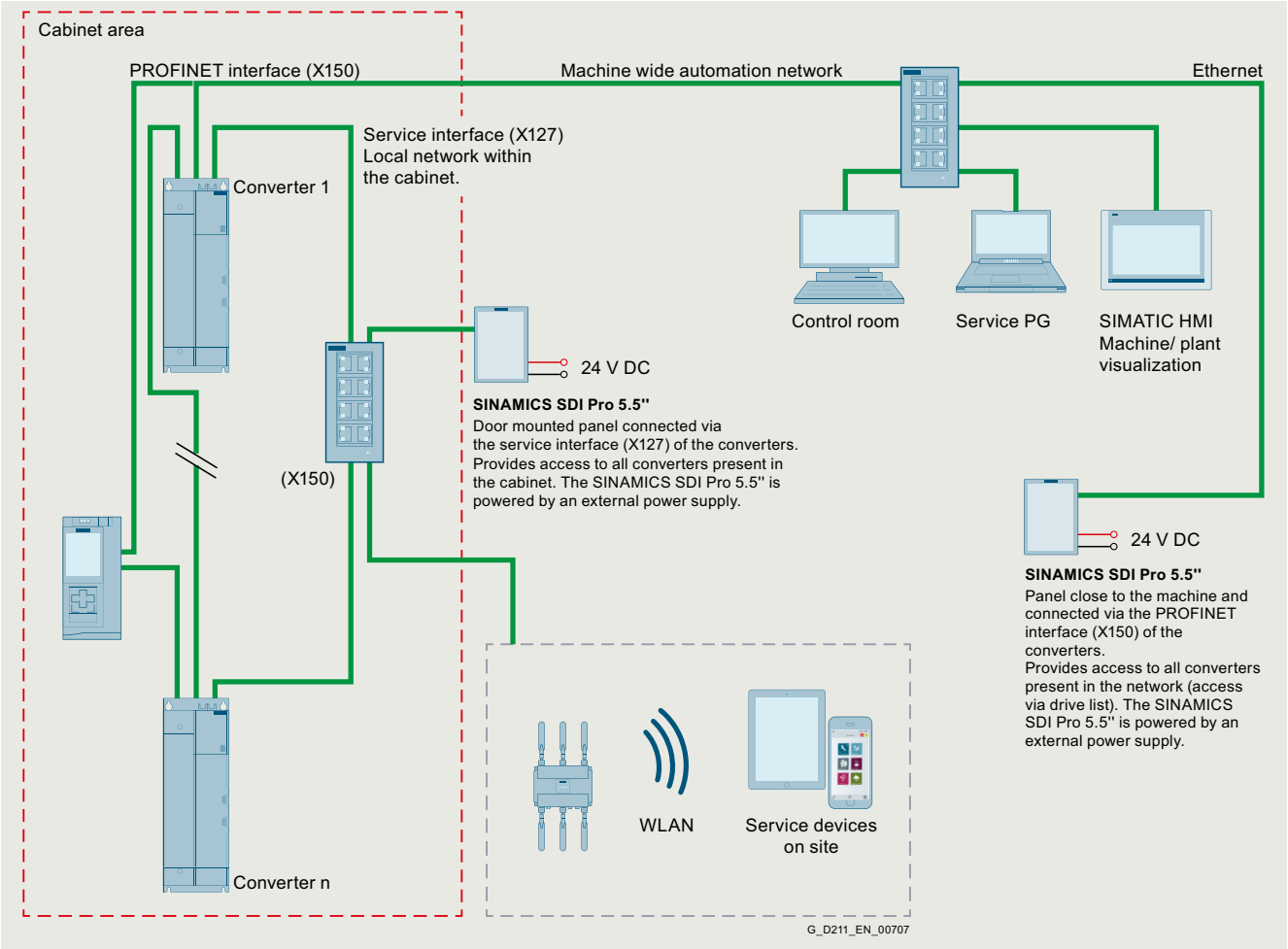
Benefits

- User interface
  - Intuitive user interface for the drive provided by the converter itself
  - High-contrast 5.5" color touch display
  - SINAMICS SDI Pro device design open for future function expansions (e.g. device functions, languages)
  - Easily upgradable to latest features via USB C interface
- Commissioning
  - Easy commissioning of the connected converter via the Quick/Advanced Commissioning Wizard. Neither variant requires expert knowledge of converter parameters.
  - Quick commissioning gives the user simple and fast access to all the basic parameters required to commission simple applications.
  - Advanced commissioning provides the parameters required to commission more complex applications, dispensing with the need to switch between different areas within the user interface.
  - Fast series commissioning of frequency converters thanks to cloning function (backup/restore)
  - For quicker access right on the SDI Pro, the names of the backup files you wish to create can be entered or modified with the on-screen keyboard.
  - Context-sensitive help functions provide support for the user during commissioning.
  - Simple local commissioning on-site using the handheld kit
- Operator control and monitoring
  - Simple, individual local drive control (start/stop, setpoint value specification, change in direction of rotation)
  - Actual values from the converter are displayed clearly and can be shown as values for the trend display. You can change the parameters you wish to monitor depending on the requirement.
- Diagnostics
  - Rapid diagnostics thanks to on-site plain text display
  - Integrated plain text help function for local display and resolution of fault messages
- Service and Support function
  - Input/output of a service contact person
  - Easy access to component information via QR code shown on the display
  - Quick access to product information, documentation, FAQs using mobile devices (e.g. smartphones, tablets) by scanning a QR code generated on the SDI Pro
  - Optional scanning and evaluation of the QR code with the Industry Online Support app (https://support.industry.siemens.com/cs/ww/en/sc/2067)
  - Simple cloning of specific settings of the SINAMICS SDI Pro such as the language setting, backlight timer, date/time settings, interface settings (IP address), list of available converters, user administration of the SDI Pro. Settings made once can thus be transferred easily to many other SINAMICS SDI Pro 5.5" devices.
- Management of users allowed to have access to the SDI Pro settings (UMAC)
- Management of certificates for encrypted communication to the converter (https)
  - Firmware upgrade for the SINAMICS SDI Pro 5.5" The SDI Pro can be updated and expanded with the integrated USB C port. Data can be transferred from a PC to the device for future expansions. Furthermore, the USB interface allows user languages and firmware updates[1)] that will become available in future to be downloaded.

4

Integration

- Flexible deployment in point-to-point and network configurations
  - The SDI Pro can either be connected to the service interface (X127) or the PROFINET interface (X150) of the converter.
  - SDI Pro can be directly supplied with power via the converter service interface. An external power supply is not required. [1)]
  - If the SDI Pro is operated in a network with n converters ($1 < n \leq 20$), the converters can be accessed in a flexible way via a drive list. As such, a wide range of converters can be operated or diagnosed via an SDI Pro, for instance. The drive list can be conveniently created on the SDI Pro either automatically or manually.



Application example in which multiple converters in a control cabinet can be reached with one SINAMICS SDI Pro

[1)] To use the operator panel without an additional power supply at the service interface of the converter (X127; point-to-point connection), an 8-wire RJ45 Ethernet cable is required.
Pre-assembled cables can be ordered as an accessory.

Technical specifications

	SINAMICS SDI Pro 5.5" 6SL4950-0AH35-2AA0
Display	High-contrast color display
• Resolution	320 × 580 pixels
Operator panel	Touch display
User languages	German, English, French, Italian, Spanish, Chinese Simplified
Power supply	20 ... 29 V DC 24 V DC via the RJ45 (8-core) X127 cable connection from the converter [1] or external power supply via the external power supply terminals on the Operator Panel
Current, max.	300 mA
Ambient temperature	
• During transport and storage	-40 ... +70 °C (-40 ... +158 °F)
• During operation	When using the SINAMICS SDI Pro 5.5" handheld kit: -20 ... +55 °C (-4 ... +131 °F) If installed with the SINAMICS SDI Pro 5.5" door mounting kit: -20 ... +55 °C (-4 ... +131 °F)
Air humidity	Relative air humidity < 95 %, non-condensing
Environmental class/harmful chemical substances	
• Operation	Class 3C3 per IEC 60721-3-3: 2002
Degree of protection	IP20 on the rear side or when in use with the SINAMICS SDI Pro 5.5" handheld kit IP55 on the front side, mounted with the SINAMICS SDI Pro 5.5" door mounting kit
Dimensions (H × W × D)	167 mm × 111 mm × 16.1 mm (6.57 in × 4.37 in × 0.63 in)
Weight, approx.	0.275 kg (0.61 lb)
Certificate of suitability	CE, UKCA, RCM, cULus, EAC, KC-REM-S49-SINAMICS

	SINAMICS SDI Pro 5.5" handheld kit 6SL4950-0AH65-2AA0
Ambient temperature	
• During transport and storage	-40 ... +70 °C (-40 ... +158 °F)
Air humidity	Relative air humidity < 95 %, non-condensing
Degree of protection	IP20
Weight, approx.	0.265 kg (0.58 lb)

	SINAMICS SDI Pro 5.5" door mounting kit 6SL4950-0AH55-0AA0
Ambient temperature	
• During transport and storage	-40 ... +70 °C (-40 ... +158 °F)
Air humidity	Relative air humidity < 95 %, non-condensing
Degree of protection	IP20 on the rear side or inside of the cabinet IP55 on the front side, mounted with the SINAMICS SDI Pro 5.5" door mounting kit
Dimensions	
• Door mounting kit dimensions	Cabinet cutout: 93 mm × 153 mm (3.66 in × 6.02 in), Screws: M4 × 20, 6 pcs., Tightening torque: 0.1 Nm (0.89 lbf-in) / M3 × 6, 2 pcs., Tightening torque: 1.2 Nm (10.6 lbf-in)
Weight, approx.	0.214 kg (0.47 lb)

	SINAMICS IP55 Panel mounting frame 6SL4950-0AH75-0AA0
Ambient temperature	
• During transport and storage	-40 ... +70 °C (-40 ... +158 °F)
Air humidity	Relative air humidity < 95 %, non-condensing
Degree of protection	IP55, including the SINAMICS SDI Operator Panel
Dimensions	
• Mounting frame dimensions	180 mm × 150 mm × 35 mm (7.09 in × 5.91 in × 1.38 in), Screws: M4 × 20, 4 pcs., Tightening torque: 1.2 Nm (10.6 lbf-in)
Weight, approx.	0.405 kg (0.89 lb) + 0.275 kg (0.61 lb) if the SINAMICS SDI Pro Operator Panel is inserted in the mounting frame

[1] The Ethernet connection cable to connect the SDI Pro to the service interface of the converter (X127) or the PROFINET interface (X150) must be ordered separately.
To use the operator panel without an additional power supply at the service interface of the converter (X127; point-to-point connection), an 8-wire RJ45 Ethernet cable is required. Pre-assembled cables can be ordered as an accessory.

4

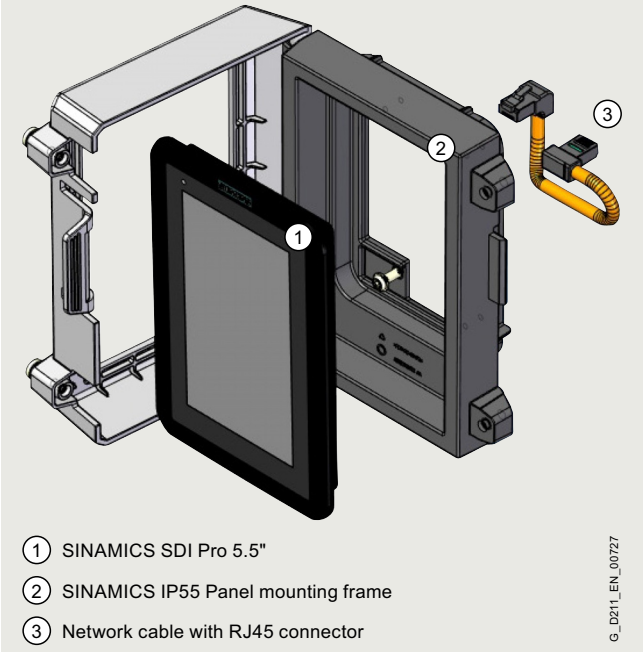
Accessories

SINAMICS SDI Pro 5.5" handheld kit

SINAMICS SDI Pro 5.5" with handheld kit

A handheld kit can be ordered to assist with using the SINAMICS SDI Pro 5.5" while on the go. It contains a rubber housing and a 3 m long Ethernet connecting cable.

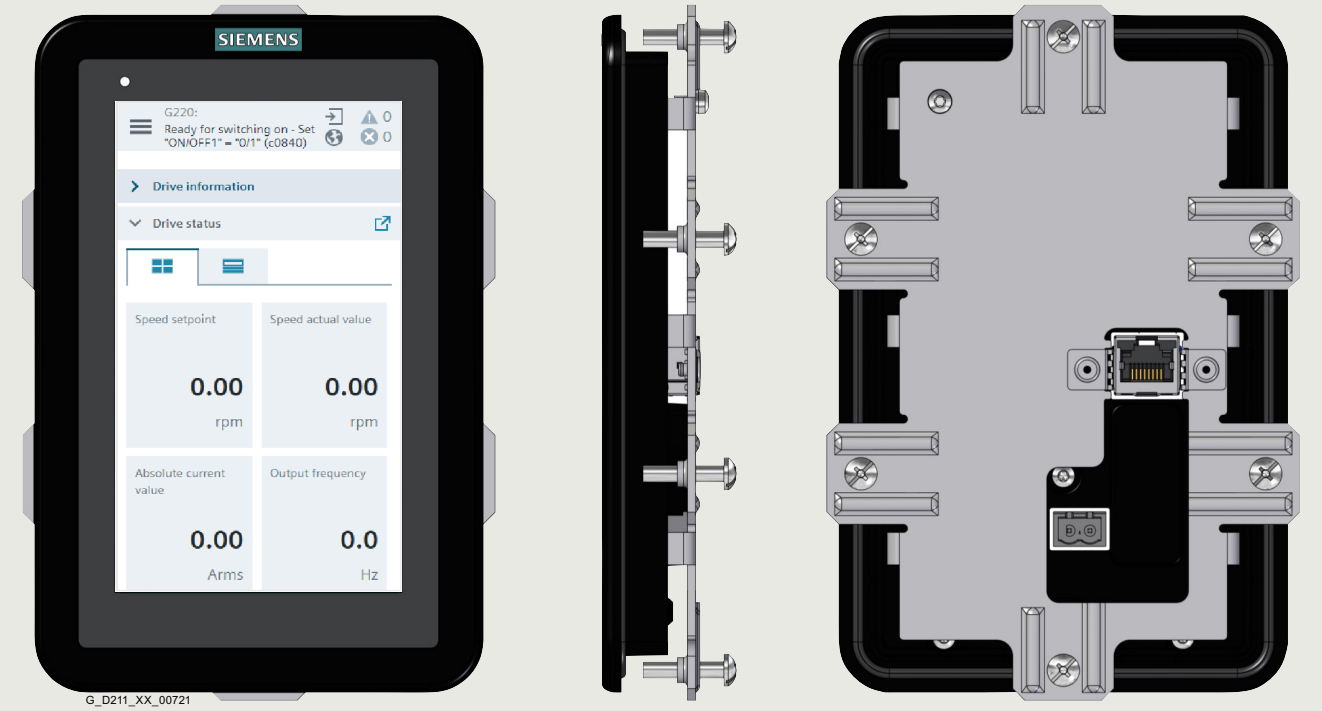
SINAMICS IP55 Panel mounting frame



SINAMICS IP55 Panel mounting frame

The SINAMICS IP55 Panel mounting frame is designed so that the SINAMICS SDI Pro Operator Panel can be connected to the IP55 converter while retaining the IP55 degree of protection of the converter.

SINAMICS SDI Pro 5.5" door mounting kit

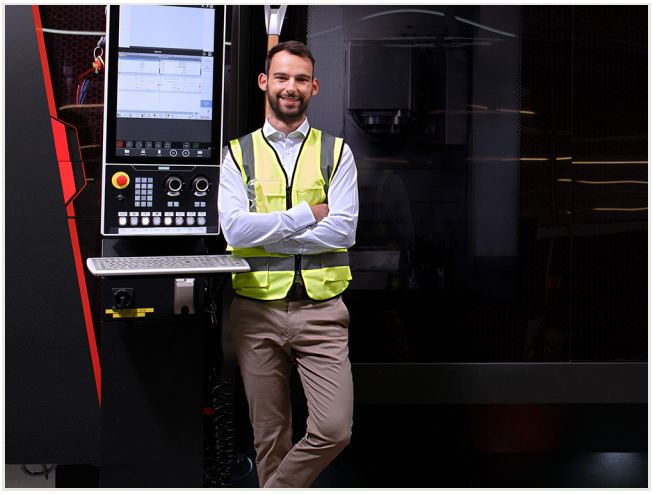


With the optional SINAMICS SDI Pro 5.5" door mounting kit, a SINAMICS SDI Pro 5.5" can be easily installed in a control cabinet door in just a few steps. The door mounting kit includes a metal plate for installing the SINAMICS SDI Pro 5.5" e.g. in a cabinet cutout. [1)]
In case of door mounting with the SDI Pro 5.5" Operator Panel, the degree of protection IP55/UL type 12 enclosure is achieved for the front side.

[1)] The Ethernet connection cable to connect the SDI Pro to the service interface of the converter (X127) or the PROFINET interface (X150) must be ordered separately.

To use the operator panel without an additional power supply at the service interface of the converter (X127; point-to-point connection), an 8-wire RJ45 Ethernet cable is required.
Pre-assembled cables can be ordered as an accessory.

Overview



Legal framework

Machine manufacturers and plant construction companies must ensure that their machines or plants cannot cause danger due to malfunctions in addition to the general risks of electric shock, heat or radiation.

In Europe, for example, compliance with the Machinery Directive 2006/42/EC is legally stipulated by the EU framework directive for occupational safety. In order to ensure compliance with this directive, it is recommended that the corresponding harmonized European standards are applied. This triggers the "assumption of conformity" and gives manufacturers and operators the legal security in terms of compliance with both national regulations and EU directives. The machine manufacturer uses the CE marking to document compliance with all relevant directives and regulations in the free movement of goods.

Safety-related standards

Functional safety is specified in various standards. For example, ISO 12100 specifies standards pertaining to machine safety (risk assessment and risk reduction). IEC 61508 specifies basic requirements for electronic and programmable safety-related systems. IEC 62061 (only applicable for electrical and electronic control systems) and ISO 13849-1 define the functional and safety-related requirements of safety-oriented control systems.

The above-mentioned standards define different safety requirements that the machine has to satisfy in accordance with the risk potential, frequency of a dangerous situation, probability of occurrence and the opportunities for recognizing impending danger.

- ISO 13849-1: Performance Level PL a ... e; Category B, 1 ... 4
- IEC 62061: Safety Integrity Level SIL 1 ... 3

Trend toward integrated safety systems

The trend toward greater complexity and higher modularity of machines has seen a shift in safety functions away from the classical central safety functions (for example, shutdown of the complete machine using a main disconnecting means) and into the machine control system and the drives. This is often accompanied by a significant increase in productivity because the setup times are shortened. Depending on the type of machine, it may even be possible to continue manufacturing other parts while the setup is in progress.

Integrated safety functions act much faster than those of a conventional design. The safety of a machine is increased further with Safety Integrated. Furthermore, thanks to the faster method of operation, safety measures controlled by integrated safety systems are perceived as less of a hindrance by the machine operator, therefore significantly reducing the motivation to consciously bypass safety functions.

Function

Safety functions integral to the SINAMICS drives

SINAMICS drives are characterized by a large number of Safety Integrated Functions. In combination with the sensors and safety control required for the safety functionality, they ensure that highly-effective protection for persons and machines is implemented in a practice-oriented manner.

They comply with the requirements of the following safety categories:

- PL e and category 3 or 4 according to ISO 13849-1
- SIL 3 according to IEC 61508 and IEC 61800-5-2

Note:

The Safe Brake Test (SBT) diagnostic function meets the requirements for Category 2 according to ISO 13849-1.

The Safety Integrated Functions are generally certified by independent institutes. You can obtain the corresponding test certificates and manufacturer's declarations from your Siemens contacts.

The Safety Integrated Functions that are currently available are described below. Their functional safety satisfies the requirements defined in the international standard IEC 61800-5-2 for variable-speed drive systems.

The safety functions integrated into the SINAMICS drive system can be roughly divided into three categories:

- **Functions for safely stopping a drive**
  - Safe Torque Off (STO)
  - Safe Stop 1 (SS1)
  - Safe Stop 2 (SS2)
  - Safe Operating Stop (SOS)
- **Functions for safe brake management**
  - Safe Brake Control (SBC)
  - Safe Brake Test (SBT)
    (this diagnostic function exceeds the scope of IEC 61800-5-2)
- **Functions for safely monitoring the motion of a drive**
  - Safely-Limited Speed (SLS)
  - Safe Speed Monitor (SSM)
  - Safe Direction (SDI)
  - Safely-Limited Acceleration (SLA)
- **Functions for safely monitoring the temperature of a drive**
  - Safe Motor Temperature (SMT)

Safe Torque Off (STO)

The STO function is the most common and basic drive-integrated safety function. It ensures that no torque-generating energy can continue to affect a motor and prevents unintentional start-ups.

Effect

This function is a mechanism that prevents the drive from restarting unexpectedly, in accordance with IEC 60204-1, Section 5.4. The STO function suppresses the drive pulses (corresponds to Stop Category 0 according to IEC 60204-1). The drive is reliably torque-free. This state is monitored internally in the drive.

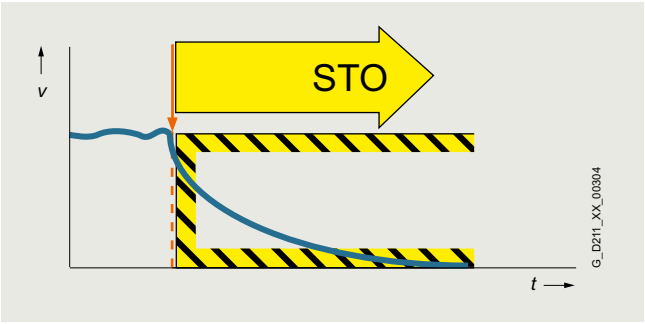
Application

STO has the immediate effect that the drive cannot supply any torque-generating energy. STO can be used wherever the drive will naturally reach a standstill due to load torque or friction in a sufficiently short time or when "coasting down" of the drive will not have any relevance for safety.

STO makes it possible for persons to work safely when the protective door is open (restart interlock) and is used on machines/installations with moving axes, e.g. on handling or conveyor systems.

Customer benefits

Some of the advantages of the integrated STO safety function over conventional safety technology with electromechanical switchgear include the elimination of separate components as well as of the work that would be required to wire and service them, i.e. no wearing parts as a result of the electronic shutdown. Because of the fast electronic switching times, the function provides a shorter reaction time than the conventional solution comprising electromechanical components. When STO is triggered, the converter remains connected to the network and can be fully diagnosed.



Function

Safe Stop 1 (SS1) and Safe Stop 1 with external stop (SS1E)

The SS1 function causes a motor to stop rapidly and safely and switches the motor to torque-free mode after coming to a standstill by activating STO.

Effect

The SS1 function can safely stop the drive in accordance with IEC 60204-1, Stop Category 1. When the SS1 function is selected, the drive brakes autonomously along a quick-stop ramp and automatically activates the Safe Torque Off and Safe Brake Control functions (if configured) when the parameterized safety delay time expires.

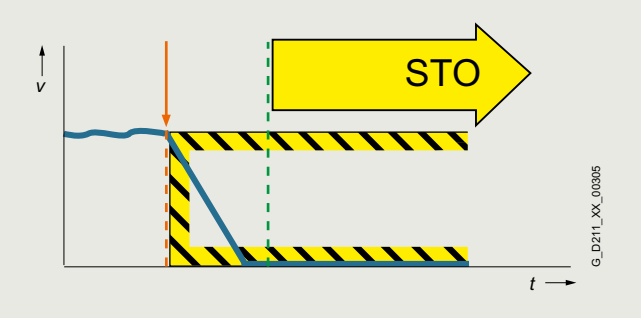
If SS1 with external stop (SS1E) is used, the drive does not brake autonomously when the function is selected. In this case, the higher-level control must bring the drive to a standstill within a parameterized STO transition time. SS1E is a useful function for drives that need to be stopped as a group by the Motion Control system in order to prevent potential damage to the machine or product.

Application

The SS1 function is used when, in the event of a safety-relevant incident, the drive must stop as quickly as possible with a subsequent transition into the STO state (e.g. EMERGENCY STOP). It is thus used to bring large centrifugal masses to a stop as quickly as possible for the safety of the operating personnel, or to brake motors at high speeds as quickly as possible. Examples of typical applications are saws, grinding machine spindles, centrifuges, winders and storage and retrieval machines.

Customer benefits

The targeted stopping of a drive by means of SS1 reduces the risk of danger, increases the productivity of a machine, and allows the safety clearances in a machine to be reduced. The principle is to bring the drive actively to a standstill, compared with just using the STO function. Complex mechanical brakes that are susceptible to wear are normally not required to brake the motor.



Safe Stop 2 (SS2) and Safe Stop 2 with external stop (SS2E)

The SS2 function brings the motor to a standstill quickly and safely and then activates the SOS function once the motor has stopped.

Effect

The Safe Stop 2 function can safely stop the drive in accordance with IEC 60204-1, Stop Category 2. When the SS2 function is selected, the drive brakes autonomously along a quick stop ramp. In contrast to SS1, the drive control remains operational afterwards, i.e. the motor can supply the full torque required to maintain zero speed. Standstill is safely monitored (Safe Operating Stop function).

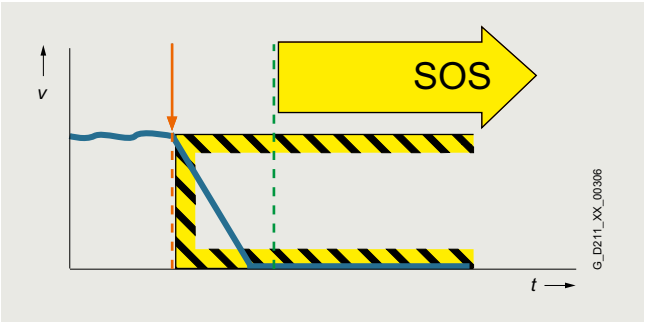
If SS2 with external stop (SS2E) is used, the drive does not brake autonomously when the function is selected. In this case, the higher-level control must bring the drive to a standstill within a parameterized SOS (Safe Operating Stop) transition time. SS2E is a useful function for drives that need to be stopped as a group by the Motion Control system in order to prevent potential damage to the machine or product.

Application

As with SS1, the SS2 function ensures the quickest possible deceleration of the motor. However, the motor power is not switched off. Instead, a control system prevents it from leaving the standstill position – even if it is affected by external forces. Typical applications for SS2 include machine tools, for example.

Customer benefits

The SS2 function ensures a rapid axis stop. Because the control remains active, after the safety function is deselected, productive operation can continue without referencing. This ensures short setup and standstill times and high productivity.



Function

Safe Operating Stop (SOS)

With the SOS function, the stopped motor is held in position by the drive control system and its position is monitored.

Effect

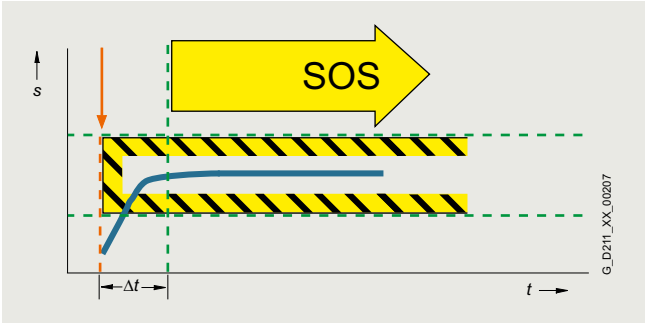
The SOS function constitutes safe standstill monitoring. The drive control remains in operation. The motor can therefore deliver the full torque to hold the current position. The actual position is reliably monitored. In contrast to safety functions SS1 and SS2, the speed setpoint is not influenced autonomously. After SOS has been activated, the higher-level control must bring the drive to a standstill within a parameterized time and then hold the position setpoint.

Application

SOS is an ideal solution for all those applications for which the machine or parts of the machine must be at a safe standstill for certain steps, but the drive must also supply a holding torque. It is ensured that despite counter torque the drive remains in its current position. In contrast to SS1 and SS2, the drive does not brake autonomously in this case. It expects the higher-level controller to ramp down the relevant axes as a coordinated group within an adjustable delay time. This can be used to prevent any damage to the machine or product. Typical applications for SOS include winders, converting and packaging machines and machine tools.

Customer benefits

No mechanical components are necessary to keep the axis in position despite any counterforce that may occur. Due to the short switching times and the fact that the drive control always remains active, setup and downtimes are reduced. Recalibration of the axis after exiting the SOS function is not necessary. The axis can immediately be moved again after deactivation of the SOS function.



Safe Brake Control (SBC)

The SBC function permits the safe control of a holding brake. SBC is always activated in parallel with STO.

Effect

A holding brake which is active in a de-energized state is controlled and monitored using safe two-channel technology. Due to the two-channel control, the brake may still be activated in the event of an insulation fault in the control cable. Errors of this kind are detected early by means of test pulses.

Note:

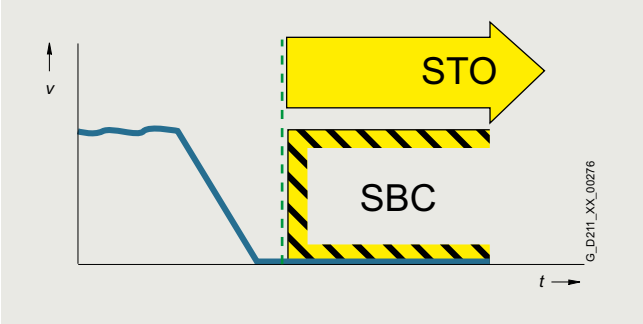
Safe Brake Control does not detect mechanical faults in the brake itself, such as worn brake linings. For Motor Modules in booksize format, the terminals for the motor brake are integrated. An additional Safe Brake Relay is required for Power Modules in blocksize format. An additional Safe Brake Adapter is necessary for Power Modules in chassis format.

Application

The SBC function is used in conjunction with the functions STO or SS1 to prevent the movement of an axis in the torque-free state, e.g. because of gravity.

Customer benefits

Again, the function saves the use of external hardware and the associated wiring.



Function

Safe Brake Test (SBT)

The SBT diagnostic function carries out a brake function test at regular intervals or before personnel enter the danger zone.

Effect

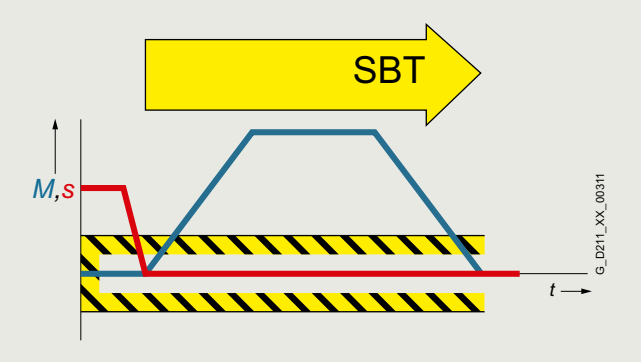
A good way to check the proper functioning of brakes that have become worn is to apply a torque to the closed brake. Drive systems that have two brakes, e.g. motor brake and external brake, can be tested with different torque values.

Application

The SBT diagnostic function is suitable for implementing a safe brake in combination with the SBC function.

Customer benefits

The function detects faults or wear in the brake mechanics. Automatically testing the effectiveness of brakes reduces maintenance costs and increases the safety and availability of the machine or plant.



Safely-Limited Speed (SLS)

The SLS function monitors the drive to ensure that it does not exceed a preset speed or velocity limit.

Effect

The SLS function monitors the drive against a parameterized speed limit. Four different limit values can be selected. As in the case of SOS, the speed setpoint is not influenced independently. After SLS has been selected, the higher-level control must bring the drive down below the selected speed limit within a parameterizable time. If the speed limit is exceeded, a customizable drive-integrated fault reaction occurs.

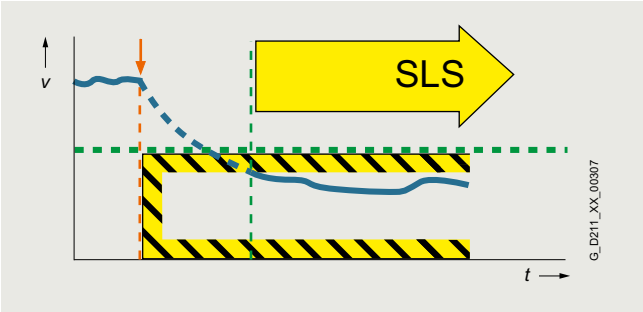
The SLS limit stage 1 can be multiplied by a factor that is transferred in 16-bit resolution via PROFIsafe. This allows an almost unlimited number of limits to be specified.

Application

The SLS function is used if people are in the danger zone of a machine and their safety can only be guaranteed by reduced speed. Typical application cases include those in which an operator must enter the danger zone of the machine for the purposes of maintenance or setting up, such as a winder in which the material is manually threaded by the operator.
To prevent injury to the operator, the roller may only spin at a safely reduced speed. SLS is often also used as part of a two-stage safety concept. While a person is in a less critical zone, the SLS function is activated, and the drives are only stopped safely in a smaller area with higher potential risk. SLS can be used not only for operator protection, but also for machinery protection, e.g. if a maximum speed must not be exceeded.

Customer benefits

The SLS function can contribute to a significant reduction in downtime, or greatly simplify or even accelerate setup.
The overall effect achieved is a higher availability of the machine. Moreover, external components such as speed monitors can be omitted.



Function

Safe Speed Monitor (SSM)

The SSM function warns when a drive is working below an adjustable speed limit. As long as it remains below the threshold, the function issues a safety-related signal.

Effect

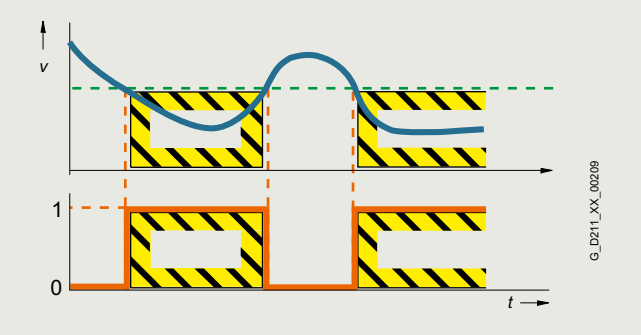
If a speed value drops below a parameterized limit, a safety-related signal is generated. This can, for example, be processed in a safety control unit to respond to the event by programming, depending on the situation.

Application

With the SSM function, in the simplest case, a safety door can be unlocked if the speed drops below a non-critical level. Another typical example is that of a centrifuge that may be filled only when it is operating below a configured speed limit.

Customer benefits

Unlike SLS, there is no drive-integrated fault reaction when the speed limit is exceeded. The safe feedback can be evaluated in a safety control unit, allowing the user to respond appropriately to the situation.



Safe Direction (SDI)

The SDI function ensures that the drive can only move in the selected direction.

Effect

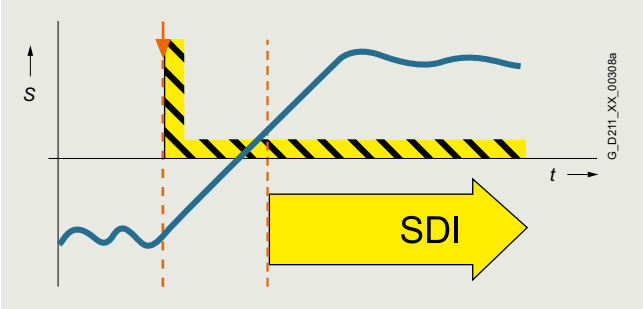
Deviation from the direction of motion currently being monitored is detected reliably and the configured drive-integrated fault reaction is initiated. It is possible to select which direction of rotation is to be monitored.

Application

The SDI function is used when the drive may only move in one direction. A typical application is to permit the operator access to a danger zone, as long as the machine is rotating in the safe direction, i.e. away from the operator. In this state, the operator can feed material into the work zone or remove material from the work zone without danger.

Customer benefits

The function saves the use of external components such as speed monitors and the associated wiring. The release of a danger zone while the machine is moving away from the operator increases productivity. Without the SDI function, the machine must be safely stopped during material loading and removal.



Function

Safely-Limited Acceleration (SLA)

The SLA function monitors that the drive does not exceed a preset acceleration limit value.

Effect

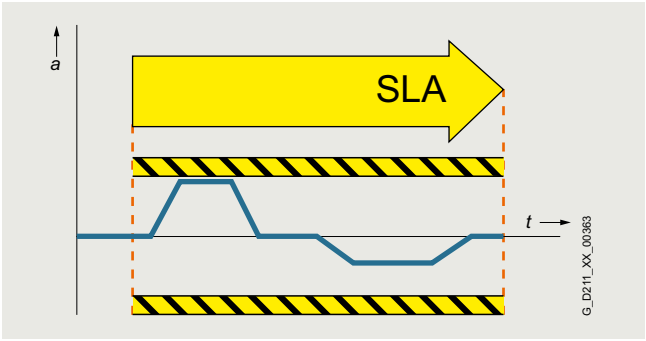
The SLA function monitors that the motor does not violate the defined acceleration limit (e.g. in setup mode). SLA detects early on whether the speed is increasing at an inadmissible rate (the drive accelerates uncontrollably) and initiates the stop response.

Application

The SLA function is used, e.g., for SIMATIC Safe Kinematics. SLA can only be used in safety systems with an encoder.

Customer benefits

The function monitors for maximum permissible acceleration in setup mode and safe monitoring of the tool center point with different kinematics.



Safe Motor Temperature (SMT)

Safe Motor Temperature (SMT) prevents the motor temperature from exceeding a specified limit.

Effect

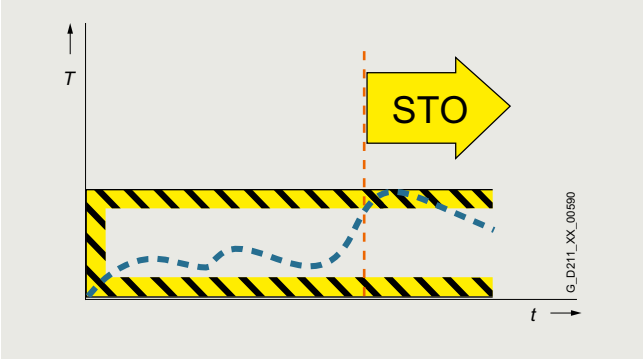
SMT works in conjunction with the signal from a PTC thermistor of type A in accordance with IEC 60947-8 and DIN VDE 0898-1-401. When the limit temperature specific to the PTC thermistor is exceeded, the thermistor's electrical resistance increases suddenly. This is securely recorded by the SMT function and STO (Safe Torque Off) is triggered as the subsequent response. This ensures that the motor does not receive any more energy from the converter, and the motor temperature cannot increase further.

Application

SMT is used to protect against overtemperature of a motor in explosive environments (ATEX), e.g. in the chemical industry, in paper mills, or in paint shops.

Customer benefits

This function obviates the need for external components such as thermistor motor protection relays and the associated wiring investment and space demands in the control cabinet. Motor protection is strictly required in ATEX applications. The SMT function makes it easy to integrate such requirements so they are implemented in the drive.



Function

Basic Functions and Extended Functions

With SINAMICS S drives the safety functions are implemented with encoders – individual safety functions can also be operated without encoders.

The Safety Integrated Functions are grouped into Basic Functions and Extended Functions.

The Basic Functions are included in the standard scope of supply.
The Extended Functions must be activated by a license.

The electronic license certificate is the paperless type of delivery for runtime options with SINAMICS. It contains information about the type of usage rights obtained with the software.

- Basic Functions
  - Safe Torque Off (STO)
  - Safe Brake Control (SBC)
  - Safe Stop 1 (SS1)
  - Safe Stop 1 with external stop (SS1E)
  - Safe Motor Temperature (SMT)
- Extended Functions
  - Safe Stop 1 with external stop (SS1E) with SBR or SAM
  - Safe Stop 1 (SS1) with SBR or SAM
  - Safe Stop 2 with external stop (SS2E)
  - Safe Stop 2 (SS2)
  - Safe Operating Stop (SOS)
  - Safely-Limited Speed (SLS)
  - Safe Speed Monitor (SSM)
  - Safe Direction (SDI)
  - Safely-Limited Acceleration (SLA)
  - Safe Brake Test (SBT) diagnostic function

For the Extended Functions SS1 and SS2 with SAM, Safe Acceleration Monitor (SAM) is performed during braking to identify any faults already during the braking phase.

With SS1 and SS2, a Safe Brake Ramp (SBR) can be configured as an alternative.

The Basic Functions – activated via on-board terminals on the device or via PROFIsafe – do not require an encoder.

Activation of the integrated safety functions

The safety functions for SINAMICS drives can be activated via terminals, e.g. for use of a conventional safety circuit.

For standalone safety solutions for small to medium-sized applications, it is frequently sufficient that the various sensing components are directly hardwired to the drive.

For integrated safety solutions, the safety-relevant sequences are generally processed and coordinated in the fail-safe SIMATIC controller. Here, the system components communicate via the PROFINET or PROFIBUS fieldbus. The safety functions are controlled via the safe PROFIsafe communication protocol.

SINAMICS drives can be easily integrated into the plant or system topology.

PROFIsafe

SINAMICS drives support the PROFIsafe profile based on PROFINET as well as on PROFIBUS.

PROFIsafe is an open communications standard that supports standard and safety-related communication over the same communication path (wired or wireless). A second, separate bus system is therefore not necessary. The telegrams that are sent are continually monitored to ensure safety-relevant communication.

Possible errors such as telegrams that have been lost, repeated or received in the incorrect sequence are avoided. This is done by consecutively numbering the telegrams in a safety-relevant fashion, monitoring their reception within a defined time and transferring an ID for transmitter and receiver of a telegram. A CRC (cyclic redundancy check) data security mechanism is also used.

The operating principle of Safety Integrated

Two independent switch-off signal paths

Two independent switch-off signal paths are available. All switch-off signal paths are low active. This ensures that the system is always switched to a safe state if a component fails or in the event of cable breakage. If a fault is discovered in the switch-off signal paths, the STO or SS1 function (depending on parameter settings) is activated and a system restart inhibited.

Two-channel monitoring structure

All the main hardware and software functions for Safety Integrated are implemented in two independent monitoring channels (e.g. switch-off signal paths, data management, data comparison). A cyclic crosswise comparison of the safety-relevant data in the two monitoring channels is carried out.

The monitoring functions in each monitoring channel work on the principle that a defined state must prevail before each action is carried out and a specific acknowledgement must be made after each action. If these expectations of a monitoring channel are not fulfilled, the drive coasts to a standstill (two channels) and an appropriate message is output.

Internal self-test

To meet the requirements of ISO 13849-1 and IEC 61508 in terms of timely error detection, the SINAMICS performs an internal self-test.

The internal self-test checks the shutdown paths for Safe Torque Off, safety functions and failsafe digital inputs and outputs cyclically.

The self-test does not require user interaction and does not influence the operation of the SINAMICS.

Function

Safe speed/position sensing with encoder

Safe actual value sensing with encoder

Incremental encoders or absolute encoders can be used for safe sensing of the position values on a drive.

Safe actual value sensing relies on redundant evaluation of the incremental tracks A/B that supply sin/cos signals of 1 V_{pp}. Only encoders of the type whose A/B track signals are created and processed using purely analog techniques can be used.

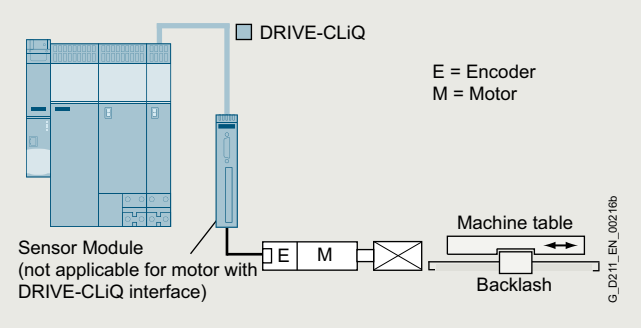
As an alternative, motors with an integrated DRIVE-CLiQ interface can be used. The speed or position actual values are generated directly in the motor as safe values and are transferred to the Control Unit over safe communication via DRIVE-CLiQ.

Certified built-on rotary encoders with DRIVE-CLiQ interface may also be used (see https://support.industry.siemens.com/cs/document/65402168).

The encoder must be mechanically attached in such a manner that the encoder shaft is unable to unplug or slide off. For notes on this, see IEC 61800-5-2: 2016, Table D.16.

A list of Siemens motors that fulfill the electrical and mechanical requirements is available at: https://support.industry.siemens.com/cs/document/33512621

Safe encoder system



Example: Safe encoder system

The motor encoder is used exclusively for safe actual value sensing.

The safety functions are listed below with criteria for actual value sensing:

	Functions	Abbreviation	Encoder required	Description
Basic Functions	Safe Torque Off	STO	No	Safe Torque Off
	Safe Stop 1	SS1	No	Safe stopping process in accordance with stop category 1
	Safe Brake Control	SBC	No	Safe Brake Control
	Safe Motor Temperature	SMT	No	Safe motor temperature monitoring
Extended Functions	Safe Stop 1	SS1	Yes	Safe stopping process in accordance with stop category 1
	Safe Operating Stop	SOS	Yes	Safe monitoring of the stand-still position
	Safe Stop 2	SS2	Yes	Safe stopping process in accordance with stop category 2
	Safely-Limited Speed	SLS	Yes	Safe monitoring of the maximum speed
	Safe Speed Monitor	SSM	Yes	Safe monitoring of the minimum speed
	Safe Direction	SDI	Yes	Safe monitoring of the direction of motion
	Safely-Limited Acceleration	SLA	Yes	Safely-Limited Acceleration
	Safe Brake Test	SBT	Yes	Diagnostic function for safe testing of the required holding torque of a brake

Integration

The safety functions for the next generation of SINAMICS converters integrated in the drive as of firmware version V6.3 for SINAMICS S210 (New) and as of firmware version V6.2 for SINAMICS G220 and SINAMICS S200 are listed below.

Safety Integrated	Low voltage		
	Servo converters SINAMICS		High performance frequency converters
	S200	S210 (New)	G220
Functions			
- STO	✓	✓	✓
- SS1	–	✓	✓
- SS1E	–	✓	–
- SS2	–	✓	–
- SS2E	–	✓	–
- SOS	–	✓	–
- SBC	–	✓	–
- SBT	–	✓	–
- SLS	–	✓	✓
- SDI	–	✓	✓
- SSM	–	✓	✓
- SLA	–	✓	–
- SMT (ATEX)	–	–	✓
Control via terminals			
- Emergency Stop via Onboard terminals 1 axis	✓	✓	✓
- Extended/Advanced via Onboard terminals 1 axis	–	–	✓
Control via PROFIsafe			
- Control via PROFIsafe	–	✓	✓

Overview

Safety Integrated overview

The SINAMICS S200 frequency converter offers the Safe Torque Off (STO) function as a standard feature.

The Safety Integrated function is completely integrated into the drive system. The STO function is already enabled in the converter at the factory and assigned to the fail-safe digital input F-DI 0. When wiring an emergency stop control device, the STO function can therefore be used directly without additional configuring. F-DI 0 is provided with a jumper on delivery so that the drive can also be moved without wiring an emergency stop control device.

The Safety Integrated function is implemented electronically and therefore offers short response times in comparison to solutions with externally implemented monitoring functions.

Function

Function	Control	Encoder required	License required
STO	• F-DI	No	No

Overview

The SINAMICS S210 (New) converter features Safety Integrated Functions as standard.
Example: SINAMICS S210 (New), 3 AC series, frame sizes FSA to FSC

Safety Integrated overview

The Safety Integrated Functions are implemented electronically and therefore offer short response times and easy handling in comparison to solutions with externally implemented monitoring functions.

The integrated safety functions comply with the requirements of SIL 3 according to IEC 61508 and IEC 61062 and PL e/category 4 according to ISO 13849-1.

No additional license is required for the Basic Functions STO, SS1-t, SS1E-t and SBC. One Safety Extended Runtime license per device is required for the Extended Functions SS1-r, SS1-a, SS1E-r, SS1E-a, SS2, SS2E, SOS, SLS, SSM, SDI, SLA and SBT.

Controlling the Safety Integrated Functions

The Safety Integrated Functions are completely integrated into the drive system.

The Basic Functions can be activated via fail-safe digital inputs or via PROFINET with PROFIsafe. The Extended Functions can be activated via PROFINET with PROFIsafe.

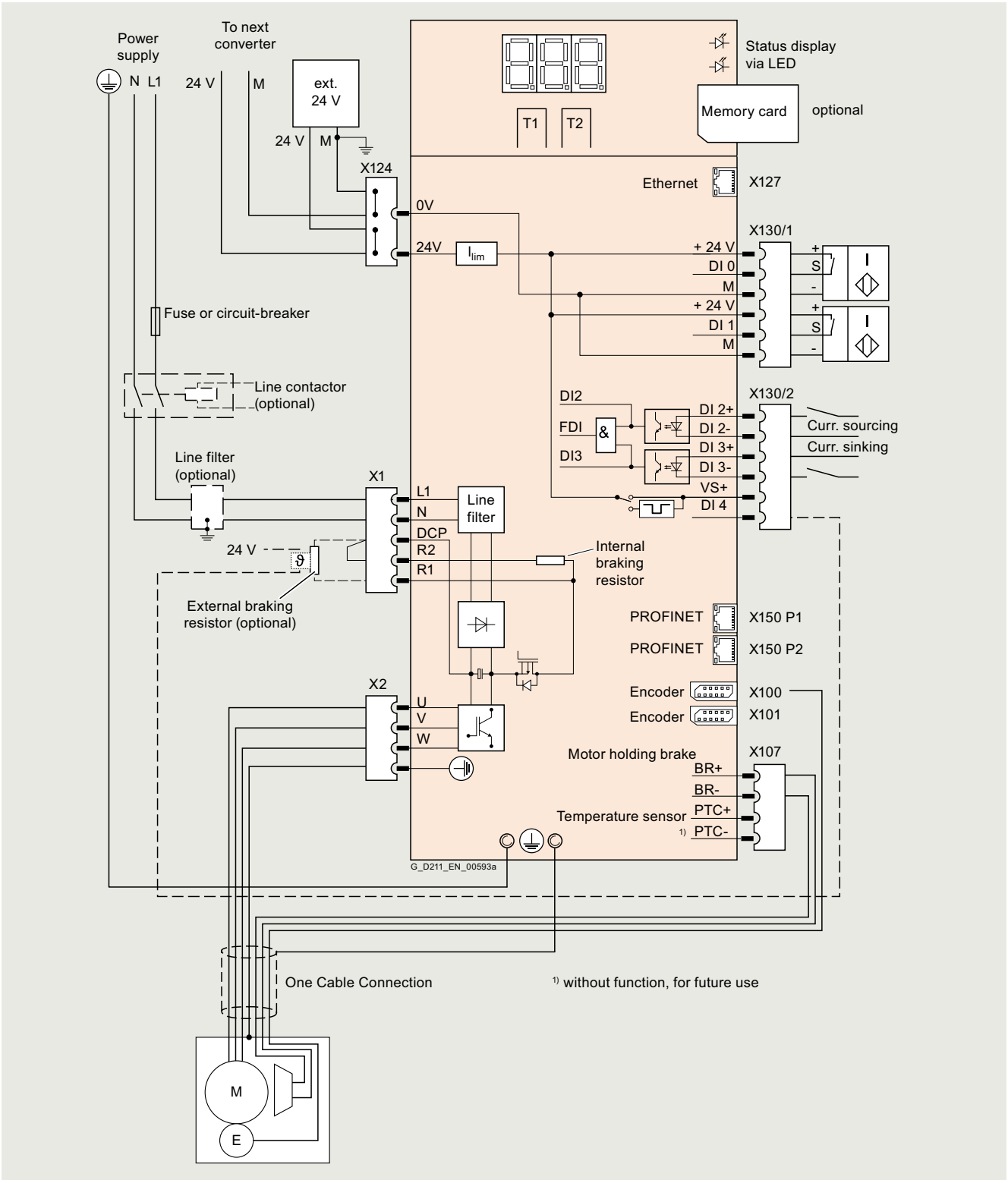
To comply with the requirements of ISO 13849-1 and IEC 61508 for timely error detection, the fail-safe inputs and switch-off signal paths of the SINAMICS S210 (New) are tested cyclically and automatically during operation. A test stop and consequent shutdown of the drive is therefore not necessary for error detection.

Safety Integrated for SINAMICS S210 (New)

Function

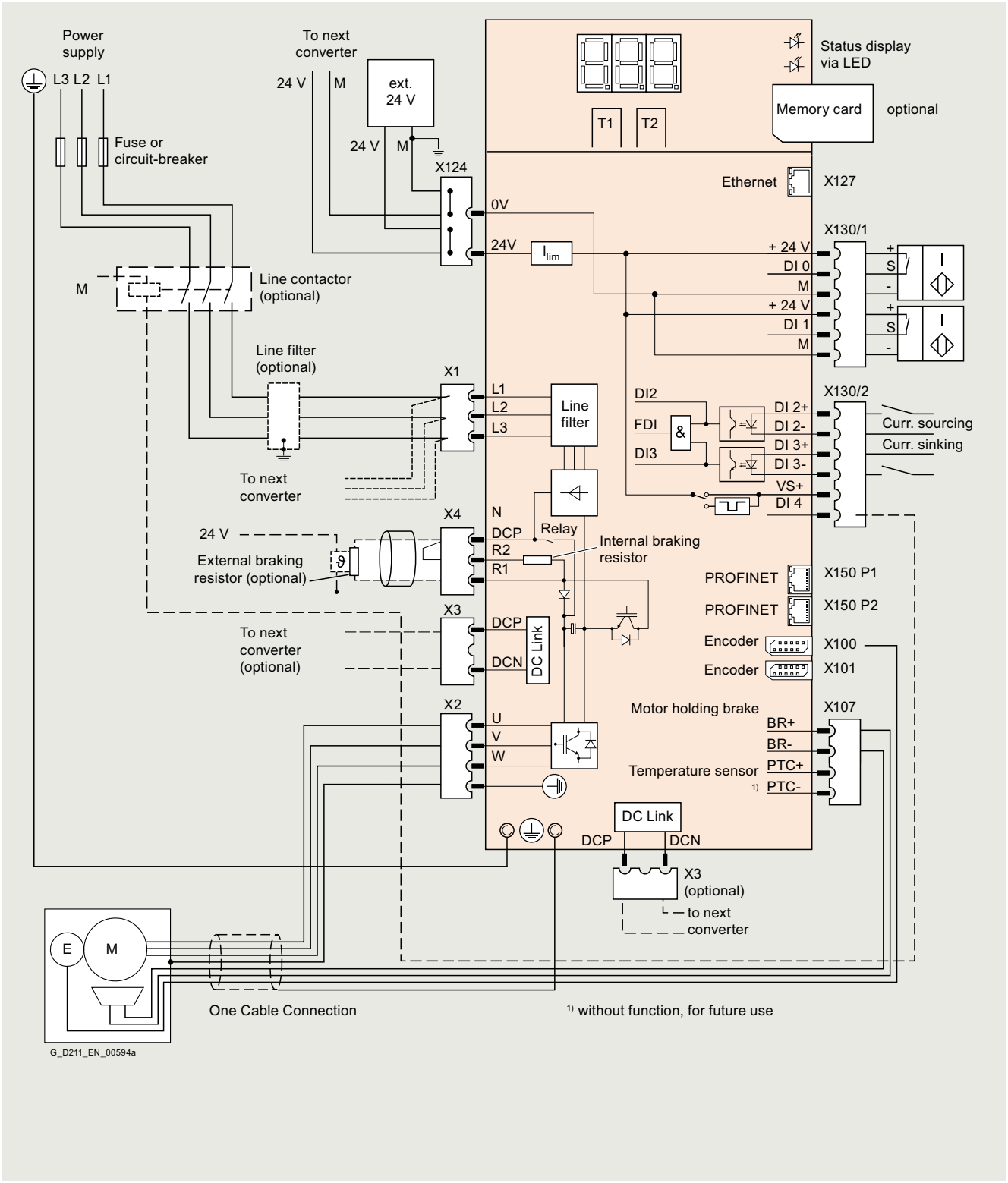
Function	Control	Underlying function	Reaction to limit overshoot	Encoder required	License required
Basic functions (no additional license is required)					
STO	• F-DI • PROFIsafe	–	–	No	No
SS1 time-controlled	• F-DI • PROFIsafe	Following expiry of the parameterized delay time STO	–	No	No
SS1E time-controlled	• F-DI • PROFIsafe	Following expiry of the parameterized delay time STO	–	No	No
SBC	• With STO	Secure control of the motor holding brake	–	No	No
Extended functions (an additional license is required)					
SS1 with SBR/SAM	• F-DI • PROFIsafe	Safe Acceleration Monitor (SAM) or Safe Brake Ramp (SBR) during braking. Following expiry of the parameterized delay time or if the speed falls below the minimum speed limit STO	STO	Yes	Yes
SS1E with SBR/SAM	• F-DI • PROFIsafe	Safe Acceleration Monitor (SAM) or Safe Brake Ramp (SBR) during braking. Following expiry of the parameterized delay time or if the speed falls below the minimum speed limit STO	STO	Yes	Yes
SS2-t	• PROFIsafe	Following expiry of the parameterized delay time SOS	–	Yes	Yes
SS2 with SBR/SAM	• PROFIsafe	Safe Acceleration Monitor (SAM) or Safe Brake Ramp (SBR) during braking. Following expiry of the parameterized delay time or if the speed falls below the minimum speed limit STO	STO	Yes	Yes
SS2E-t	• PROFIsafe	Following expiry of the parameterized delay time SOS	–	Yes	Yes
SS2E with SBR/SAM	• PROFIsafe	Safe Acceleration Monitor (SAM) or Safe Brake Ramp (SBR) during braking. Following expiry of the parameterized delay time or if the speed falls below the minimum speed limit STO	STO	Yes	Yes
SOS	• PROFIsafe	–	STO	Yes	Yes
SLS	• PROFIsafe	–	STO, SS1, SS1E, SS2, SS2E (can be parameterized)	Yes	Yes
SDI	• PROFIsafe	–	STO, SS1, SS1E, SS2, SS2E (can be parameterized)	Yes	Yes
SSM	• PROFIsafe	–	Signals that the speed has fallen below a specified value	Yes	Yes
SLA	• PROFIsafe	–	STO, SS1, SS1E, SS2, SS2E (can be parameterized)	Yes	Yes
SBT	• Safety Control Channel	–	–	Yes	Yes

Integration



Connection example SINAMICS S210 servo converter (New), 1 AC series

Integration



Connection example SINAMICS S210 servo converter (New), 3 AC series

Overview

The SINAMICS G220 converter features Safety Integrated Functions as standard.

Safety Integrated overview

The Safety Integrated Functions are implemented electronically and therefore offer short response times and easy handling in comparison to solutions with externally implemented monitoring functions.

The integrated safety functions comply with the requirements of SIL 3 according to IEC 61508 and IEC 61062 and PL e/category 4 according to ISO 13849-1.

No additional license is required for the Basic Functions STO, SS1-t and SMT. One Safety Extended Runtime license per device is required for the Extended Functions SS1-r, SS1-a, SLS, SSM and SDI.

Use of the Basic Functions does not require a motor encoder, but use of the Extended Functions does require a Safety-capable encoder connected via DRIVE-CLiQ or SMC20 Sensor Module Cabinet-Mounted.

Controlling the Safety Integrated Functions

The Safety Integrated Functions are completely integrated into the drive system. They can be activated via fail-safe digital inputs or via PROFINET with PROFIsafe.

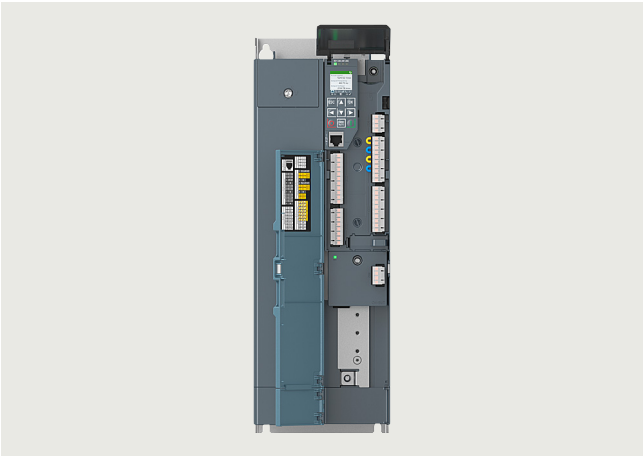
The SINAMICS G220 converter has up to three fail-safe digital inputs.

The STO function in the converter is released ex works, and is assigned to the fail-safe digital input F-DI 0. When wiring an emergency stop operating device, the STO function can therefore be used right away with no additional configuration.
The F-DI 0 is delivered with a bridge, meaning that the drive can be operated even without wiring an emergency stop operating device.

To comply with the requirements of ISO 13849-1 and IEC 61508 for timely error detection, the fail-safe inputs and switch-off signal paths of the SINAMICS G220 are tested cyclically and automatically during operation. A test stop and consequent shutdown of the drive is therefore not necessary for error detection.

OM-SMT Option Module Safe Motor Temperature

OM-SMT Option Module Safe Motor Temperature



Integrated safety solution: SINAMICS G220
with inserted OM-SMT Option Module Safe Motor Temperature

The Option Module OM-SMT
(Option Module Safe Motor Temperature)

- is suitable for monitoring the temperature of a motor in an explosive atmosphere (ATEX applications).
- is required for the SMT (Safe Motor Temperature) safety function.
- monitors the temperature of motors with two connected PTC temperature sensors for a warning threshold and a shutdown threshold.
- also detects short-circuits and wire breaks in the sensor circuit.
- detects when the limit temperature is exceeded. Once the shutdown threshold is reached, the converter automatically triggers the STO stop function, which prevents the motor from receiving any more energy from the converter; and the temperature can no longer rise.
- is classified for EX II (2) GD. Shutdown is certified for ATEX to SIL 2 in accordance with IEC 61508 and IEC 61062 and PL d, category 3 in accordance with ISO 13849-1.
- is intended for operation in the option slot of the converter. Operation is possible in converters with degree of protection IP20 / UL Open Type and IP55 / UL Type 12.

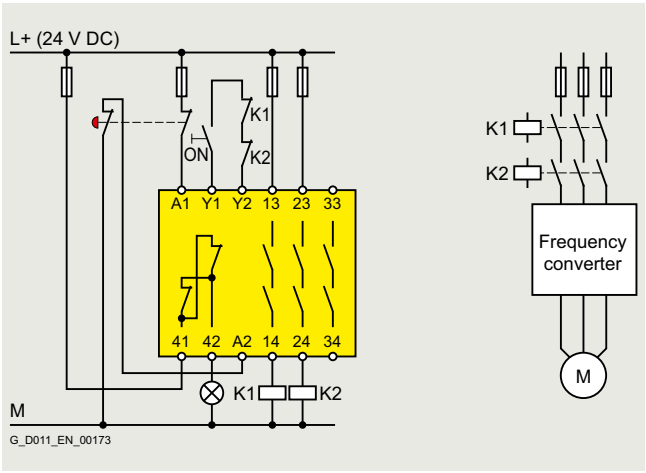
Benefits

Comparison between conventional and integrated safety systems

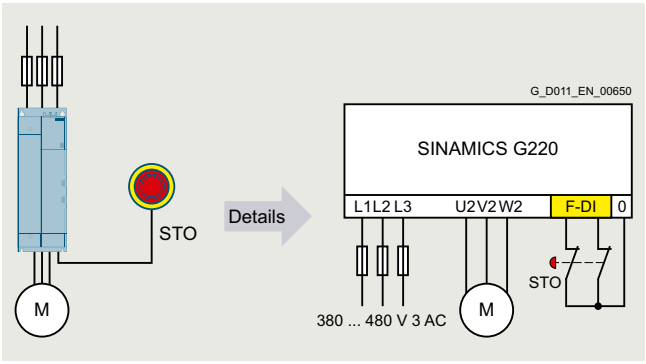
The safety functions integrated into the drive can greatly reduce the effort required to implement safety concepts.

The integrated safety functions provide support when setting up tailored safety concepts. Configurations of safety concepts are given below based on the example of the SINAMICS G220.

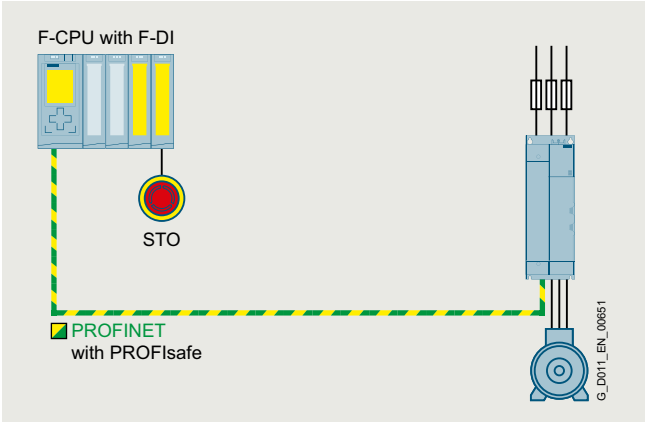
Safe Torque Off (STO)



Classic implementation using an external circuit

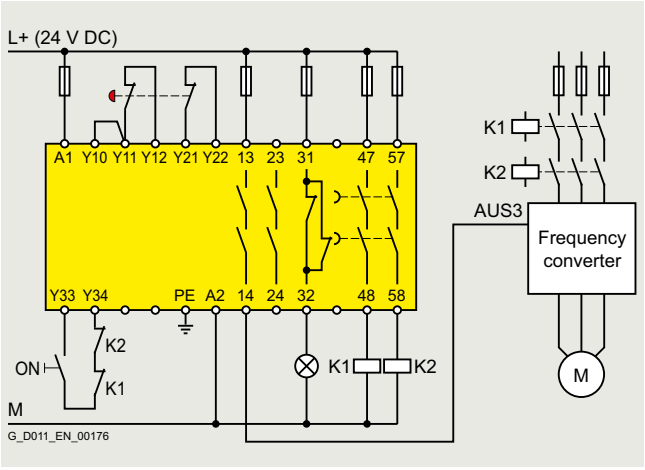


Standalone safety solution via fail-safe inputs

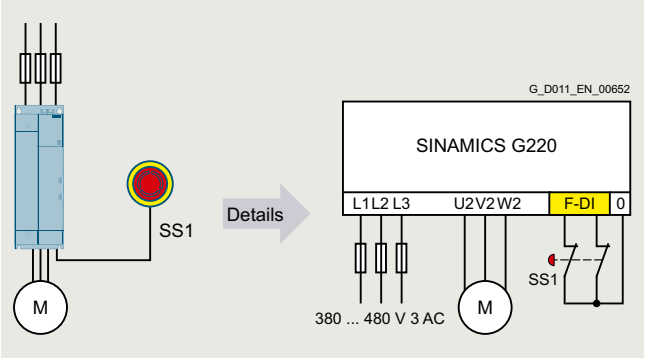


Integrated safety via PROFIsafe

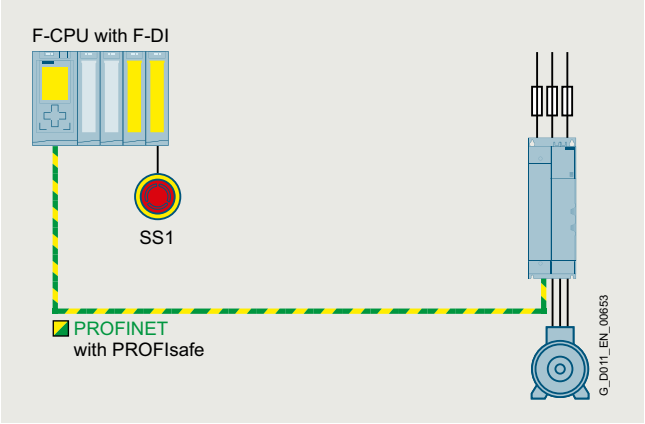
Safe Stop 1 (SS1)



Classic implementation using an external circuit



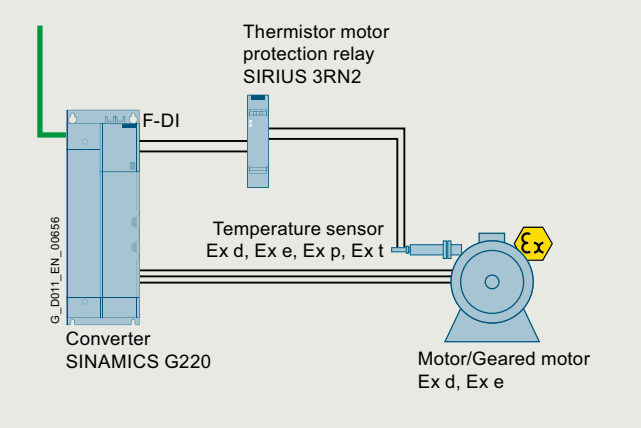
Standalone safety solution via fail-safe inputs



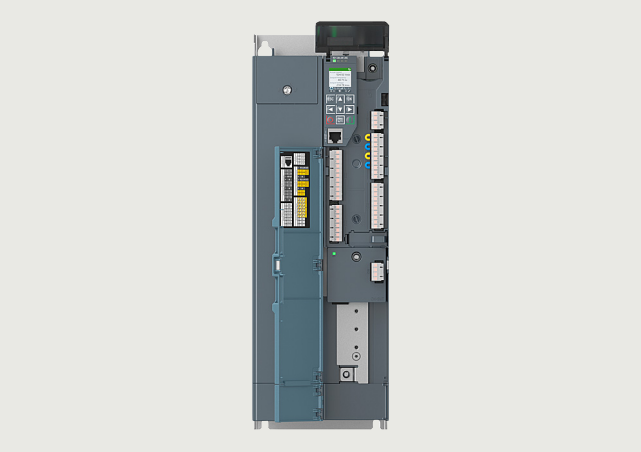
Integrated safety via PROFIsafe

Benefits

Safe Motor Temperature (SMT)

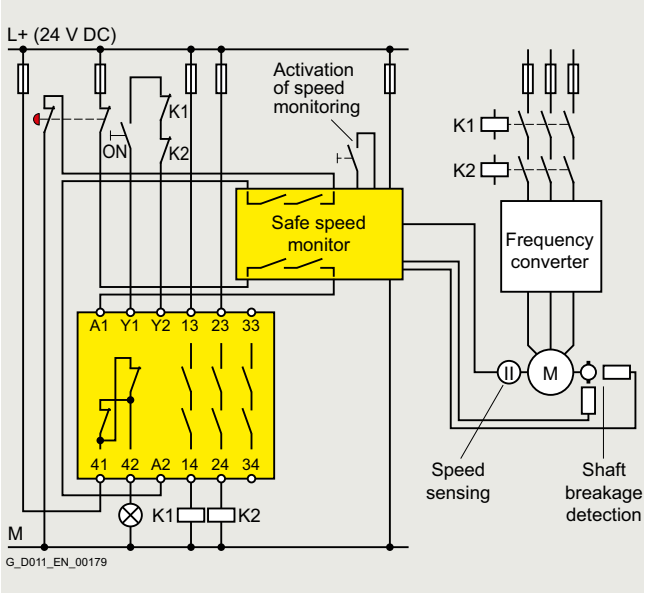


Classic implementation using an external circuit

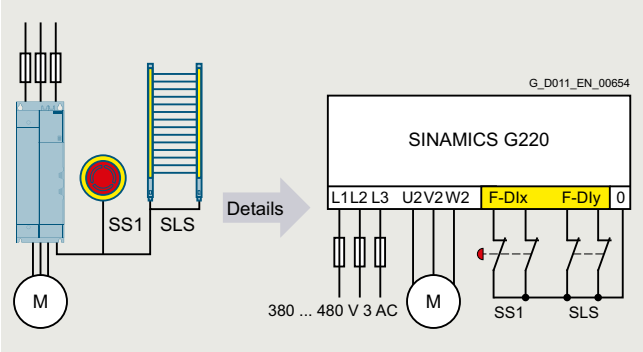


Integrated safety solution: SINAMICS G220 with inserted OM-SMT Option Module

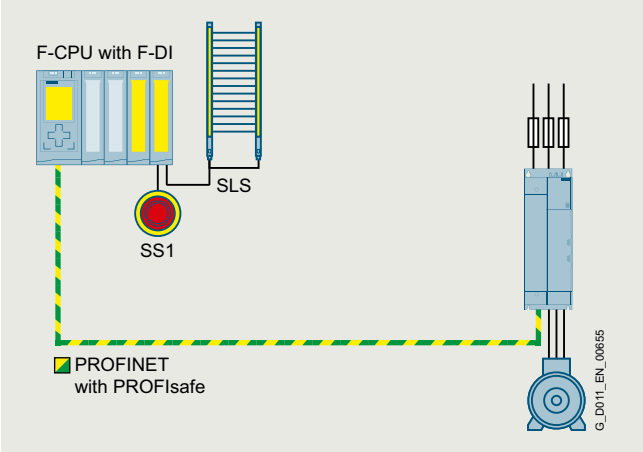
Safely-Limited Speed (SLS)



Classic implementation using an external circuit



Standalone safety solution via fail-safe inputs

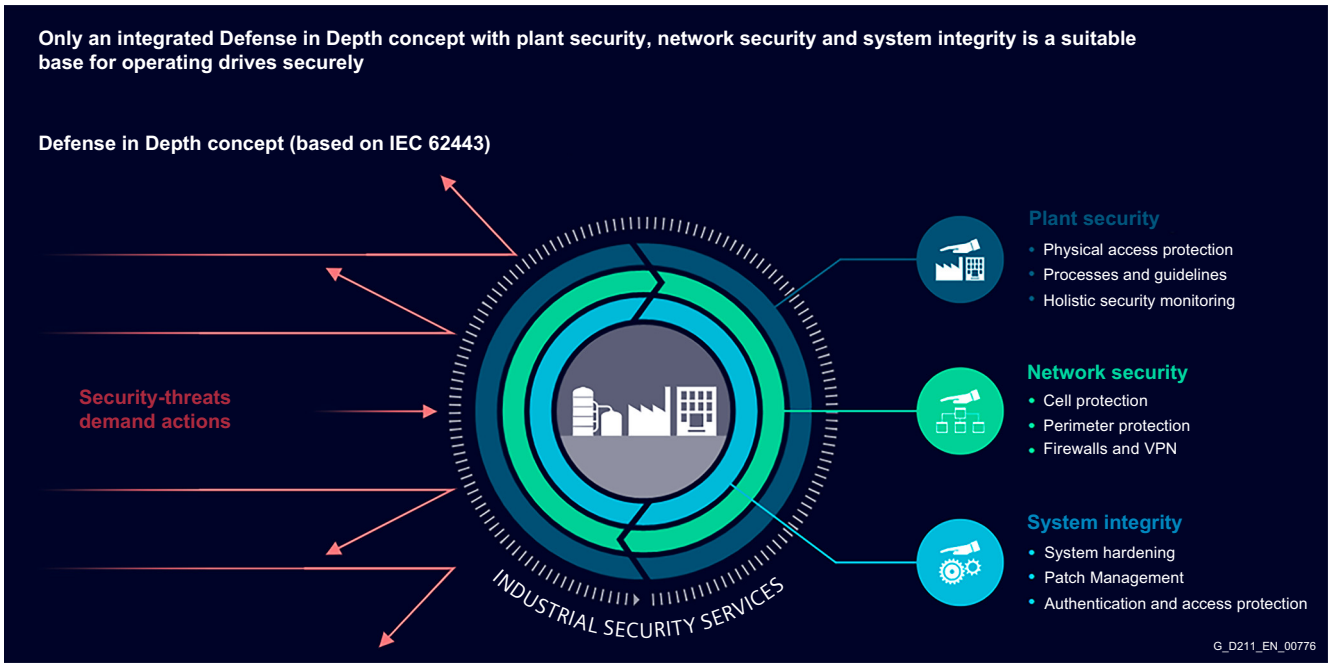


Integrated safety via PROFIsafe

Function

Function	Control	Underlying function	Reaction to limit overshoot	Encoder required	License required
Basic functions (no additional license is required)					
STO	• F-DI • PROFIsafe	–	–	No	No
SS1 time-controlled	• F-DI • PROFIsafe	Following expiry of the parameterized delay time or if the speed falls below the minimum speed limit STO	–	No	No
SMT	–	When STO limit temperature exceeded	STO	No	No
Extended functions (an additional license is required)					
SS1 with SBR/SAM	• F-DI • PROFIsafe	Safe Acceleration Monitor (SAM) or Safe Brake Ramp (SBR) during braking. Following expiry of the parameterized delay time or if the speed falls below the minimum speed limit STO	STO	Yes	Yes
SLS	• F-DI • PROFIsafe	–	STO, SS1 (can be parameterized)	Yes	Yes
SDI	• F-DI • PROFIsafe	–	STO, SS1 (can be parameterized)	Yes	Yes
SSM	• F-DI • PROFIsafe	–	Signals that the speed has fallen below a specified value	Yes	Yes

Overview



Digitalization and the increasingly networked nature of machines and industrial plants increase the risk of cyber attacks and their potential fallout. Therefore, industrial plants and infrastructure must be fully protected against cyber attacks from inside and from outside, from the enterprise level to the field level.

Defense in Depth

A suitable security concept must contain three layers: plant security, network security and system integrity.

With "Defense in Depth", Siemens provides such a multi-layered security concept that offers industrial plants comprehensive and far-reaching protection in accordance with the recommendations of the international IEC 62443 standard. It is aimed at plant owners, integrators and component manufacturers and covers all security-relevant aspects of cybersecurity for industry.

Network security through cell protection

One of the things that the Defense in Depth concept provides is that production plants are segmented into secured cells. The cells contain automation and drive products such as SINAMICS frequency converters. Communication to the individual cells is protected by so-called cell protection, e.g. SCALANCE S products, and restricted to permitted connections by firewall rules.

Patch management

Siemens offers a targeted hotfix/patch management system and communicates security vulnerabilities and patches via Siemens ProductCERT. Customers can be automatically informed when new advisories are available for the products they use. Standardized interfaces are also available for automatically interfacing with customer-specific tools.

Overview

The SINAMICS S200, S210 (New) and G220 converters have Security Integrated functions as standard.

Secure default settings

The SINAMICS S200, S210 (New) and G220 converters are delivered from the factory with security functions activated, yet in such a way that allows for a user-friendly first commissioning. When configuring the converter in TIA Portal or via the SINAMICS web server, the user is automatically guided through a security wizard to adjust the most important security settings. Among other things, this determines whether the converter should be protected by user administration and access control.

Security Integrated functions

The SINAMICS S200, S210 (New) and G220 converters support the following Security Integrated functions:

User management and access control

This function makes it possible to create various users and protect their access to the converter with passwords. Each user is assigned one or more roles. Various rights can be assigned to each role. There are various rights, both for offline configuration as well as for online access to the device. In this way, it is possible to set which users have full access to the device's settings and which users only receive limited rights. For example, you could create users who only have read access for diagnostic purposes or users who have write access to the device settings but no rights to change the safety configuration.

TIA Portal provides cross-device user administration. Users and rights can be configured in the TIA Portal at a central location in the project across devices for SINAMICS converters, SIMATIC HMI Panels, SIMATIC PLCs, and for the TIA Portal project engineering. This means that settings for users and rights can be made and changed consistently and rapidly for multiple devices.

Protected communication with engineering systems (SINAMICS Startdrive and SINAMICS web server)

The SINAMICS S200, S210 (New) and G220 converters enable TLS-based communication between the converter and the TIA Portal commissioning tool (secure S7 protocol) and to web clients (https protocol).

Firmware integrity and authenticity

The Siemens-provided firmware of the SINAMICS S200, S210 (New) and G220 converters is equipped with integrity protection and is signed by Siemens. Through this, the converter can detect whether the firmware code was manipulated by a third party and whether the code is from a reliable source.

Firmware updates can be carried out via memory card, TIA Portal and web clients and SINAMICS Startdrive.

Backup and restore

The configuration for SINAMICS S200, S210 (New) and G220 can be backed up and restored remotely via the SINAMICS web server, Startdrive or locally via the SD card. Creating a backup after changes is an important step of a comprehensive security concept. This means that the converter can be quickly restored to a known state in the event of a cyber attack.

Restoring the backup file can also be used to provide the new converter with the desired configuration when replacing a part.

Session handling

The SINAMICS S200, S210 (New) and G220 converters feature session handling. A session starts as soon as a user logs in to the device and ends when the user logs out manually or after a preset period of inactivity. Session handling ensures that each user only receives the access rights that are assigned to him, even if multiple users with different rights are connected to the device at the same time.

Physical access protection

Access to the SINAMICS SDI (Smart Drive Interface) and SD card slot of the SINAMICS G220 IP55 drive can optionally be locked with a padlock. This prevents configurations from being changed directly on the device by unauthorized persons.

Encryption of sensitive data

The Drive Data Encryption feature stores encrypted data for user management and access control in backups and on the memory card of the converter. Independent of this feature, passwords are hashed before they are stored.

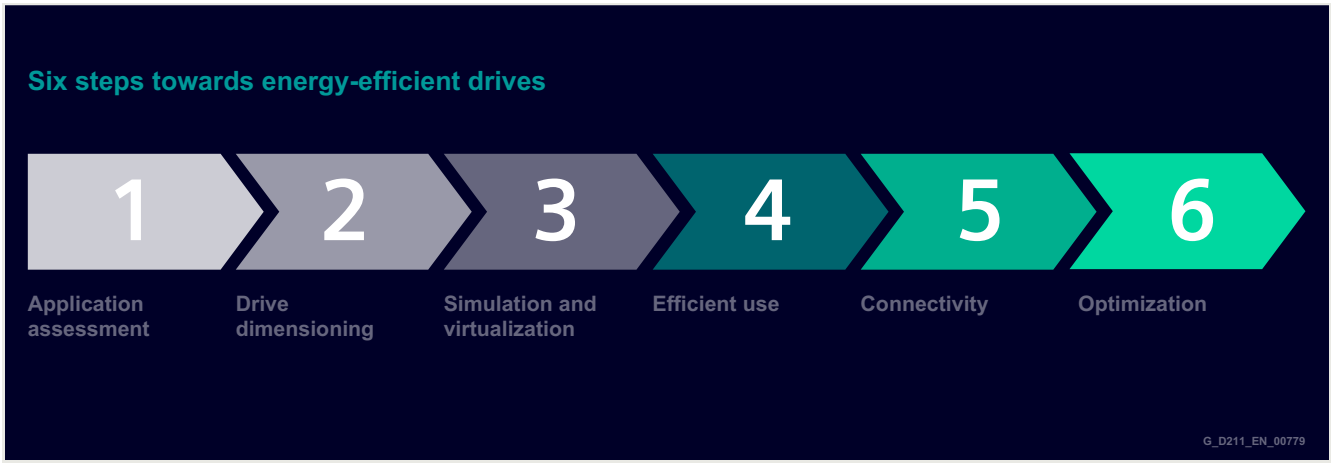
Security documentation

The Configuration manual SINAMICS Industrial Cybersecurity provides comprehensive security documentation:
https://support.industry.siemens.com/cs/ww/en/view/109823969

Notes

Energy Efficiency and Grid Capability

Overview



Siemens helps reducing energy consumption and costs, while increasing the sustainability of the operations

Fighting the rising energy costs, ensuring regulatory compliance, optimizing maintenance, and increasing machine reliability, while striving for the lowest environmental footprint of the business. These are just a few of the major challenges industries face in today's world. Turning the attention to the drive applications within the plants should be an obvious choice, as the drive systems are the main energy consumers in industry. Optimization of the drives thus offers a great chance for higher efficiency and sustainability in industrial operations.

Siemens is offering an energy efficiency concept that continually and systematically reduces the power consumption of machines and equipment and thereby boosts the competitive advantage of industrial producers. When implementing energy-efficient solutions, Siemens not only draws from its vast expertise and domain know-how, but also engages digitalization tools to combine the real and the digital worlds and enable a continuous loop of optimization.

Six steps towards energy-efficient drives

1 Application assessment

It is important to start with an evaluation of what drive and motor to use for your specific application. Overall drive system optimization is the key – combining cutting edge technology with digital solutions can achieve energy savings of 60 % or more. Thus, instead of pondering over the parameters of the individual drive system elements in isolation, it is advisable to always take into consideration the interplay of the motor, converter, application, and the entire operations.

Finding the right solution for your specific case might be complex, because Siemens offers a wide range of energy-efficiency functions in SINAMICS drives (while the cascading function might be great for pump applications, the energy buffering feature is more suitable for stacker crane apps). Our experts are always happy to consult and advise on each specific use case.

Customer Services for Drive Systems are supporting in this step with their offering of Energy Performance Contracting, Energy & Decarbonization audits and Retrofit for drive systems.

Siemens also offers numerous tools to make the right decision easy. One of them being the SinaSave software application, which can help you to calculate how soon you will recoup your investment if you purchase an energy-efficient drive.

2 Drive dimensioning

As the next step then comes the definition of the optimal dimensions of the drive. Proper dimensioning ensures that the drive system is configured to deliver the appropriate amount of power for the application. This prevents energy waste and promotes maximum efficiency, helping to reduce operational costs. Furthermore a well-dimensioned drive system ensures increased lifespan, improved performance, reduced maintenance and enhanced safety. SIZER for Siemens Drives (integrated in the TIA Selection Tool) engineering tool is the perfect starting point for finding the correct drive size.

3 Simulation and virtualization

With the help of the digital twin of a drive, simulation and virtual commissioning could be easily performed. Through simulation, you can create virtual models of drive systems and test different configurations, operating parameters, and control strategies. This allows for testing and fine-tuning the system's energy efficiency before installation. You can simulate the drive system's behavior and interactions with other equipment to detect and rectify any inefficiencies or potential energy losses. This approach helps in optimizing the system even before it is put into operation, saving time and resources. DriveSim Designer and DriveSim Engineer are the tools that Siemens offers for drive simulation.

4 Efficient use

Use innovative drive technology to reduce your energy consumption! The energy-efficient components and systems developed by Siemens can cut the energy consumption of your plant. Important components in an energy-efficient plant are, for example, frequency converters with regenerative feedback functions for applications with variable speeds or soft starters for fixed-speed drives. With its Smart Power Management system, Siemens is also offering solutions that permit to compensate peak loads, recover braking energy, and supply the machine with power in case of grid faults. Among other energy-efficient functions of SINAMICS drives are Eco mode, energy buffering, automatic flux adaption, clean power, DC link, PROFIenergy, hibernation mode, bypass operation and cascading.

5 Connectivity

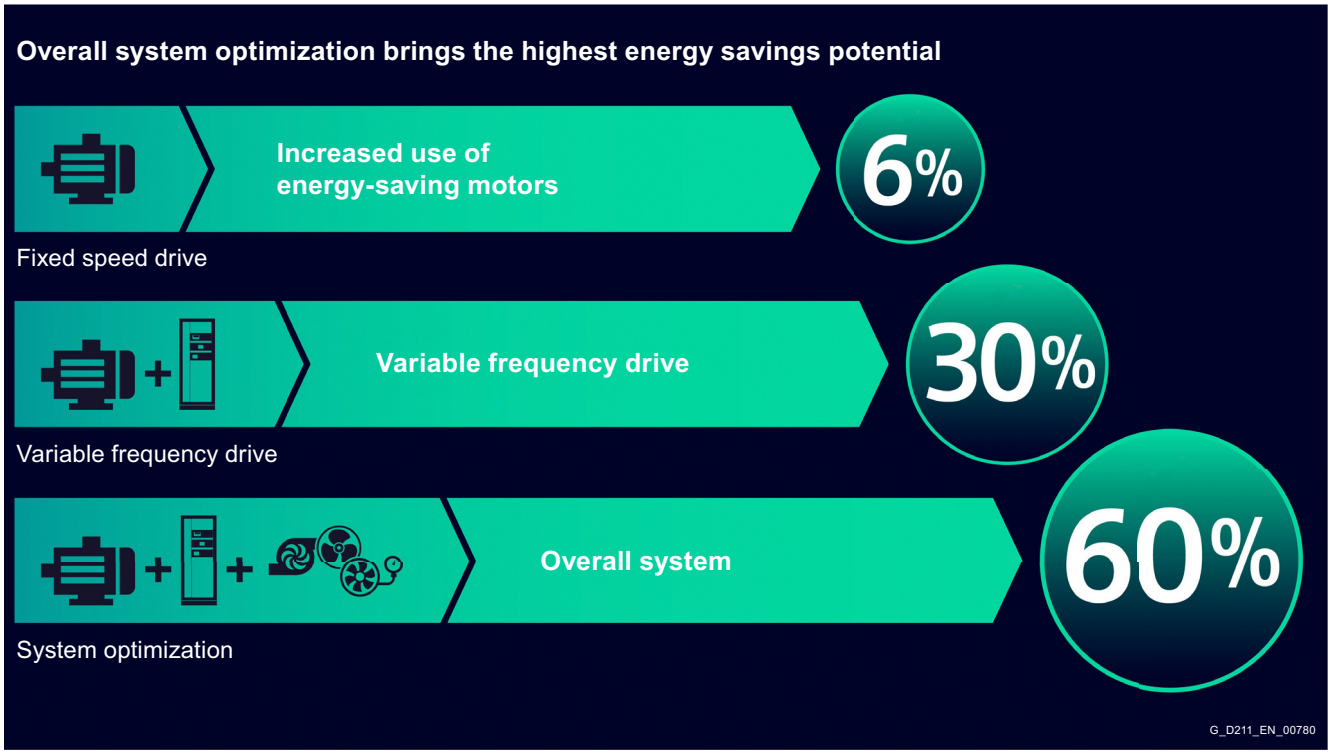
The next step is to get operational data out of the drives in order to gain transparency of the energy consumption of the drive systems and to lay foundations for further analysis and optimization. To do so Siemens is able to provide Drive Connector SINAMICS Industrial Edge app and various IoT gateways.

Overview

6 Optimization

Once connected, the drives send data to Industrial Edge and Cloud apps (Analyze MyDrives, SIDRIVE IQ Fleet), where real-time monitoring of performance and energy consumption of drive systems can happen. This allows operators and maintenance personnel to identify inefficiencies or anomalies promptly. By detecting and addressing energy-consuming issues in real time, energy waste can be minimized, leading to improved energy efficiency.

Analysis of large volumes of data related to drive system performance and energy consumption can be executed as well. By leveraging this data, patterns, trends, and energy usage profiles can be identified with the help of AI. This analysis helps in gaining insights into the energy consumption patterns of the drive system, allowing for targeted optimization efforts to be made.



Overview

Decarbonization

Siemens is making accelerated efforts to reduce CO_2 emissions throughout the entire value chain. With our innovative initiatives such as the "Carbon Web Assessment, Green Digital Twin, and SIGREEN2", we are taking concrete steps towards a more sustainable future.

Starting from the procurement phase, we implement governance upstream and downstream to minimize negative impacts on the environment and society. By employing sustainable resins, we actively work to reduce CO_2 emissions and ensure a greener manufacturing process.

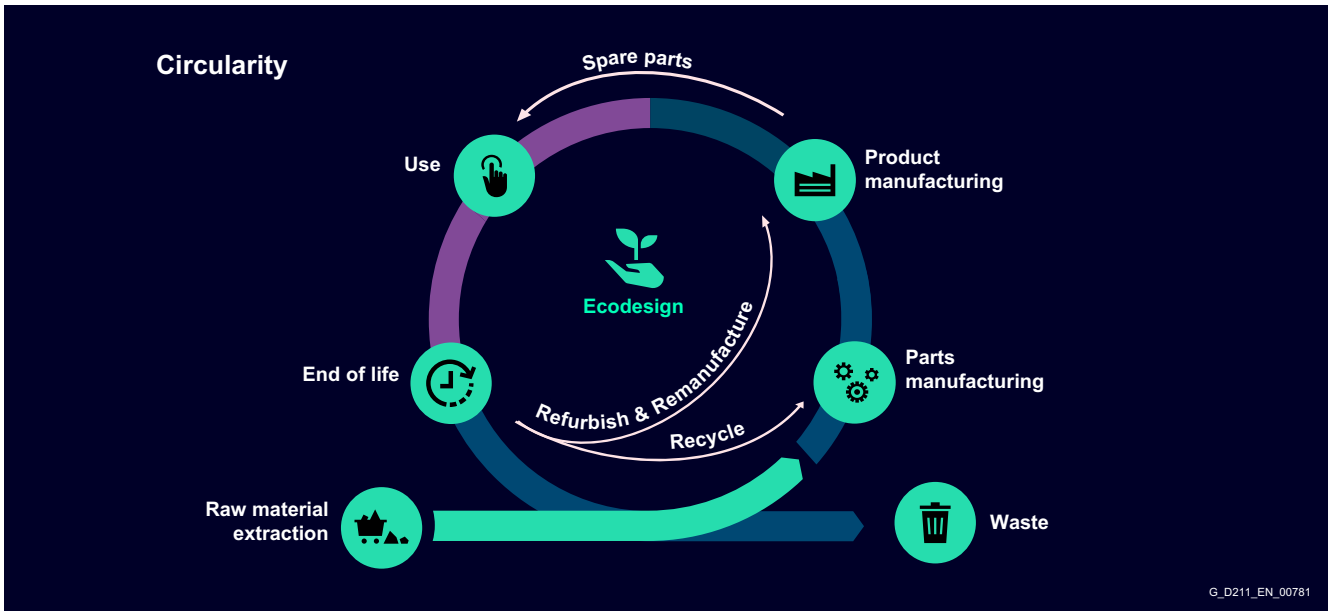
At our production sites, we go beyond mere concepts and implement sustainable practices. Through various actions such as renewable energy sourcing, energy consumption optimization and continuous waste reduction, we actively contribute to the development of more sustainable operations.

One major milestone on our path towards decarbonization is the issuance of the Environmental Product Declaration (EPD) for SINAMICS drives. This document provides complete transparency regarding the environmental footprint of our converters.

It showcases key environmental performance indicators, including the overall impact of the product on climate change throughout all its lifecycle phases. Additionally, you can find valuable information on end-of-life product results such as recyclability percentage and minimum disposal rates.

Siemens is dedicated to reducing the carbon footprint of our products, and the EPD data plays a crucial role in these efforts. We believe that transparency and information are key to driving sustainability forward.

To further support our commitment, we offer value-added services such as energy audits, retrofit for drive systems, energy performance contracting and repair services, that help our customers continuously reduce carbon emissions.



Circularity

The concept of the circular economy is gaining significant importance in the industrial sector, and Siemens Customer Services has been actively engaged in this field for several years. With stricter environmental regulations coming into play, the shift from a linear economy to a circular one has become imperative to ensure sustainability. Embracing circularity not only aids in the fight against climate change but also ensures the availability of essential raw materials, thereby enhancing supply chain security. Furthermore, adopting circular practices assists industries in achieving their sustainability goals.

Unlock the full potential of drive systems circularity with three ways of repair:

- Through **repairs**, the functionality of your defective product is restored without any further preventive measures.
- By **refurbishing** your defective products, their previous functionality is recovered and additional preventive measures are taken to improve their condition.
- With **remanufacturing** you get the most out of your product: Disassembling your used product, restoring and testing its components, as well as reassembling them into a product that is as new. This way, remanufacturing prolongs the product lifetime and reduces the downtimes of your machines, all while contributing to a sustainable future

Overview

Step by step to more efficiency

One of the core objectives of the European Union is a sustainable power industry. In industrial plants today, around 70 % of the power demand is from electrically driven systems. This high percentage contains huge potential for saving energy in electrical drives. For that reason, the European Union introduced minimum requirements for the energy efficiency of electric motors in the form of a statutory motor regulation as early as 2011.

These activities are expanded by EU Directive 2019/1781, which deals with more stringent requirements for DOL motors (Direct On Line) and defines the efficiency limits for frequency converters. The directive offers a legal basis for technical content in terms of the efficiency of specific products and services. However, standardization plays a leading role in determining the range and available market technology.

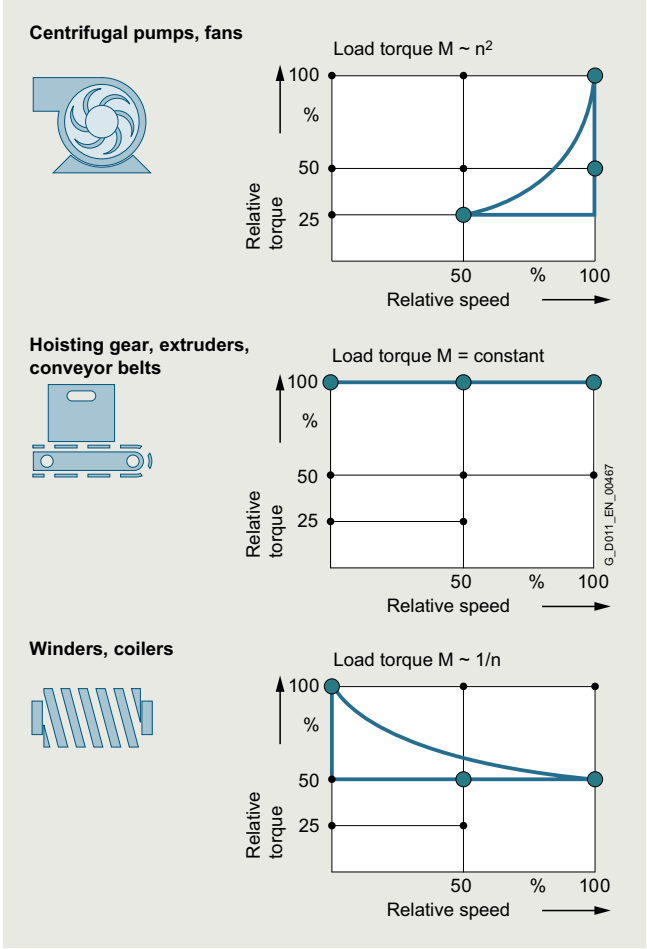
Improving energy efficiency is supported by a systematic selection of the most efficient converter and drive system technologies on the IEC 61800-9 series of standards. Part 1 specifies the methodology to determine the energy efficiency index of an application on the basis of the expanded product approach (EPA) and semi-analytical models (SAMs), whereas part 2 entails indicators for the evaluation of the energy efficiency performance and classification of converters and drive systems.

First of all, the consideration of eight application-relevant operating points is introduced as mandatory, in order to take the different applications into account in a targeted manner. Determination of loss values at these eight points and definition of efficiency classes are laid down by the standard in a uniform way. This enables data relevant to operation, such as application-specific load profiles, to now be taken into account more easily in the energy efficiency analysis.

The standard is especially important for variable-speed drives of the following types:

- for AC/AC converters without energy recovery functionality
- for motors with integrated converters
- for supply voltages of 100 V to 1000 V
- for power ratings of 0.12 kW to 1000 kW

To cover all applications of driven machines, the IEC 61800-9-2 standard defines operating points in full-load and partial-load operation, at which the losses of the motor and drive systems have to be determined. Based on the loss data at the operating points in partial-load operation, variable-speed drives can be explicitly considered in more detail. This makes their advantages especially clear.



Duty cycles for different driven machines

Moreover, frequency converters and motor systems are classified in efficiency classes, which permit an initial rough estimate of the potential saving. Definition of reference systems is a key aspect of this because they provide standard reference values. The positioning of these reference systems defines the efficiency class. The relative distance from the reference system can be used as an absolute measure of the efficiency at the operating point in question.

Overview

Advantages of the detailed loss consideration of IEC 61800-9-2 over the previous consideration of efficiencies and maximum loss values

For motors, the efficiency consideration was previously only defined for operation without a converter at 50/60 Hz. It provides a good way of comparing the energy efficiency of motors from different manufacturers for this use case.

The more detailed loss analysis of IEC 61800-9-2, on the other hand, is aimed at speed-controlled operation and therefore now also includes motors especially designed for converter operation in the energy analysis. These were previously not covered by the applicable standards.
Moreover, a loss analysis over the entire setting and load range of the motor is possible. This is done in accordance with the standard IEC 61800-9-2 with typical values.

For holistic consideration, it is essential to include all the relevant components of a drive system. The IEC 61800-9-2 standard defines this in detail. The standardized expression of power loss data as a percentage makes comparison considerably easier and more transparent.

The method also makes it possible to consider a motor that produces a holding torque at speed zero, for example. In this case, the efficiency is zero, but a power loss from current producing magnetization and holding torque does occur. In summary, the key advantage of standard IEC 61800-9-2 is the ability to perform the energy analysis of an electrical drive system based on standardized load profiles in all operating ranges due to uniform general conditions. This provides the user with complete transparency irrespective of the manufacturer.

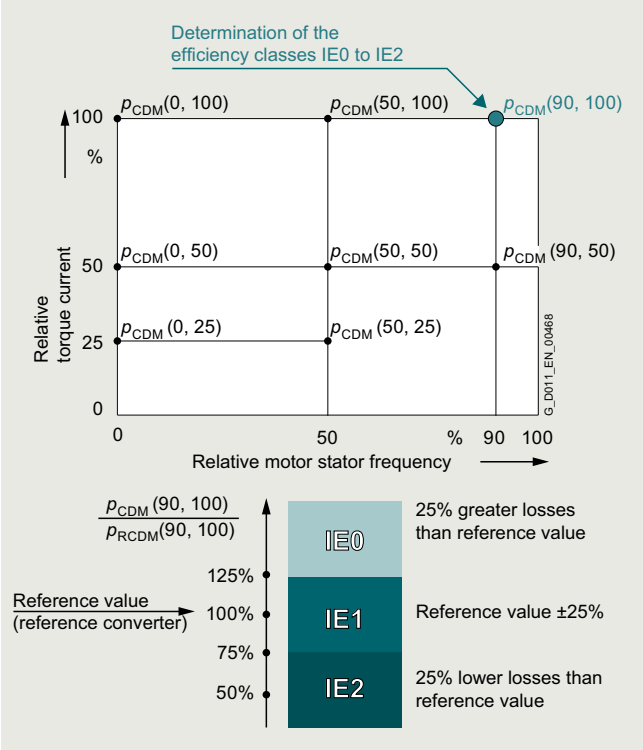
Establishing efficiency classes of frequency converters (Complete Drive Modules CDM)

To avoid overmodulation and to ensure comparability between makes, which cannot be achieved otherwise, the efficiency classes of CDMs refer to the 90/100 operating point (90 % motor stator frequency, 100 % torque current).

Standard IEC 61800-9-2 defines the relative losses of a CDM in efficiency classes IE0 to IE2. With reference to the value of a CDM of efficiency class IE1 (reference converter), a CDM of efficiency class IE2 has 25 % lower losses and a CDM of efficiency class IE0 has 25 % higher losses.

The publication of EU Directive 2019/1781 makes compliance with the eco-design requirements for the product declaration of conformity mandatory.
AC/AC transformers, that belong to the aforementioned categories (specific voltage and performance level without regenerative feedback capability), must meet efficiency class IE2, in order to be authorized for installation/use within the EU.

Operating points for CDMs



Complete Drive Module (CDM) – determining the efficiency class

Establishing the efficiency classes of drive systems (Power Drive Systems PDS)

What is possible for the individual systems, of course, also applies to the entire electrical PDS (frequency converter plus motor). Detailed comparisons are now possible at this level, too. The reference values for the reference system provide clear indications of the energy performance of the PDS.

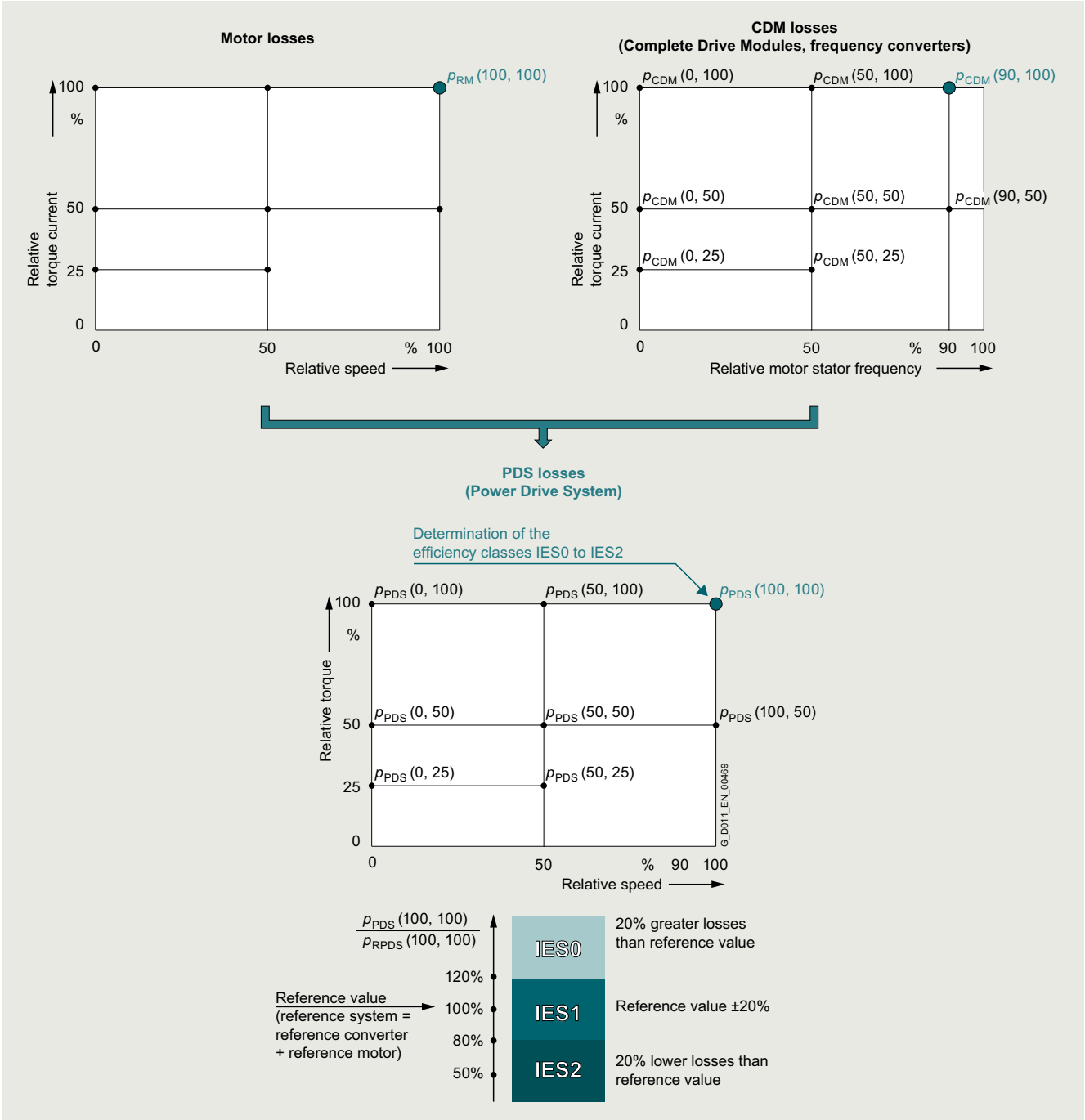
Because targeted matching of the motor and CDM provides additional potential for optimization in electrical drive systems, it is especially important for the user to consider the entire drive system.

For the efficiency class of a PDS, too, a specific load point is defined. In this case, the reference point used is the 100/100 operating point (100 % motor stator frequency, 100 % torque).

Standard IEC 61800-9-2 defines the relative losses of a PDS in efficiency classes IES0 to IES2. With reference to the value of a PDS of efficiency class IES1 (reference drive), a PDS of efficiency class IES2 has 20 % lower losses and a PDS of efficiency class IES0 has 20 % higher losses.

Overview

Operating points for PDS



Power Drive System (PDS) – determining the efficiency class

More information

An example of a highly efficient drive system with efficiency class IES2 is the new synchronous inductance drive system with SIMOTICS reluctance motors and SINAMICS drives. More information is available on the internet at
www.siemens.com/drivesystem-reluctance
www.siemens.com/simotics-gp
www.siemens.com/simotics-sd

Power loss data of SINAMICS converters for single-axis drives are available on the internet at
https://support.industry.siemens.com/cs/document/94059311

More information on current laws and standards, new standards, and mandatory guidelines is available on the internet at
www.siemens.com/legislation-and-standards

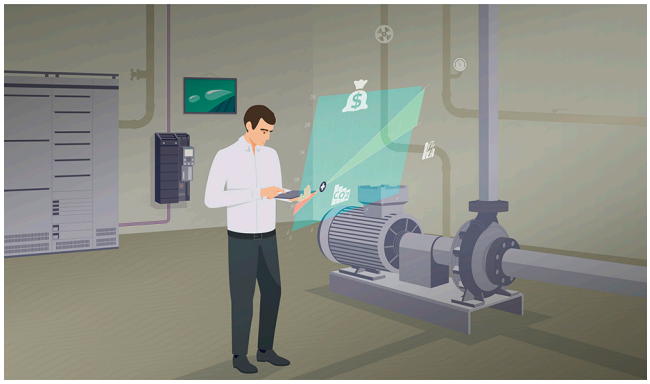
SinaSave energy efficiency tool

Overview

SinaSave determines the energy saving potential and payback time based on your application setup. SinaSave is a web tool which is intuitive to operate and supports you in an investment decision:

- Is it worthwhile to use more energy efficient systems?
- When will my investment pay off?

SinaSave supports you to find the optimum solution: technically, economically, and ecologically.



SinaSave KeyVisual

In which cases can SinaSave support you?

- Motors
  - Calculate your potential energy savings and amortization times with SIMOTICS motors
- Pump systems
  - Calculate your potential energy and CO2 savings with our pump drive systems
- Fan systems
  - Calculate your potential energy and CO2 savings with our fan drive systems

Access to the SinaSave energy efficiency tool

SinaSave can be accessed without the need for registration or logging in:
http://www.siemens.com/sinasave

Benefits

- **Transparency of overall savings potential and individual amortization plan**
  - SinaSave calculates the expected energy consumption and the resulting savings of energy, CO2 and energy cost, based on your individual energy prices, operating times and load profiles.
- **Support to find the optimum solution to make easy decision**
  - SinaSave directly compares your existing motors with SIMOTICS motors of various energy efficiency classes, for new systems and retrofits.
- **Ease of use and self-explanatory user guidance to calculate savings potential on overall system level**
  - SinaSave compares different drive system configurations for pump or fan applications. Regardless of greenfield or brownfield projects, SinaSave offers the flexibility to choose from different motor types and control modes, including variable speed drives and softstarters.
- **Well-structured SinaSave projects give you transparency of the savings potential of your entire facility**
  - SinaSave lets you combine several items in a single project. That means it's possible to reflect entire facilities and identify the savings potential they offer.

Function

- Determine savings potential for energy, power costs, and CO2
- Estimate expected amortization and Total Costs of Ownership (TCO)
- Output of system power losses for motor inverter systems as per IEC 61800-9-2
- Calculate possible financing, such as energy performance contracting (EnPC)
- Take government subsidies into account
- Simple design with intuitive usability
- Results presented in graphic form
- Save and load, share a handout e.g with your customer or decision-maker
- Eight languages, 14 currencies, IEC and NEMA standards
- Direct transfer to next processes, e.g. product configuration

More information

Further information about the amortization calculator for energy-efficient drive systems is available on the internet at:
http://www.siemens.com/tools-sinasave

Further information about services for energy saving is available on the internet at:
https://www.siemens.com/energy-saving

https://www.siemens.com/energy-efficiency

Overview

Communication overview

Digital bus systems are commonly used in industrial automation today. These handle communication between the control level, the machine control, the sensors and actuators. The SINAMICS product family offers integrated communication interfaces in all product groups – which can be used to connect the most important fieldbus systems in the simplest possible way.

The properties and special application areas of the various bus systems for the next generation of SINAMICS converters as of firmware version V6.1 for SINAMICS S210 (New) and as of firmware version V6.2 for SINAMICS G220 and SINAMICS S200 are briefly described in the following.

Protocol	Low voltage		
	Servo converters		High performance frequency converters
	SINAMICS		
	S200	S210 (New)	G220
PROFINET	✓	✓	✓
• PROFINET RT	✓	✓	✓
• PROFINET IRT isochronous	✓	✓	✓
• PROFINET IRT non-isochronous	✓	✓	✓
• PROFINET Shared Device	✓	✓	✓
• PROFINET media redundancy MRP (surge prone)	✓	✓	✓
• PROFINET media redundancy MRPD (surge free)	✓	✓	✓
• System redundancy S2	–	–	✓
• PROFIsafe	–	✓	✓
• PROFIenergy	–	✓	✓
• PROFIdrive application class 1	✓	–	✓
• PROFIdrive application class 3	✓	–	✓
• PROFIdrive application class 4	✓	✓	✓ [1]
PROFIBUS DP	–	–	–
• PROFIBUS DP equidistance and isochronous mode	–	–	–
• PROFIBUS DP peer-to-peer communication	–	–	–
EtherNet/IP	–	–	✓
Modbus TCP	–	–	✓ [2]
Modbus RTU	–	–	–

[1] Only possible without Dynamic Servo Control (DSC).

[2] Function possible with optional communication module.

8

Overview

PROFINET – the Ethernet standard for automation

PROFINET is the world's leading Industrial Ethernet standard for automation with more than 40 million nodes installed worldwide.

PROFINET makes companies more successful, because it speeds up processes and raises both productivity and plant availability.

Your advantages at a glance

Flexibility	Efficiency	Performance
Tailor-made plant concepts	Optimal use of resources	Increased productivity
Industrial Wireless LAN	One cable for everything	Speed
Safety	Device/network diagnostics	High precision
Flexible topologies	Energy efficiency	Large quantity structures
Open standard	Simple wiring	High transmission rate
Web tools	Fast device replacement	Redundancy
Expandability	Ruggedness/stability	Fast start-up

G_IK10_XX_10304

8

Overview

Flexibility

Short response times and optimized processes are the basic requirements for competitiveness in global markets because the product life cycles are becoming shorter and shorter.

PROFINET ensures maximum flexibility in plant structures and production processes, and it enables you to implement innovative machine and plant concepts. For example, mobile devices can also be integrated at locations that are difficult to access.

Flexible topologies

In addition to the linear structure characterized by the established fieldbuses, PROFINET also enables the use of star, tree and ring structures. This is made possible by switching technology via active network components, such as Industrial Ethernet switches and media converters, or by integrating switch functionality into the field devices. This results in increased flexibility in the planning of machines and plants, as well as savings in cabling.

The PROFINET network can be installed without any specialist knowledge at all and meets all requirements that are relevant to the industrial environment. The "PROFINET Installations Guidelines" assist manufacturers and users with network planning, installation and commissioning. Symmetrical copper cables or RFI-resistant fiber-optic cables are used, depending on the application. Devices from different manufacturers are easily connected via standardized and rugged plug-in connectors (up to IP65/IP67 degree of protection).

By integrating switch functionality into the devices, linear topologies can be created that are directly oriented toward an existing machine or plant structure. This reduces cabling overhead and cuts down on components such as external switches.

IWLAN

PROFINET also supports wireless communication with Industrial Wireless LAN, thus opening up new fields of application. For example, technologies subject to wear, such as trailing cables, can be replaced and automated guided vehicle systems and mobile operator panels can be used.

Safety

The PROFIsafe safety profile, which has been tried and tested with PROFIBUS and which permits the transmission of standard and safety-related data on a single bus cable, can also be used with PROFINET. No special network components are necessary for fail-safe communication, which means that standard switches and standard network transitions can continue to be used without any restrictions. In addition, fail-safe communication is equally possible via Industrial Wireless LAN (IWLAN).

Open standard

PROFINET, the open multi-vendor standard (IEC 61158/IEC 61784), is supported by PROFIBUS and PROFINET International (PI). It stands for maximum transparency, open IT communication, network security and simultaneous real-time communication.

Thanks to its openness, PROFINET provides the basis for a standardized automation network in the plant, to which all other machines and devices can be connected. Even the integration of existing plant components, for example using PROFIBUS, presents no problems due to the use of network transitions.

Use of web tools

Thanks to the unrestricted support of TCP/IP, PROFINET permits the use of standard web services such as web servers. Irrespective of the tool used, information from the automation level can be accessed from virtually any location using a commercially available internet browser. This considerably simplifies commissioning and diagnostics. Users can then decide for themselves how much openness to the IT world they want to allow for their machine or plant. This means that PROFINET can be used simply as an isolated plant network or connected via appropriate Security Modules, such as the SCALANCE S modules, to the office network or the internet. In this way, new remote maintenance concepts or the high-speed exchange of production data become possible.

Expandability

On the one hand, PROFINET facilitates the integration of existing systems and networks without any great effort. In this way, PROFINET safeguards investments in existing plant components that communicate via PROFIBUS and other fieldbuses such as AS-Interface. On the other hand, additional PROFINET nodes can be added at any time. By using additional network components, network infrastructures can be expanded using cabling or wireless methods – even while the plant is operating.

Overview

Efficiency

Greater global competition means that companies must use their resources economically and efficiently. This applies in particular to production. This is where PROFINET ensures greater efficiency. Simple engineering guarantees fast commissioning, while reliable devices ensure a high level of plant availability. Comprehensive diagnostic and maintenance concepts help to reduce plant downtimes and keep maintenance costs to a minimum.

One cable for everything

PROFINET permits simultaneous fieldbus communication with isochronous mode and standard IT communication (TCP/IP) on one cable. This real-time communication for the transmission of user/process data and diagnostic data takes place on a single cable. Specific profile communication (PROFIsafe, PROFIdrive and PROFIenergy) can be integrated without any additional cabling. This solution offers a wide scope of functions at a low level of complexity.

Device and network diagnostics

By retaining the tried and tested PROFIBUS device model, the same diagnostics information is available with PROFINET. In addition, module-specific and channel-specific data can also be read out from the devices during device diagnostics, enabling faults to be located quickly and easily. Apart from the availability of device information, the reliability of network operation has top priority in the network management.

In existing networks the Simple Network Management Protocol (SNMP) has established itself as the de facto standard for the maintenance and monitoring of the network components and their functions. PROFINET uses this standard and gives users the opportunity to maintain their networks with tools that are familiar to them, such as the SINEMA Server network management software.

For easier maintenance of PROFINET devices, both on-site and remotely via a secure VPN connection, application-specific websites can be set up on the web server of the field devices using the familiar HTML standard.

Energy efficiency

Moving toward the green factory: PROFIenergy is a profile that provides functions and mechanisms for PROFINET field devices that support energy-efficient production.

The profile, which is defined by the PNO and is independent of any manufacturers or devices, enables energy demand and costs to be significantly reduced: Using PROFIenergy, any specific loads that are not currently being used can be switched off. This achieves a noticeable reduction in energy costs during breaks in production. PROFIenergy permits the simple, automated activation and deactivation of technologically related plant components. It is coordinated centrally by means of a higher-level controller and is networked via PROFINET. This ensures that as much energy as possible is saved during long breaks. Temporarily switching off plant components contributes to the even distribution and most efficient use of energy.

The use of PROFIenergy is made easy for the machine builder by its integration into familiar series of products. In addition, PROFIenergy is defined in such a way that the necessary function blocks can easily be integrated into existing automation systems at a later stage.

Simple wiring

Particularly stringent demands are made on the installation of cables in the industrial environment. In addition, there is a requirement to set up industry-standard networks in the shortest possible time without any special knowledge.

With FastConnect, Siemens offers a high-speed installation system that meets all of these requirements. FastConnect is the standard-compliant, industry-standard cabling system consisting of cables, connectors and assembly tools for PROFINET networks. The time required for connecting terminals is minimized by the simple installation method using just a single tool, while installation errors are prevented by the practical color-coding. Both copper cables and glass fiber optic cables can be easily assembled on site in this way.

Fast device replacement

PROFINET devices are identified by means of a name assigned during configuration. When replacing a defective device, a new device can be recognized from its topology information by the IO controller and a new name can be assigned to it automatically. This means that no engineering tool is necessary for the replacement of equipment.

This mechanism can even be used for the initial commissioning of a complete system. This speeds up commissioning, particularly in the case of series machines.

Ruggedness

An automation network must be able to withstand most external sources of interference. The use of Switched Ethernet prevents faults in one section of the network from affecting the entire plant network. For areas that are particularly prone to radio frequency interference (RFI), PROFINET allows the use of fiber optic cables.

Performance

Productivity and product quality determine the level of success in the market. Precise motion control, dynamic drives, high-speed controllers and the deterministic synchronization of devices are therefore key factors in achieving superior production. They facilitate high production rates and optimum product quality at the same time.

Speed and precision

Fast motion control applications demand precise and deterministic exchange of data. This is implemented by means of drive controllers using isochronous real time (IRT).

With IRT and isochronous mode, PROFINET permits fast and deterministic communication. This synchronizes the various cycles of a system (input, network, CPU processing and output), even in the case of parallel TCP/IP traffic. The short cycle times of PROFINET make it possible to raise the productivity of machines and plants and to guarantee the product quality and high level of precision.

The standardized PROFIdrive profile permits vendor-independent communication between CPUs and drives.

Overview

Large quantity structures

The use of PROFINET makes it possible to overcome the existing restrictions regarding the scope of machines and systems that can be implemented. In one network, several different controllers can interact with their assigned field devices. The number of field devices per PROFINET network is virtually unlimited – the entire range of IP addresses is available.

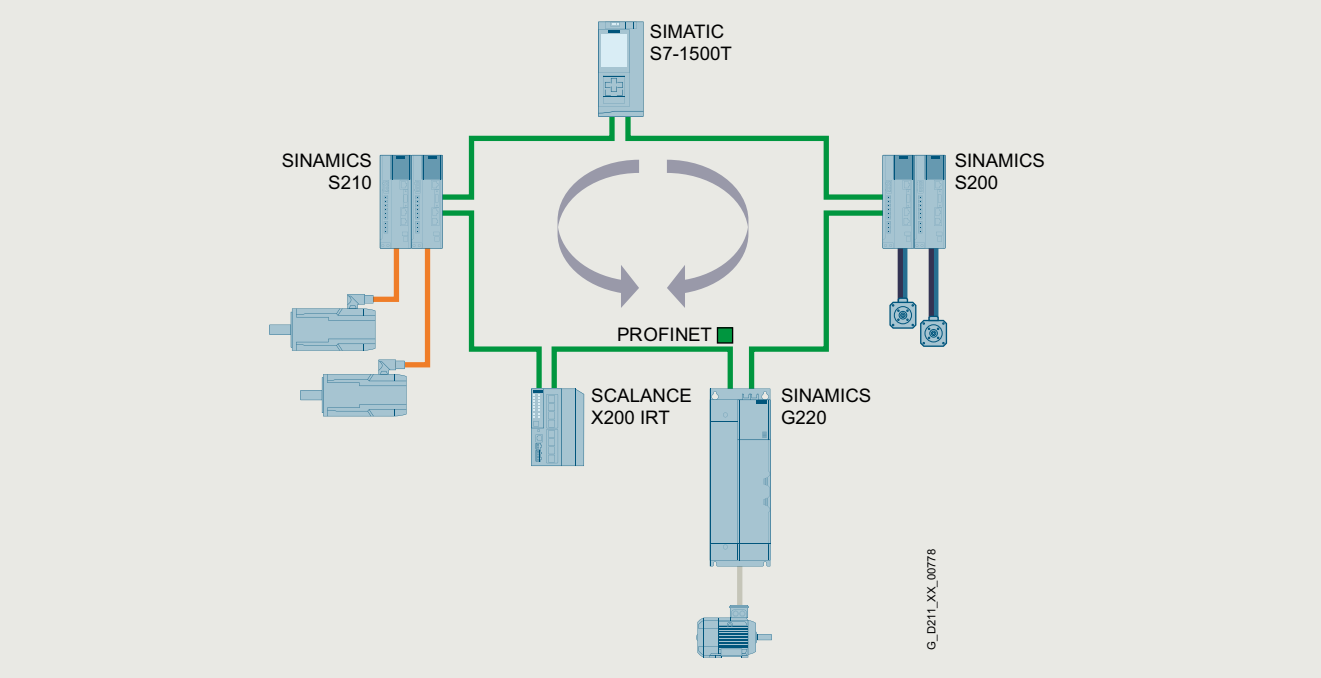
High data rate

By using 100 Mbit/s in full duplex mode, PROFINET achieves a significantly higher data rate than previous fieldbuses. This means that other plant data can be transmitted over TCP/IP without any problems, in addition to the process data. PROFINET therefore meets the combined industrial demands for simultaneously transmitting high-speed IO data and large volumes of data for additional sections of the application. Even the transmission of large volumes of data, such as that from cameras, has no adverse effect on the speed and precision of the IO data transmission, thanks to PROFINET mechanisms.

Media redundancy

A higher plant availability can be achieved with a redundant installation (ring topology). The media redundancy can be implemented not only with the aid of external switches, but also by means of integrated PROFINET interfaces. Using the media redundancy protocol (MRP), reconfiguration times of 200 ms can be achieved. If the communication is interrupted in just one part of the ring installation this means that a plant standstill is prevented and any necessary maintenance or repair work can be performed without any time pressure.

For motion control applications, PROFINET with IRT in ring topologies offers extended media redundancy for planned duplication (MRPD) which operates in a bumpless mode without any reconfiguration time. If communication is interrupted (e.g. a cable break) the process can continue operating without interruption.



Bumpless media redundancy illustrated by example of SINAMICS G220, SINAMICS S210, SINAMICS S200, SIMATIC S7-1500 T and SCALANCE X200IRT

Benefits

- PROFINET is the open Industrial Ethernet standard for automation
- PROFINET is based on Industrial Ethernet
- PROFINET uses TCP/IP and IT standards
- PROFINET is real-time Ethernet
- PROFINET enables seamless integration of fieldbus systems
- PROFINET supports fail-safe communication via PROFIsafe and also via IWLAN

More information

More information is available on the internet at:
www.siemens.com/profinet

Overview

PROFIdrive – the standardized drive interface for PROFINET and PROFIBUS

PROFIdrive defines the device behavior and technique to access internal device data for electric drives connected to PROFINET and PROFIBUS – from basic frequency converters up to high-performance servo controllers.

It describes in detail the practical use of communication functions – device-to-device communication, equidistance and clock cycle synchronization (isochronous mode) in drive applications. In addition, it specifies all device characteristics which influence interfaces connected to a controller over PROFINET or PROFIBUS. This also includes the state machine (sequence control), the encoder interface, scaling of values, definition of standard telegrams, access to drive parameters, etc.

The PROFIdrive profile supports both central as well as distributed motion control concepts.

What are profiles?

For devices and systems used in automation technology, profiles define properties and modes of behavior. This allows manufacturers and users to define common standards. Devices and systems that comply with such a cross-manufacturer profile, are interoperable on a fieldbus and, to a certain degree, can be interchanged.

Are there different types of profiles?

A distinction is made between what are known as application profiles (general or specific) and system profiles:

- Application profiles (also device profiles) predominantly refer to devices (e.g. drives) and include an agreed selection regarding bus communication as well as specific device applications.
- System profiles describe classes of systems, including master functionality, program interfaces and integration resources.

Is PROFIdrive fit for the future?

PROFIdrive has been specified by the PROFIBUS and PROFINET International (PI) user organization, and is specified as a standard that is fit for the future through standard IEC 61800-7.

The basic philosophy: Keep it simple

The PROFIdrive profile tries to keep the drive interface as simple as possible and free from technology functions. As a result, referencing models as well as the functionality and performance of the PROFINET/PROFIBUS master have either no or only little influence on the drive interface.

One drive profile – different application classes

The integration of drives into automation solutions depends very strongly on the particular drive application. In order to be able to address the complete, huge bandwidth of drive applications – from basic frequency converters up to synchronized multi-axis systems with a high dynamic performance – using just one profile, PROFIdrive defines six application classes, to which most drive applications can be assigned:

- Class 1 – standard drives (pumps, fans, agitators, etc.)
- Class 2 – standard drives with technological functions
- Class 3 – positioning drives
- Class 4 – motion control drives with central, higher-level motion control intelligence and the patented "Dynamic Servo Control" positioning concept
- Class 5 – motion control drives with central, higher-level motion control intelligence and position setpoint interface
- Class 6 – motion control drives with distributed motion control intelligence integrated in the drives

Design

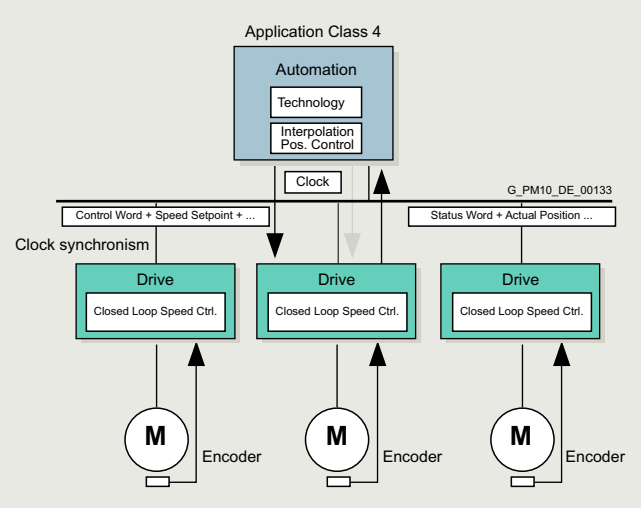
The device model of PROFIdrive

PROFIdrive defines a device model comprising function modules, which interoperate inside the device and which reflect the intelligence of the drive system. These modules have objects assigned to them which are described in the profile and are defined with respect to their functions. The overall functionality of a drive is therefore described through the sum of its parameters.

In contrast to other drive profiles, PROFIdrive defines only the access mechanisms to the parameters as well as a subset of profile parameters (approx. 30) such as the fault buffer, drive control and device identification.

All other parameters are vendor-specific which gives drive manufacturers great flexibility with respect to implementing control functions. The elements of a parameter are accessed acyclically over data records.

As a communication protocol, PROFIdrive uses DP-V0, DP-V1, and the DP-V2 expansions for PROFIBUS including the functions "Device-to-Device Communication" and "Isochronous Operation", or PROFINET IO with real-time classes RT and IRT.



More information

More information on PROFINET and PROFIBUS is available at:
www.profibus.com

Overview

Ethernet is the basic internet technology for worldwide networking. The many possibilities of intranet and internet, which have been available for office applications for a long time, are now utilized for production automation with Industrial Ethernet.

Apart from the use of information technology, the deployment of distributed automation systems is also on the increase. This entails breaking up complex control tasks into smaller, manageable and drive-based control systems. This increases the demand for communication and consequently a comprehensive and powerful communication system.

Industrial Ethernet provides a powerful area and cell network for the industrial field, compliant with the IEEE 802.3 (ETHERNET) standard.

Benefits

Ethernet enables a very fast data transfer (10/100 Mbit/s, 1/10 Gbit/s) and at the same time has full-duplex capability. It therefore provides an ideal basis for communication tasks in the industrial field. With a share of over 90 %, Ethernet is the number one network worldwide and offers important features which have essential advantages:

- Fast commissioning thanks to the simplest connection method
- High availability since existing networks can be extended without any adverse effects
- Almost unlimited communication performance because scalable performance is available through switching technology and high data rates when required
- Networking of different application areas such as office and production areas
- Company-wide communication based on WAN (Wide Area Network) technology or the internet
- Investment protection due to continuous compatibility with further developments
- Wireless communication using Industrial Wireless LAN

In order to make Ethernet suitable for industrial applications, considerable expansions with respect to functionality and design are required:

- Network components for use in harsh industrial environments
- Fast assembly of the RJ45 connectors
- Fail-safety through redundancy
- Expanded diagnostics and message concept
- Use of future-oriented network components (e.g. switches)

SIMATIC NET offers corresponding network components and products.

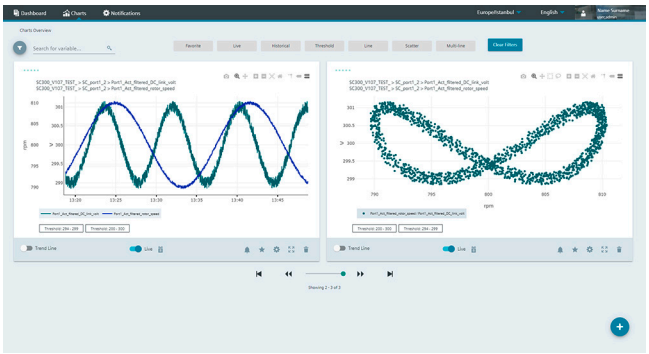
Overview

Ethernet Industrial Protocol (EtherNet/IP) is an open standard for industrial networks. EtherNet/IP is used to transmit cyclic I/O data and acyclic parameter data. EtherNet/IP was developed by the ODVA (Open DeviceNet Vendor Association) and belongs to the international standard series IEC 61158.

More information about the Digitalization in drive technology topic is available at:
www.siemens.com/digital-drives

Analyze MyDrives Cloud

Overview



Analyze MyDrives Cloud overview

The Industrial IoT, Insights Hub application Analyze MyDrives allows you to centrally monitor drive systems in the manufacturing and process industry.

Data, such as electricity consumption, torque, frequency, and power flow, for example, are gathered and evaluated giving you a holistic overview of the electrical and mechanical domain of your drive train in one application.

Analyze MyDrives offers a range of filter options, trend analysis with time sequences and scatter plots, and an email-based notification service built around configurable limit values.

Key features include:

- Customizable and easy-to-use dashboard showing the actual status of the drive system
- View hour-by-hour, daily average and historical utilization at a glance
- Create multi-line charts or scatter plots to monitor and compare different parameters
- Adjustable, event-based notification system to give you more control over your notifications
- Import relevant vibration and status variables from SIPLUS Condition Monitoring Systems SM 1281

Benefits

- Easy overview of all relevant drive system and machine vibration data
- Simplify maintenance schedule and easily keep track of your drive system
- Understand machine performance over time, in comparison to other machines/ parameters
- Detect problems before they arise, enabling preventive maintenance and better maintenance scheduling
- Get a combined overview of the electrical and mechanical domain in one app

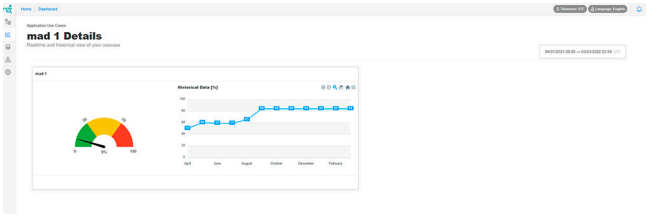
More information

This product can only be ordered via S-DEX, Industrial IoT store. Please find the link below for Analyze MyDrives Cloud on S-DEX, Industrial IoT store.

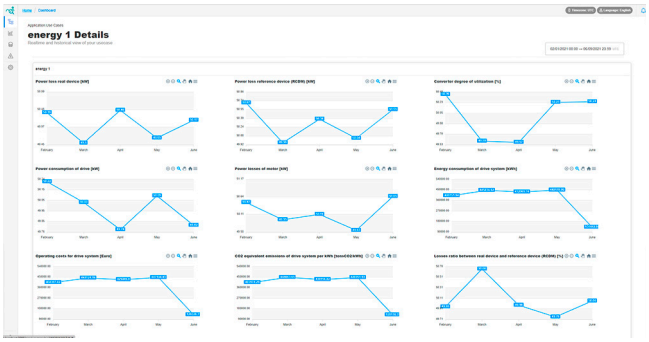
www.siemens.com/order-analyze-mydrives

Overview

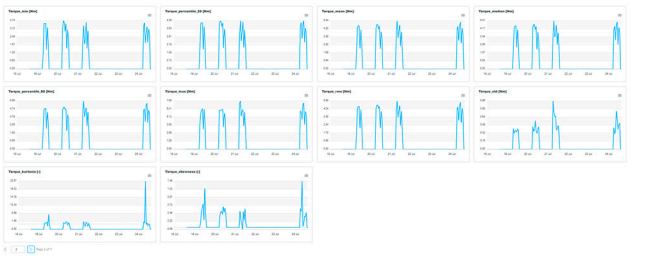
Drivetrain Analyzer Edge Product Details



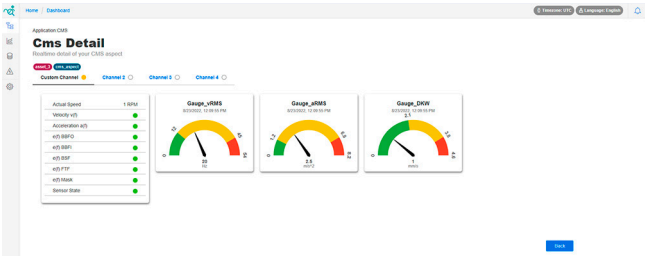
Drivetrain Analyzer Edge – Mechanical Anomaly Detector feature



Drivetrain Analyzer Edge – Energy Efficiency feature



Drivetrain Analyzer Edge – Basic Anomaly Detection feature



Drivetrain Analyzer Edge – CMS feature

Drivetrain Analyzer Edge provides data analytics models to increase the Overall Equipment Effectiveness and sustainability of all connected systems and applications by analyzing SINAMICS drives data.

Key features

- Detect deviations in the mechanical system with the Mechanical Anomaly Detector through drive data analysis.
- Get insights into the energy consumption including operation costs and CO2 footprint for the 2nd generation SINAMICS G drives through the Energy Efficiency feature.
- Monitor your drivetrain condition through the vibration data from SIPLUS CMS 1200 and the integrated CMS Dashboard.
- Monitor drivetrain anomalies specific to your application with the customizable AI model get operational insights into long-term degradation trends of your drivetrain through the Basic Operation Analysis as well as into dynamic and repetitive processes through the Dynamic Operation Analysis.

Benefits

- Increase the Overall Equipment Effectiveness of connected systems without the need for additional sensors or extended commissioning efforts.
- Optimize the service and maintenance strategies through analytics models for mechanical anomalies or connected SIPLUS CMS 1200 systems.
- Sustainability insights into the drive system, energy consumption, operating costs and CO2 footprint.
- Operational insights into dynamic and repetitive operating modes as well as long-term degradations.
- Flexible application design for the extension to address user specific use cases and failure patterns.
- Enable interactive workflows for the shopfloor through the extension of the Industrial Edge application with additional services (e.g. Industrial Edge Notifier).

More information

You can find Drivetrain Analyzer Edge manual at:
https://support.industry.siemens.com/cs/document/109827091

This product can also be ordered via S-DEX,
Industrial Edge Marketplace store. Please find the link below for Drivetrain Analyzer Edge on S-DEX,
Industrial Edge Marketplace store.
www.siemens.com/order-drivetrain-analyzer-edge

SIPLUS CMS1200 Condition Monitoring System

Overview

The SIPLUS CMS1200 Condition Monitoring System is part of SIMATIC S7-1200 and is designed for the early detection of mechanical damage.

It provides the following benefits:

- vRMS machine monitoring in acc. with ISO 10816-3
- aRMS machine monitoring
- Detailed identification of damage with frequency-selective diagnostics
- Raw data recording and export for SIPLUS CMS X-Tools
- Trend recording and analysis
- Signaling of limit violations
- Permanent monitoring to protect the machines
- Effective monitoring of important processes and systems
- Early detection of damage
- Scheduled maintenance instead of spontaneous repair
- Reduction in maintenance costs
- Increase in system availability
- Optimum utilization of the service life of the units

Benefits

Easy integration of condition monitoring of mechanical components in SIMATIC S7-1200

Further advantages include:

- Monitoring of individual machines up to complex drive trains
- No additional software is required for parameterization and visualization
- Proactive maintenance through detailed and early localization of damage
- Fast full diagnostics at a glance
- Event-driven notification to the Service Center
- Expert analysis based on raw data

Application

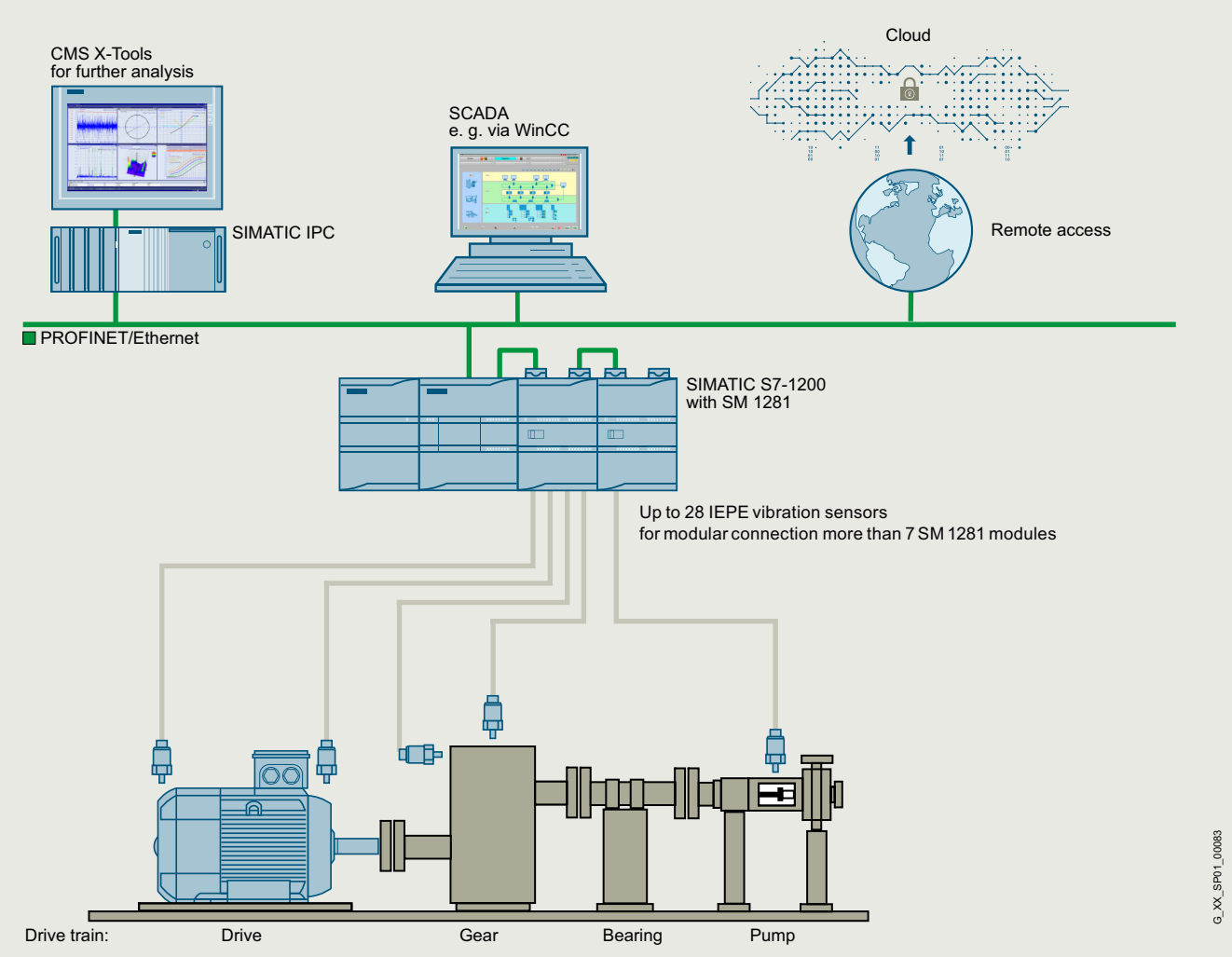
In addition to the productivity of a plant, lifecycle costs are increasingly becoming the focus of attention. Increasing plant availability is an important topic in all sectors in which machines are used.

Continuous plant monitoring and thus the early detection of impending failures are an appropriate means of minimizing downtimes. Status-oriented maintenance permits an increase in availability with a simultaneous reduction of lifecycle costs.

As part of the SIMATIC S7-1200, the Condition Monitoring System is simple to integrate via the TIA Portal (Totally Integrated Automation) engineering framework.

Fundamental parameter assignment and characteristic value-based diagnostics of the SIPLUS CMS1200 take place via the TIA Portal, and frequency-selective diagnostics take place via a web browser.

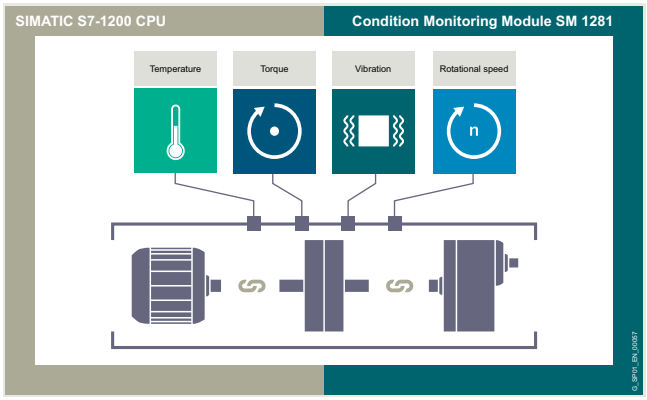
Design



SIPLUS CMS1200 Condition Monitoring System

SIPLUS CMS1200 forms part of SIMATIC S7-1200 and is made up of a maximum of 7 SM 1281 Condition Monitoring modules.

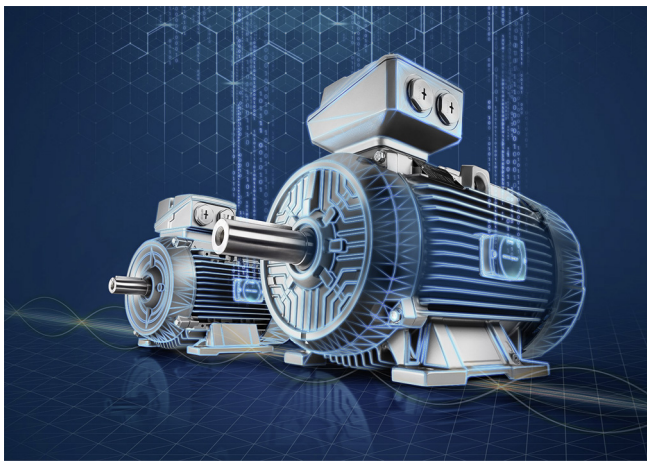
Application range:	
Mechanical components	Motors, generators, fans, pumps, wind mills, etc.
Damage analysis	Unbalance, misalignment, roller bearings, etc.
Analytical procedures:	
Characteristic values	• Bearing monitoring: aRMS • Vibration monitoring: vRMS based on ISO 10816-3 • Diagnostic characteristic value: DKW
Vibration analysis	FFT, envelope curve, fingerprint comparison, trend analysis parameterizable
Monitoring function:	
Characteristic values	Adjustable limiting value for aRMS, vRMS and DKW: Warning, alarm
Frequency spectra	Adjustable warning and alarm bands
Recording function	
Saving	Raw data logging: Manually or event-triggered, FFT snapshot, characteristic values, long-term trend recording
Output	
Parameterization and visualization	TIA Portal and web browser



SM 1281, connections

SIDRIVE IQ Fleet

Overview



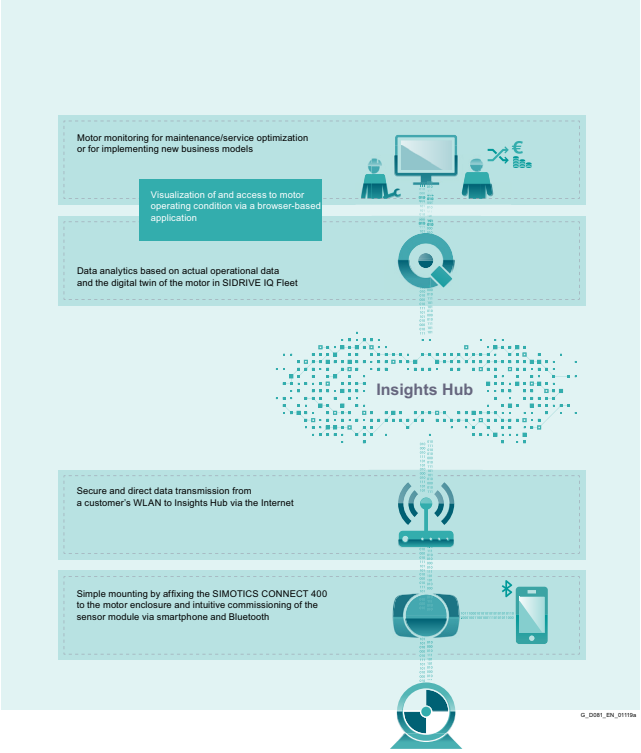
Drive systems keep production running and play a key role in countless production processes. Faults or the failure of individual drive components often result in costly production outages, which is why it's so important to monitor the condition of the machine park.

The prevention of failures through timely and planned action requires end-to-end operational transparency and measures such as targeted, proactive maintenance.

With the plug&play connectivity module SIMOTICS CONNECT 400 and the analytics app SIDRIVE IQ Fleet, you can implement a cost effective, cloud-based solution for continuous condition monitoring and comprehensive fleet management of your low-voltage motors – worldwide and 24/7.

Your low-voltage motors are equipped with SIMOTICS CONNECT 400, a connectivity module for measuring and preprocessing the motor-specific status data that's analyzed in SIDRIVE IQ Fleet.

Whether you're monitoring new motors or flexibly upgrading your installed base – in many use cases, the SIDRIVE IQ Fleet Insights Hub application improves the reliability, availability, efficiency, performance, and productivity of your low-voltage motors. You take advantage of preventive maintenance for your motors using reliable status data and information on maintenance intervals.



Besides monitoring the actual health of your motor fleet, the cloud-based SIDRIVE IQ Fleet application embedded in the Insights Hub ecosystem provides nearly endless opportunities for customer business models.

Enabling new digital business models is a key feature and differentiator in the architecture of SIDRIVE IQ Fleet.

Plug&play is key:

Installation, commissioning and configuration of SIMOTICS CONNECT 400 is as easy as it gets. Operators have the system up and running within minutes.

Data is transferred automatically and therefore guarantees a continuous condition monitoring of your motor fleet.

Benefits

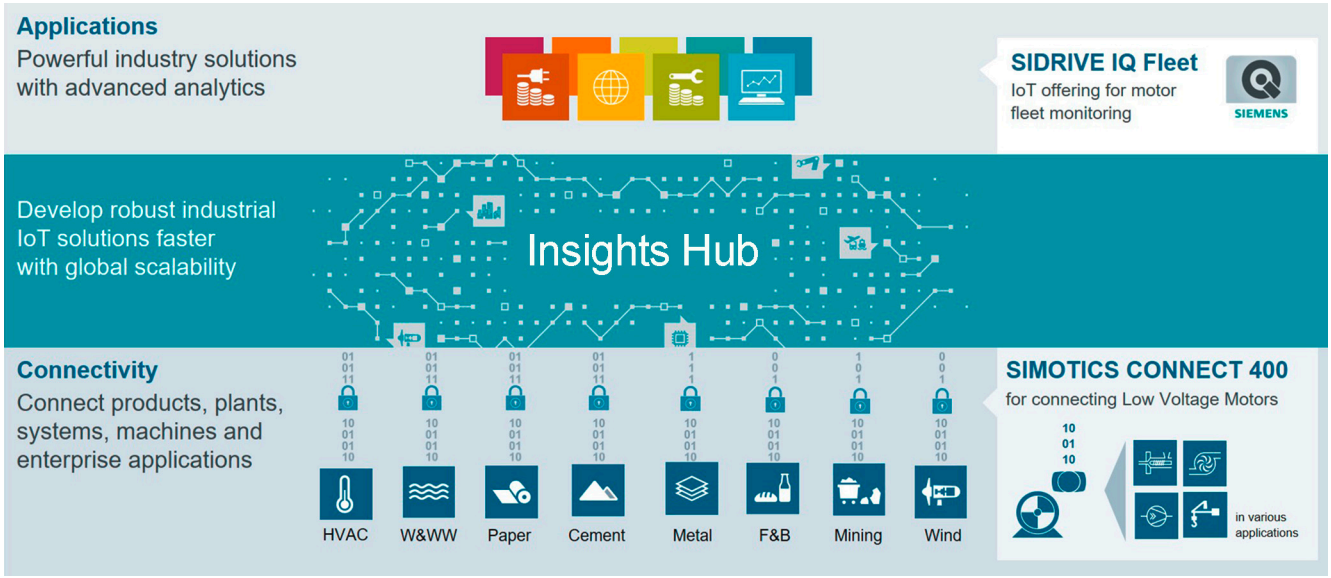
- Simplicity and user-friendliness:
  - Simple mounting by gluing the sensor module SIMOTICS CONNECT 400 to the motor
  - Fast commissioning and configuration, thanks to the intuitively operated smartphone app SIDRIVE IQ Config
  - Use of standard network hardware (no manufacturer-specific gateways needed)
- Autonomous design: Power supply via battery pack and data transfer via WLAN require no connecting cables
- Optimized serviceability: Simple as well as ecologically and economically practical maintenance by replacing the battery pack
- Optimum operational transparency: SIMOTICS CONNECT 400 and SIDRIVE IQ Fleet help machine operators to better understand their machines and all relevant components. With knowledge of how the motors are currently running and what changes in operation have occurred, it's possible to make predictions about operational performance in the future.
- Anomaly detection and trend analyses based on historical data for optimizing your plant
- Adjustable limit values and automated alarms help you to detect impending failures well in advance and prevent them through maintenance activities
- Take advantage of our expert knowledge of drive technology by taking into account operational data (including historical), digital twins of the motors, intelligent algorithms, and analytics
- Access to cloud-based analytics in Insights Hub from any terminal device via a web browser, without software installation

Higher data quality and precision for Siemens motors, thanks to the use of equivalent electrical circuit diagrams, product-specific data from production, and other additional elements from the digital twin of the motor.

Integration

Insights Hub – the Siemens IoT-as-a-service solution

Insights Hub is the leading industrial IoT as a service solution. Using advanced analytics and AI, Insights Hub powers IoT solutions from the edge to the cloud – with data from connected products, plants and systems – to optimize operations, create better quality products and deploy new business models. Insights Hub empowers customers and partners to quickly build and integrate personalized IoT applications or utilize the existing ones, such as SIDRIVE IQ Fleet.



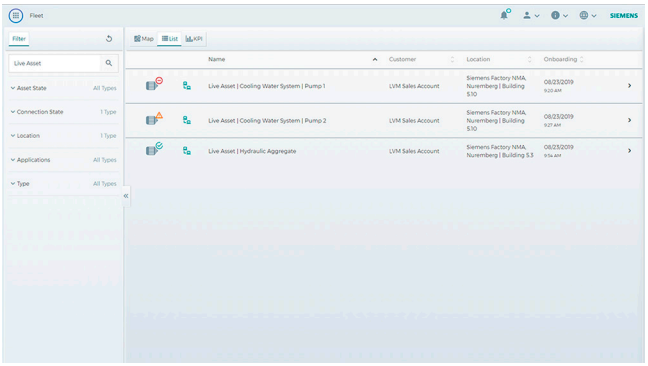
SIEMENS

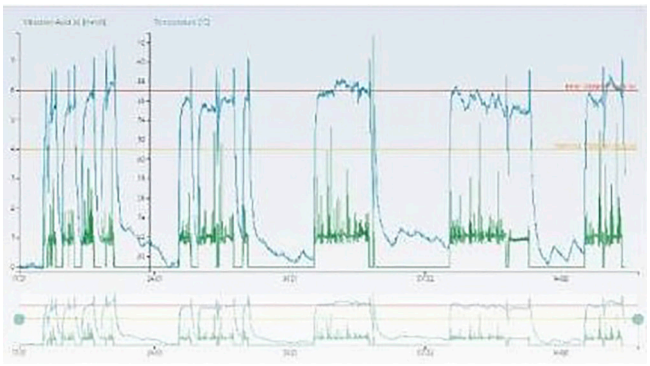
SIDRIVE IQ Fleet – cloud-based solution for motor monitoring

The Insides Hub application SIDRIVE IQ Fleet allows you to access all relevant data of your installed motors.

The application includes a variety of functions which assist you in managing motors' maintenance and operations. SIDRIVE IQ Fleet provides you with aggregated statistics and localization of your fleet, as well as individual KPIs, logbook, motor profile and product documentation.

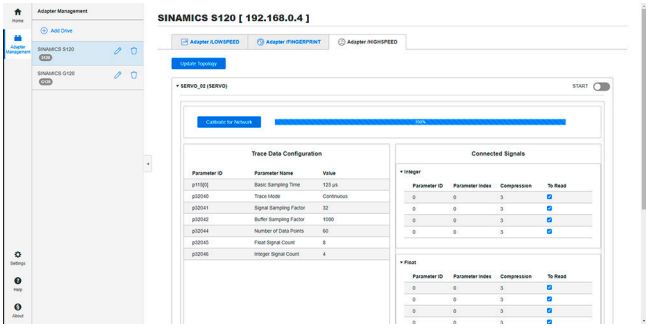
By using SIDRIVE IQ Fleet you can optimize your fleet maintenance tasks, reduce unscheduled downtime and increase your plant availability.



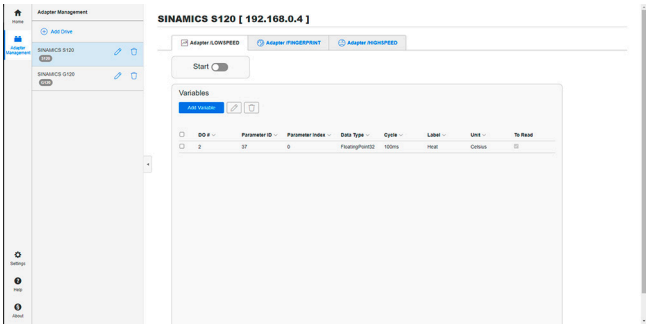


Overview

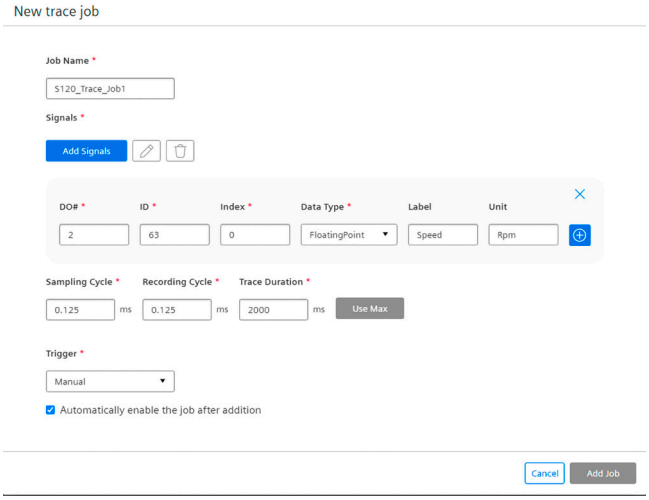
Drive Connector SINAMICS product details



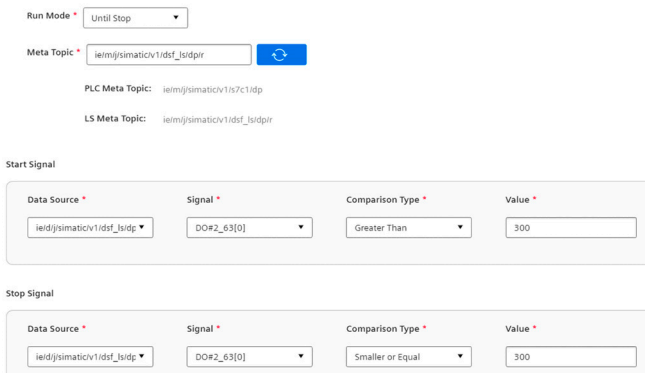
Drive Connector SINAMICS – High-Speed-Adapter



Drive Connector SINAMICS – Low-Speed-Adapter



Drive Connector SINAMICS – Fingerprint-Adapter



Drive Connector SINAMICS – Fingerprint-Adapter - Fingerprint triggering via IE-Databus

Drive Connector SINAMICS is an Industrial Edge application which supports easy connectivity with 2nd generation SINAMICS drives.

Drive Connector SINAMICS provides three adapters:

- High-Speed-Adapter (HS Adapter)
  - Supports CU320-2 Control Unit based drives SINAMICS S120, S150, G130, G150.
  - Supports continuous data streaming up to 8 kHz. Maximum speed depends on network and drive configuration.
  - Requires the extension TRCDATA running on CU320-2 Control Unit.
- Fingerprint-Adapter (Fingerprint)
  - Supports all 2nd generation SINAMICS S and SINAMICS G drives which support drive internal trace functionality.
  - Supports Trace configuration (e.g. number of parameters, sampling cycle, Trace duration).
  - Generates time defined snapshot of the drive data.
  - Fingerprint triggering via IE-Databus enables the user to trigger fingerprint traces via the signals that are published on IE-Databus by other IE applications (e.g. external devices such as PLCs).
  - Fingerprint-Adapter enables the user to receive traces that are configured via commissioning tools STARTER or SINAMICS Startdrive by Fingerprint-Adapter.
- Low-Speed-Adapter (LS Adapter)
  - Supports 2nd generation SINAMICS S and SINAMICS G drives.
  - Supports continuous data streaming up to 10 Hz.

Drive Connector SINAMICS has a dedicated Drive Status Information page for each connected 2nd generation SINAMICS drive.

- Provides basic nameplate information (article number, serial number and firmware) for connected drive objects of each connected 2nd generation SINAMICS drive.
- Provides drive status and temperature information for existing drive objects of each connected 2nd generation SINAMICS drive.

Other features:

- Export and import single drive configuration or single adapter configuration for Low-Speed and Fingerprint-Adapter into a new drive or a new adapter.
- Low-Speed-Adapter Simulator enables the user to simulate drive data (without a real drive) in the same format as LS adapter to be used in other IE applications such as Drivetrain Analyzer Edge.
- The web interface of Drive Connector SINAMICS supports configuration and starting the data acquisition process in a straightforward manner.
- By configuring Drive Connector SINAMICS, the target drive, drive object and signals can be selected easily.

Key features

Drive Connector SINAMICS provides continuous connection between 2nd generation of SINAMICS Drives and Edge Databus with following adapters:

- High-Speed-Adapter supports continuous data acquisition up to 8 kHz via Technology extension TRCDATA.
- Fingerprint-Adapter generates time defined snapshot of the drive data and supports data acquisition up to 2 kHz.
- Low-Speed-Adapter supports continuous data acquisition up to 10 Hz.

Benefits

- Provides transparency about the status of the drive system at any time in high quality.
- Enables basic and advanced analytics and maintenance scheduling like Mechanical Anomaly Detector and Basic Anomaly Detection.
- Enables basic statistics like Energy Efficiency.
- Opens doors for new innovative analysis approaches.
- Highly expandable with other Industrial Edge applications.
- Easy update on app functionality through central Industrial Edge Management system.
- Collects drive data for defined machine operational state by fingerprint triggering via IE-Databus functionality or trace configuration via commissioning tools STARTER or SINAMICS Startdrive.

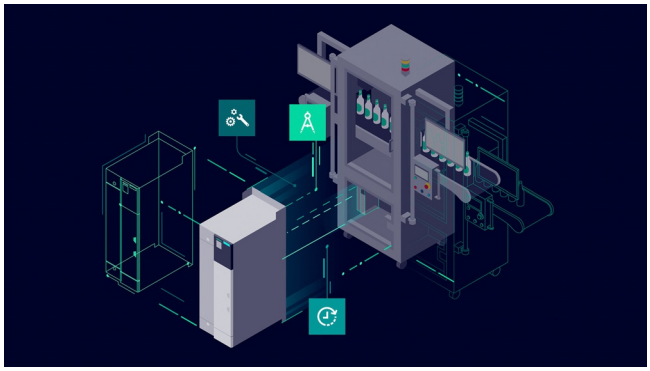
More information

You can find the manual and additional information of Drive Connector SINAMICS at:
https://sieportal.siemens.com/su/bjTFD

This product can also be ordered via S-DEX, Industrial Edge Marketplace store. Please find the link below for Drive Connector SINAMICS on S-DEX, Industrial Edge Marketplace store.
www.siemens.com/order-drive-connector-sinamics

DriveSim Designer

Overview



DriveSim Designer provides easy-to-use models for PROFIdrive-enabled SINAMICS converters, so you can create a digital twin of your drive.

The models are validated and tested against real SINAMICS converters and are available in the form of a standardized FMU (Functional Mockup Unit). Therefore, they are compatible with various standard time-based simulation programs such as SIMIT, Simcenter Amesim, ANSYS Twin Builder, MATLAB Simulink or Hopsan.

DriveSim Designer is another element in your engineering toolbox. Together with other virtual Siemens solutions, e.g. SIMATIC S7-PLCSIM Advanced or NX Mechatronics Concept Designer, a consistent model-based development process can be implemented.

Benefits

- Speed up time-to-market for OEMs
- Test validated SINAMICS models under real conditions already at the design or planning stage and make needed adjustments
- Identify issues and improvement capabilities early in the design stage and reduce testing effort to save time and cost
- Download the free-of-charge basic version with reduced functionality set, DriveSim Basic, to try the suitability of our solution before buying it
- The full version DriveSim Designer offers a wide range of additional functionalities to improve the SINAMICS simulation model, e. g. safety or position telegrams
- Valid for the most used Siemens drives

Advantages of DriveSim Designer compared to SIMIT PROFIdrive blocks:

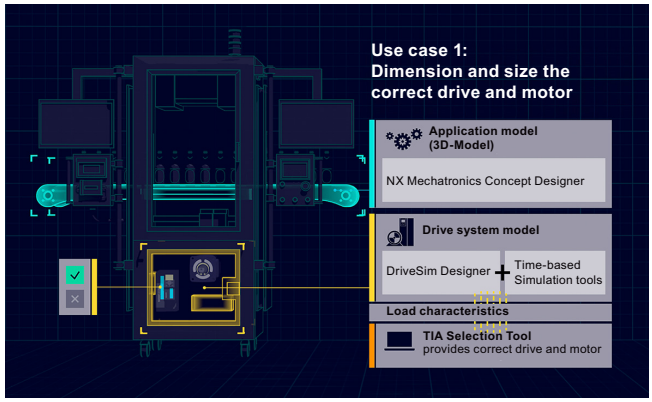
- Increased level of detail due to speed controller, current setpoint filters and internal load model
- Identical parameter values and meaning as in the real SINAMICS device
- Direct reference to SINAMICS documentation
- Basic Safety functions
- Brake control functions for lifting applications
- Validated against the real SINAMICS drive
- No wiring effort to represent functional configurations
- Significant reduction of SIMIT simulation tags (even more is possible if unused in-/ outputs are deselected within the Component Type Editor (CTE)
- Enables simulation of an (internal) two-mass oscillator as application with realistic SINAMICS parameter settings, besides the known limitations by the minimum sample time in SIMIT
- Compatible with every FMU Co-Simulation 2.0 compatible simulation too

Application

With DriveSim Designer, you can implement three major use cases:

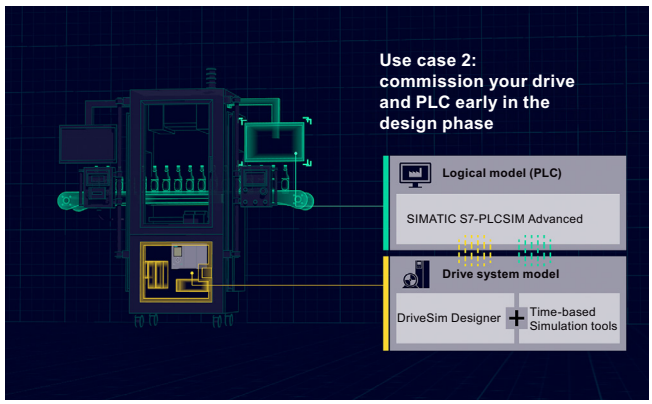
- Providing load characteristics for drive selection and dimensioning
- Virtual commission your PLC already in the design phase
- Test and improve interaction between PLC, drives and application virtually

Use case 1: Dimension and size the correct drive and motor for your application



If you are designing a machine, you want to make sure that you select the SINAMICS converter and SIMOTICS motor most suitable for your drive application. As DriveSim Designer is control-unit-agnostic and thus represents a generic drive, you can parametrize it according to the functionality of your application. Running the simulation results in load characteristics, i.e. torque or speed curves over time. You can import these load profiles into TIA Selection Tool to select the suitable Control Unit and dimension the drive to best fit to the demand. So as a result you have well selected SINAMICS converters and SIMOTICS motors with the help of the digital twin.

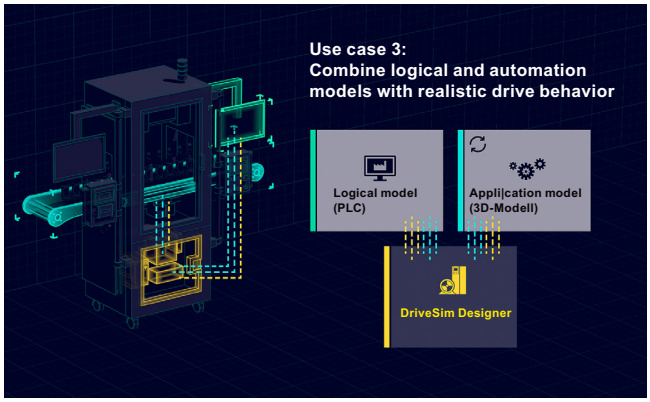
Use case 2: Virtual commission your drive and PLC early in the design phase



If you are designing a machine, you want to make sure the PLC code works with your SINAMICS drive. After writing the PLC code in TIA Portal, you can connect it via PLCSIM Advanced to any time-based simulation tool (e.g. SIMIT). Integrated into the simulation tool, DriveSim Designer acts as a realistic communication partner for the PLC. Next, you can commission the virtual PLC in TIA Portal as you would do with a real PLC connected to a real drive. Without simulation, you would need to do that on-site. With simulation, you not only save time, but also have the freedom to try out various configurations and optimize your PLC code early in the process.

Application

Use case 3: Combine the application model and automation model with realistic drive system behavior



With the third Use case, you can connect a simulation tool such as NX Mechatronic Concept Designer to visualize the mechanical movements of your application. This way, you ensure that the drive behaves according to the desired machine performance. You can test several fault scenarios and optimize the interaction between PLC, application and drive virtually so overall, you can avoid unplanned machine behavior and increase the performance of your setup.

Integration

DriveSim Designer can be run in tools that support FMU 2.0 Co-Simulation Import (https://fmi-standard.org/tools/).

The FMU has been tested in the following simulation environments and is available in the attached application examples.

Tool	Manufacturer	DriveSim*** variant	PLC Sim Advanced interface	Notes
SIMIT	Siemens	***.fmu	Yes	• Permissible configuration: ExternalLoad = 1 & . Speed-Controller = 0 or ExternalLoad = 0 & . Speed-Controller = 1 • Simulation with external load can provide wrong results because the minimum possible time step is 1 ms
Simcenter Amesim	Siemens	***_double.fmu	Yes	
MATLAB Simulink	MathWorks	< 2019a ***_unstruct.fmu ≥ 2019a ***.fmu	Yes	
ANSYS Twin Builder	ANSYS	***.fmu	No	
Hopsan	Linköping University	***_double.fmu	No	• Open Source • Install "win64-with_compiler-installer.exe" package

Selection and ordering data

Description	Article No.
DriveSim Designer	**9SV1110-3AA00-0AA0**

More information

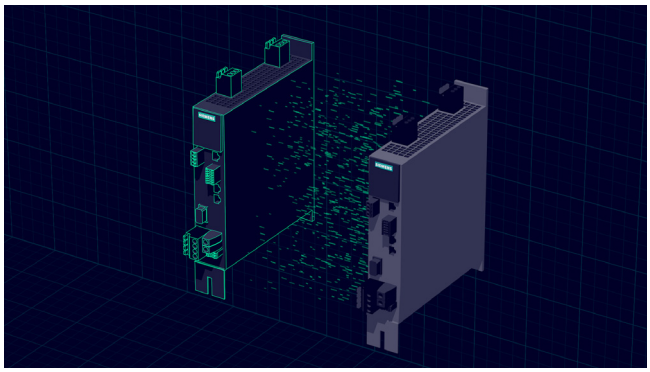
More information is provided on the internet at:
www.siemens.com/drive-virtualization
https://support.industry.siemens.com/cs/document/109812859

You can find more videos on the topic at:

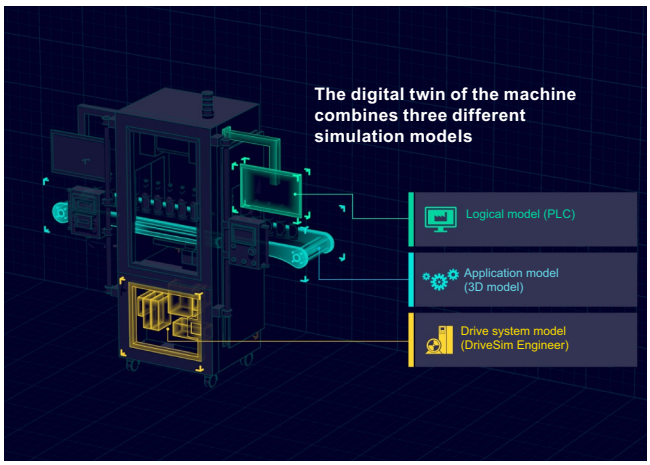
- Simulation of drive systems - Quick, Easy and Validated
- Simulation of drive systems - An introduction to SINAMICS
- Getting started with DriveSim Designer
- How to import DriveSim Designer into SIMIT, Matlab Simulink, Amesim and ANSYS TwinBuilder
- How to connect DriveSim Designer via PLCSim Advance to TIA Portal
- How to use DriveSim Designer for drive sizing with TIA Selection Tool
- How to visualize drive system behavior in NX Mechatronics Concept Designer

SINAMICS DriveSim Engineer

Overview



In summary, DriveSim Engineer is a powerful tool that provides a complete digital twin of the next generation of SINAMICS converters SINAMICS G220 and SINAMICS S210 (New), ensuring unparalleled accuracy and reliability.
With its seamless integration into the TIA Portal and SINAMICS Startdrive, the advanced level of customization, the detailed and intuitive interface, it is the ultimate solution for optimizing your drive train system.



DriveSim Engineer is an innovative solution that combines drive simulation and virtual commissioning. With this powerful combination, you can optimize your drive systems, test and validate your projects and ensure that your drive systems function correctly prior to the installation.
DriveSim Engineer is the ultimate solution for optimizing your drive systems. With its advanced technology and user-friendly interface, you can simulate and optimize the performance of your drive systems to meet the demands of your processes.
DriveSim Engineer is the solution you have been searching for to improve efficiency, productivity, as well as the overall performance of your drive systems.

The complete digital twin of the real SINAMICS firmware for the next generation of SINAMCS converters SINAMICS G220 and SINAMICS S210 (New) ensures that all parameters and configurations are identical to those of the real drive, providing unparalleled accuracy and reliability.

DriveSim Engineer is a software-dependent solution that works seamlessly with the TIA Portal and SINAMICS Startdrive, eliminating the need for additional simulation tools. Its low-level interaction with the current control loop of the real drive ensures that the behavior is validated and verified, making it a reliable partner for optimizing your drive train system.

What sets DriveSim Engineer apart is its advanced level of customization and detail, allowing for more accurate testing and optimization of the drive train system. Its intuitive interface enables the fast set-up and configuration of your digital twin as well as the simulation of different operating conditions and scenarios.

Whether you are designing, commissioning or optimizing your drive train system, DriveSim Engineer is the tool you need. Its advanced features and high level of accuracy make it an essential tool for the best possible system performance.

Benefits

- Reduce costs and time: Eliminate the need for on-site visits, reduce costs and speed up the commissioning process.
- Testing and optimization of the drive train system without material damage.
- Improved accuracy: Perform precision simulations and tests on your systems, ensuring that they are optimized before the actual purchase.
- Increased flexibility: Make changes to your systems quickly and easily with flexibility to respond to the changes in your project requirements.
- Train the engineers and new users with the help of the virtual twin acting as a realistic partner.
- Virtual demonstration of the SINAMICS converters (prior to mounting or purchase).
- Diagnose and validate the faults or issues in the real environment and fix them with the help of the simulation without any risk of material damage and save resources (lower maintenance and downtime time, i.e. lower costs) without time pressure on the plant side.
- Identify issues and improvement capabilities early in the design stage and reduce testing effort to save time and cost.
- Valid for the next generation of SINAMICS converters SINAMICS G220 and SINAMICS S210 (New).

Application

DriveSim Engineer can be implemented in three major use cases.

Use case	Old approach	Advantages of the new approach with DriveSim Engineer
Virtual commissioning and engineering of the next generation of SINAMICS converters SINAMICS G220 and SINAMICS S210 (New) prior to the mounting	Commissioning of the converters after mounting or purchase	• Saving of resources (lower maintenance and shorter downtime, i.e. lower costs) • No time pressure in the real installation, quick and fast reconfiguration of the system • Improved accuracy of the drive train system in detecting and resolving potential issues • Virtual commissioning helps ensure that the system is future-proof by incorporating the latest technologies and design standards.
Virtual training and demonstration of the next generation of SINAMICS converters SINAMICS G220 and SINAMICS S210 (New) for engineers and new users	Trainings and demonstrations on the plant side (not in advance)	• Virtual trainings and demonstrations in advance with the digital twin acting as a realistic partner • Make the changes to your systems quickly and easily. • Show and use different application (drives) just on one computer (no need for demo cases). • Traveling costs for trainings and demonstrations will not rise. Everything can be done virtually and in advance (before the hardware is purchased or released).
Diagnose and validate the faults or issues in the real environment and fix them with the digital twin (optimization of the real machine)	Faults and issues of the system are solved on the plant side	• Saving of resources (lower maintenance and shorter downtime, i.e. lower costs) • No time pressure in the real installation, quick and fast reconfiguration of the system • Improved accuracy of the drive train system in detecting and resolving potential issues • Virtual commissioning helps ensure that the system is future-proof by incorporating the latest technologies and design standards.

Integration

DriveSim Engineer is directly integrated in TIA Portal and SINAMICS Startdrive, i.e. different software tools are not necessary. Only the installation of DriveSim Engineer and TIA Portal with SINAMICS Startdrive is required.

Selection and ordering data

Description	Article No.
DriveSim Engineer V1.1 - Perpetual license (unlimited)	**9SV1210-4AA00-0AA0**
DriveSim Engineer V1.1 - Subscription (1 year license)	**9SV1210-3AA00-0AA0**

More information

More information is provided on the internet at:
www.siemens.com/drive-virtualization

Notes

Appendix

10

Certificates of suitability (approvals)

Overview

Many of the products in this catalog fulfill requirements, e.g. for UL, CSA or FM and are labeled with the corresponding approval designation.

All of the certificates of suitability, approvals, certificates, declarations of conformity, test certificates, e.g. CE, UL, Safety Integrated etc. have been performed with the associated system components as they are described in the Catalogs and Configuration Manuals.

The certificates are only valid if the products are used with the described system components, are installed according to the Installation Guidelines and used for their intended purpose.

In other cases, the vendor of these products is responsible for arranging for the issue of new certificates.

Test code	Tested by	Device series/ Component	Test standard	Product category/ File No.
UL: Underwriters Laboratories Independent public testing body in North America				
	UL according to UL standard	SINUMERIK	Standard UL 508, CSA C22.2 No. 142	NRAQ/7.E164110 NRAQ/7.E217227
		SIMOTION	Standard UL 508, CSA C22.2 No. 142	NRAQ/7.E164110
	UL according to CSA standard	SINAMICS	Standard UL 508, 508C, 61800-5-1 CSA C22.2 No. 142, 274	NRAQ/7.E164110, NMMS/2/7/8.E192450, NMMS/2/7/8.E203250, NMMS/7.E214113, NMMS/7.E253831
	UL according to UL and CSA standards			NMMS/2/7/8.E121068 NMMS/7.E355661 NMMS/7.E323473
	UL according to UL standard	SIMODRIVE	Standard UL 508C, CSA C22.2 No. 274	NMMS/2/7/8.E192450 NMMS/7.E214113
	UL according to CSA standard	SIMOTICS	Standard UL 1004-1, 1004-6, 1004-8, CSA C22.2 No. 100	PRGY2/8.E227215 PRHZ2/8.E93429 PRHJ2/8.E342747 PRGY2/8.E253922 PRHZ2/8.E342746
	UL according to UL and CSA standards			
		Line/motor reactors	Standard UL 508, 506, 5085-1, 5085-2, 1561, CSA C22.2 No. 14, 47, 66.1-06, 66.2-06	XQNX2/8.E257859 NMTR2/8.E219022 NMMS2/8.E333628 XPTQ2/8.E257852 XPTQ2/8.E103521 NMMS2/8.E224872 XPTQ2/8.E354316 XPTQ2/8.E198309 XQNX2/8.E475972
		Line filters, dv/dt filters, sine-wave filters	UL 1283, CSA C22.2 No. 8	FOKY2/8.E70122
		Resistors	UL 508, 508C, CSA C22.2 No. 14, 274	NMTR2/8.E224314 NMMS2/8.E192450 NMTR2/8.E221095 NMTR2/8.E226619
TUV: TUV Rheinland of North America Inc. Independent public testing body in North America, Nationally Recognized Testing Laboratory (NRTL) TÜV: TÜV SÜD Product Service Independent public testing body in Germany, Nationally Recognized Testing Laboratory (NRTL) for North America				
	TUV according to UL and CSA standards	SINAMICS	NRTL listing according to standard UL 508C	U7V 12 06 20078 013 U7 11 04 20078 009 U7 11 04 20078 010 U7 11 04 20078 011
		SIMOTION	NRTL listing according to standard UL 508	U7V 13 03 20078 01
		SIMODRIVE	NRTL listing according to standard UL 508C, CSA C22.2. No. 14	CU 72090702
		Motion Control Encoder	NRTL listing according to UL 61010-1 CSA C22.2 No. 61010-1	U8V 10 06 20196 024

Overview

Test code	Tested by	Device series/ Component	Test standard	Product category/ File No.
CSA: Canadian Standards Association Independent public testing body in Canada				
	CSA according to CSA standard	SINUMERIK	Standard CSA C22.2 No. 142	2252-01 : LR 102527
FMRC: Factory Mutual Research Corporation Independent public testing body in North America				
	FM according to FM standard	SINUMERIK	Standard FMRC 3600, FMRC 3611, FMRC 3810, ANSI/ISA S82.02.1	–
EAC: Independent public testing body within the Eurasian Conformity Area				
	EAC in accordance with the EAC Directive	SINAMICS SINUMERIK SIMOTION	Standard IEC 61800-5-1/-2, IEC 61800-3	–
RCM: Australian Communications and Media Authority Independent public testing body in Australia				
	RCM according to EMC standard	SINAMICS SINUMERIK SIMOTION	Standard IEC AS 61800-3, EN 61800-3	–
KC: National Radio Research Agency Independent public testing body in South Korea				
	KC according to EMC standard	SINAMICS SINUMERIK SIMOTION	Standard KN 11	–
BIA Federal Institute for Occupational Safety				
–	Functional safety	SINAMICS SINUMERIK SIMOTION	Standard EN 61800-5-2	–
TÜV SÜD Rail				
–	Functional safety	SINAMICS SINUMERIK SIMOTION	Standard EN 61800-5-2	–

More information about certificates can be found online at:
https://support.industry.siemens.com/cs/ww/en/ps/cert

Overview

Software types

Software requiring a license is categorized into types.
The following software types have been defined:

- Engineering software
- Runtime software

Engineering software

This includes all software products for creating (engineering) user software, e.g. for configuring, programming, parameterizing, testing, commissioning or servicing.

Data generated with engineering software and executable programs can be duplicated for your own use or for use by third-parties free-of-charge.

Runtime software

This includes all software products required for plant/machine operation, e.g. operating system, basic system, system expansions, drivers, etc.

The duplication of the runtime software and executable programs created with the runtime software for your own use or for use by third-parties is subject to a charge.

You can find information about license fees according to use in the ordering data (e.g. in the catalog). Examples of categories of use include per CPU, per installation, per channel, per instance, per axis, per control loop, per variable, etc.

Information about extended rights of use for parameterization/configuration tools supplied as integral components of the scope of supply can be found in the readme file supplied with the relevant product(s).

License types

Siemens Digital Industries and Smart Infrastructure offers various types of software license:

- Floating license
- Single license
- Rental license
- Rental floating license
- Trial license
- Demo license
- Demo floating license

Floating license

The software may be installed for internal use on any number of devices by the licensee. Only the concurrent user is licensed. The concurrent user is the person using the program. Use begins when the software is started.
A license is required for each concurrent user.

Single license

Unlike the floating license, a single license permits only one installation of the software per license.

The type of use licensed is specified in the ordering data and in the Certificate of License (CoL). Types of use include for example per instance, per axis, per channel, etc.

One single license is required for each type of use defined.

Rental license

A rental license supports the "sporadic use" of engineering software. Once the license key has been installed, the software can be used for a specific period of time (the operating hours do not have to be consecutive).
One license is required for each installation of the software.

Rental floating license

The rental floating license corresponds to the rental license, except that a license is not required for each installation of the software. Rather, one license is required per object (for example, user or device).

Trial license

A trial license supports "short-term use" of the software in a non-productive context, e.g. for testing and evaluation purposes. It can be transferred to another license.

Demo license

The demo license support the "sporadic use" of engineering software in a non-productive context, for example, use for testing and evaluation purposes. It can be transferred to another license. After the installation of the license key, the software can be operated for a specific period of time, whereby usage can be interrupted as often as required.

One license is required per installation of the software.

Demo floating license

The demo floating license corresponds to the demo license, except that a license is not required for each installation of the software. Rather, one license is required per object (for example, user or device).

Certificate of License (CoL)

The CoL is the licensee's proof that the use of the software has been licensed by Siemens. A CoL is required for every type of use and must be kept in a safe place.

Downgrading

The licensee is permitted to use the software or an earlier version/release of the software, provided that the licensee owns such a version/release and its use is technically feasible.

Delivery versions

Software is constantly being updated.
The following delivery versions

- PowerPack
- Upgrade

can be used to access updates.

Existing bug fixes are supplied with the ServicePack version.

PowerPack

PowerPacks can be used to upgrade to more powerful software. The licensee receives a new license agreement and CoL (Certificate of License) with the PowerPack. This CoL, together with the CoL for the original product, proves that the new software is licensed.
A separate PowerPack must be purchased for each original license of the software to be replaced.

Upgrade

An upgrade permits the use of a new version of the software on the condition that a license for a previous version of the product is already held.
The licensee receives a new license agreement and CoL with the upgrade. This CoL, together with the CoL for the previous product, proves that the new version is licensed.
A separate upgrade must be purchased for each original license of the software to be upgraded.

Overview

ServicePack

ServicePacks are used to debug existing products. ServicePacks may be duplicated for use as prescribed according to the number of existing original licenses.

License key

Siemens Digital Industries and Smart Infrastructure supplies software products with and without license keys.

The license key serves as an electronic license stamp and is also the "switch" for activating the software (floating license, rental license, etc.).

The complete installation of software products requiring license keys includes the program to be licensed (the software) and the license key (which represents the license).

Software Update Service (SUS)

As part of the SUS contract, all software updates for the respective product are made available to you free of charge for a period of one year from the invoice date. The contract will automatically be extended for one year if it is not canceled three months before it expires.

The possession of the current version of the respective software is a basic condition for entering into an SUS contract.

You can download explanations concerning license conditions from https://mall.industry.siemens.com/legal/ww/en/terms_of_trade_en.pdf

Conversion tables

Rotary inertia (to convert from A to B, multiply by entry in table)

A \ B	lb-in^2	lb-ft^2	lb-in-s^2	lb-ft-s^2 slug-ft^2	kg-cm^2	kg-cm-s^2	gm-cm^2	gm-cm-s^2	oz-in^2	oz-in-s^2
lb-in^2	1	6.94×10^{-3}	2.59×10^{-3}	2.15×10^{-4}	2.926	2.98×10^{-3}	2.92×10^{3}	2.984	16	4.14×10^{-2}
lb-ft^2	144	1	0.3729	3.10×10^{-2}	421.40	0.4297	4.21×10^{5}	429.71	2304	5.967
lb-in-s^2	386.08	2.681	1	8.33×10^{-2}	1.129×10^{3}	1.152	1.129×10^{6}	1.152×10^{3}	6.177×10^{3}	16
lb-ft-s^2 slug-ft^2	4.63×10^{3}	32.17	12	1	1.35×10^{4}	13.825	1.355×10^{7}	1.38×10^{4}	7.41×10^{4}	192
kg-cm^2	0.3417	2.37×10^{-3}	8.85×10^{-4}	7.37×10^{-5}	1	1.019×10^{-3}	1000	1.019	5.46	1.41×10^{-2}
kg-cm-s^2	335.1	2.327	0.8679	7.23×10^{-2}	980.66	1	9.8×10^{5}	1000	5.36×10^{3}	13.887
gm-cm^2	3.417×10^{-4}	2.37×10^{-6}	8.85×10^{-7}	7.37×10^{-8}	1×10^{-3}	1.01×10^{-6}	1	1.01×10^{-3}	5.46×10^{-3}	1.41×10^{-5}
gm-cm-s^2	0.335	2.32×10^{-3}	8.67×10^{-4}	7.23×10^{-5}	0.9806	1×10^{-3}	980.6	1	5.36	1.38×10^{-2}
oz-in^2	0.0625	4.34×10^{-4}	1.61×10^{-4}	1.34×10^{-5}	0.182	1.86×10^{-4}	182.9	0.186	1	2.59×10^{-3}
oz-in-s^2	24.13	0.1675	6.25×10^{-2}	5.20×10^{-3}	70.615	7.20×10^{-2}	7.09×10^{4}	72.0	386.08	1

Torque (to convert from A to B, multiply by entry in table)

A \ B	lb-in	lb-ft	oz-in	N-m	kg-cm	kg-m	gm-cm	dyne-cm
lb-in	1	8.333×10^{-2}	16	0.113	1.152	1.152×10^{-2}	1.152×10^{3}	1.129×10^{6}
lb-ft	12	1	192	1.355	13.825	0.138	1.382×10^{4}	1.355×10^{7}
oz-in	6.25×10^{-2}	5.208×10^{-3}	1	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.007	7.061×10^{4}
N-m	8.850	0.737	141.612	1	10.197	0.102	1.019×10^{4}	1×10^{7}
kg-cm	0.8679	7.233×10^{-2}	13.877	9.806×10^{-2}	1	10^{-2}	1000	9.806×10^{5}
kg-m	86.796	7.233	1.388×10^{3}	9.806	100	1	1×10^{5}	9.806×10^{7}
gm-cm	8.679×10^{-4}	7.233×10^{-5}	1.388×10^{-2}	9.806×10^{-5}	1×10^{-3}	1×10^{-5}	1	980.665
dyne-cm	8.850×10^{-7}	7.375×10^{-8}	1.416×10^{-5}	10^{-7}	1.0197×10^{-6}	1.019×10^{-8}	1.019×10^{-3}	1

Length (to convert from A to B, multiply by entry in table)

A \ B	inches	feet	cm	yd	mm	m
inches	1	0.0833	2.54	0.028	25.4	0.0254
feet	12	1	30.48	0.333	304.8	0.3048
cm	0.3937	0.03281	1	1.09×10^{-2}	10	0.01
yd	36	3	91.44	1	914.4	0.914
mm	0.03937	0.00328	0.1	1.09×10^{-3}	1	0.001
m	39.37	3.281	100	1.09	1000	1

Power (to convert from A to B, multiply by entry in table)

A \ B	hp	Watts
hp (English)	1	745.7
(lb-in) (deg./s)	2.645×10^{-6}	1.972×10^{-3}
(lb-in) (r/min)	1.587×10^{-5}	1.183×10^{-2}
(lb-ft) (deg./s)	3.173×10^{-5}	2.366×10^{-2}
(lb-ft) (r/min)	1.904×10^{-4}	0.1420
Watts	1.341×10^{-3}	1

Force (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	dyne	N
lb	1	16	453.6	4.448×10^{5}	4.4482
oz	0.0625	1	28.35	2.780×10^{4}	0.27801
gm	2.205×10^{-3}	0.03527	1	1.02×10^{-3}	N.A.
dyne	2.248×10^{-6}	3.59×10^{-5}	980.7	1	0.00001
N	0.22481	3.5967	N.A.	100000	1

Mass (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	kg	slug
lb	1	16	453.6	0.4536	0.0311
oz	6.25×10^{-2}	1	28.35	0.02835	1.93×10^{-3}
gm	2.205×10^{-3}	3.527×10^{-2}	1	10^{-3}	6.852×10^{-5}
kg	2.205	35.27	10^{3}	1	6.852×10^{-2}
slug	32.17	514.8	1.459×10^{4}	14.59	1

Rotation (to convert from A to B, multiply by entry in table)

A \ B	r/min	rad/s	degrees/s
r/min	1	0.105	6.0
rad/s	9.55	1	57.30
degrees/s	0.167	1.745×10^{-2}	1

Temperature Conversion

°F	°C	°C	°F
0	–17.8	–10	14
32	0	0	32
50	10	10	50
70	21.1	20	68
90	32.2	30	86
98.4	37	37	98.4
212	100	100	212
subtract 32 and multiply by $^5/_9$		multiply by $^9/_5$ and add 32	

Mechanism Efficiencies

Acme-screw with brass nut	~0.35–0.65
Acme-screw with plastic nut	~0.50–0.85
Ball-screw	~0.85–0.95
Chain and sprocket	~0.95–0.98
Preloaded ball-screw	~0.75–0.85
Spur or bevel-gears	~0.90
Timing belts	~0.96–0.98
Worm gears	~0.45–0.85
Helical gear (1 reduction)	~0.92

Friction Coefficients

Materials	μ
Steel on steel (greased)	~0.15
Plastic on steel	~0.15–0.25
Copper on steel	~0.30
Brass on steel	~0.35
Aluminum on steel	~0.45
Steel on steel	~0.58

Mechanism	μ
Ball bushings	<0.001
Linear bearings	<0.001
Dove-tail slides	~0.2++
Gibb ways	~0.5++

Material Densities

Material	lb-in^3	gm-cm^3
Aluminum	0.096	2.66
Brass	0.299	8.30
Bronze	0.295	8.17
Copper	0.322	8.91
Hard wood	0.029	0.80
Soft wood	0.018	0.48
Plastic	0.040	1.11
Glass	0.079–0.090	2.2–2.5
Titanium	0.163	4.51
Paper	0.025–0.043	0.7–1.2
Polyvinyl chloride	0.047–0.050	1.3–1.4
Rubber	0.033–0.036	0.92–0.99
Silicone rubber, without filler	0.043	1.2
Cast iron, gray	0.274	7.6
Steel	0.280	7.75

Wire Gauges[1)]

Cross-section mm^2	Standard Wire Gauge (SWG)	American Wire Gauge (AWG)
0.2	25	24
0.3	23	22
0.5	21	20
0.75	20	19
1.0	19	18
1.5	17	16
2.5	15	13
4	13	11
6	12	9
10	9	7
16	7	6
25	5	3
35	3	2
50	0	1/0
70	000	2/0
95	00000	3/0
120	0000000	4/0
150	–	6/0
185	–	7/0

[1)] The table shows approximate SWG/AWG sizes nearest to standard metric sizes; the cross-sections do not match exactly.

Notes

1. General Provisions

By using this catalog you can purchase hard- and software products as well as services (together hereinafter referred to as "products") described therein from Siemens Aktiengesellschaft subject to the following Terms and Conditions of Sale and Delivery (hereinafter referred to as "T&C"). Note, for products purchased from any Siemens entity having a registered office outside of Germany, the respective terms and conditions of sale and delivery of the respective Siemens entity apply exclusively. The following T&C apply exclusively for orders placed with Siemens Aktiengesellschaft, Germany.

1.1 For customers with a seat or registered office in European Union

For customers with a seat or registered office in European Union, the following terms and conditions apply subordinate to T&C:

- for products, which include specific terms and conditions in the text of the product description, these specific terms and conditions shall apply and subordinate thereto,,
- for stand-alone software products and software products forming a part of a product or project, the "General Conditions for Software Products for Infrastructure & Industry Business (German law)"[1] and/or
- for consulting services the "Allgemeine Geschäftsbedingungen für Beratungsleistungen für Infrastructure & Industry Geschäft (Deutsches Recht)"[1] (available only in German) and/or
- for other services, the „Supplementary Terms and Conditions for Services for Infrastructure & Industry Business (German Law) ("BL")"[1] and/or
- for other products the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry"[1].
  In case such products should contain Open Source Software, the conditions of which shall prevail over the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry"[1], the Product will be given a note as to which special conditions apply to this open source software. This shall apply mutatis mutandis for notices referring to other third-party software components.

1.2 For customers with a seat or registered office outside European Union

For customers with a seat or registered office outside European Union, the following terms and conditions apply subordinate to T&C:

- for products, which include specific terms and conditions in the description text, these specific terms and conditions shall apply and subordinate thereto,
- for consulting services the "Standard Terms and Conditions for Consulting Services for Infrastructure & Industry Business (Swiss Law)"[1] and/or
- for other services the "International Terms & Conditions for Services"[1] supplemented by "Software Licensing Conditions"[1] and/or
- for other products the "International Terms & Conditions for Products"[1] supplemented by "Software Licensing Conditions"[1]

1.3 For customers with master or framework agreement

To the extent products offered are covered by an existing master or framework agreement, the terms and conditions of that agreement shall apply instead of T&C.

2. Prices

The prices are in € (Euro) ex point of delivery, exclusive of packaging.

The sales tax (value added tax) is not included in the prices. It shall be charged separately at the respective rate according to the applicable statutory legal regulations.

Prices are subject to change without prior notice. We will charge the prices valid at the time of delivery.

To compensate for variations in the price of raw materials (e.g. silver, copper, aluminum, lead, gold, dysprosium and neodym), surcharges are calculated on a daily basis using the so-called metal factor for products containing these raw materials.
A surcharge for the respective raw material is calculated as a supplement to the price of a product if the basic official price of the raw material in question is exceeded.

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. The metal factor, provided it is relevant, can be found in the respective product description.

An exact explanation of the metal factor can be downloaded at:

https://mall.industry.siemens.com/legal/ww/en/terms_of_trade_en.pdf

To calculate the surcharge (except in the cases of copper, 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 copper, the official price from two days prior to that on which the order was received or the release order was effected is used.

To calculate the surcharge applicable to dysprosium and neodym ("rare earths"), the corresponding three-month basic average price in the quarter prior to that in which the order was received or the release order was effected is used with a one-month buffer (details on the calculation can be found in the explanation of the metal factor).

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.

[1] The text of the Terms and Conditions of Siemens AG can be downloaded at
https://mall.industry.siemens.com/legal/ww/en/terms_of_trade_en.pdf

4. Export Control and Sanctions Compliance

4.1 General

Customer shall comply with all applicable sanctions, embargoes and (re-)export control laws and regulations, and, in any event, with those of the European Union, the United States of America and any locally applicable jurisdiction (collectively “Export Regulations”).

4.2 Checks for Products

Prior to any transaction by customer concerning products (including hardware, documentation and technology) delivered by Siemens, or products (including maintenance and technical support) performed by Siemens with a third party, customer shall check and certify by appropriate measures that

- (i) the customer’s use, transfer, or distribution of such products, the brokering of contracts or the provision of other economic resources in connection with products will not be in violation of any Export Regulations, also taking into account any prohibitions to circumvent these (e.g., by undue diversion)
- (ii) the products are not intended or provided for prohibited or unauthorized non-civilian purposes (e.g. armaments, nuclear technology, weapons, or any other usage in the field of defense and military);
- (iii) customer has screened all direct and indirect parties involved in the receipt, use, transfer, or distribution of the products against all applicable restricted party lists of the Export Regulations concerning trading with entities, persons and organizations listed therein and
- (iv) products within the scope of items-related restrictions, as specified in the respective annexes to the Export Regulations, will not, unless permitted by the Export Regulations, be
  (a) exported, directly or indirectly (e.g., via Eurasian Economic Union (EAEU) countries), to Russia or Belarus, or
  (b) resold to any third party business partner that does not take a prior commitment not to export such products to Russia or Belarus.

4.3 Non-Acceptable Use of Software and Cloud Services

Customer shall not, unless permitted by the Export Regulations or respective governmental licenses or approvals,

(i) download, install, access or use the products from or in any location prohibited by or subject to comprehensive sanctions or subject or to license requirements according to the Export Regulations;
(ii) grant access to, transfer, (re-)export (including any "deemed (re-)exports"), or otherwise make available the products to any entity, person, or organization identified on a restricted party list of the Export Regulations;
(iii) use the products for any purpose prohibited by the Export Regulations (e.g. use in connection with armaments, nuclear technology or weapons);
(iv) upload to a products platform any customer content unless it is non-controlled (e.g. in the EU: AL = N;
in the U.S.: ECCN = N or EAR99);
(v) facilitate any of the afore mentioned activities by any user. Customer shall provide all users with all information necessary to ensure compliance with the Export Regulations.

4.4 Semiconductor Development

Customer will not, without advance written authorization from Siemens, use offerings for the development or production of integrated circuits at any semiconductor fabrication facility located in China meeting the criteria specified in the U.S. Export Administration Regulations, 15 C.F.R. 744.23.

4.5 Information

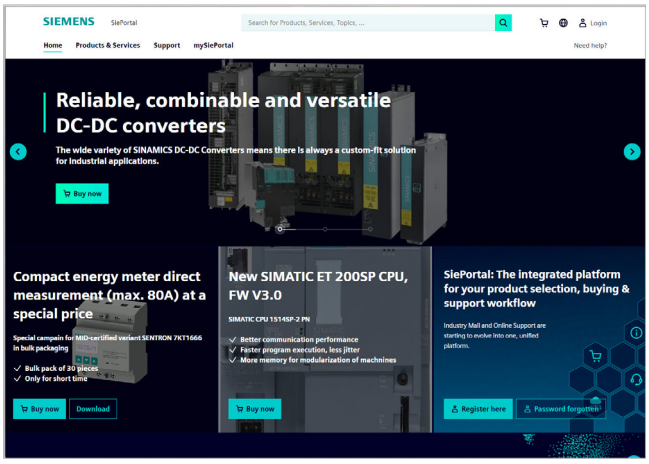
Upon request by Siemens, customer shall promptly provide Siemens with all information pertaining to users, the intended use and the location of use or the final destination (in the case of hardware, documentation and technology) of the products. Customer will notify Siemens prior to customer disclosing any information to Siemens that is defense-related or requires controlled or special data handling pursuant to applicable government regulations, and will use the disclosure tools and methods specified by Siemens.

4.6 Reservation

Siemens shall not be obligated to fulfill this agreement if such fulfillment is prevented by any impediments arising out of national or international foreign trade or customs requirements or any embargoes or other sanctions. Customer acknowledges that Siemens may be obliged under the Export Regulations to limit or suspend access by customer and/or users to products.

5. Miscellaneous

Errors excepted and subject to change without prior notice.



Easy product selection and ordering with SiePortal

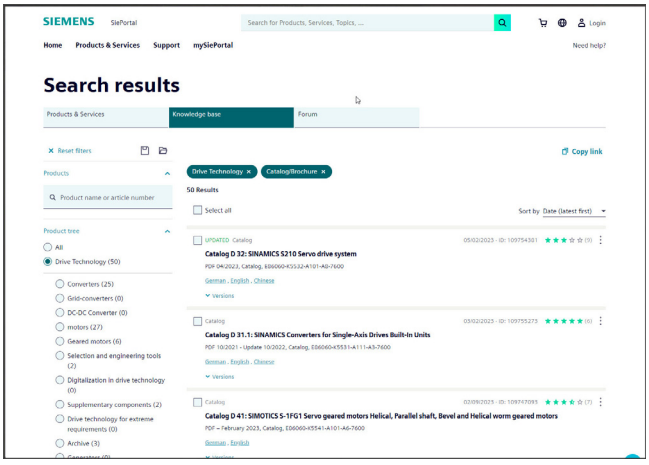
SiePortal > Products & Services

The internet ordering platform of Siemens AG is located in SiePortal. It provides you with online access to a comprehensive product spectrum that is presented in an informative, well-organized way.

Powerful search functions help you select the required products, while configurators enable you to configure complex product and system components quickly and easily. CAx data are also available for you to use.

Data transfer allows the entire procedure, from selection through ordering to tracking and tracing, to be carried out online. Availability checks, individual customer discounting, and quotation preparation are also possible.

https://sieportal.siemens.com



Downloading catalogs

SiePortal > Support > Knowledge base

You can download catalogs and brochures in PDF format from Siemens Industry Online Support without having to register.

The filter box makes it possible to perform targeted searches.

https://sieportal.siemens.com

Cybersecurity information

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

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

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

For additional information on industrial cybersecurity measures that may be implemented, please visit
www.siemens.com/cybersecurity-industry

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under **https://www.siemens.com/cert**

Get more information

SINAMICS Drive Software:
www.siemens.com/sinamics-drive-software

Motion Control Systems and Solutions for production machine and machine tool equipment:
www.siemens.com/motioncontrol

Local partners worldwide:
www.siemens.com/automation-contact

Published by
Siemens AG

Digital Industries
Motion Control
Postfach 31 80
91050 Erlangen, Germany

For the U.S. published by
Siemens Industry Inc.

100 Technology Drive
Alpharetta, GA 30005
United States

PDF (Article No.E86060-K5599-A101-A1-7600)
V6.MKKATA.GMC.600
KG 0424 108 En
Produced in Germany