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1. Disclaimer

A. For customers domiciled outside Germany / Für Kunden mit Sitz außerhalb Deutschlands

„Warranty, Liability:
The user shall be solely responsible for the use of this AC500-S Training Case described within this file. ABB shall be under no warranty whatsoever. ABB’s liability in connection with this application example or the files included within this file, irrespective of the legal ground, shall be excluded. The exclusion of liability shall not apply in the case of intention or gross negligence. The present declaration shall be governed by and construed in accordance with the laws of Switzerland under exclusion of its conflict of laws rules and of the Vienna Convention on the International Sale of Goods (CISG).“

„Gewährleistung und Haftung:

B. Nur für Kunden mit Sitz in Deutschland
„Gewährleistung und Haftung:

Der Nutzer ist für die ordnungsgemäße, insbesondere vollständige und fehlerfreie Programmierung der Steuerungen selbst verantwortlich. Im Falle der teilweisen oder ganzen Übernahme der Programmierbeispiele können gegen ABB keine Ansprüche geltend gemacht werden.


Es gilt materielles deutches Recht unter Ausschluss des UN-Kaufrechts."
2. Introduction

The operational guidelines described below are information which relates to the device, place of actual use, transportation, storage, assembly, use and maintenance.

This TA514-SAFETY Training Case has been designed for use in an industrial environment in compliance with the 2004/108/EC EMC Directive and 2006/95/EC Low Voltage Directive with the following harmonized standards:

- EN 61000-6-4
- EN 61000-6-1
- EN 50178

The product has been designed in compliance with:

- EN 61000-6-4 EN 55022 Class A
- EN 61000-6-1 EN 61000-4-2
  - EN 61000-4-3
  - EN 61000-4-4
  - EN 61000-4-5
  - EN 61000-4-6
  - EN 61000-4-8
  - Light industry level, criteria A

The product is in compliance with the Restrictions on Certain Hazardous Substances (RoHS) Directive 2011/65/EC. In compliance with the above regulations the product is CE marked.

**WARNING**

This is a product designed for an industrial environment. In a residential, commercial or light industrial environment it may cause radio interference. The user may be required to take adequate measures to reduce interference.

This operation manual describes the main features of the TA514-SAFETY Training Case. The operation manual refers to the following model:

<table>
<thead>
<tr>
<th>Picture</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Image" /></td>
<td>TA514-SAFETY (Order No.1SAP182900R0001)</td>
<td>AC500-S Training Case</td>
</tr>
</tbody>
</table>
3. Before you start

3.1. Safety notices

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER</td>
<td>Indicates an imminent risk. It will lead to death or serious injury if not avoided.</td>
</tr>
<tr>
<td>WARNING</td>
<td>Indicates a possible risk. It may lead to death or serious injury if not avoided.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Indicates a possible risk. It may lead to light or slight injury or material damage if not avoided.</td>
</tr>
</tbody>
</table>

3.2. Markups

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTICE</td>
<td>Helpful information with background information or an emphasized notice.</td>
</tr>
</tbody>
</table>
3.3. Definitions, expressions, abbreviations

<table>
<thead>
<tr>
<th>AC500-S</th>
<th>ABB Safety PLC for applications up to SIL3 (IEC 61508 ed.2 and IEC 62061) and PLe (ISO 13849)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic Redundancy Check. A number derived from and stored or transmitted with a block of data in order to detect data corruption.</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission Standard</td>
</tr>
<tr>
<td>SIL</td>
<td>Safety Integrity Level</td>
</tr>
<tr>
<td>PL</td>
<td>Performance Level</td>
</tr>
<tr>
<td>NC</td>
<td>Normally Closed</td>
</tr>
<tr>
<td>FB</td>
<td>Function Block</td>
</tr>
</tbody>
</table>

3.4. References / related documents

[1.] Automation Builder 1.1 (or newer) – Complete English Documentation
[2.] Online Help Documentation of CoDeSys V2.3.x
[3.] AC500-S Safety User Manual V1.0.1 or newer
4. Product overview


AC500-S is a Safety PLC (Programmable Logic Controller) comprising I/O modules to which a safety device, e.g., an emergency stop switch, safety light curtain or any other device could be connected. In TA514-SAFETY, functional safety related diagnostic functions of the Safety PLC can be experienced as well as the main safety function of AC500-S Safety PLC e.g. to read safety digital and analog inputs and to control the safety digital outputs according to a user-defined IEC 61131 application program and configuration.

TA514-SAFETY Training Case is designed to demonstrate the following configuration scenarios of Safety CPU and IOs:

- The communication of SM560-S Safety CPU to Safety I/O modules using a PROFIsafe profile for safe data transmission in both central and remote configurations

TA514-SAFETY Training Case is designed to demonstrate the following functionalities:

- Configuring the safety hardware
- Safety I/O mapping
- I/O wiring test
- Channel passivation and reintegration
- Channel reintegration through program
- Module passivation
- Module reintegration
- E-ERR usage
- PLCopen Safety function block usage
- Data exchange between SM560-S and PM573

⚠️ WARNING

AC500-S Safety User Manual [3.] warnings must be taken into consideration.
4.1. Product identification

<table>
<thead>
<tr>
<th>Information on product label (example)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA514-SAFETY</td>
<td>Product type</td>
</tr>
<tr>
<td>1SAP182900R0001</td>
<td>Product part number</td>
</tr>
<tr>
<td>1494 1S12025000000000</td>
<td>Serial number</td>
</tr>
<tr>
<td>A1</td>
<td>Version number of the product</td>
</tr>
</tbody>
</table>

4.2. Environmental conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>According to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation temperature (ambient air temperature)</td>
<td>0 … +50 °C (32 … 122 °F)</td>
<td>EN 60068-2-14</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20 … +60 °C (-4 … 140 °F)</td>
<td>EN 60068-2-14</td>
</tr>
<tr>
<td>Operation humidity</td>
<td>20 … 90% rel. H, non-condensing</td>
<td>EN 60068-2-78</td>
</tr>
<tr>
<td>Storage humidity</td>
<td>95% rel. H, non-condensing</td>
<td>EN 60068-2-78</td>
</tr>
<tr>
<td>Vibration</td>
<td>10 - 150 Hz&lt;br&gt;10 Hz - 57 Hz, ± 0,075 mm&lt;br&gt;57 Hz - 150 Hz, 1 g&lt;br&gt;1 Oct./min&lt;br&gt;10 sweep cycles / axis, in 3 axis</td>
<td>EN 60068-2-6</td>
</tr>
<tr>
<td>Shock</td>
<td>Half sine wave, 10G, 11ms&lt;br&gt;3 times in each direction of X-, Y-, Z-axis</td>
<td>EN 60068-2-27</td>
</tr>
</tbody>
</table>
5. Deliverables

TA514-SAFETY Training Case includes following AC500/S500 and AC500-S products. The communication of Safety CPU to remote Safety I/O modules is done by using PROFINET IO field bus with a PROFIsafe profile for safe data transmission. When the system requirements expand, ABB’s wide product range provides a flexible and cost-efficient way to meet the system’s growing needs. The advantages of the Training Case are easily shown:

1. Compact size of the Training Case, easy to carry;

2. TA514-SAFETY System will be delivered in a case (L546 x W347 x H197mm) for safe transportation which is waterproof, resistant to chemicals, humidity and dust. The weight of case including the TA514-SAFETY setup will meet the limitations of hand luggage restrictions (max. 10kg).

3. Includes three safe IO signal types DI, DO and AI, which are commonly used in safety applications. Easy and quick demonstration of the AC500-S safety functionalities.

4. The system can be configured as a SIL1-3 and/or (PLa-e) application, according to customers’ requirements.

5.1. AC500-S

<table>
<thead>
<tr>
<th>No.</th>
<th>Module</th>
<th>Details</th>
<th>Default switch address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SM560-S</td>
<td>Safety CPU (Safety Module) for up to SIL3 (IEC 61508 ed. 2 and IEC 62061) and PL e (ISO 13849) safety applications.</td>
<td>x00H</td>
</tr>
</tbody>
</table>
### 5.2. AC500/S500

<table>
<thead>
<tr>
<th>No.</th>
<th>Device</th>
<th>Details</th>
<th>Default switch address</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>CM579-PNIO</td>
<td>PROFINET® IO-Controller communication module</td>
<td>x00H (not used)</td>
</tr>
<tr>
<td>7</td>
<td>PM573-ETH</td>
<td>PM573-ETH, CPU, memory 512 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, Onboard Ethernet TCP/IP with Webserver, SNTP, IEC60870-5-104 protocols.</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>CI502-PNIO</td>
<td>PROFINET® IO-Device Bus Module with 8 DI, 8 DO and 8 DC.</td>
<td>x02H</td>
</tr>
<tr>
<td>9</td>
<td>TU508-PNIO</td>
<td>Terminal Unit, screw-type terminal</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 5.3. Accessories

<table>
<thead>
<tr>
<th>No.</th>
<th>Device</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>MC502</td>
<td>SD Memory Card</td>
</tr>
<tr>
<td>11</td>
<td>TA521</td>
<td>Lithium Battery</td>
</tr>
<tr>
<td>12</td>
<td>X1 / X2</td>
<td>Light curtain interface socket (2 channel OSSD)</td>
</tr>
<tr>
<td>13</td>
<td>Power Adapter</td>
<td>AFM45US24</td>
</tr>
</tbody>
</table>
6. Dimensions

TA514-SAFETY:

TA514-SAFETY Training Case will be delivered in a case (L546 x W347 x H197 mm). The Training Case setup itself has following dimensions:
7. Getting started

Before you start, make sure following documents and the application program are available:

1. 3ADR025003M99*: “Regulations Concerning the Setting up of Installations AC500 Control System, AC500-S Safety PLC”

2. 3ADR025091M*: AC500-S Safety User Manual


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NOTICE

To edit the provided application program for TA514-SAFETY, the following Software is needed:

- Automation Builder V1.1 (or higher)

See also “PS501-S License enabling package” for Safety: 3ADR025001M06* at www.abb.com/PLC and follow license guidelines for Automation Builder.

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NOTICE

A modification of the safety application program generates a new project CRC version number.

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WARNING

The exemplary project is NOT intended to be used on real machines. It is for training purposes only.

Programming Guidelines described in AC500-S Safety User Manual shall be followed.
7.1. How to remove TA514-SAFETY from the case

Following picture demonstrates the holding positions (see arrows) to remove TA514-SAFETY from the carrying case.

7.2. Power supply

Steps to connect the power supply to TA514-SAFETY:
1. Connect power supply cable with power adapter
2. Connect 24 VDC of power adapter to 24 VDC connector on TA514-SAFETY
3. Plug in power supply cable to 220 / 230 / 240 VAC socket

For detailed information please refer to the Installation Instructions of TA514-SAFETY at http://www.abb.com/PLC.
WARNING

AC500-S Training Case is only intended to be used by skilled persons aware of the risks using electrical equipment and knowing the technical rules, codes and relevant standards.

WARNING

This Training Case must only be used with the delivered power supply adapter. The use of another power supply is prohibited.

WARNING

Power adapter is Class I Equipment. Make sure that the right power cable (suitable for your country) is used. This assures that earth pin of power supply is connected to the Protective Earthing Conductor of the building.
7.3. Functionality - front panel

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Functionality (see circuit diagrams and AC500-S training application project for detail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main power On/Off switch</td>
<td>Control switch to power on/off the 24V DC power of TA514-SAFETY</td>
</tr>
<tr>
<td>2</td>
<td>Power socket</td>
<td>24V DC input connector for power supply adapter</td>
</tr>
<tr>
<td>3</td>
<td>Analog potentiometer(s)</td>
<td>AI 1, AI 2: Adjustable 4 ... 20 mA signal for analog inputs of AI581-S.</td>
</tr>
<tr>
<td>4</td>
<td>Channel passivation simulator switches</td>
<td>T1: Switch to simulate broken wire condition (measurement underflow) for analog channel I0 of AI581-S. T2: Switch to simulate a 24V DC short circuit (channel passivation) for digital channels I0 and I4 of DX581-S.</td>
</tr>
<tr>
<td>5</td>
<td>Input simulator switches</td>
<td>S6: Switch to activate/deactivate the module passivation of AI581-S and DX581-S modules through SM560-S Safety CPU program. S7, S8: Switches connected to DI581-S module to demonstrate safety digital input behaviour in single channel mode. S9: Switch to reintegrate all passivated safety module channels.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
| **6** | Indicating LEDs | H5: Indicator for contactor K1 activation  
H6: Indicator for contactor K2 activation  
H7: Indicator connected to safety digital output channel O6 on DX581-S module (not used in the example project).  
H8: Indicator connected to safety digital output channel O7 on DX581-S module (not used in the example project).  
H9: Indicator for T1 activation  
H10: Indicator for T2 activation  
H11: Indicator for S6 activation  
H12: Indicator for S7 activation  
H13: Indicator for S8 activation  
H14: Indicator for S9 activation |
| **7** | Indicator lamps | H1: Indicator for deactivation of 2-hand control realized using S1 and S4 push buttons.  
H2: Indicator for activation of 2-hand control realized using S1 and S4 push buttons.  
H3: Indicator connected to safety digital output channel O2 on DX581-S module (not used in the example project).  
H4: Indicator connected to safety digital output channel O3 on DX581-S module (not used in the example project). |
| **8** | Push buttons for input simulation | S1, S4: Push buttons which simulate the Two-Hand Control Safety Functionality. By pushing S1 and S4 simultaneously within a discrepancy time of 500 ms, output contactors K1 (H5 indicator) and K2 (H6 indicator) will be in ON state (TRUE, H2 becomes ON and H1 goes to OFF state). The main contactors K1 and K2 are connected in series to energize H2.  
S2: Push button (antivalent, 2-channel) connected to safety digital input channels I2 and I10 of DI581-S.  
S3: Push button to reset all PLCopen Safety Function Blocks used in the example project. |
| **9** | Emergency stop button | S5: Emergency stop button (2-channel, equivalent NC). When S5 is pressed, emergency safety function is triggered and contactors K1 and K2 will become de-energized. After S5 deactivation, unless the reset operation using push button S3 is not performed, the contactors K1 and K2 will stay de-energized even if the Two-Hand control is triggered. |

**Operation guidelines:**

1. Connect power supply as described in Power Supply section.
2. Press power “ON” switch and wait till CPUs (PM573 and SM560-S) have completed their boot sequence.
3. Use a programming cable (e.g. Ethernet cable) and connect it to the Ethernet interface of the CPU PM573.
4. Program the PLC with ABB Automation Builder software, which is available from:  
**NOTICE**

For information on how to place or remove AC500/AC500-S modules please refer to Installation Instructions of AC500/AC500-S modules at [http://www.abb.com/PLC](http://www.abb.com/PLC).

**WARNING**

Hot plug and hot swap of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system, including Safety Modules.

**WARNING**

Exceeding the maximum process or supply voltage range (< -35 VDC or > +35 VDC) could lead to unrecoverable damage of the system.
8. Circuit diagrams
9. Environmentally friendly disposal

All AC500/AC500-S components from ABB are designed with a minimal environment pollution effect. To enable environmentally friendly disposal of TA514-SAFETY components, they can be partially disassembled to separate various components from each other. Disposal of those materials shall be done in accordance with applicable national and international laws.

Please contact a company certified in the disposal of electronic scrap for environmentally safe recycling and disposal of TA514-SAFETY system.

⚠️ WARNING

- The battery must not be disposed as unsorted domestic waste.
- Dispose the battery according to the local regulations.
10. Attachment

Wiring diagram for TA514-Safety.

⚠️ WARNING

Maintenance of AC500-S Training Case is only allowed by skilled persons aware of the risks of electrical equipment and knowing the technical rules, codes and relevant standards.