# Welcome to AC500-S Safety PLC
# Engineering Functional Safety

Power and productivity
for a better world™

ABB

# ABB – Unsurpassed experience in safety automation for over 30 years

**Let ABB's extensive experience in pioneering safety technology work for you with our new AC500-S Safety PLC, the latest addition to the tried and true AC500 family.**

When it comes to reliability, efficiency and flexibility in safety automation, for over 30 years, ABB has been the partner experts rely on to cover even their most complex applications. Our engineers are known around the globe for their innovative and solid approach aimed at protecting people, machines, processes and the environment. And our latest development, the AC500-S Safety PLC (SIL3, PL e), is no exception: This groundbreaking safety PLC is the ideal choice when you've got a complex safety application to manage but aren't willing to make any compromises on reliability, efficiency or flexibility. Especially suited for wind turbine, crane, hoist and robot applications.

## Your complex safety application, our daily business

### Wind turbines

Worried about what would happen if your wind power application malfunctioned? Don't be. The new AC500-S Safety PLC from ABB offers you unsurpassed technology that lets you implement even the most challenging of safety applications – putting the power in your hands to achieve everything from speed and safety value monitoring to emergency stop functions – and that in a cost-effective way. Our wide array of safety and non-safety products allows for optimal customizing of solutions to meet your exact wind power application needs. Furthermore, you can use our AC500 modules at the base, on the tower or at the engine, giving you limitless possibilities for configuring your specific solution.

### Cranes

Wherever safety is the #1 priority, ABB's AC500-S Safety PLC is your reliable partner in protecting people, buildings and machinery. Accidents like uncontrolled movement or load disengagement are not only dangerous, but also divert attention and subtract time from the real work to be done. With features like trigonometric functions and processing of analog values, the AC500-S allows you to focus on your projects without questioning the safety of your crane applications – letting our safety PLC take care of reducing downtime, increasing precision and keeping your work areas safe.

### Hoists

Controlling heavy loads at high speeds requires a PLC that provides the ultimate in safety and reliability – no chances taken. ABB's AC500 family of PLCs gives hoist and elevator manufacturers a cost-effective and dependable way to be one step ahead of the competition by offering a product that has a PLC already integrated in it, cutting costs and increasing safety in one step. And with our new safety PLC, the AC500-S, you can benefit from the advantages of programming with Structured Text, a flexible and simple programming language, giving you faster application-specific safety PLC library development – an appreciated feature for hoists and other safety applications.

### Robotics

When it comes to the specific needs of robotics applications, the ability to customize an application according to precise requirements is an absolute must. ABB's AC500-S Safety PLC opens the door to even more specialized and reliable robotics applications through features like digital or analog signaling and high speed CPU cycle times, giving you the state-of-the-art in safety programming. Put our pioneering technology to the test in your work areas and engine monitoring systems and benefit from immediate gains in Functional Safety.

# Trigonometric functions
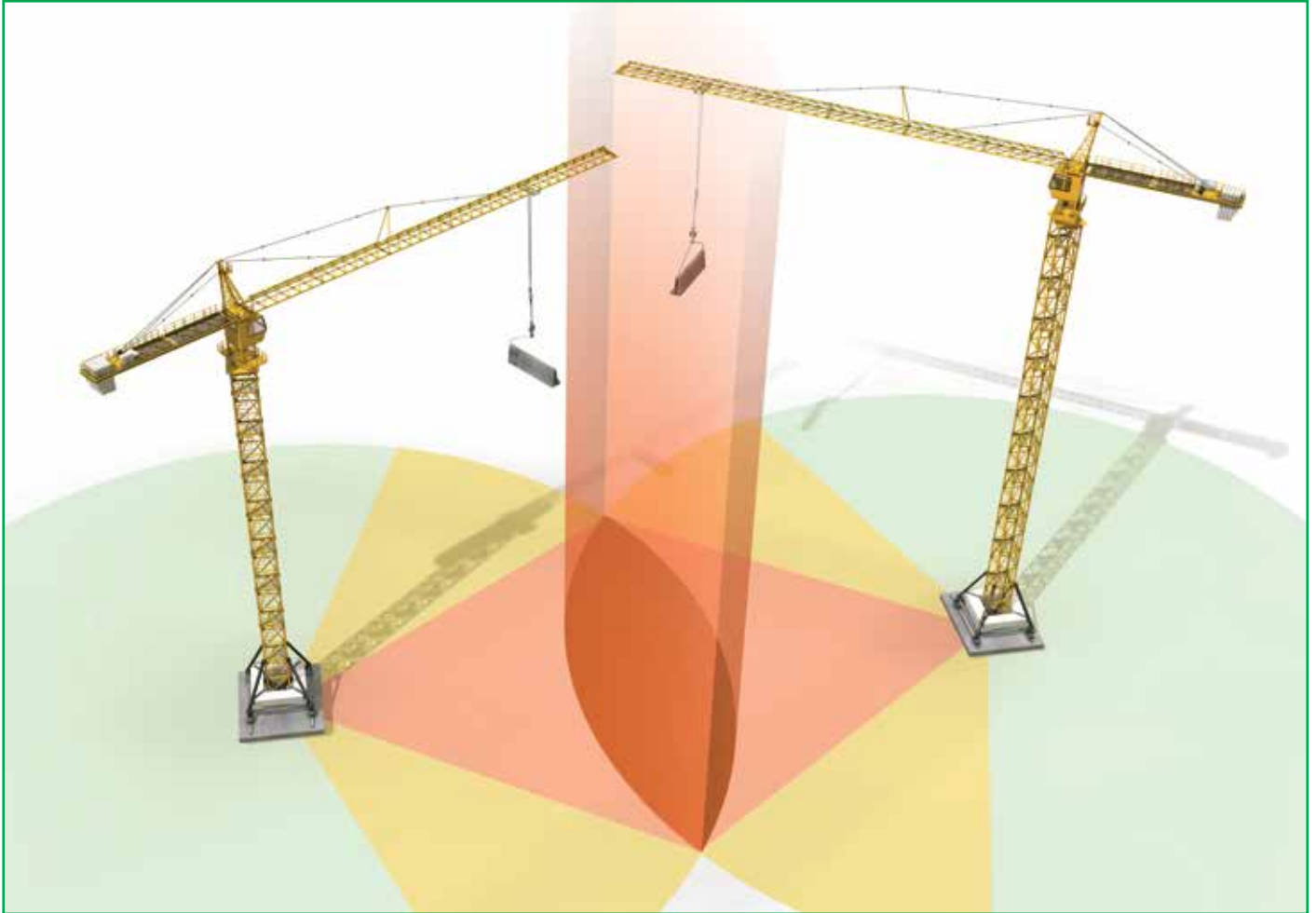


**Safety, simplicity and reliability through an array of trigonometric functions from the preferred partner of crane manufacturers**

## ABB's innovative safety PLC comes with a fully-featured array of custom trigonometric functions

Our powerful set of ready-to-use functions, including COS, SIN, TAN, ASIN, ACOS and LOG, gives you the tools you need to implement even the most challenging of safety applications quickly and flexibly.

Specifically tailored to get you up and running right out-of-the-box, this new range of safety devices is the optimal choice in fields like crane and hoist engineering as well as for customized robot applications.

# For truly customized safety applications, where compromises on trigonometric functions are out of the question

**ABB's groundbreaking addition to the popular AC500 PLC series features a powerful array of trigonometric functions to satisfy even the most demanding industrial safety requirements.**

## Integrated functions out-of-the-box

ABB's new AC500-S Safety PLC sets new standards in the field of safety engineering by bringing you an incredibly powerful set of functions for trigonometric operations, including COS, SIN, TAN, ASIN, ACOS and LOG. Ideally suited for tasks such as the creation of safe motion control systems for cranes, hoists and a vast array of automated machinery, we've got your application covered.

Ready-to-use right out-of-the-box, these functions get you up and running in no time and make the use of approximation tables to implement trigonometric functions a thing of the past.

## Easy and safe monitoring

Our engineers have developed the AC500-S system to make implementing tasks such as the monitoring of speed, torque and positioning states in machines with complex kinematics easier than ever before.

This is ideally suited to a broad spectrum of situations, but is especially beneficial in applications involving the control of
– cranes,
– manipulators,
– robots,
– wind power turbines,
– stagecraft machinery.
As a result, the use of position switches and proprietary electronics systems for safety applications is no longer required.

## Ultimate simplicity and integration

The new AC500-S Safety PLC is fully integrated into the renowned AC500 family of modular PLCs, but adds a unique combination of safety features specifically designed to help you solve the challenges of today's safety-oriented industrial automation tasks.

Features like our simplified application engineering let you save both time and money when designing and implementing your application.

Moreover, compatibility with the PM572 right up to the PM592 CPU means it's a snap to combine with our non-safety modules, making it the obvious choice for varied environments that include safety and non-safety-oriented applications.
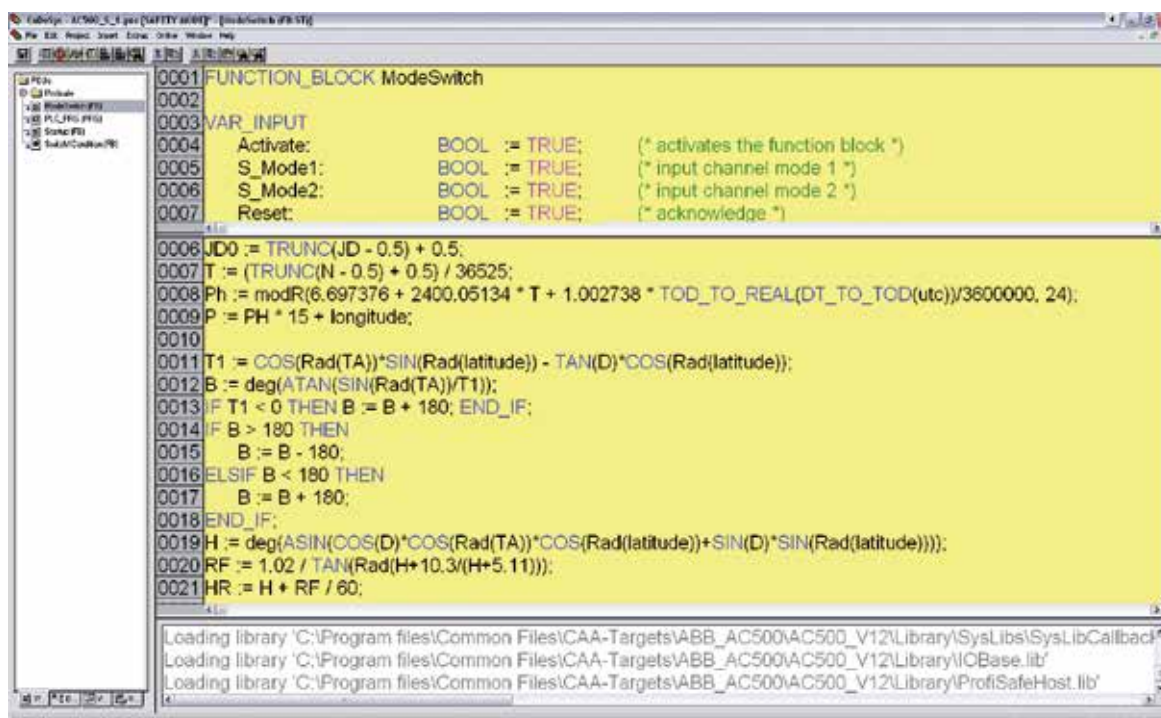


**Use of trigonometric functions simplifies complex application programming**

# Safety analog current module

Analog input
module AI581-S

## ABB's pioneering safety PLC features a high-speed dedicated analog current module on PROFINET with PROFIsafe

The new AC500-S offers an advanced range of safety PLC solutions providing you with unrivalled power and performance combined in a state-of-the-art integrated package from ABB, the world's leading supplier of industrial automation solutions.

Our engineers designed this innovative system around a dedicated analog current module based on PROFINET with PROFIsafe, the real-time open industrial Ethernet standard for automation – offering you extraordinary performance and flexibility for even the most challenging of safety applications.

# When a real-time dedicated analog current module on PROFINET with PROFIsafe is key to your safety application

**ABB's brand new addition to the renowned AC500 PLC series comes with a dedicated analog current module covering 0 to 20 mA (or 4 to 20 mA) on PROFINET with PROFIsafe, the state-of-the-art communications technology for industrial networking in automation.**

## More flexibility and practicality

PROFINET offers virtually real-time measurement of your critical safety values, facilitating faster, safer, more economical and higher quality manufacturing. ABB now gives you the option of connecting analog inputs in machinery applications to your PROFINET network in addition to local connection to the PLC, bringing the flexibility and practicality of Ethernet to your industrial environment.

## The ultimate choice for safety measurement

The AC500-S analog input module makes it possible to measure safety pressures, positions, torques or temperatures on your machinery applications, making it the ideal choice for applica-

tions from braking systems in hoists and lifting equipment, to positioning systems and temperature control on cranes or even selective shutdown systems on wind power turbines. And that makes the need for using AD converters or proprietary electronics for safety applications a thing of the past.

## Multiple connection options

ABB's innovative AC500-S Safety PLC supports various network configurations to give you broader flexibility in the design of your application. Our system makes it possible to connect safety sensors and actuators either centrally or as part of a decentralized configuration via PROFINET with PROFIsafe. Moreover, we put the power in your hands to set up flexible connections for customized solutions in accordance with your specific requirements. And because the AC500-S is seamlessly integrated into the AC500 PLC family, it's a snap to combine it with our non-safety modules. For varied environments that include safety-oriented applications such as robots, cranes, stagecraft machinery and much more, it's the obvious choice.

Example of communication on PROFINET with PROFIsafe network
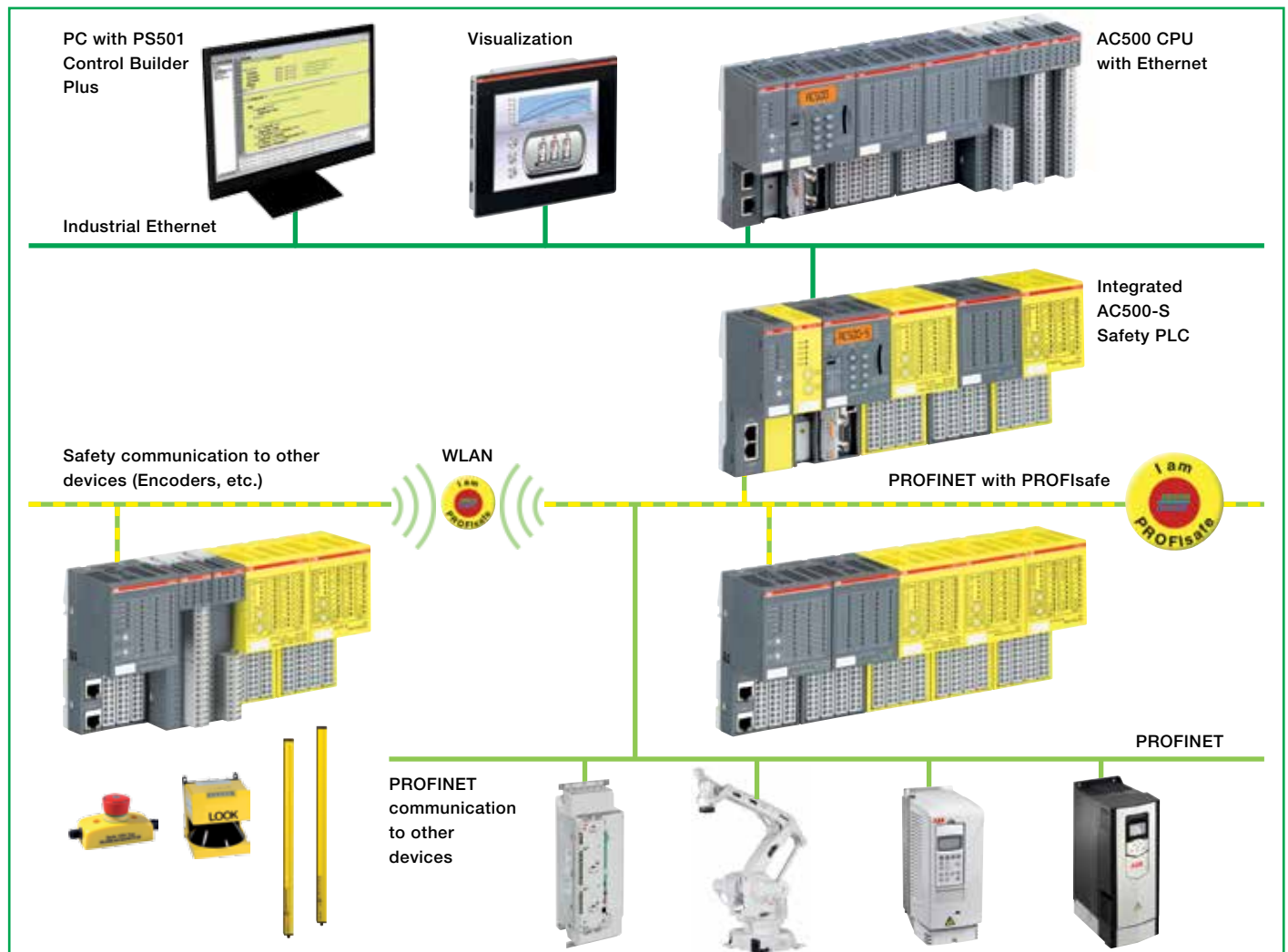
# Total integration for unlimited flexibility



**Mixed, integrated components for truly customized solutions**

## Top-down integration across the range combined with real integrated user-friendly engineering, including a standardized look and feel for safety and non-safety areas

Get the ultimate in flexibility and reliability with ABB's innovative AC500-S range of safety devices. With integrated user-friendly engineering technology for both safety and non-safety applications, programming your safety applications has never been easier.

And that's not all: We offer you a first class host of integrated hardware and software features such as standardized casings for both safety and non-safety components with the same installation concept as for the rest of the AC500 family – all designed to power you to the next level.

Product Service

# C E R T I F I C A T E

No. Z10 13 01 83652 001

**Holder of Certificate:** **ABB Automation Products GmbH**
Eppelheimer Str. 82
69123 Heidelberg
GERMANY

**Factory(ies):** 59269

**Certification Mark:**

**Product:** **Automation Equipment, Safety Referred**

**Model(s):** **Safety PLC AC500-S (-XC)**

**Parameters:**

| | |
|---|---|
| Process and supply voltage: | 24 VDC (-25 %...+30 %) |
| Operating temperature | |
| AC500-S: | 0 °C ... +60 °C |
| AC500-S-XC: | -40 °C ... +70 °C |
| Storage / Transport: | -40 °C ... +85 °C |

The report and the user documentation in the
currently valid revision are mandatory part of this
certificate. The product complies with the below listed
safety requirements only if the specifications documented
in the currently valid revision of this report are met. The
certified components are listed in the following report:
AH84732C according to the currently valid revision.

**Tested according to:**
EN 61131-2:2003
IEC 61508-1:2010 (SIL 3)
IEC 61508-2:2010 (SIL 3)
IEC 61508-3:2010 (SIL 3)
IEC 61508-4:2010 (SIL 3)
IEC 62061:2005 (SILCL 3)
EN ISO 13849-1:2008 (PL e, Cat. 4)

The product was tested on a voluntary basis and complies with the essential requirements. The
certification mark shown above can be affixed on the product. It is not permitted to alter the
certification mark in any way. In addition the certification holder must not transfer the certificate
to third parties. See also notes overleaf.

**Test report no.:** AH84732C

**Date,** 2013-02-08 ( Jürgen Blum )

Page 1 of 1

472432

TÜV®

A1 / 04.11

ZERTIFIKAT ◆ CERTIFICATE ◆ CEPTИФИКАТ ◆ 証明書 ◆ CERTIFICADO ◆ CERTIFICAT ◆ CERTIFICAT

3ADR025011B0201 9

# The ultimate in user-friendly engineering for even the most complex safety and non-safety applications

**ABB's cutting-edge range of safety devices sets new standards in terms of integration, convenience and user-friendliness – giving you the ultimate symbiosis of safety and non-safety engineering for optimal ease of use.**

## Supreme integration

ABB's cutting-edge range of safety devices sets new standards in terms of integration, convenience and user-friendliness. Our engineers have designed the AC500 PLC line from the ground up to ensure our safety and non-safety system modules integrate seamlessly with one another. And that provides you with a level of flexibility, ease-of-use and adaptability that saves both time and money.

## Standardized look & feel

This advanced range of PLCs is housed in smart color-coordinated polycarbonate cases featuring the same modern look and feel across the range for both safety and non-safety components. In addition, the new AC500-S comprises identical dimensions to the standard CPU and I/O modules and features precisely the same mounting and wiring concept as the rest of the AC500 family.

## Integrated architecture

The AC500-S truly takes user-friendly engineering into the next dimension by featuring the same easy-to-learn programming environment – based on IEC 61131-3 programming editor – for safety and non-safety application programming. And that gives you new options for your applications such as direct variable mapping and data exchange between your safety and non-safety PLCs.

We've made the configuration of your safety and non-safety systems easier than ever before by streamlining its management into one single programming tool – giving you clear savings in both time and effort.

Moreover, you can vastly reduce the complexity of projects and cut down on unnecessary programming and maintenance, because you only need to be familiar with a single programming environment.
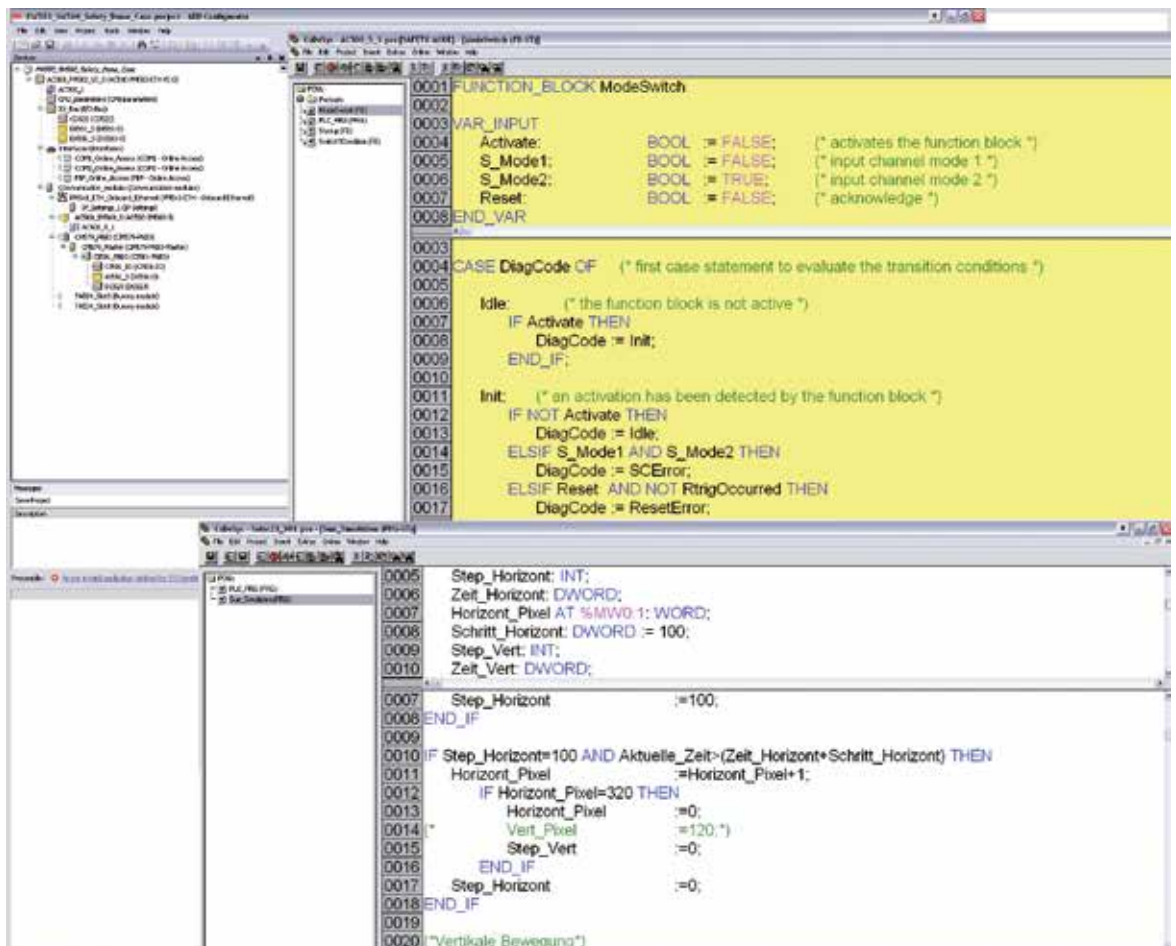
**Same look & feel for safety and non-safety programming reduces engineering time and money**
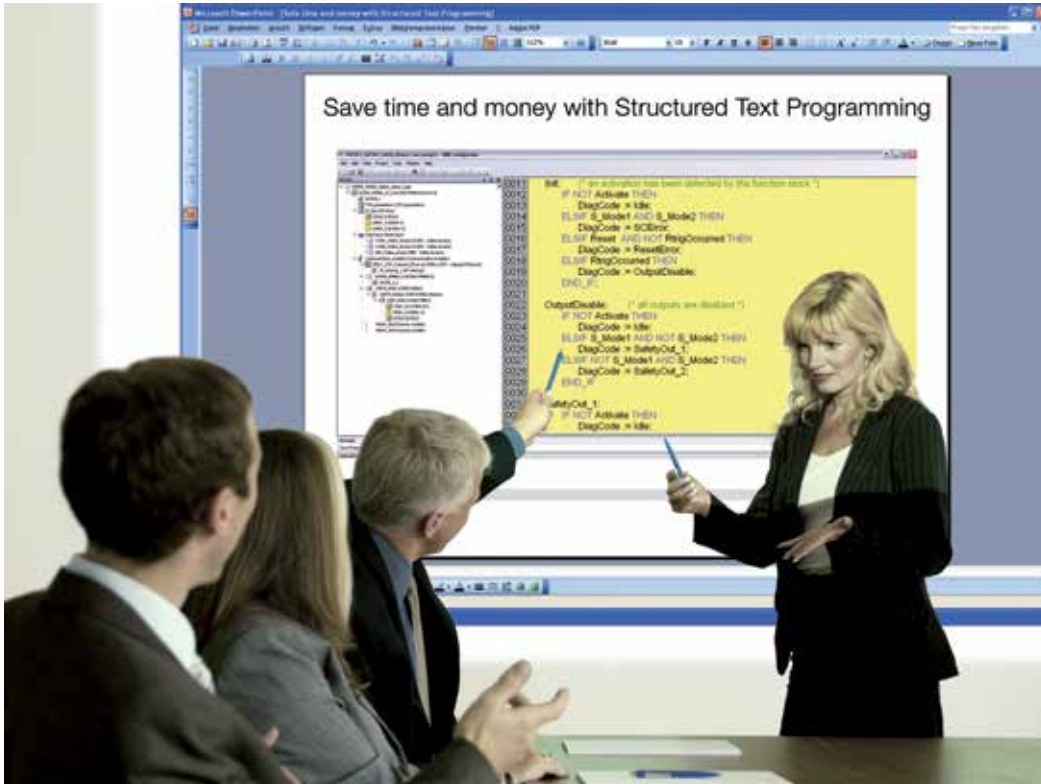
# Structured Text (ST)

## Greater flexibility and simplicity thanks to safety programming under Structured Text as well as full support for Function Block Diagram and Ladder Diagram

ABB's AC500-S Structured Text (ST) programming language is the ultimate choice for facing the challenges of modern safety applications.

This flexible and intuitive language makes it easier and more convenient than ever before to create powerful and reliable safety applications for your PLCs – while still giving you the flexibility of using Function Block Diagram (FBD) and Ladder Diagram (LD).

### Structured Text

This IEC 61131-3-compatible, widely-used programming language is not only incredibly intuitive and flexible, it also makes programming your PLC easier than ever before thanks to its extremely straightforward program flow.

Although we still give you the option of using Function Block Diagram (FBD) and Ladder Diagram (LD), Structured Text saves you time and money in many ways, such as by making the implementation of complex mathematical operations a snap. The use of Structured Text also means faster application specific safety PLC library development – particularly convenient for cranes, wind turbines and robotics.

### Packed with safety features

The new AC500-S Safety PLC now extends the scope of the renowned AC500 family of modular PLCs with a unique combination of safety features, all of which have been designed specifically to aid you in solving the challenges of today's safety-oriented industrial automation tasks. Because the AC500-S integrates seamlessly into the existing AC500 PLC family, it's easy to combine safety modules with our non-safety modules, making it the obvious choice for varied environments that include safety-oriented applications such as cranes, hoists, wind turbines and much more.

# ABB – the only provider worldwide to offer TÜV certified Safety Code Analyzer

**PS501-SCA Safety Code Analyzer tool**

ABB's in-house developed PS501-SCA Safety Code Analyzer tool is tailor-made for verifying safety-related software according to IEC 61508-3 under FBD, LD and ST. This powerful tool is the optimal choice for developing application-specific safety libraries or working on concrete safety automation projects.

We put the effortless development of PLC code that conforms to the safety rules prescribed by major technical inspection agencies such as TÜV right at your fingertips. A pleasant side effect is a resulting PLC code that's more reliable, better structured, and thus more easily readable, which means lower certification effort and post-release maintenance costs.

PS501-SCA opens the door to writing truly well-structured, easily understandable code, dramatically saving you time and money on certification.

**Proven reliability**

PS501-SCA has been certified by TÜV SÜD – one of the world's leading independent technical inspection associations. TÜV subjected the software to a set of stringent tests designed to push it to the limit and beyond.

The result is documented in a technical report which verifies the AC500-S Safety Code Analyzer's unique set of features, its standards compliance and its unrivaled performance in terms of safety application source code analysis.

Code verification with PS501-SCA results in lower effort towards certification and engineering cost

TÜV SÜD

Rail

# KONFORMITÄTSBESTÄTIGUNG
## LETTER OF CONFIRMATION

# AC500-S
Safety Code Analyzer

**Hersteller:**
Manufacturer:

ABB STOTZ-KONTAKT GmbH

Eppelheimer Str. 82

69123 Heidelberg

**Prüfstelle:**
Testing body:

TÜV SÜD RAIL GmbH
Rail Automation

Ridler Str. 57

D-80339 München

## 1. Allgemein / General

AC500-S Safety Code Analysis (weiter SCA genannt) ist ein Programmiertool, das der Verifikation von sicherheitsgerichteter Software (erstellt in CoDeSys V2.3, siehe "Programmierhandbuch: Erstellung sicherheitsgerichteter Applikationen mit CoDeSys V2.3") bis SIL3 nach IEC 61508:2010 dient.

AC500-S Safety Code Analysis (SCA) is a Software Tool for verification of safety-relevant Software (developed using CoDeSys V2.3, see "Programming Guide: Creation of safety-oriented applications with CoDeSys V2.3") up to SIL3 according to IEC 61508:2010.

## 2. Version / Version

SCA Versionen:        1.0.x

## 3. Prüfgrundlagen / Test bases

Das zertifizierte Programmiertool, nach IEC 61508-4 klassifiziert als "T2" offline Programmiertool, ist zur Verifikation von sicherheitsgerichteter Software nach IEC 61508-3 geeignet.

The certified tool, classified as "T2" offline support tool according to IEC 61508-4, is suitable for the use to verify safety related software according to IEC 61508-3.

## 4. Zusammenfassung / Summary

Gegen den Einsatz von **SCA** der Fa. ABB STOTZ KONTAKT GmbH sprechen von Seiten TÜV SÜD Rail GMBH, Rail Automation, keine sicherheitstechnischen Bedenken.

TÜV SÜD Rail GmbH, Rail Automation, has no doubts as to the safety-related issues of the use of **SCA**.

TÜV SÜD Rail GmbH
Alfred Beer

08. März 2011

Dieser Konformitätsbestätigung wurde auf Grundlage des Review Report AC 500S Safety Code Analysis Tool erstellt. Diese enthalten das Ergebnis einer einmaligen Untersuchung an dem zur Prüfung vorgelegten Erzeugnis.

This Technical Report was created on basis of the TÜV internal Review Report AC 500S Safety Code Analysis Tool. It contains the result of a unique investigation of the product submitted for examination.

# Uniqueness and key features of AC500-S Safety PLC

## Key Features

– Separate Safety-CPU ensures free choice of non-safety CPU performance

– Direct connection to PNO certified safety components saves I/O modules and eliminates wiring efforts

– More number of test pulses (one of the highest in the market) ensures high degree of fault diagnostics and reaction

– Safety CPU can be configured to work even if the non-safety CPU is in STOP or maintenance mode or during online change

– Address switch on the Safety CPU allows implementing flexible configuration concept in machines (One safety program for various machine types)

– Failure of a PN slave will not STOP the safety CPU

**The system solution in safety**
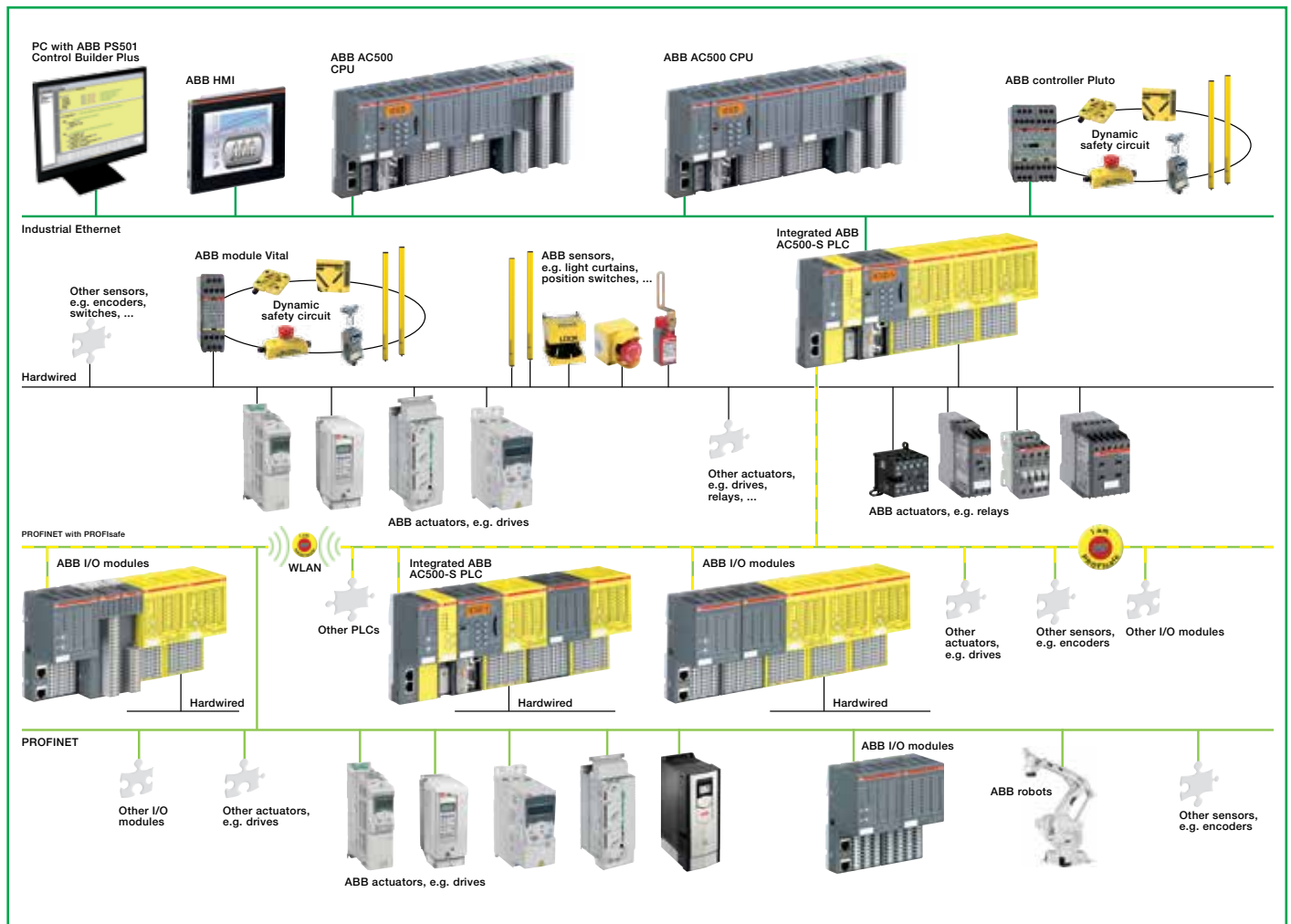
- Standard SD card could be used to clone both safety and non-safety programs and configuration for later replication on other machines

- Max. cable length for connected process signals could go up to 1000 m (Shielded cable) or 600 m (Unshielded cable)

- Easy handling of modules (easy to remove and plug-in)

- Front panel rotary switch for PROFIsafe address ensures less maintenance effort

- Ease of wiring (spring terminals)

- 100% fool-proof system (unskilled people may not be able to RUN the safety CPU)

- Extreme condition (XC) modules are available (-40 to +70 deg C)

- Wide variety of non-safety communication possibilities like Ethernet, Modbus, CAN Open, EtherCAT, PROFIBUS, PROFINET, ASCII, FTP etc.)

- A single safety channel could be individually reintegrated

- Channel diagnostics for each individual safety channel

- Built-in module power supply (no additional 24V DC power supply needed)

- Simple expansion of a non-safety PLC system with safety functions by adding the Safety CPU and safety modules

- Safety related analog inputs in the centralized or decentralized I/O rack via PROFINET/PROFIsafe

- Non-safety and safety programming editor look just the same (short learning curve)

- Structured Text (ST) programming as per IEC 61131-3 in safety applications in addition to  Ladder Diagram (LD), Function Block Diagram (FBD).

- Trigonometric functions COS, SIN, TAN, ASIN, ACOS, LOG etc. support easy implementation of complex kinematic tasks

- PLCopen Safety-Library & Programming of customized safety libraries possible

- PS501-SCA Safety Code Analyzer tool for ensuring well-structured (syntax analysis), easily understandable program code. Saves time and money towards certification issues, first of its kind in the market.

- One diagnostic system for Safety & Non-safety CPU

- Field wiring and module replacement actions are independent of each other

- Fool-proof protection implemented in all safety I/O modules (reverse signal or power supply polarity, wrong module placement, short circuit etc.)

- AC500 CPUs that support PROFINET communication could easily be engineered to have safety function with the addition of SM560-S and I/Os

- Non-safety projects could easily be upgraded to safety with the integration safety library

- Extensive user management to protect the program and configuration data

- Safety CPU ensures high data security due to no direct access through Ethernet connection

- Name setting of PROFINET slave station  by rotary switches eliminate the need of engineering station during module replacement

- Safe data exchange between Safety CPUs through PROFINET/PROFIsafe gateways

- Missing PROFIsafe device on PROFINET network will not stop safety CPU program execution

- Triggering of safety drive functions through PROFINET/ PROFIsafe interface

- Safe position monitoring and speed monitoring using PROFINET/PROFIsafe encoders

# AC500 PLC family



**ABB's AC500 series is a PLC-based modular automation solution that makes it easier than ever before to mix and match standard and safety I/O modules to expertly meet your exact requirements.**

### More integration and easier programming

Featuring a consistent look and feel across the entire range, the AC500 is the PLC of choice for applications where uncompromising flexibility, integration and communication are a must. Our PS501 Control Builder Plus conforms to IEC 61131-3, letting you get up and running in no time at all. And not only that: Clear configuration of the overall system with one single tool ensures optimal transparency.

With the new AC500-S Safety PLC, the latest addition to the AC500 family, ABB takes the stress out of managing even the most complex safety applications. Support for safety-relevant arithmetic operations such as COS, SIN, TAN, ASIN, ACOS and LOG makes the AC500-S ideal for applications in fields like crane engineering, wind power generation, robotics and hoist technology. Plus it gives you greater flexibility and simplicity thanks to safety programming under Structured Text (ST) as well as full support for Function Block Diagram (FBD) and Ladder Diagram (LD).

### 1 Standard communication module

ABB's AC500 family is packed with advanced communications technologies to bring you to the next level in communication. Combinable to form optimally scaled network nodes, we put the power to cover everything from small-scale applications to comprehensive large-scale industrial systems right in your hands. We've got all common communication standards covered, such as Ethernet, EtherCAT, PROFINET IO, PROFI-

BUS DP, CANopen, DeviceNet, Modbus TCP, Modbus serial, Serial, ABB CS31 and PROFIsafe via PROFINET.

### 2 Safety PLC

Just as you've come to expect from ABB, our safety PLC is SIL3 (IEC 62061, IEC 61508) and PL e (ISO 13849) certified. And an array of features such as system diagnostics provided via LEDs and onboard display of standard CPUs gives you the added diagnostic concept your applications demand.

### 3 Standard PLC

ABB's complete AC500 range of CPUs, from the PM572 to the PM592, can be used with our AC500-S CPU to create truly customized solutions – even for your most challenging requirements. We keep it simple by offering programming of safety and non-safety applications via a standard PLC interface.

### 4 Standard I/O module

With ABB's standard I/O module, the complete S500 and S500-eCo I/O module range can be connected to the standard PLC, providing you with the ultimate in flexibility and simplicity. And a wealth of functions in our configurable I/O modules allows you to get the customized and low-priced solutions you need to sustainably optimize your applications.

### 5 Safety I/O module

Our safety I/O modules are certified up to SIL3 (IEC 62061, IEC 61508) and PL e (ISO 13849), giving you the reliable security you need to be able to focus on what really matters – your applications. Features such as channel-wise error diagnostics and the flexibility to choose between channel-wise or module switch-off in case of channel error make working safely that much easier.

# Your integrated solution

**ABB's AC500 series Safety PLC integrates seamlessly into your AC500 applications to deliver our most powerful and flexible industrial automation solution ever.**

### Customer requirements met to perfection

Ultimate integration, simplicity, consistent expandability and flexibility are vital characteristics for any modern automation solution. This is particularly important for mechanical engineering and plant applications that demand a combination of safety and non-safety control and monitoring options. ABB's new AC500-S Safety PLC solution has been designed from the ground up to integrate perfectly into the AC500 family to offer you a never before seen level of scalability and flexibility.

### Homogeneous look & feel

This advanced system features a consistent look and feel across the entire range of hardware and software, regardless of whether you are building applications for safety-related or non-safety functions. Housed in tough polycarbonate cases, our modules are more than up to facing the challenges of industrial environments. And thanks to the standardized architecture of the AC500 family, adding safety functionality to your existing application could hardly be easier. Simply plug your AC500-S modules onto the busbar alongside your other AC500 components and you are good to go.

### Parallel connections and more

The new AC500-S consists of different devices that can be combined and flexibly expanded to suit your individual requirements. In real terms this means you have the power, for example, to operate several field buses simultaneously in any desired combination with a single control system. Choose from a spectrum of CPU performance classes, all easy to subsequently replace to meet increasing requirements. This is particularly useful where mixed safety and non-safety features are required, because it allows for the extremely straightforward combination of I/O components. In addition, our common engineering tool, the PS501 Control Builder Plus, provides standardized programming for the entire platform according to IEC 61131-3 – and that's just one of the advanced features and utilities our PLC family has to offer.

**28 mm space to transform your standard PLC into a safety PLC system**

# Step into the future with PS501 Control Builder Plus

With the PS501 Control Builder Plus, you have an intuitive tool for configuration and programming of your whole AC500 system.

Our programming package is full of sophisticated features such as easy and fast configuration of the overall system including fieldbuses and interfaces, extensive diagnostic functions, advanced code checking features, alarm handling, integrated visualization and open software interfaces.

### Conformity with IEC 61131-3 standards

For optimal planning, programming, testing and commissioning of your safety automation application, we also include three standardized programming languages: Function Block Diagram (FBD), Ladder Diagram (LD) and now Structured Text (ST).

### Powerful visualization and testing features with PS501 Control Builder Plus

PS501 Control Builder Plus supports color change, moving elements, bitmaps, text display, and even allows for the input of setpoint values. Display of process variables read from the PLC, dynamic bar diagrams, alarm and event management, function keys and ActiveX elements are just a few more of the features sure to make managing your application that much easier.

Easy configuration of the communication interfaces for PROFIBUS DP, PROFINET IO, CANopen, DeviceNet, Ethernet, EtherCAT, Modbus, CS31 and PROFIsafe.

### Open interfaces via AC500 standard CPU

DDE and OPC alarm and events.

### Programming

Serial, via Ethernet or network.

### Web server

An integrated web server easily allows you to access the AC500 PLC through your Intranet, offering you worldwide access to your system. And configuration is extremely straightforward thanks to the PS501 Control Builder Plus software.

**1** Structured Text | **2** Function Block Diagram | **3** Ladder Diagram
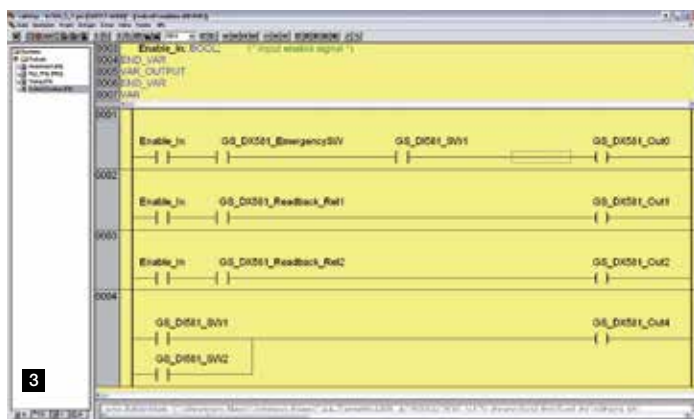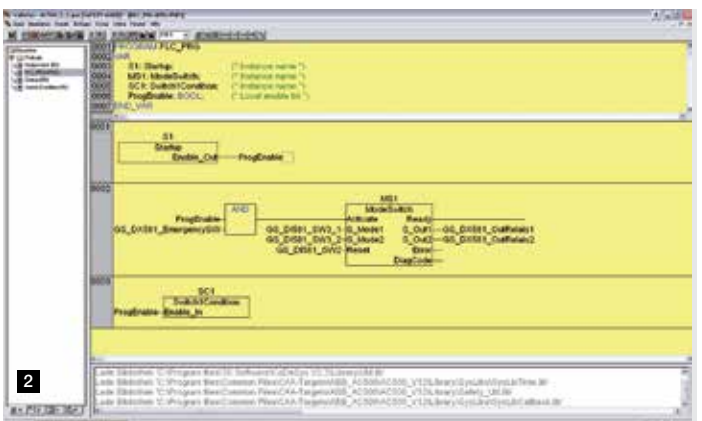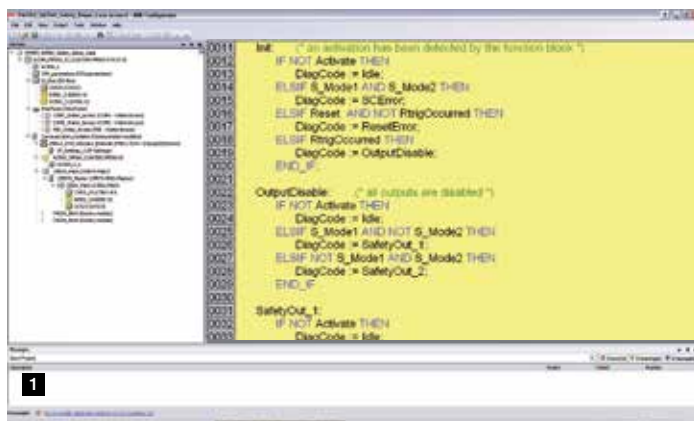
TÜV SÜD
Rail

## LETTER OF CONFIRMATION

# PS501 Control Builder Plus V 2.2.x

| **Manufacturer:** | **Testing body:** |
|---|---|
| ABB Automation Products GmbH | TÜV SÜD RAIL GmbH |
| | Generic Safety Systems |
| Eppelheimer Str. 82 | Barthstrasse 16 |
| 69123 Heidelberg | D-80339 München |

### 1. General

**PS501 Control Builder Plus V2.2.x** is an engineering tool to configure, program and download safety related applications (up to SIL 3 according to IEC 61508 Ed 2) using the AC500-S Safety PLC, provided that AC500-S Safety PLC is certified for SIL3 (IEC 61508 Ed 2) and that the guidelines of safety manual of AC 500-S are followed.

### 2. Version

CBP Version:     2.2.x

### 3. Test bases

The engineering tool, implementing the certified software components SPT, S-PlugIn and CoDeSys V2.3.x safety, classified as *T3 offline support tool* according to IEC 61508-4, is suitable to develop safety related applications according to IEC 61508-3 and download to the safety controller AC 500-S.

The result is based on the documents as follows:

| | |
|---|---|
| AC 500-S SRS | v 1.0.10 |
| Letter of Conformity | S-PlugIn |
| Letter of Conformity | Safety Parameter Tool – SPT |
| Technical Report SK82342T | CoDeSys V2.3 Safety |
| Technical report Control Builder Plus | v 1.0.1 |

### 4. Summary

TÜV SÜD Rail GmbH, Generic Safety Systems, has no doubts as to the safety-related issues of the use of **PS501 Control Builder Plus V2.2.x** for safety related applications up to SIL3 according to IEC 61508 Ed 2.

TÜV SÜD Rail GmbH
Guido Neumann

München, den 21.Mai 2012

# Ordering Data (1)

## AC500-S Standard modules



### Safety CPU

| Type | Description | User program memory | Order code |
|---|---|---|---|
| SM560-S | Safety CPU module | 1 MB | 1SAP 280 000 R0001 |

### S500 Safety I/O

| Type | Description | Input signal | Output signal | Order code |
|---|---|---|---|---|
| DI581-S | Safety digital input module | 16 (SIL2) or 8 (SIL3) | - | 1SAP 284 000 R0001 |
| DX581-S | Safety digital input / output module | 8 (SIL2) or 4 (SIL3) | 8 (SIL3) | 1SAP 284 100 R0001 |
| AI581-S | Safety analog input module | 4 (SIL2) or 2 (SIL3) | - | 1SAP 282 000 R0001 |

### S500-S terminal unit

| Type | Description | Order code |
|---|---|---|
| TU582-S | Spring terminal unit for safety I/O modules | 1SAP 281 200 R0001 |

## Software

| Type | Description | Order code |
|---|---|---|
| PS501-S* | Licence enabling package for AC500-S Safety PLC programming | 1SAP 198 000 R0001 |

*PS501 Control Builder Plus required (V2.2.1 or a later version)

# Ordering Data (2)

## AC500-S Extreme condition (XC) modules
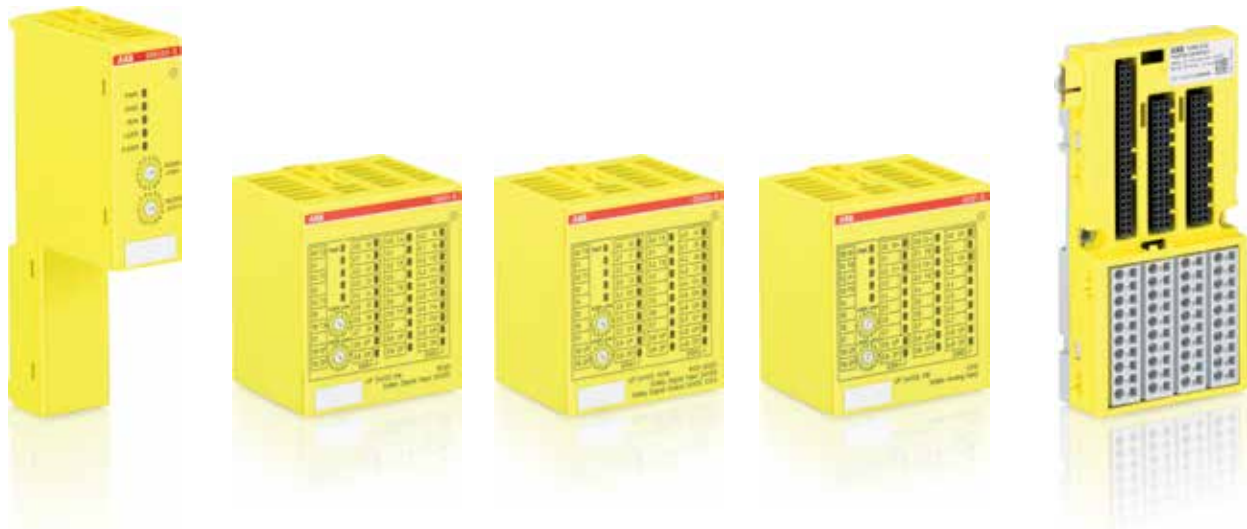
### Safety CPU

| Type | Description | User program memory | Order code |
|---|---|---|---|
| SM560-S-XC | Safety CPU module | 1 MB | 1SAP 380 000 R0001 |

### S500 Safety I/O

| Type | Description | Input signal | Output signal | Order code |
|---|---|---|---|---|
| DI581-S-XC | Safety digital input module | 16 (SIL2) or 8 (SIL3) | - | 1SAP 484 000 R0001 |
| DX581-S-XC | Safety digital input / output module | 8 (SIL2) or 4 (SIL3) | 8 (SIL3) | 1SAP 484 100 R0001 |
| AI581-S-XC | Safety analog input module | 4 (SIL2) or 2 (SIL3) | - | 1SAP 482 000 R0001 |

### S500-S terminal unit

| Type | Description | Order code |
|---|---|---|
| TU582-S-XC | Spring terminal unit for safety I/O modules | 1SAP 481 200 R0001 |

# Technical data (1)

| Type | SM560-S / SM560-S-XC |
|---|---|
| Performance Level | PL e (ISO 13849) |
| Safety Integrity Level | SIL3 (IEC 61508: 2010, IEC 62061) |
| Safety protocol | PROFIsafe V2 via PROFINET |
| Program memory Flash EPROM and RAM | 1 MB |
| Integrated data memory | 1 MB thereof 120 KB saved |

| Cycle time for 1 instruction | |
|---|---|
| Binary | 0.05 µs |
| Word | 0.06 µs |
| Flöating point | 0.5 µs |

| Max. number of centralized inputs/outputs | |
|---|---|
| Max. number of safety extension modules on I/O bus | up to max. 10 |
| Digital inputs | 160 (SIL2) / 80 (SIL3) |
| Digital outputs | 80 (SIL3) |
| Analog inputs | 40 (SIL2) / 20 (SIL3) |
| Max. number of decentralized inputs/outputs | On PROFINET: up to 128 stations with up to 10 safety extension modules |

| Program execution | |
|---|---|
| Cyclical | ✓ |
| User program protection by password | ✓ |

| Interfaces | |
|---|---|
| Ethernet | Via non-safety AC500 CPU or PROFINET coupler |
| COM | Via non-safety AC500 CPU |
| Programming | Via non-safety AC500 CPU |

| Approvals | |
|---|---|
| | CE, cUL, UL, C-Tick |

| Type | DI581-S / DI581-S-XC | DX581-S / DX581-S-XC | AI581-S / AI581-S-XC |
|---|---|---|---|
| Performance Level | PL e (ISO 13849) | PL e (ISO 13849) | PL e (ISO 13849) |
| Safety Integrity Level | SIL3 (IEC 61508: 2010, IEC 62061) | SIL3 (IEC 61508: 2010, IEC 62061) | SIL3 (IEC 61508: 2010, IEC 62061) |
| Safety protocol | PROFIsafe V2 via PROFINET | PROFIsafe V2 via PROFINET | PROFIsafe V2 via PROFINET |
| **Digital inputs** | | | |
| Number of channels per module | 16 (SIL2) / 8 (SIL3) | 8 (SIL2) /4 (SIL3) | - |
| Input signal voltage | 24 V DC | 24 V DC | - |
| Frequency range | 65 Hz | 65 Hz | - |
| Input characteristic acc. to EN61131-2 | Type 1 | Type 1 | - |
| 0 signal | - 3 V DC ... + 5 V DC | - 3 V DC ... + 5 V DC | - |
| Undefined signal state | > +5 V DC ... < + 15 V DC | > +5 V DC ... < + 15 V DC | - |
| 1 signal | + 15 V DC ... + 30 V DC | + 15 V DC ... + 30 V DC | - |
| Input time delay (0 -> 1 or 1 -> 0) | Input filter configurable from 1, 2, 5... 500 ms | Input filter configurable from 1, 2, 5... 500 ms | - |
| Test pulse outputs | 8 | 4 | - |
| **Input current per channel** | | | |
| At input voltage | + 24 V DC / 7 mA typically | + 24 V DC / 7 mA typically | - |
| | + 5 V DC / < 1 mA | + 5 V DC / < 1 mA | - |
| | + 15 V DC / > 4 mA | + 15 V DC / > 4 mA | - |
| | + 30 V DC / < 8 mA | + 30 V DC / < 8 mA | - |
| **Digital outputs** | | | |
| Number of channels per module | - | 8 (SIL3) | - |
| Transistor outputs 24 V DC, 0.5 A | - | ✓ | - |
| Switching of 24 V load | - | ✓ | - |
| **Output current** | | | |
| Nominal current per channel | - | 500 mA at UP = 24 V | - |
| Maximum (total current of all channels) | - | 4 Amp. / 500 mA / channel | - |
| Residual current at signal state 0 | - | < 0,5 mA | - |
| Demagnetization when switching off inductive loads | - | By internal suppressor diods | - |
| **Switching frequency** | | | |
| Short-circuit / overload proofness | - | ✓ | - |
| For inductive load | - | On request | - |
| For lamp load | - | On request | - |
| Proofness against reverse feeding of 24 V signals | - | ✓ | - |

| Type | DI581-S / DI581-S-XC | DX581-S / DX581-S-XC | AI581-S / AI581-S-XC |
|---|---|---|---|
| **Analog inputs** | | | |
| Number of channels per module | - | - | 4 (SIL2) / 2 (SIL3) |
| Input resistance per channel | - | - | 125 Ohm |
| Time constant of the input filter | - | - | 10 ms |
| Conversion cycle | - | - | 0,33 ms |
| Overvoltage protection | - | - | - |
| **Signal resolution for channel configuration** | | | |
| 0 … 20 mA, 4 … 20 mA | - | - | 14 bits |
| **Process voltage UP** | | | |
| Nominal voltage | 24 V DC | 24 V DC | 24 V DC |
| Maximum ripple | 5% | 5% | 5% |
| Reverse polarity protection | ✓ | ✓ | ✓ |
| Fuse for process voltage UP | 10 A miniature fuse | 10 A miniature fuse | 10 A miniature fuse |
| Connections for sensor voltage supply. Terminal + 24 V and 0 V | ✓ | ✓ | ✓ |
| Conversion error of analog values caused by non-linearity, calibration errors ex and the resolution in the nominal range | - | - | ± 1,5% |
| **Maximum cable length for connected process signals** | | | |
| Shielded cable | 1000 m | 1000 m | - |
| Unshielded cable | 600 m | 600 m | - |
| Max. line length (m) of the analog lines, conductor cross section > 0.14 mm² | - | - | 100 m |
| **Potential isolation** | | | |
| Per module | ✓ | ✓ | ✓ |
| Fieldbus connection | Via non-safety AC500 CPU or PROFINET coupler | | |
| Voltage supply for the module | Internally via extension bus interface (I/O bus) | | |
| **Approvals** | CE, cUL, UL, C-Tick | | |

# AC500-S-XC



## XC stands for extreme conditions

AC500–S applications range from Crane, Hoist, Winch, Robots, Wind, Solar etc. wherein harsh environmental conditions are expected. All AC500-S components are available as XC version as well. Physical dimensions, basic electrical characteristics and software compatibility correspond with the standard version. In many cases, this makes engineering and operations much more cost-efficient.

## Benefits of XC version

AC500-S-XC benefit is cost saving in engineering and operations. Many extras become obsolete like sealing at cable entrances and doors, shock absorbers, HVAC for the panel, cooling fins and cut-outs and EMC protection

### Operating in wet environment
– Increased resistance to 95% humidity

### Use at high altitudes
– Operating altitude up to 4,000 m above sea level

### Extended immunity to vibration
– 4 g root mean square random vibration up to 500 Hz
– 2 g sinusoidal vibration up to 500 Hz

### Extended EMC requirements
– EN 61000-4-5 surge immunity test
– EN 61000-4-4 transient / burst immunity test

### Extended operating temperature
– -40 °C up to +70 °C operating temperature

### Extended immunity to hazardous gases and salt mist
– G3, 3C2 immunity
– Salt mist EN 60068-2-52 / EN 60068-2-11

# Extreme Condition specifications (1)

## Electrical requirements

### Process and supply voltages

| | |
|---|---|
| Process and supply voltage | 24 V DC (-25 %, +30 % inclusive ripple) |
| Absolute limits | 18 V...31.2 V inclusive ripple |
| Ripple | < 10 % |
| Protection against reverse polarity | yes |
| Allowed interruptions of power supply (DC supply) | Interruption < 10 ms, time between 2 interruptions > 1 s, PS2 |

## Environmental Conditions

### Temperature

| | |
|---|---|
| Operating Temperature | **-40 °C ... +70 °C** |
| | < -30 °C: Power-up only |
| | < 0 °C: Due to the LCD technology, the display might not be readable below 0 °C. |
| | -40 °C...+40 °C (vertical mounting of module output load limited to 50 % per group) |
| | +60 °C ...+70 °C with the following deratings:<br>– Terminal Bases: max. 2 Communication Modules allowed<br>– Digital inputs: maximum number of simultaneously switched on input channels limited to 50 % per group (e.g. 8 channels => 4 channels)<br>– Digital outputs: output current maximum value (all channels together) limited to 50 % per group (e.g. 4 A => 2 A)<br>– Analog inputs: No limitations |
| Storage / Transport | -40 °C ... +85 °C |

### Humidity

| | |
|---|---|
| Operating / Storage | - Max. 100 % with condensation |

### Air pressure

| | |
|---|---|
| Operating | -1000 m .... 4000 m (1080 hPa ... 620 hPa) |
| | >2000 m (<795 hPa): max. operating temperature must be reduced with 10°C (e.g. 70°C to 60°C) |

### Immunity to corrosive gases

| | |
|---|---|
| Operating | Yes, according to:<br>ISA S71.04.1985 Harsh group A, G3/GX<br>IEC 60721-3-3 3C2 / 3C3 |

### Immunity to salt mist

| | |
|---|---|
| Operating | Yes, horizontal mounting only, according to:<br>IEC 60068-2-52 severity level: 1 |

# Extreme Condition specifications (2)

### Electromagnectic Compatibility

| | |
|---|---|
| Electrostatic discharge (ESD) | Yes, according to:<br>IEC 61000-4-2, zone B, criterion B |
| Fast transient interference voltages (burst) | Yes, according to:<br>IEC 61000-4-4, zone B, criterion B |
| High energy transient interference voltages (surge) | Yes, according to:<br>IEC 61000-4-5, zone B, criterion B |
| Influence of radiated disturbances | Yes, according to:<br>IEC 61000-4-3, zone B, criterion A |
| Influence of line-conducted interferences | Yes, according to:<br>IEC 61000-4-6, zone B, criterion A |
| Influence of power frequency magnetic fields | Yes, according to:<br>IEC 61000-6-2, zone B, criterion A |

### Radiation

| | |
|---|---|
| Radio disturbance | Yes, according to:<br>IEC 55011, group 1, class A |

### Mechanical Data

| | |
|---|---|
| Wiring method | Spring terminals |
| Degree of protection | IP 20 |
| Vibration resistance | Yes, according to:<br>IEC 61131-2<br>IEC 60068-2-6<br>IEC 60068-2-64<br>IACS UR E10 |
| Vibration resistance with SD Memory Card inserted at the PM5xx module | 5 Hz ... 500 Hz, 2 g |
| Shock resistance | Yes, according to:<br>IEC 60068-2-27 |
| Mounting | DIN RAIL |
| Mounting position | Horizontal / Vertical (no application in salt mist environment; output load limited to 50 % per group) |
| DIN rail according to EN 50022 | 35 mm, depth 7.5 mm or 15 mm |
| Mounting with screws | with a diameter of 4 mm |
| Fastening torque | 1.2 Nm |

# Latest software innovation from ABB

## Automation Builder – Engineering Productivity
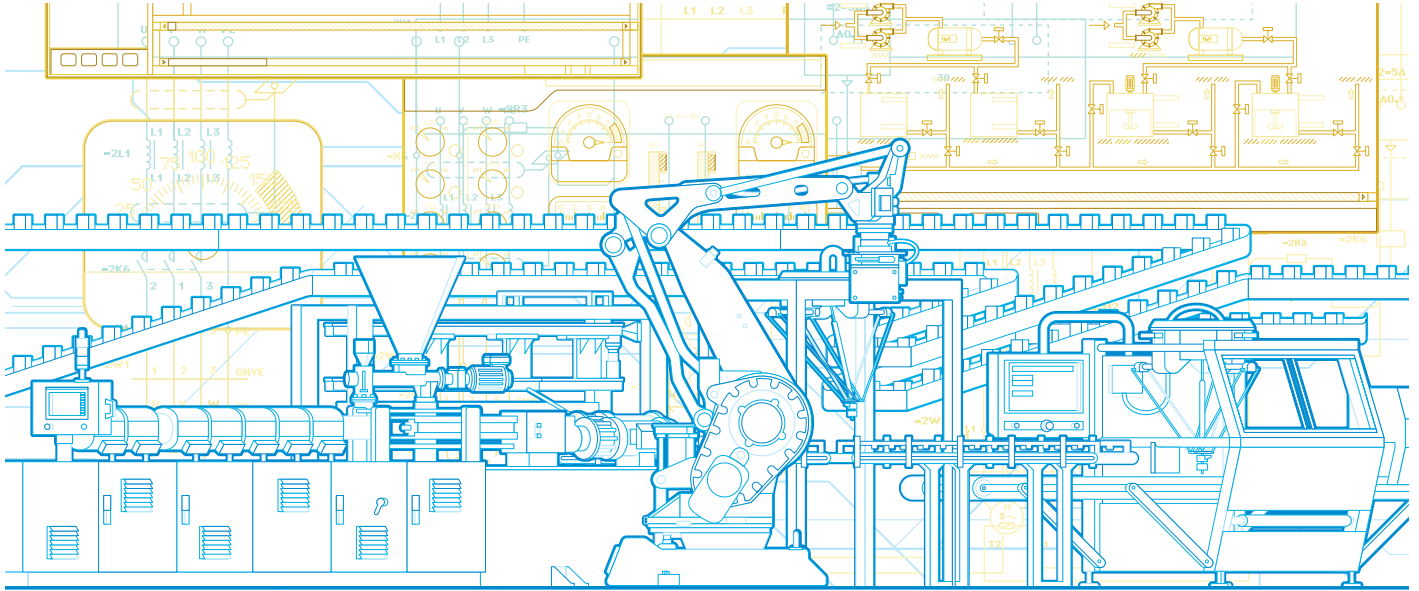
**Engineering software for integrated industrial automation**
Automate machines and systems in an integrated way – PLC, HMI, drives, motion and robots.
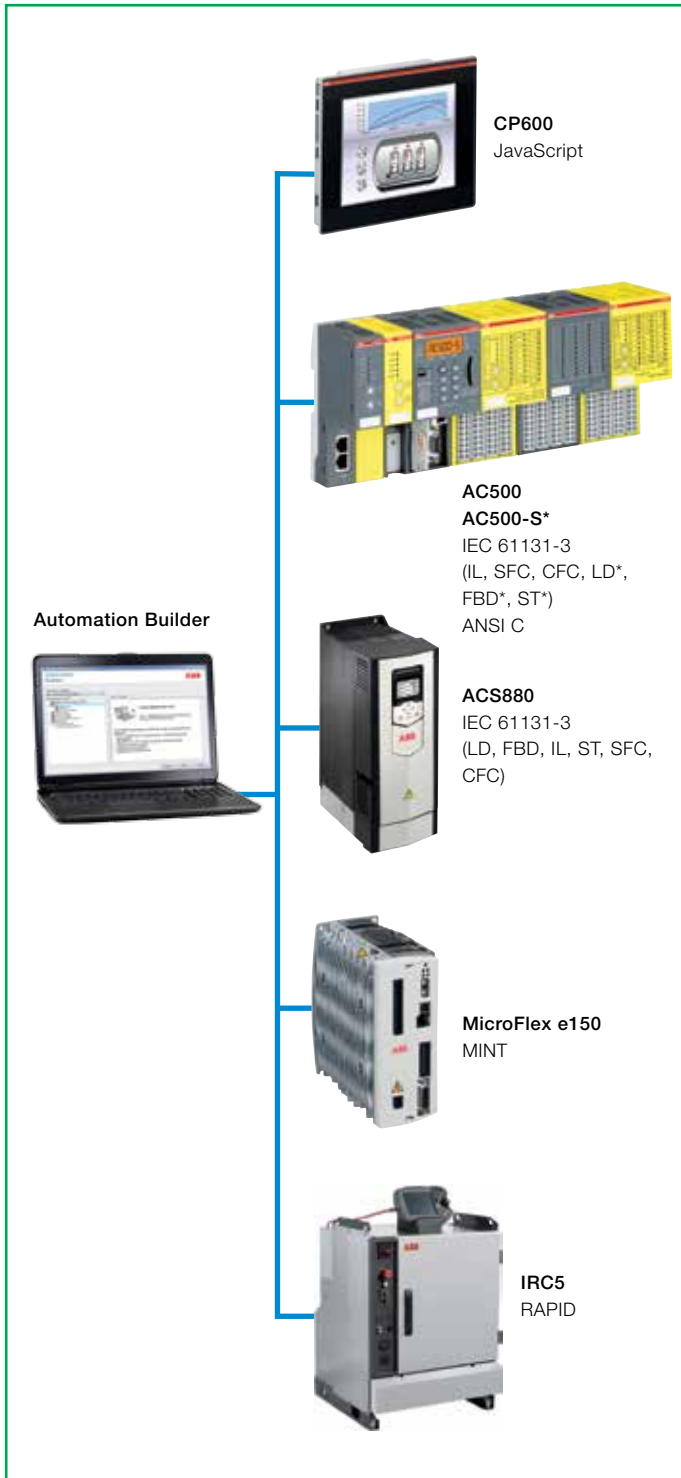
ABB Automation Builder is the new integrated software suite for machine builders and system integrators that want to automate their machines and systems in an integrated and efficient way. With this software suite, the ABB division "Discrete Automation and Motion" is reaching an important milestone on the road to achieving fully integrated engineering of discrete automation solutions including functional safety.

The software package contains the programming and configuration tool for the ABB PLC, Control Builder Plus, with electrical drives parameterization and drive application programming as integrated plug-ins. As a unique feature, ABB now includes the market leading offline robot programming and simulation tool, RobotStudio, providing customers with simple and fast interfacing of a PLC with a robot controller.

Additionally included are the Panel Builder for touch screen panel programming and the motion engineering tool, Mint Workbench. The underlying Automation Builder Platform allows common data storage and usage of common functionality by the integrated software tools.

For customers, the consistency of the ABB Automation Builder delivers significant engineering productivity improvements as well as simplified management and maintenance of the entire automation project. This helps to save time and to increase software quality by consistent data and software versions.

With the Automation Builder, various controller families can be combined in one automation project, and they can be configured and programmed from a single software suite. With a choice of various programming languages, the most suitable language for the particular application is available. At the same time, the USB-ROM distribution medium with a common installer ensures trouble-free and quick installation – on a customer-specific or project-specific basis.

**CP600**
JavaScript

**AC500**
**AC500-S***
IEC 61131-3
(IL, SFC, CFC, LD*,
FBD*, ST*)
ANSI C

**Automation Builder**

**ACS880**
IEC 61131-3
(LD, FBD, IL, ST, SFC,
CFC)

**MicroFlex e150**
MINT

**IRC5**
RAPID

The ABB Automation Builder contains the following components and functionalities:

### Installation manager

The installation of the various software packages from the USB-ROM stick can be configured on a user-specific basis. The memory space on the hard disk and the installation time can thus be adapted to reflect the requirements. Individual components and update packages from ABB can easily be installed at a later date if necessary.

### Engineering platform

The engineering platform is the core of the Automation Builder suite. All tools save their project data in the platform, which also provides a shared object data structure for configuration. The relevant plug-ins and tools for the different devices are started from the platform. It is also the portal for web-based content, like application examples, device descriptors, news and software updates.

### Engineering of PLC AC500 and AC500-eCo

The PLC configuration, programming, debugging and diagnostics are based on the PLC engineering tool Control Builder Plus. IEC 61131-3 technology guarantees comprehensive PLC functionality. It is now also possible to perform integrated C programming via the GNU compiler for the AC500 PLC. The integration of the devices via standardized Fieldbuses ensures openness to third-party devices.

### Configuration and programming of AC500-S Safety PLC

The configuration and programming of the AC500-S safety controller is seamlessly integrated into the Automation Builder. The AC500-S can optionally be combined with non-safe devices in the project. The programming takes place analogously to the standard PLC, but with a safety-certified editor in accordance with SIL 3 (IEC 62061) and PL e (ISO 13849). Unique features that should be emphasized are the safety programming in Structured Text (ST) and the use of trigonometric functions, for example for kinematic calculations.

### Human Machine Interface – CP600 touch panels

The Automation Builder also offers various options for flexibly creating a user interface for the ABB control panel family CP600, using web visualization or the Panel Builder 600 V1.8. Here joint project data management is implemented, too.

### Configuration and programming of drives

The updated, integrated Drive Manager permits the remote configuration and online diagnostics of ABB low-voltage drives via the PLC network, which speeds up commissioning and diagnostic of the entire system. A new feature is the application programming of the ABB industrial drive ACS880 with an embedded PLC based on IEC 61131-3. System integrators and machine builders can utilize the drive-based control with the drive's inputs and outputs to implement cost-effective, decentralized control.

### Motion control – MicroFlex e150 servo drive

With the integration of Mint Workbench V5706 into the Automation Builder, it is now possible to use the EtherCAT servo drive MicroFlex e150 with an AC500 as central multi-axis motion controller. A dedicated motion control library based on PLCopen is available. Hereby, the ABB motion control offering around the MINT product lines NextMove, MotiFlex and MicroFlex is extended by a PLC-based solution.

### Robot interface – IRC5 robot controller

The latest version of RobotStudio, the software tool for the configuration, programming and simulation of ABB robots, is part of the Automation Builder suite. Essential new features of version 5.15 are improved ease of use, new robot models and the option to import larger amounts of CAD data by Windows 64-bit support. The robot controller is quickly connected to the AC500 PLC as a fieldbus device. Common fieldbus I/O signals are defined and transferred to RobotStudio. From there, the IRC5 I/O communication can then be configured easily and consistently. This means that the PLC and the robot become part of the same automation project and inconsistent interfaces are now a thing of the past.
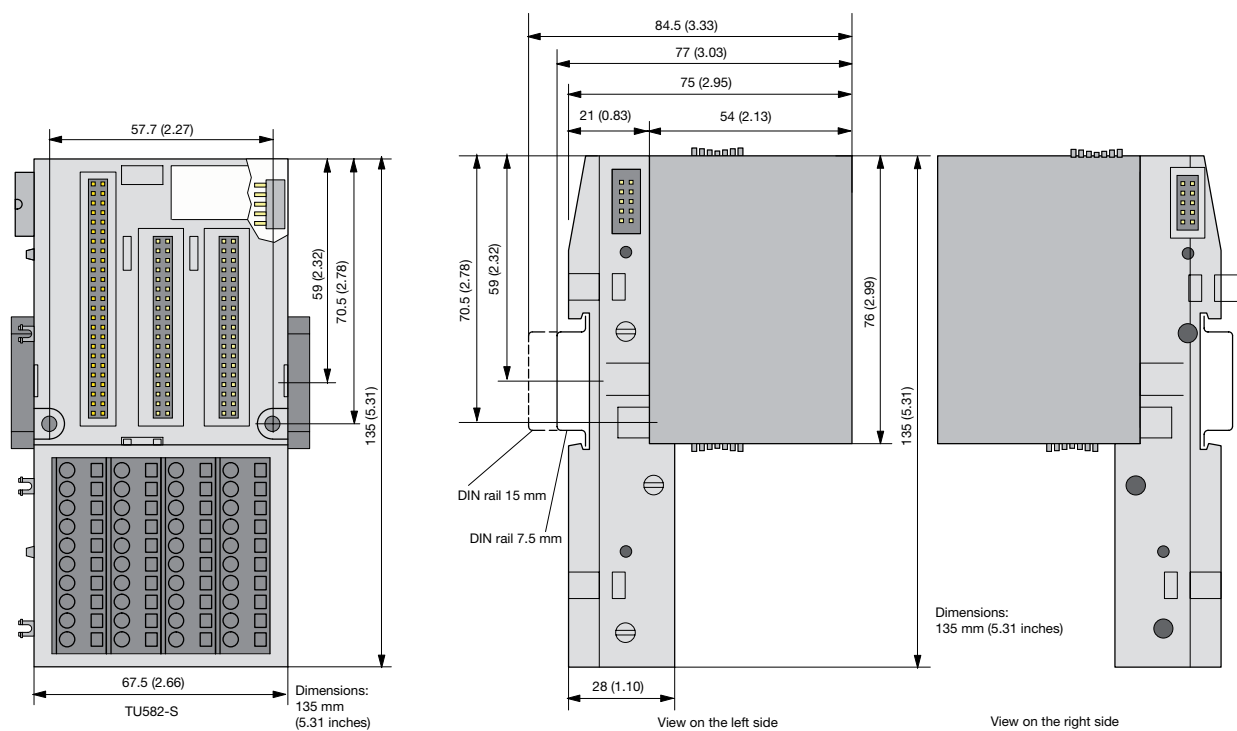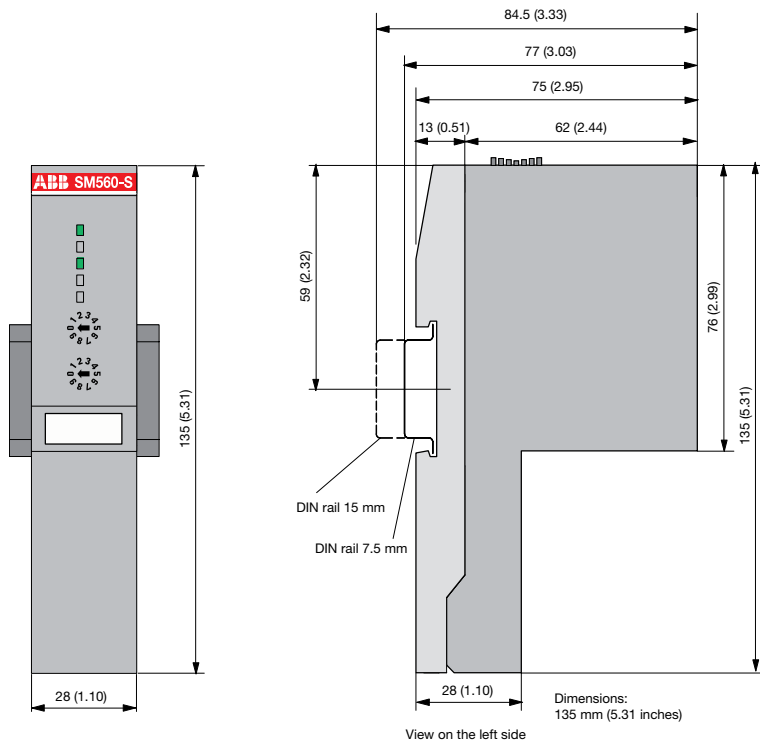
### Migration and availability

Automation Builder contains Control Builder Plus, RobotStudio, Mint Workbench and Panel builder. All software except Control Builder Plus could still be ordered separately, if required by the customers.

# Dimensions

Dimensions: mm (inches)



84.5 (3.33)
77 (3.03)
75 (2.95)
13 (0.51)   62 (2.44)

59 (2.32)
76 (2.99)
135 (5.31)

28 (1.10)
135 (5.31)

DIN rail 15 mm
DIN rail 7.5 mm

28 (1.10)

Dimensions:
135 mm (5.31 inches)

View on the left side

ABB SM560-S

57.7 (2.27)

59 (2.32)
70.5 (2.78)
135 (5.31)

67.5 (2.66)

TU582-S

Dimensions:
135 mm
(5.31 inches)

84.5 (3.33)
77 (3.03)
75 (2.95)
21 (0.83)   54 (2.13)

70.5 (2.78)
59 (2.32)
76 (2.99)
135 (5.31)

DIN rail 15 mm
DIN rail 7.5 mm

28 (1.10)

View on the left side

Dimensions:
135 mm (5.31 inches)

View on the right side

# Contact us

**ABB Automation Products GmbH**
Wallstadter Str. 59
68526 Ladenburg, Germany
Phone: +49 (0) 6221 701-1444
Fax:    +49 (0) 6221 701-1382
Email:  plc.sales@de.abb.com

**www.abb.com/plc**
**www.abb.com/drives**

ABB Global Contact Directory
The ABB Contact Directory (http://www.abb.com/contacts/) helps you find local contacts for ABB products in your country.
Please select the relevant product group from the dropdown menu to the right or from the page.

Power and productivity
for a better world™

**ABB**