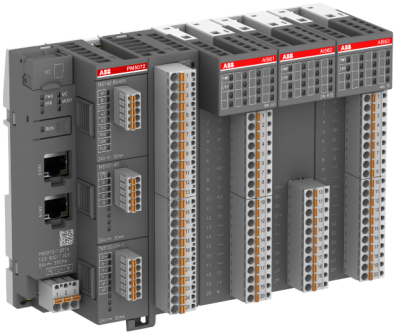
MANUAL

AC500-eCo V3 products

Overview and getting started



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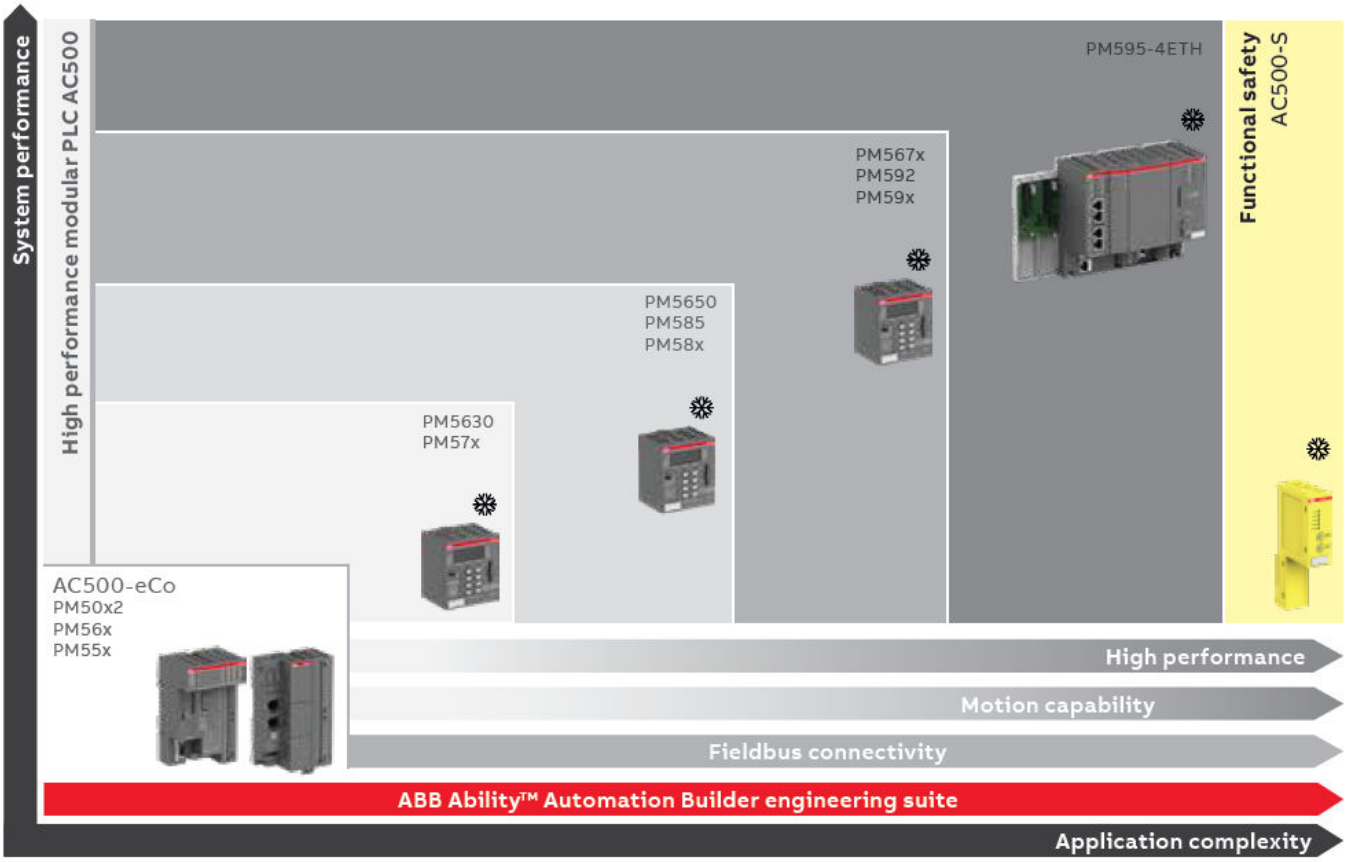
1 About this document

This document gives an introduction to AC500-eCo V3 and an overview on the characteristics and features which are new with AC500-eCo V3.

The *complete documentation for AC500-eCo V3* can be found on our website.

2 Introduction to AC500-eCo V3

As part of ABB's AC500 PLC platform, the AC500-eCo V3 product line enables cost-effective automation of industrial applications in which small and flexible PLCs represent the ideal solution. The AC500 platform ranges from entry-level to high-end PLC solutions and includes the easy-to-use Automation Builder engineering suite.

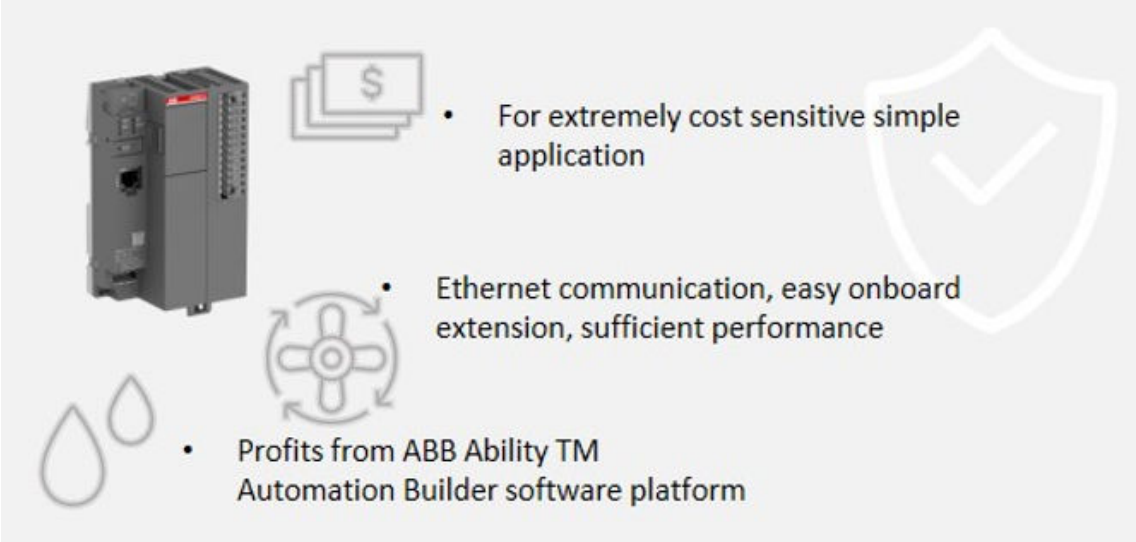


Scalable

- Save money by starting small - the flexibility of the AC500 platform enables to scale up as and when needs dictate.
- ABB's AC500-eCo V3 has been designed to integrate seamlessly into the broader AC500 family, offering you the decisive benefit of having a fully scalable and modular system.
- The AC500-eCo V3 PLC range provides three performance/feature-set classes to answer the specific needs of lot of applications
  - **Basic PLC** - for basic and compact applications with few I/O channels
  - **Standard PLC** – for modular and distributed applications
  - **Pro PLC** – for logic, motion and IoT-ready demanding applications
- The AC500-eCo V3 offers individually customized solutions to be created by using S500 and S500-eCo I/O modules for small applications.
- The Automation Builder engineering suite available across the entire AC500 PLC range will save you time with easy configuration, many libraries and function blocks for the most diverse specific customer requirements.

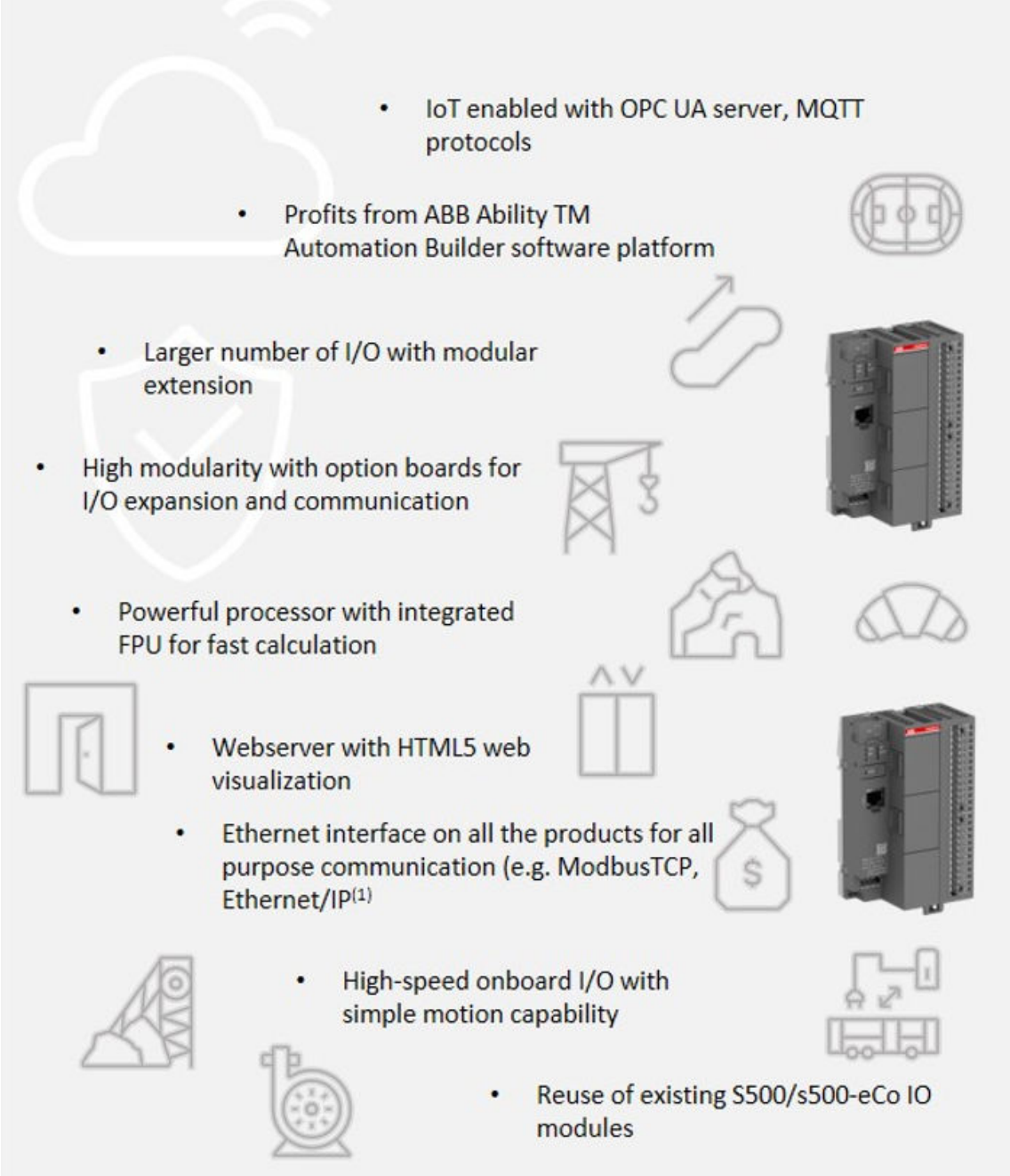
Basic

- Basic and compact application
- Few I/O channels



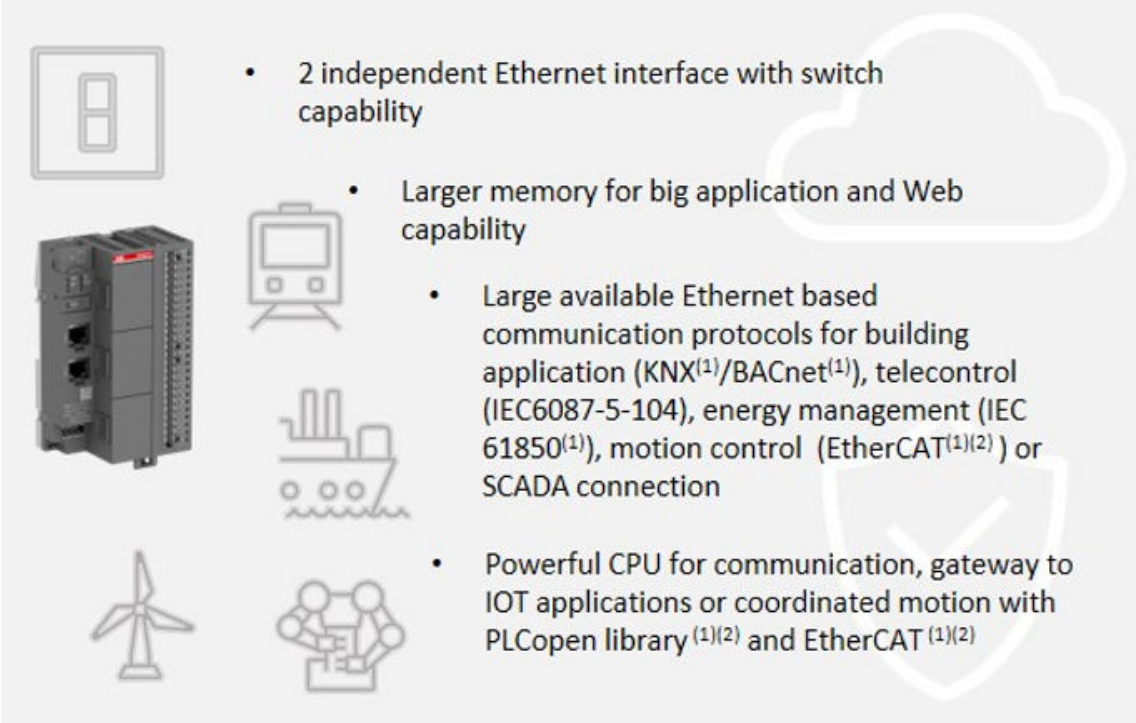
Standard

- For modular and distributed applications



Pro

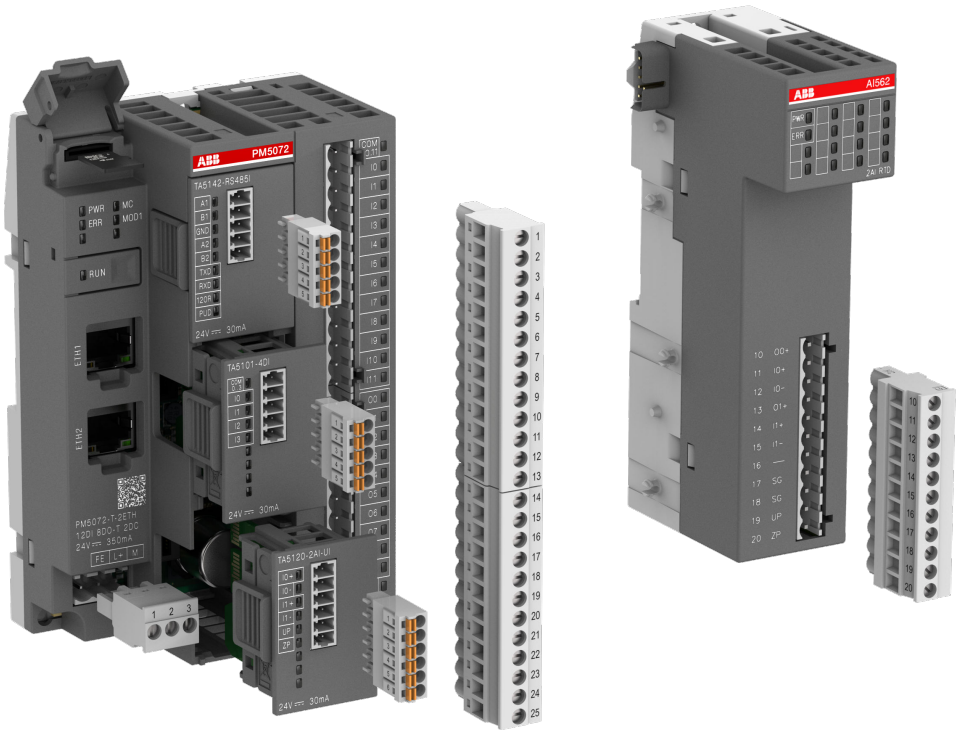
- For Logic, Motion and IoT-ready demanding applications



(1) Licensed
(2) In preparation

Easy handling

- The user program can be downloaded via a micro memory card without the need for programming tools.
- CPUs with integrated I/Os for small applications available.
- Extension of I/O channels can be done using standard S500-eCo but also S500 I/O modules.
- Pre-wiring is possible via the use of pluggable terminal blocks.
- The modules can be fitted to the DIN rail with easy-to-use snap-on mechanism.
- Insert option board for special features:
  - Simple I/O extension for digital or analog channels
  - Serial interface RS232/RS485
  - KNX address switch



Flexible

- The AC500-eCo V3 is approved for customer use by accredited certification organizations around the world. This means the entire range can be deployed safely, reliably and globally.

3 Safety instructions

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variants and requirements associated with any particular installation, ABB cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by ABB with respect to use of information, circuits, equipment or software described in this manual. No liability is assumed for the direct or indirect consequences of the improper use, improper application or inadequate maintenance of these devices. In no event will ABB be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

PLC specific safety notices

The product family AC500 control system is designed according to EN 61131-2 IEC 61131-2 standards. Data, different from IEC 61131, are caused by the higher requirements of Maritime Services. Other differences are described in the technical data description of the devices.

NOTICE!

Avoidance of electrostatic charging

PLC devices and equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Observe the following rules when handling the system:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wrist strap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

NOTICE!

PLC damage due to operation conditions

Protect the devices from dampness, dirt and damage during transport, storage and operation!

NOTICE!

PLC damage due to wrong enclosures

Due to their construction (degree of protection IP 20 according to EN 60529) and their connection technology, the devices are suitable only for operation in enclosed switchgear cabinets.

Cleaning instruction

Do not use cleaning agent for cleaning the device.

Use a damp cloth instead.

Connection plans and user software must be created so that all technical safety aspects, legal regulations and standards are observed. In practice, possible shortcircuits and breakages must not be able to lead to dangerous situations. The extent of resulting errors must be kept to a minimum.

Do not operate devices outside of the specified, technical data!

Trouble-free functioning cannot be guaranteed outside of the specified data.

NOTICE!

PLC damage due to missing earthing

– Ensure to earth the devices.
– The earthing (switch cabinet earthing, PE) is supplied both by the mains connection (or 24 V supply voltage) and via DIN rail. The DIN rail must be connected to the earth before the device is subjected to any power. The earthing may be removed only if it is certain that no more power is being supplied to the control system.

In the description for the devices (operating manual or AC500 system description), reference is made at several points to earthing, electrical isolation and EMC measures. One of the EMC measures consists of discharging interference voltages into the earthing via Y-type capacitors. Capacitor discharge currents must basically be able to flow off to the earthing (in this respect, see also VBG 4 and the relevant VDE regulations).

CAUTION!

Do not obstruct the ventilation for cooling!

The ventilation slots on the upper and lower side of the devices must not be covered.

CAUTION!

Run signal and power wiring separately!

Signal and supply lines (power cables) must be laid out so that no malfunctions due to capacitive and inductive interference can occur (EMC).

WARNING!

Labels on or inside the device alert people that dangerous voltage may be present or that surfaces may have dangerous temperatures.

WARNING!

Splaying of strands can cause hazards!

During wiring of terminals with stranded conductors, splaying of strands shall be avoided.

– Ferrules can be used to prevent splaying.

WARNING!

Removal/Insertion under power

The devices are not designed for removal or insertion under power. Because of unforeseeable consequences, it is not allowed to plug or unplug devices with the power being ON.

Make sure that all voltage sources (supply and process voltage) are switched off before you

– connect or disconnect any signal or terminal block
– remove, mount or replace a module.

Disconnecting any powered devices while energized in a hazardous location could result in an electric arc, which could create a flammable ignition resulting in fire or explosion.

Make sure that power is removed and that the area has been thoroughly checked to ensure that flammable materials are not present prior to proceeding.

The devices must not be opened when in operation. The same applies to the network interfaces.

Environment and enclosure information

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2.000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

Refer to NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also see the appropriate sections in this manual.

NOTICE!

Read safety technical instructions first

Read the safety technical instructions before first use of the products.
https://to.abb/eER6E15m

Fig. 1: Safety instructions

4 Cyber security

This product is designed to be connected to a network interface and to transfer information and data. ABB assists you to provide secure connections. Information about cyber security is provided in a *whitepaper* and in the *complete documentation for AC500-eCo V3*.

5 Getting Started

5.1 Introduction

This document gives an overview of the steps for the first use of a PLC with AC500 V3 CPU and describes:

- installation of the engineering software
- hardware needed for example projects
- setting up a first, simple project for a stand-alone CPU, including visualization and web visualization

5.2 Engineering software Automation Builder

For configuring and programming of any AC500-eCo V3 CPU you need the engineering software suite Automation Builder. Automation Builder is available for download *Further information on page 14*.

5.2.1 Installing Automation Builder

Preconditions

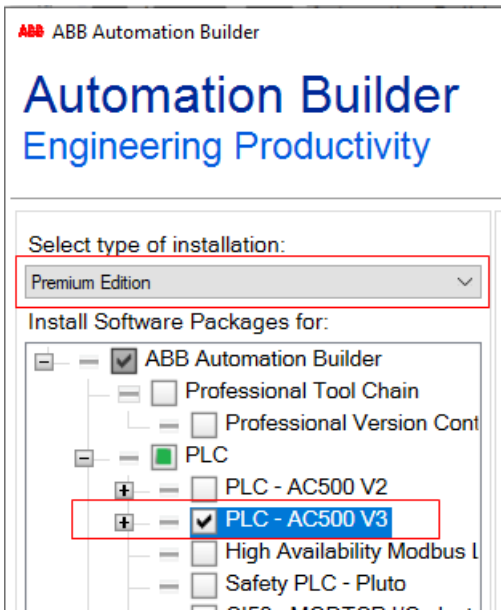
You must have admininstrator rights on your PC to install Automation Builder.

In case of an update installation:

> *Create a project archive before updating Automation Builder. Project archives contain all project data, including data that is not stored with a *.project file, e.g. device description files for third party devices.*

Installation

1. Go to *abb.com/automationbuilder* to access the homepage of Automation Builder.
2. In the *“Downloads”* section, select *“Download Automation Builder”*.
3. In the *“Latest Automation Builder”* section, select *“Automation Builder x.x. Download”* (x.x = latest version). This downloads the installer on your PC.
4. Open the downloaded installer and follow the instructions of the installation manager.



5. Keep the default type of installation to *"Premium Edition"*.
6. Select software packages to be installed:

   Enable the check box *"PLC - AC500 V3"* to activate installation of all options for AC500 V3.
7. Click *"Download and install"* and follow the instructions of the setup.

5.2.2 Licensing procedure

When you start Automation Builder software for the first time, you will be asked to choose a license option.

> *A basic license is enough for AC500-eCo V3.*

Table 1: Available editions and licenses for Automation Builder

Edition	License	PLC programming	Fieldbus support	Engineering productivity tools
Basic	Free license	x	--	--
Standard	30-day free trial, then purchase required	x	x	--
Premium	30-day free trial, then purchase required	x	x	x

Refer to our website to get details about the license model, the features of the editions and the latest license information. *new.abb.com/plc/automationbuilder/platform/software*

Activate a license

☑ Automation Builder software must be installed successfully.

☑ PC is connected to the internet.

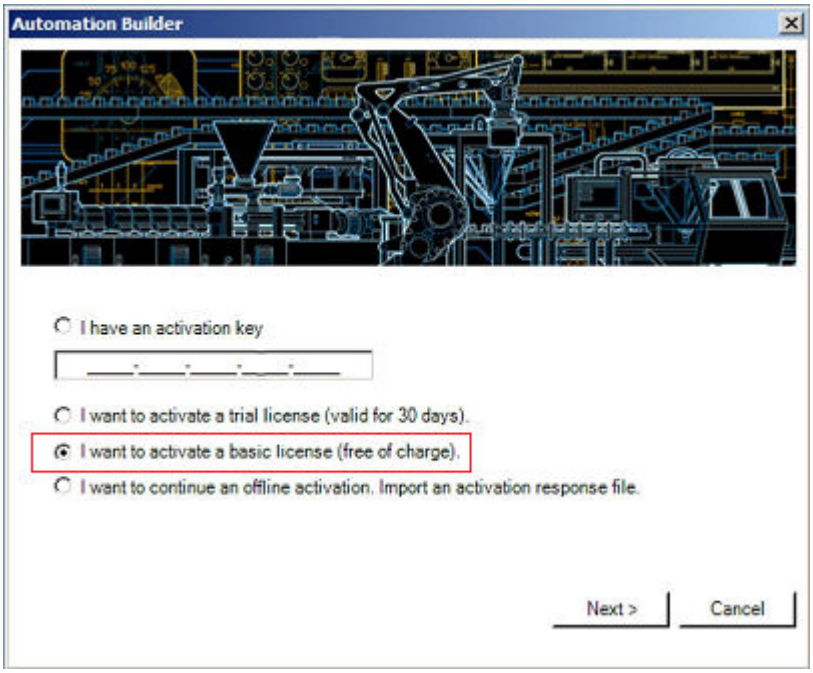
1. Start Automation Builder.

   ⇨ A licensing wizard starts and guides you through the licensing procedure.

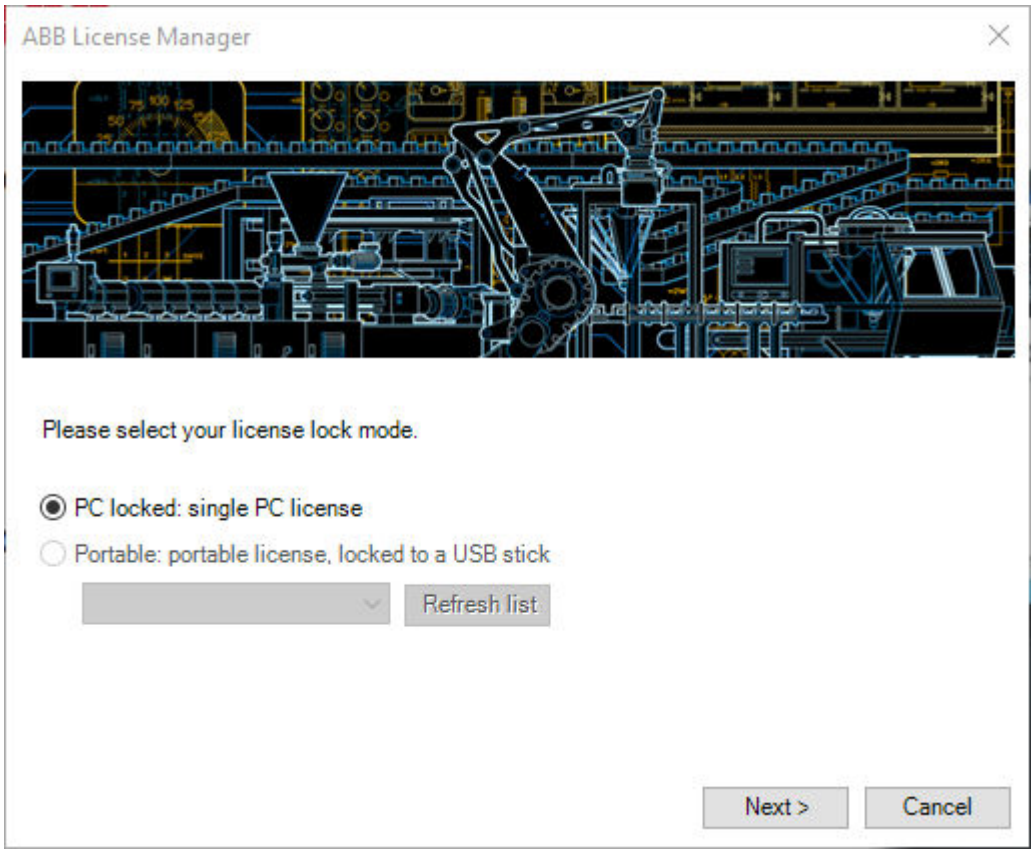
2. Enter user information.

   In case of future support requests, your registration details enable ABB support team to handle your questions quickly.

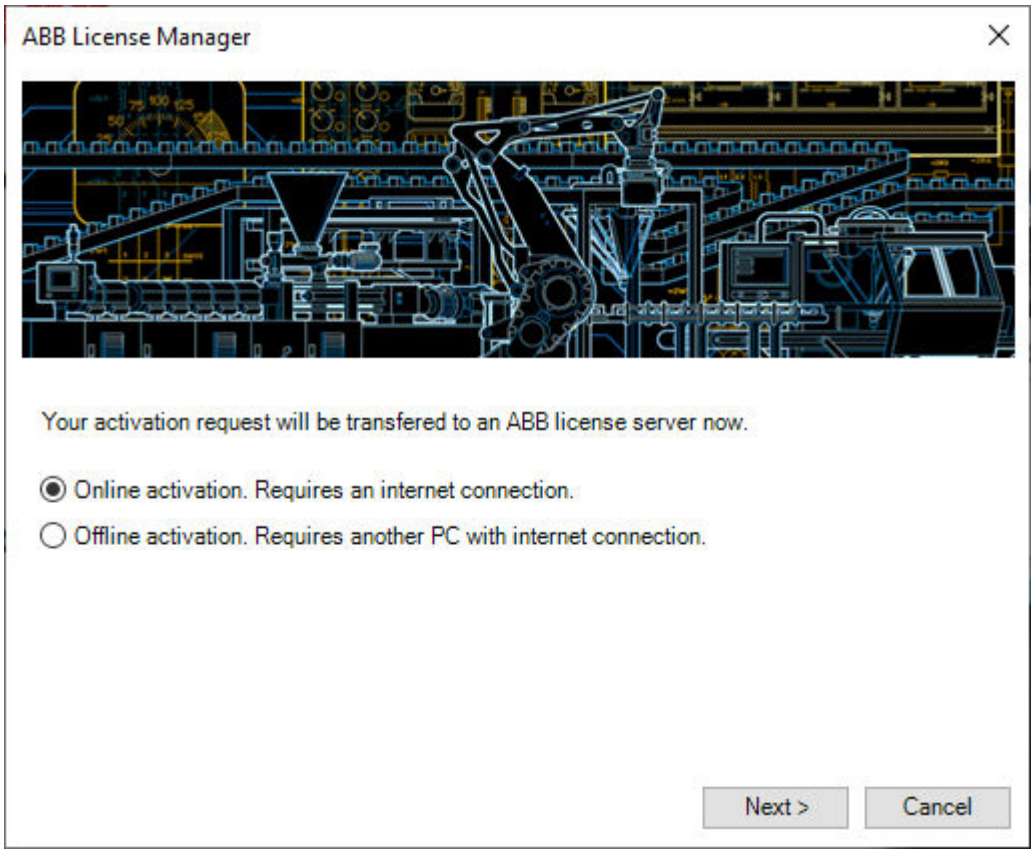
3. Select *[OK]*.



4. Enable the basic license.
5. Select *[Next]*.



6. Enable the single PC license and select *[Next]*.



7. Enable online activation and select *[Next]*.

   ⇨ License activation procedure starts. A successfully ended licensing procedure ends with a success message.

8. Select *[OK]* to end the wizard.
   ⇨ Automation Builder license is activated and starts.

5.2.3 Set-up communication parameters in windows

To set-up the communication between the PC and the PLC, e.g., for downloading the compiled program, you have to set-up the communication parameters.

The IP address of your PC must be in the same class as the IP address of the CPU.

The factory setting of the IP address of the CPU is 192.168.0.10.

The IP address of your PC should be 192.168.0.X. Avoid X = 10 in order to prevent an IP conflict with the CPU.

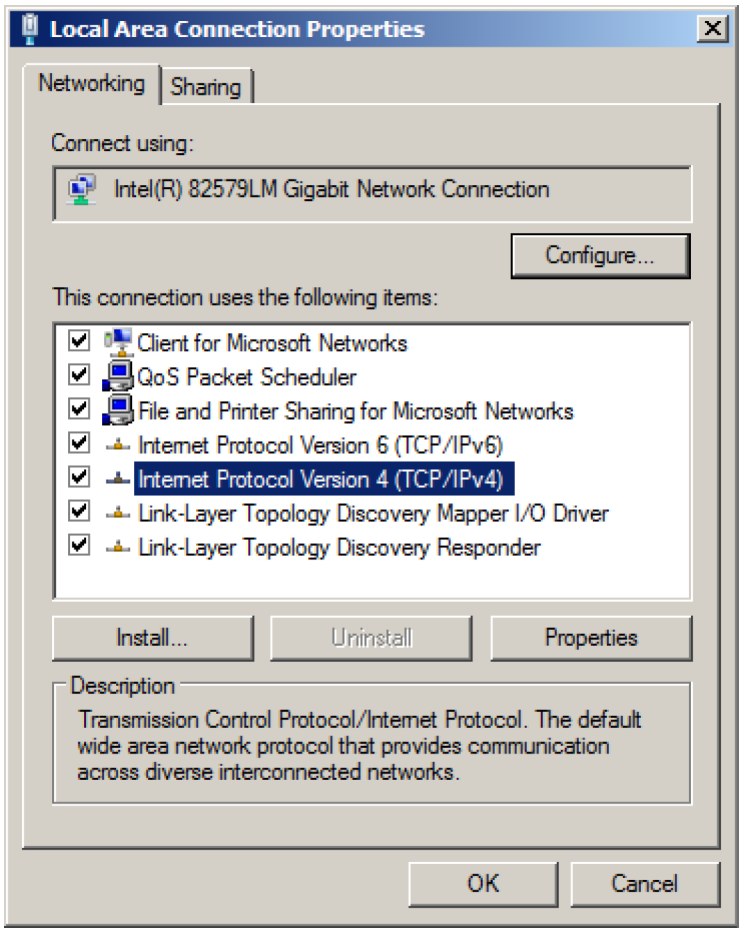
Subnet mask should be 255.255.255.0.

Change the IP address

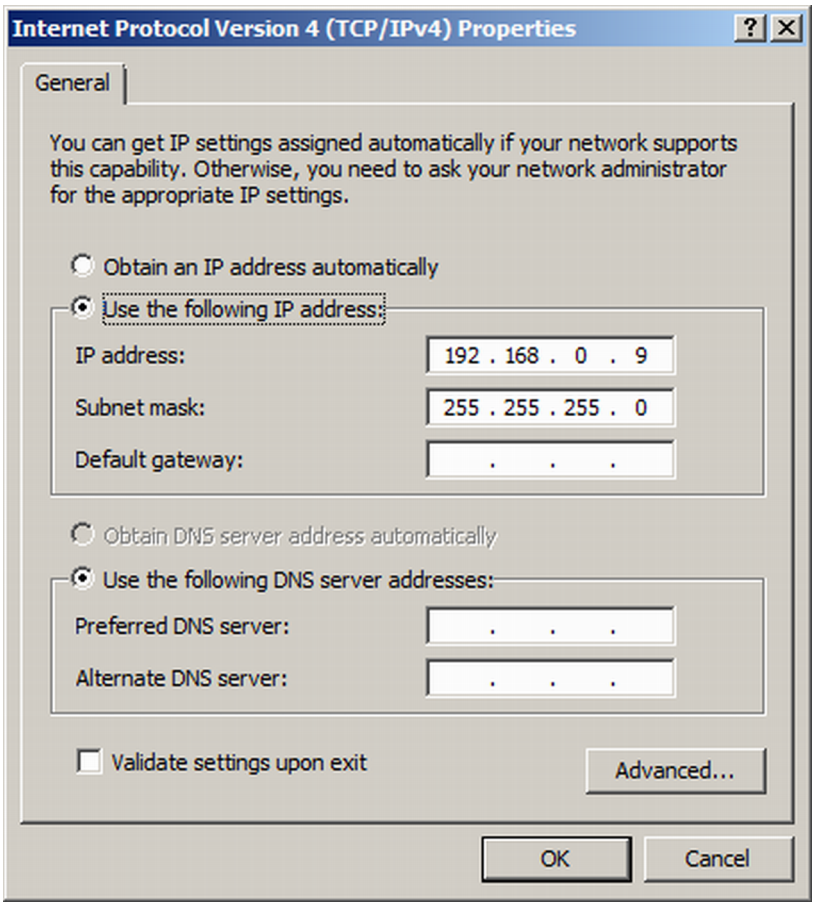
1. Open Windows **Control Panel**. Click *“Network and Internet ➔ Network and Sharing Center”*.
2. Click **Change adapter settings**.

If using existing network with several devices, please pay attention on given network rules or contact your system administrator.

3. Right-click **Local Area Connection (Ethernet)** and select **Properties**.



4. Double-click **Internet Protocol Version 4 (TCP/IPv4)**.



5. Enter your desired IP address and subnet mask.

5.3 Hardware AC500-eCo V3

5.3.1 Configuration for example projects

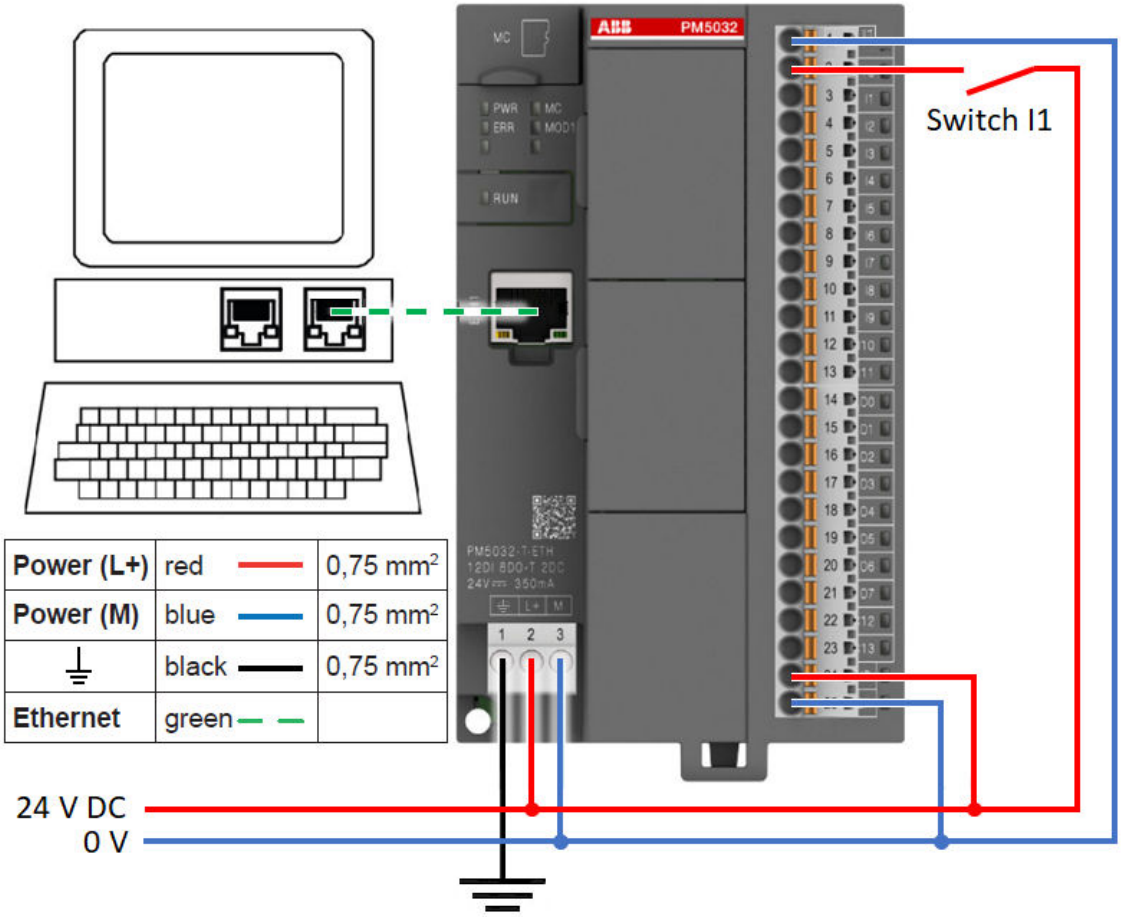
The example projects require a AC500-eCo V3 CPU. The onboard I/O channels are used.

The visualization example is running on CPUs as of PM5032-T-ETH.

Table 2: Modules for example projects to get started with AC500 V3 PLC

Product name	Type	First project
PM5032-T-ETH	CPU	x

Electrical connection



5.3.2 System assembly, construction and connection

NOTICE!

Avoidance of electrostatic charging

PLC devices and equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Observe the following rules when handling the system:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wrist strap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

You can mount AC500 PLC either to DIN rail or to a metal plate. Here, we recommend to mount on DIN rail.

1. Snap the terminal base onto DIN rail.
2. If needed, remove option covers from the CPU and insert option boards.
3. If needed, snap the additional I/O modules onto DIN rail and slide them on the rail to establish the I/O bus connection.

4.

> *The terminal blocks are not included in the scope of delivery.*
>
> *The terminal blocks have to be ordered separetellly according to the CPU type and the type of terminal blocks needed (screw or spring technology).*

Insert terminal blocks for power and I/O connection to CPU, options and I/O modules.

5. Make the sensor/actuator wire connections according to the dedicated electronic module you want to use. Provide external process power supply as required.

6. Connect a programming cable (Ethernet cable between ETH port of CPU and PC with engineering software).

5.4 Example project

The following steps show how to set-up an application project and configure the hardware. A simple logic is used as example to introduce in programming and commissioning of the PLC. The workflow for creation of a visualization is explained, as well as how to set-up a webserver for visualization.

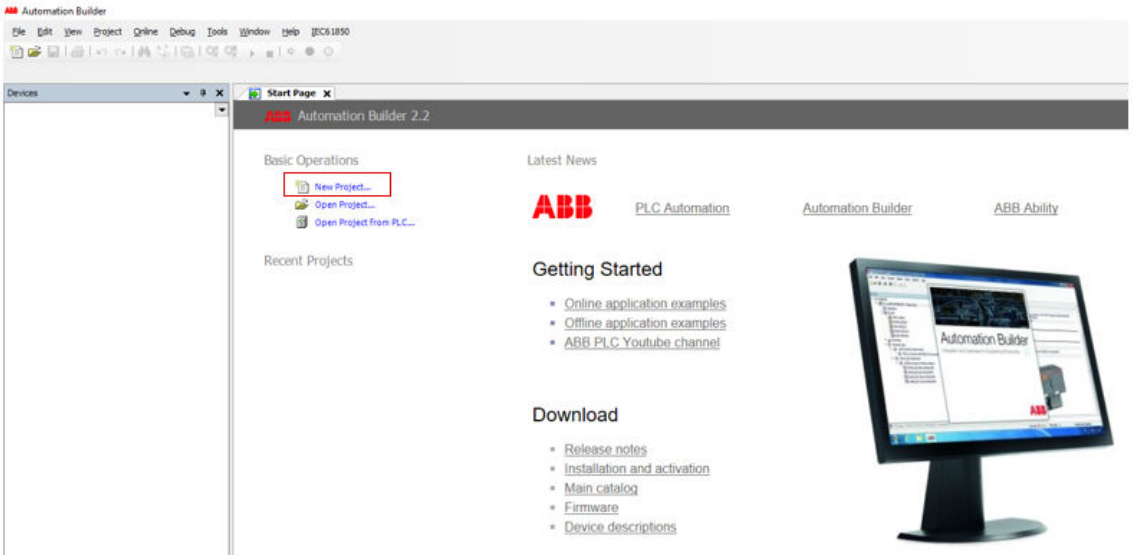
5.4.1 Preconditions

- Automation Builder is installed and licensed as, at least, basic edition.
- AC500 V3 CPU is assembled and connected to the PC.

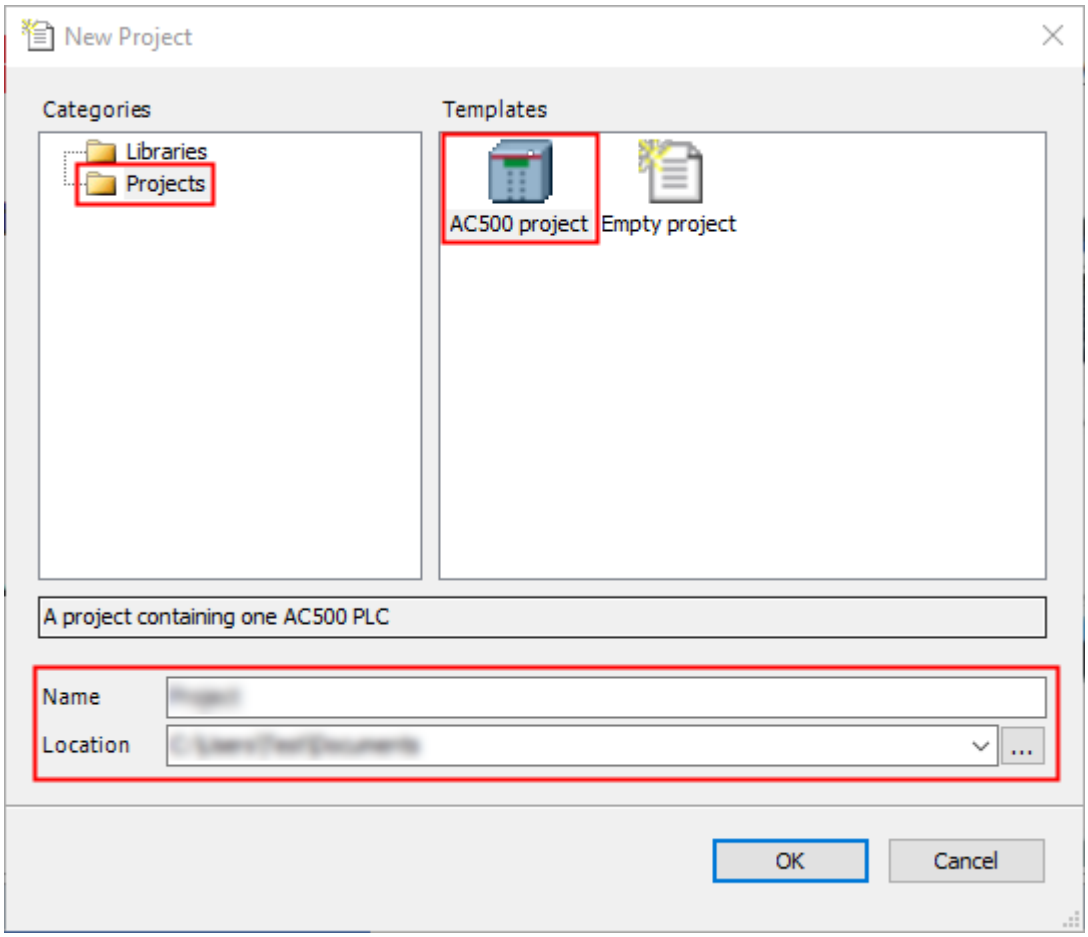
5.4.2 Create, set-up and save your AC500 V3 project

5.4.2.1 Create a project

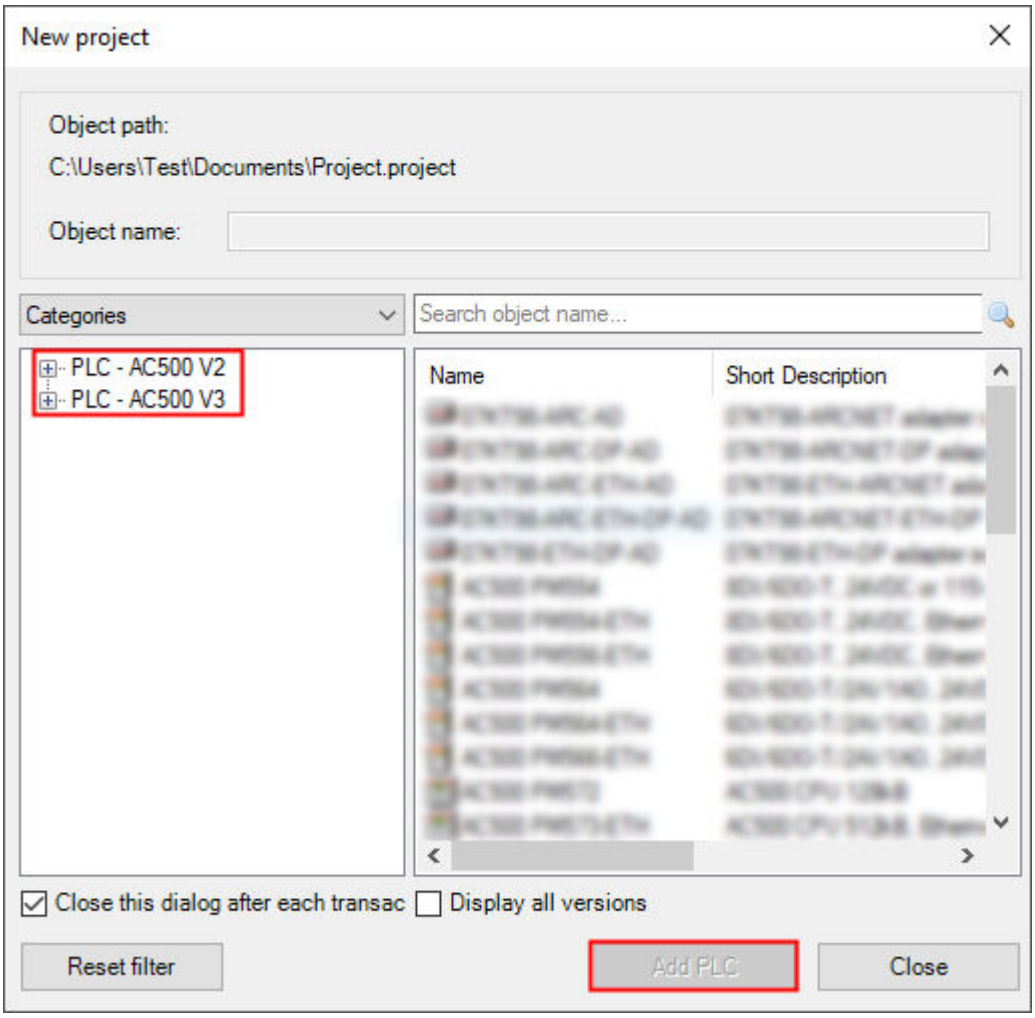
1. Launch Automation Builder either out of the desktop icon or out of the Windows menu.



2. Select *“New Project”* or go to menu *“File ➔ New Project”*.



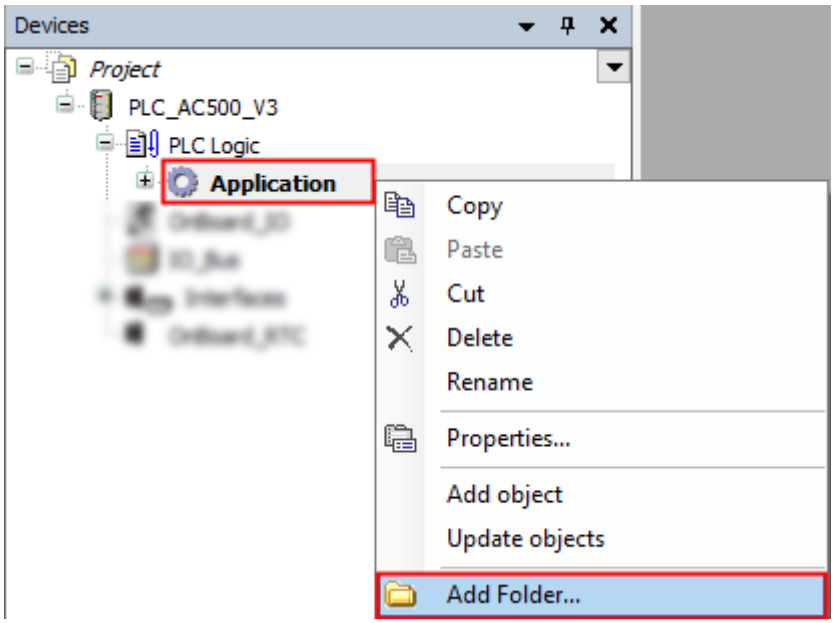
3. Select *“Projects”*.
4. Select *“AC500 project”*.
5. Fill in project name.
6. Choose a location to save the project to.
7. Select *“OK”*.
8. Select *“PLC - AC500 V3”*.
9. Select the CPU according to your hardware set-up.



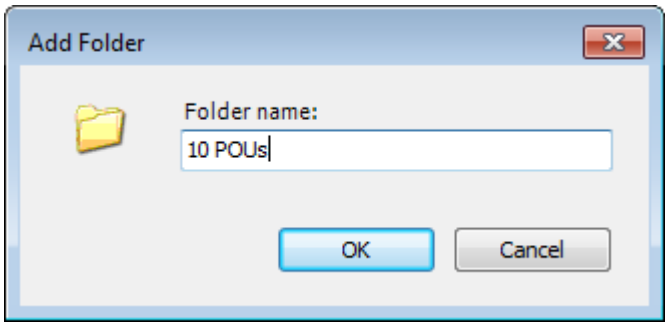
10. Select *"Add PLC"* to add the CPU to your application.

5.4.2.2 Create folders in the device tree

To optimize the project readability, you will create different folders to group similar objects. The folder names are exemplary. Because the device tree view follows an alphabetical order, we use number prefixes to determine the order.



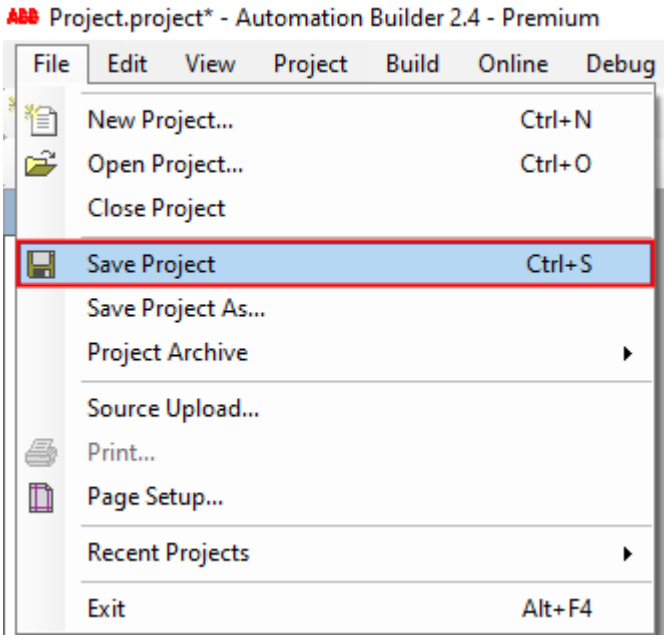
1. Right-click *“Application”*.
2. Select *“Add Folder”*.



3. Type in "10 POUs". This is a name example. Here, the intention is to see this folder as a last one.

   The folder "10 POUs" is for program organization units (POU). POUs are objects of type program, function or function block that are used to create a user program.

5.4.2.3 Save the project



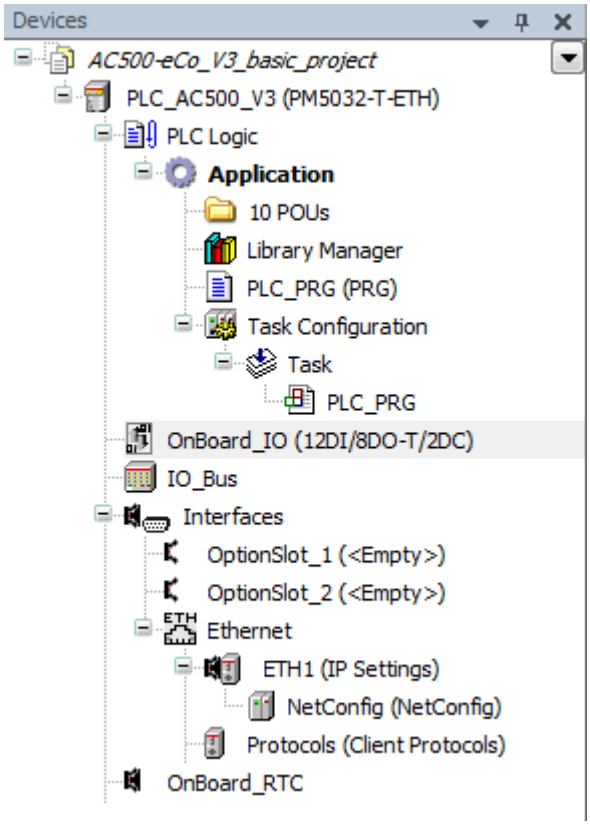
▷ Select menu *"File ➔ Save Project"*.

Alternatively, select the save icon in the tool bar.

Alternatively, press *[Ctrl]* + *[S]*.

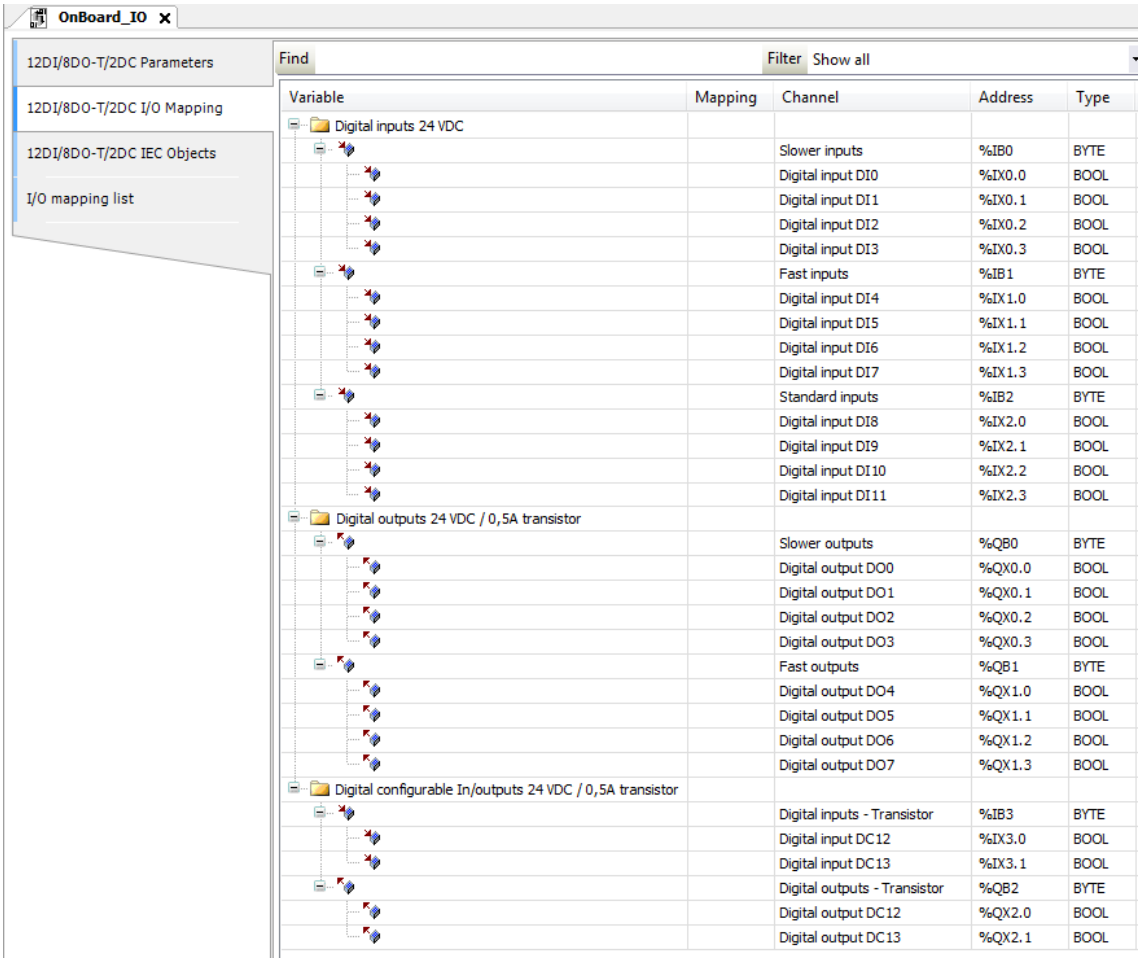
5.4.3 Configure the onboard I/O channels

5.4.3.1 Onboard I/O variable mapping



1. Double-click *"OnBoard_IO"* in the device tree.

⇨ A tab opens in the editor view.

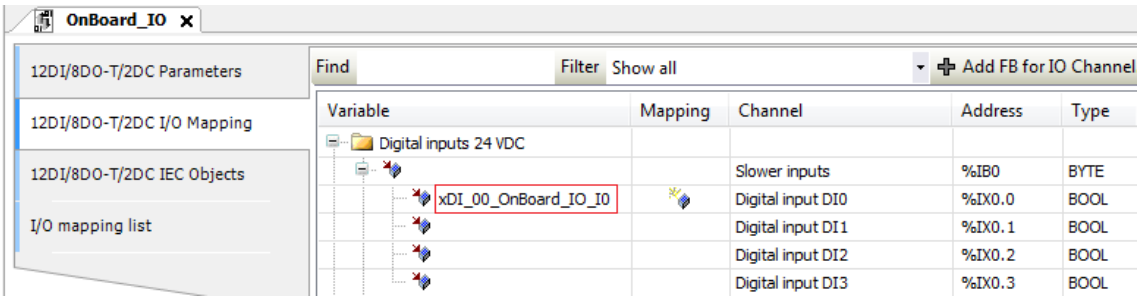


2. Select *“12DI/8DO-T/2DC I/O Mapping”*.

   ⇨ Here, you will map variable names (symbols) for the channels you will need in the program.

The suggested name convention is based on "Hungarian notation". A name prefix is describing variable type: e.g., "x" = variable of type BOOL, "w" = WORD, "i" = INT (integer) etc. This increases the code readability and is helpful for program analysis.

5.4.3.1.1 Handle the digital input variables

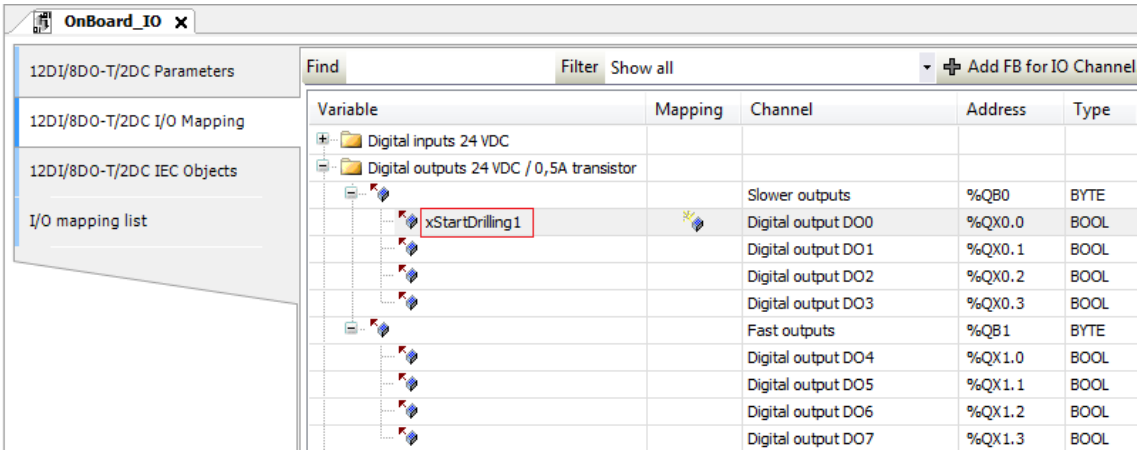


1. Open the list of the digital inputs.

2. Fill in the variable names:

Channel	Type	Variable
Digital input DI0	BOOL	xDI_00_OnBoard_IO_I0

5.4.3.1.2 Handle the digital output variables



1. Open the list of the digital outputs.
2. Fill in the variable names:

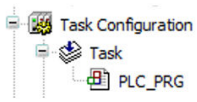
Channel	Type	Variable
Digital output DO0	BOOL	xStartDrilling1

5.4.4 Programming and compiling

5.4.4.1 Task configuration

A task is a time unit in the processing of a user program (IEC application), which defines by parameters the way and the speed the CPU is executing the user program.

For this project you will use only one cycling task.



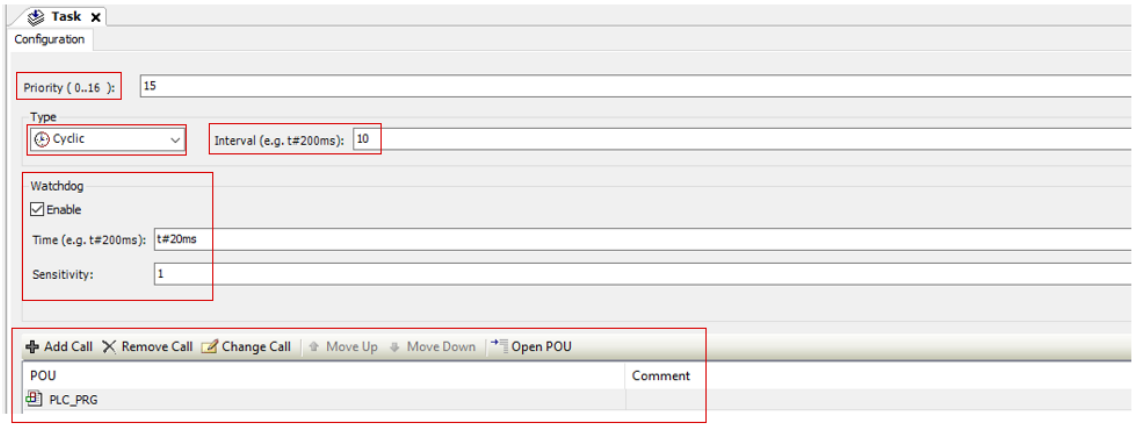
In the device tree, you see the objects *“Task configuration”* and *“Task”*. Both created automatically with the project.

For this project you will use only one cycling task.

▷ Double-click *"Task"* in the device tree.

⇨ A tab opens in the editor view.

For this project you will use only one cyclic task. Keep the default settings for the task.

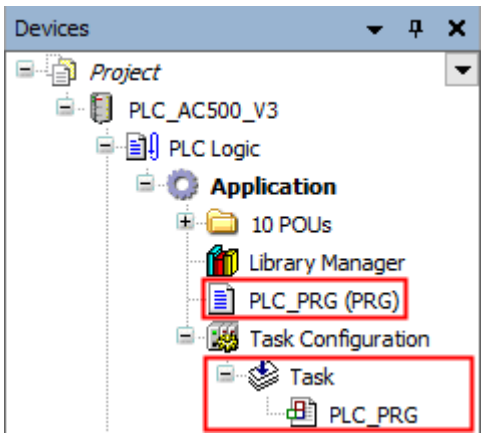


Priority	This is how the CPU prioritizes the task, when more than one task is defined. Priority 0...15 = realtime tasks, priority 16 = non-realtime task.
Type	In the CPU you can run tasks dependent on the demands of the process
Interval	For cyclic tasks you can set the cyclical execution time. It is usually set in milliseconds with IEC time syntax
Watchdog	To keep track of the time it takes to complete the task
Calls	You can call in one or more program POUs in one single task

5.4.4.2 Main program PLC_PRG

In the default task configuration, there is one call of a POU (program organization unit) i.e. "PLC_PRG".

In your project the "PLC_PRG" will become a main program containing calls to other programs (POUs) which you will create one by one.



The PLC_PRG POU has been defined by default in ST (structured text) editor. Keep this setting because of good visibility of the instructions at a glance and good handling for troubleshooting.

To optimize the project readability, you will work with the previously created folder "10 POUs" and add the created subroutines (POUs) to this folder. The subroutines will be created in FBD (function block diagram) editor.

5.4.4.3 Boolean logic "NOT"

5.4.4.3.1 Application example "driller"

Recognizing of a driller by a photo sensor. "TRUE" input signal from sensor indicates that a driller is broken. If driller has been found correct, then start drilling.

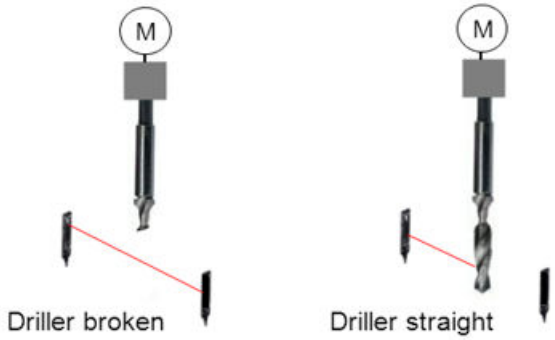


Table 3: Required behavior

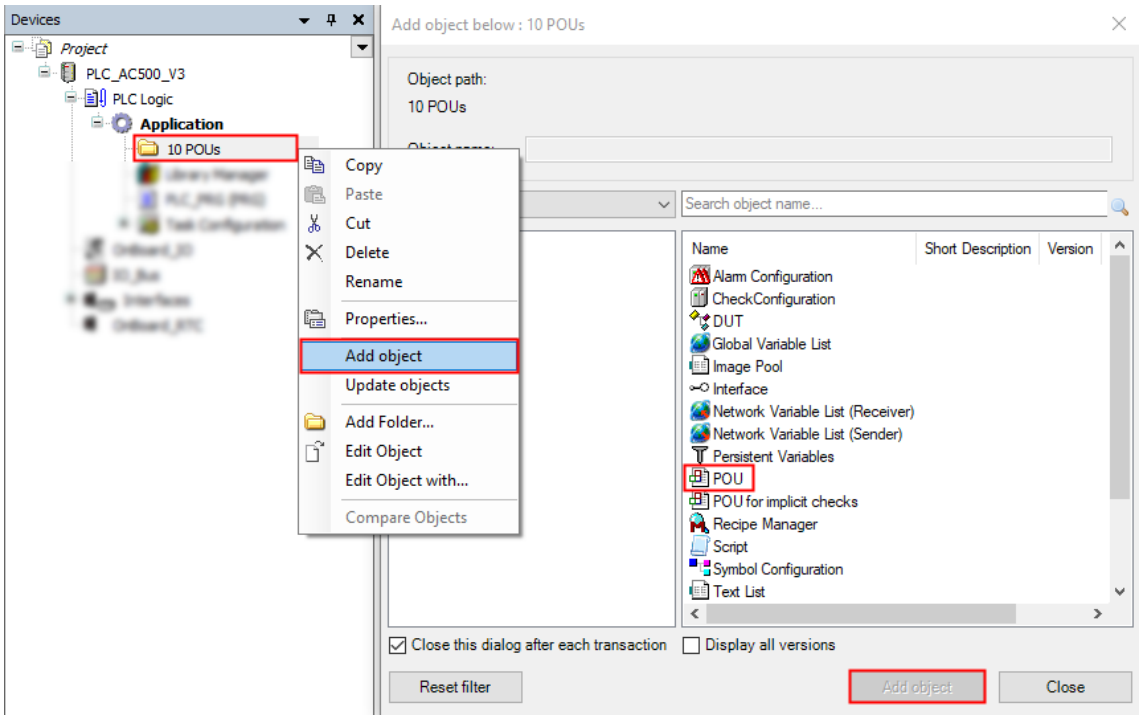
Signal from photo sensor	Required signal of motor ON
FALSE	TRUE
TRUE	FALSE

Table 4: Hardware set-up

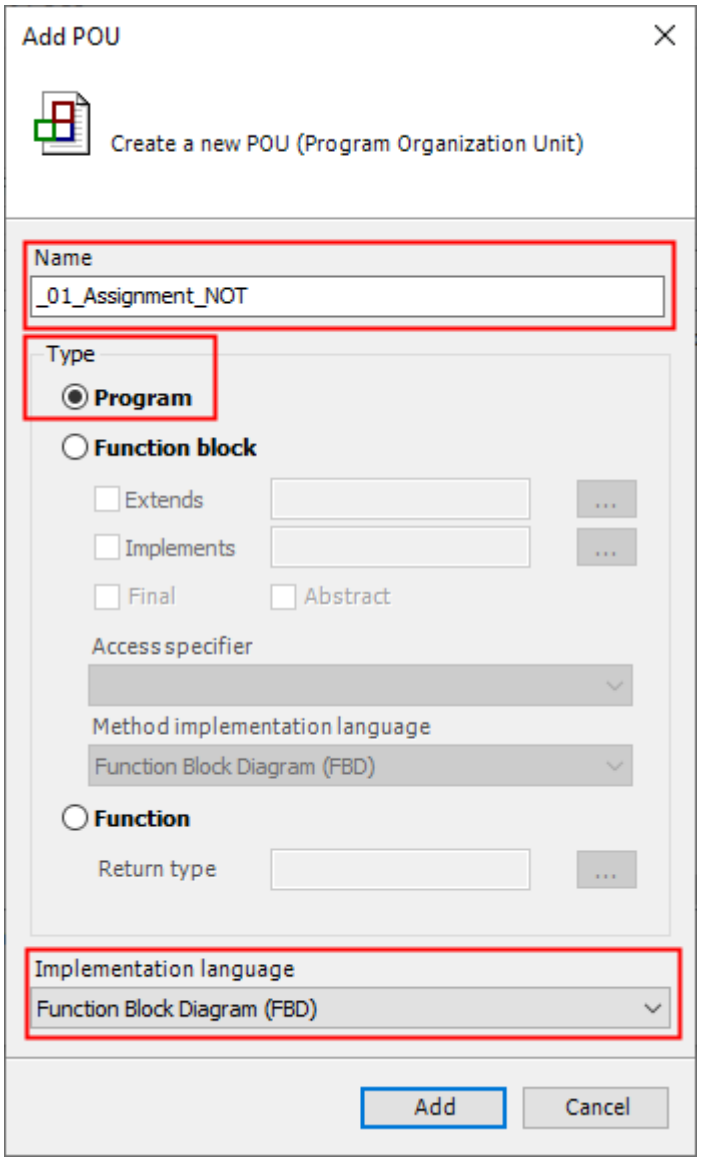
Element	HW channel	Symbol	Description
Switch I1	OnBoard_IO_I0	xDI_00_OnBoard_IO_I0	Photo sensor
LED output DO0	OnBoard_IO_O0	xStartDrilling1	Motor on

5.4.4.3.2 Implementation

Create a new program POU in the project



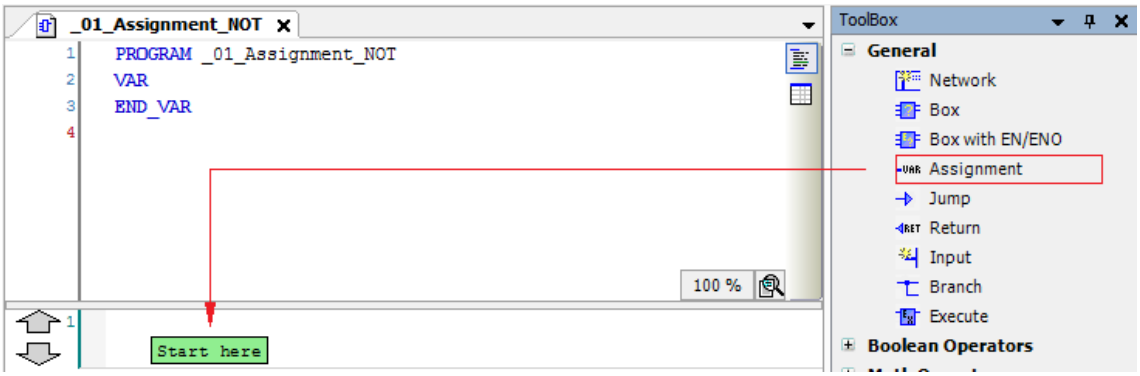
1. Right-click *“10 POUs”*.
2. Select *“Add object”*.
3. Select *“POU”*.
4. Select *“Add object”*.



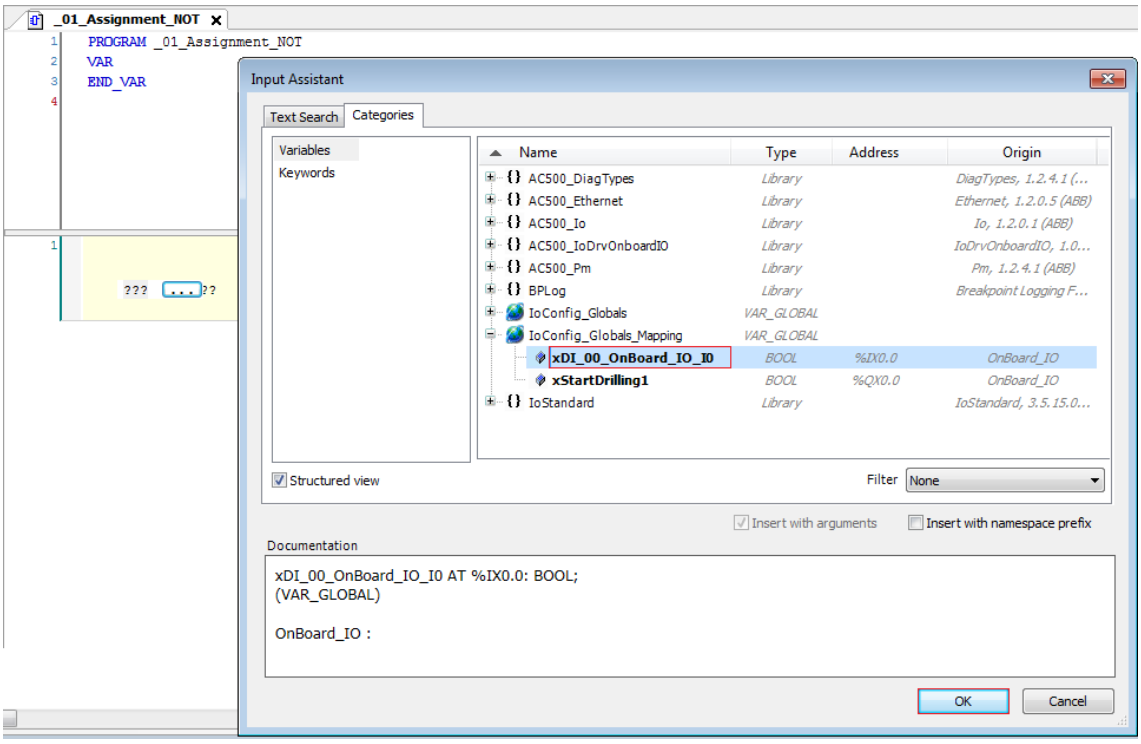
5. Enter *"_01_Assignment_NOT"*.
6. Select *"Program"*.
7. Select *"Function Block Diagram (FBD)"*.
8. Select *"Add"*.
   ⇨ POU has been added.

Assign the hardware DI signals to local variables

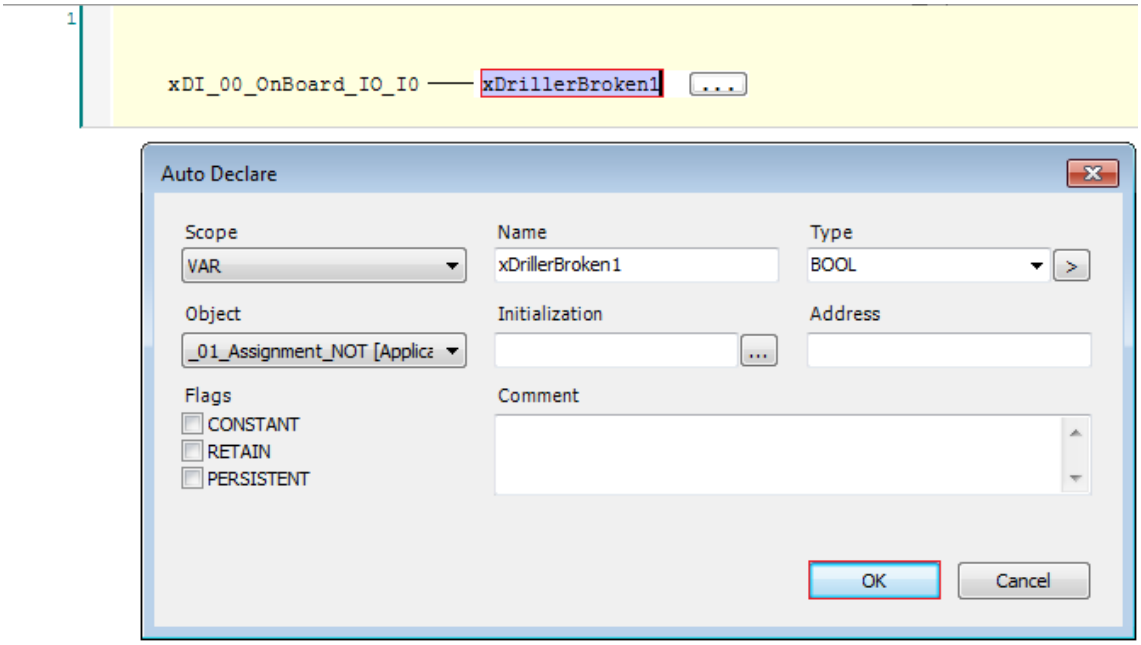
1. Double-click POU*"_01_Assignement_NOT"* in the device tree.



2. Select *"Assignment"* from the ToolBox.
3. Drag and drop *"Assignment"* into the "Start here" field in network *"1"*.



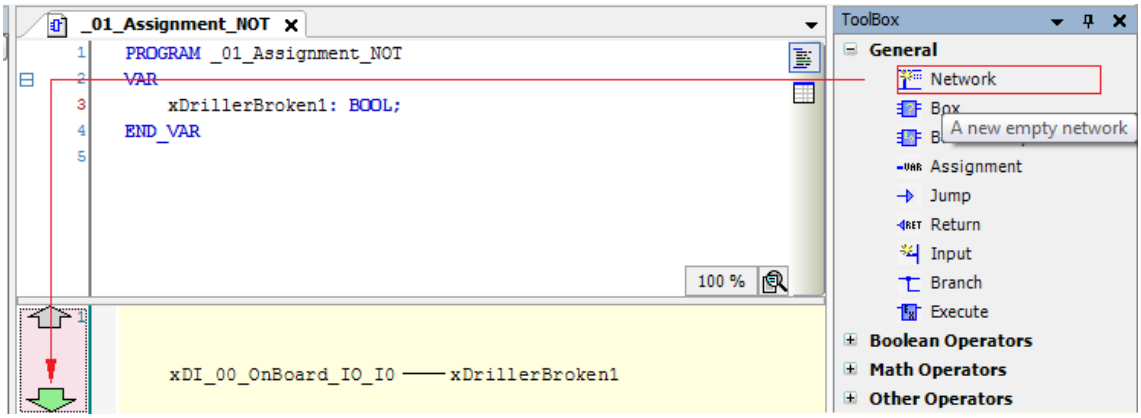
4. Select *"???"* on the left side of the assignment, then select *"..."*.
5. Open the *"Io Config_Globals_Mapping"* mapping list and select "xDI_00_OnBoard_IO_I0".
6. Select *"OK"* to add this variable to the left side of the assignment connector.



7. Select *"???"* on the right side of the assignment connector and mark the "???".
8. Create a new local variable by typing in "xDrillerBroken1" which will replace the "???".
9. Press *[Enter]*.

   ⇨ *"Auto Declare"* opens.

   You see the written variable name and the data type BOOL. The scope is "VAR". It means it is a local variable within this POU.
10. Select *"OK"* to accept the entries.



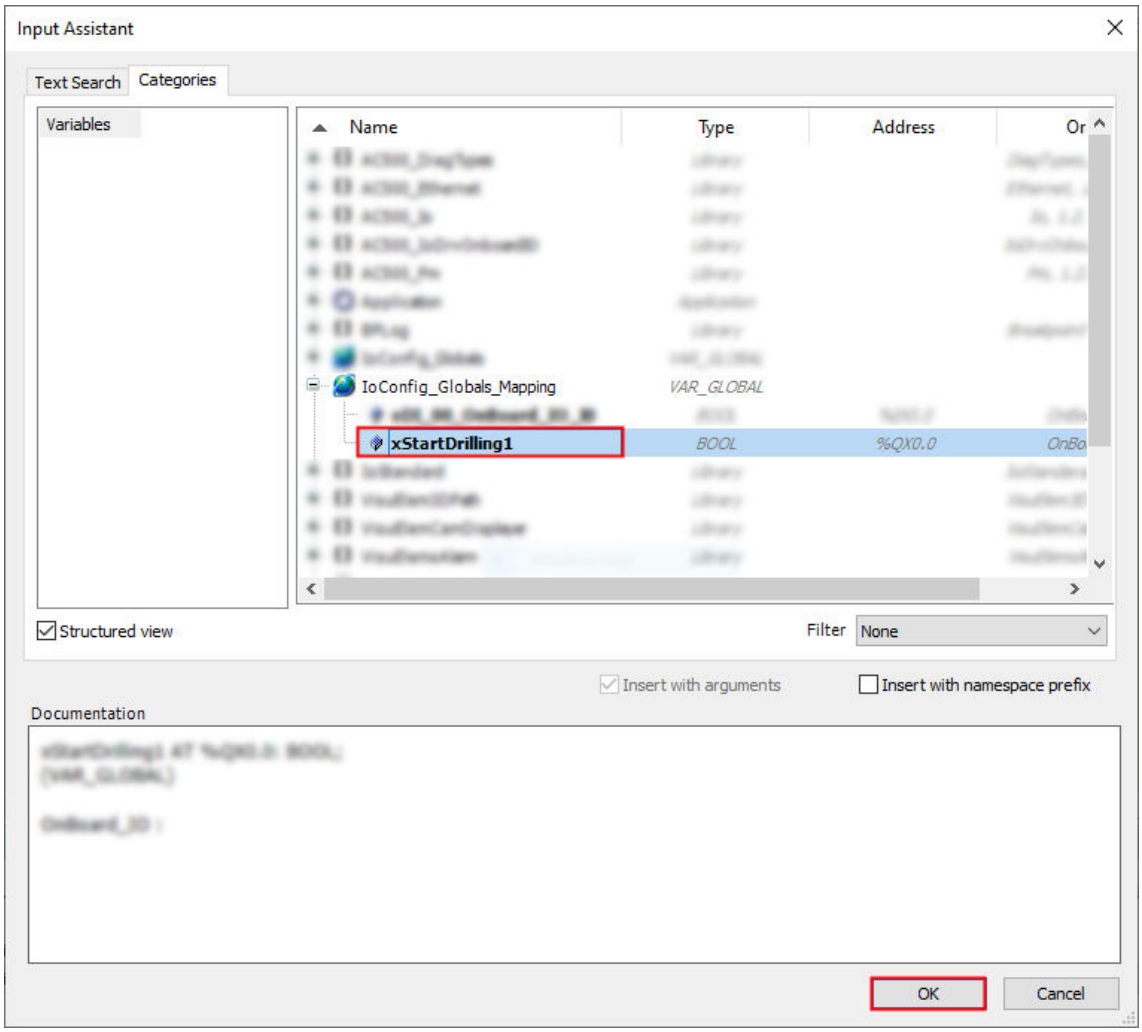
11. Drag and drop *"Network"* from the ToolBox to the down-arrow of network 1.

    ⇨ You added a network *"2"* below network 1.

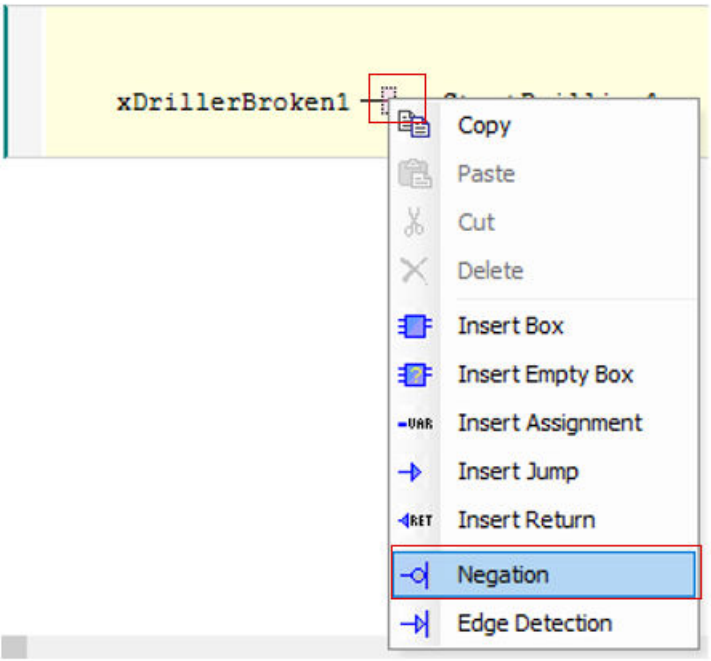
Add assignments and a Boolean NOT to the DO signals

1. Add an assingment from the ToolBox.
2. Type in or copy & paste "xDrillerBroken1" to the left side of the instruction line.
3. Select *"???"* on the right side of the instruction line, then select *"..."*.

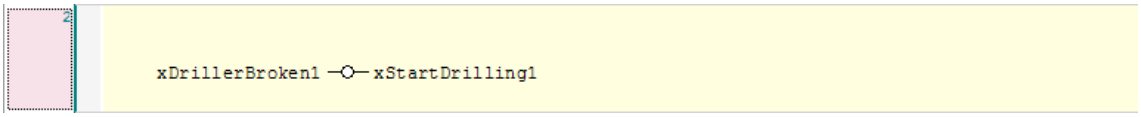
   ⇨ *"Input Assistant"* opens.



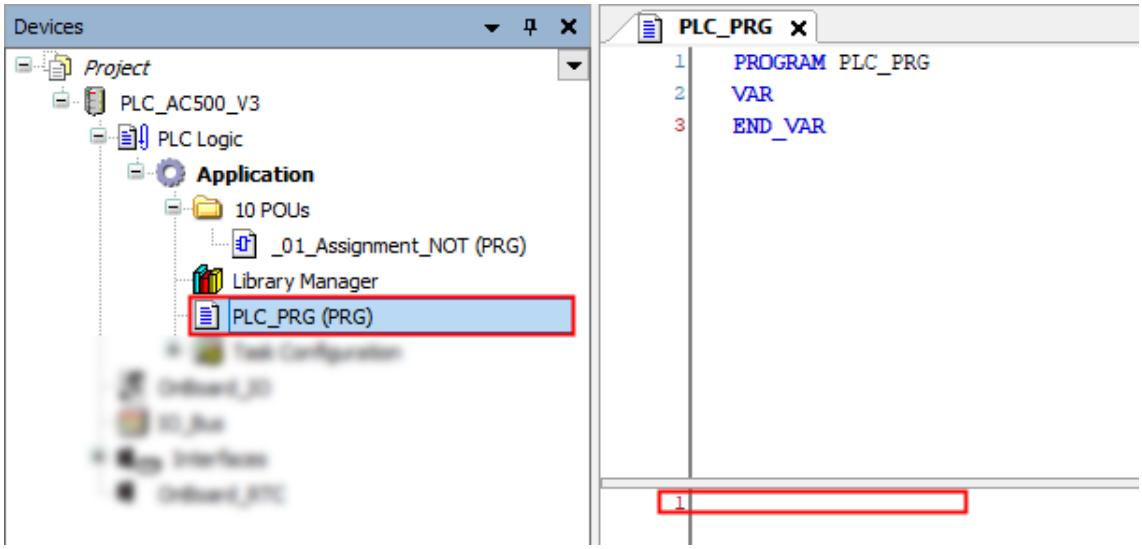
4. In the *"IoConfig_Globals_ Mapping"* variable list, select *"xStartDrilling1"*.
5. Select *"OK"* to close the dialog.



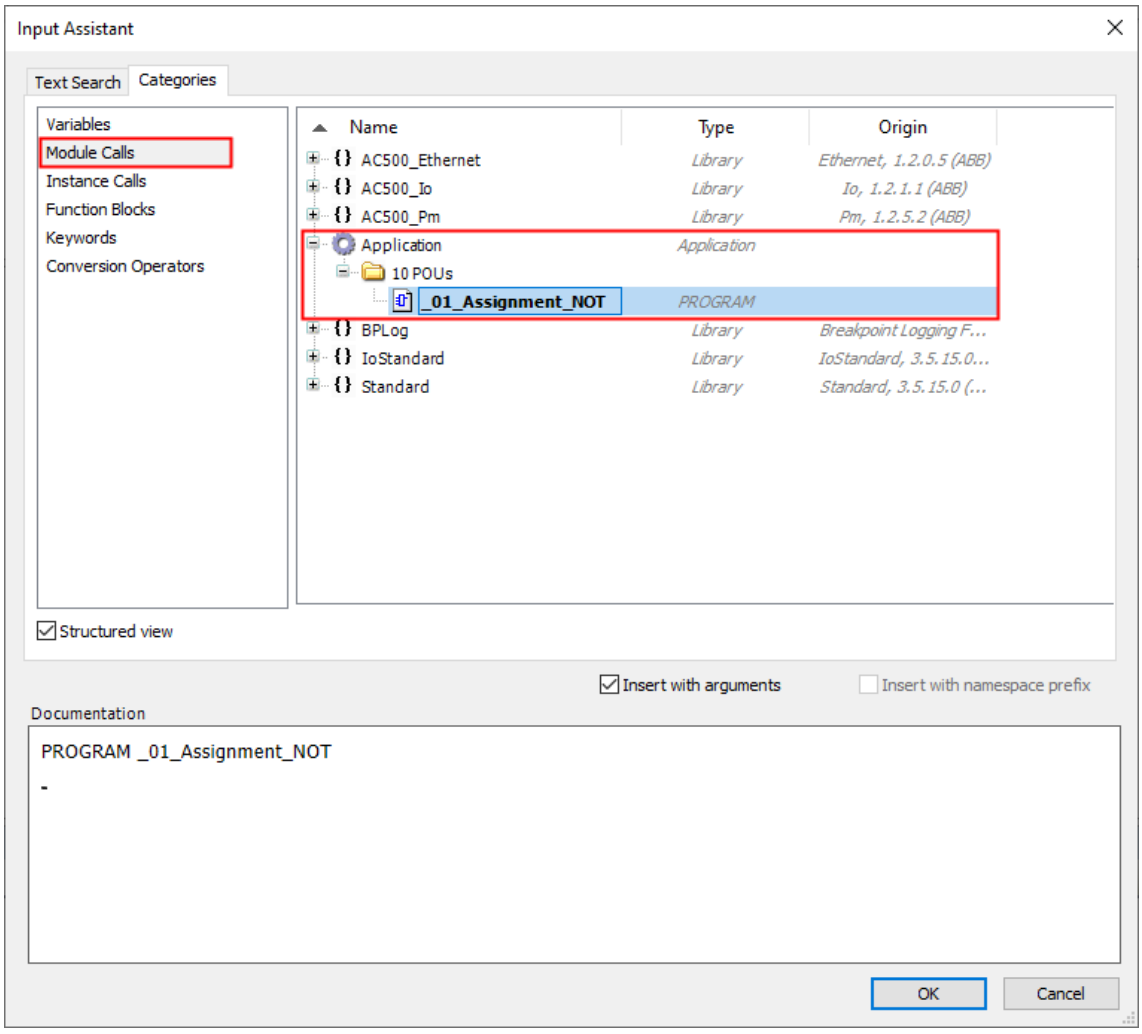
6. Right-click the center of assignment pin.
7. Select *"Negation"* to add a negation to the assignment.



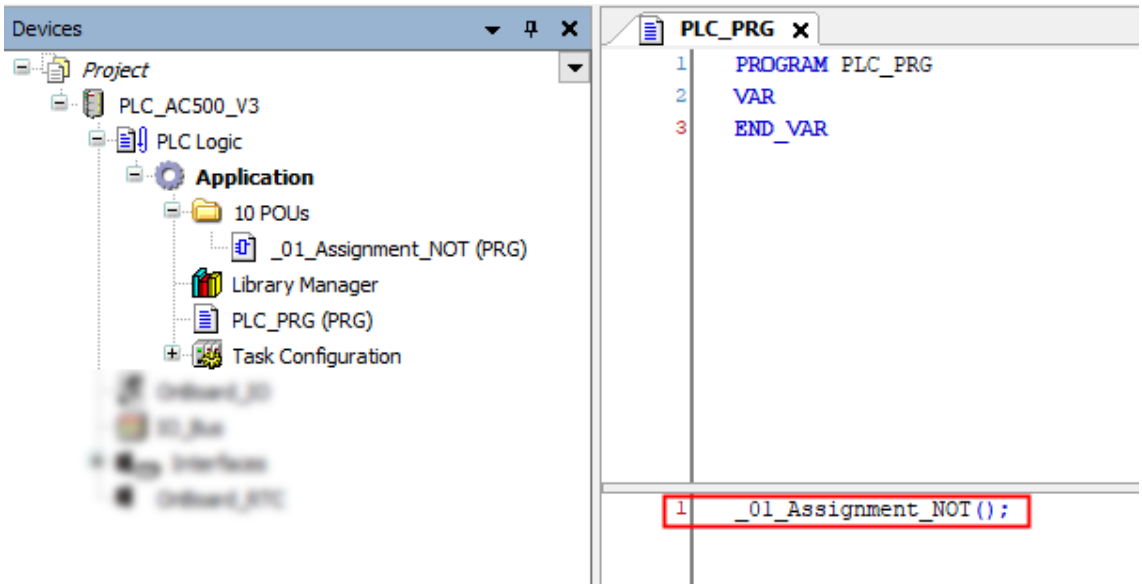
Call the POU in the PLC_PRG



1. Double-click *"PLC_PRG"*.
2. Select the first line in "PLC_PRG" and press *[F2]*.
   ⇨ *"Input Assistant"* opens.

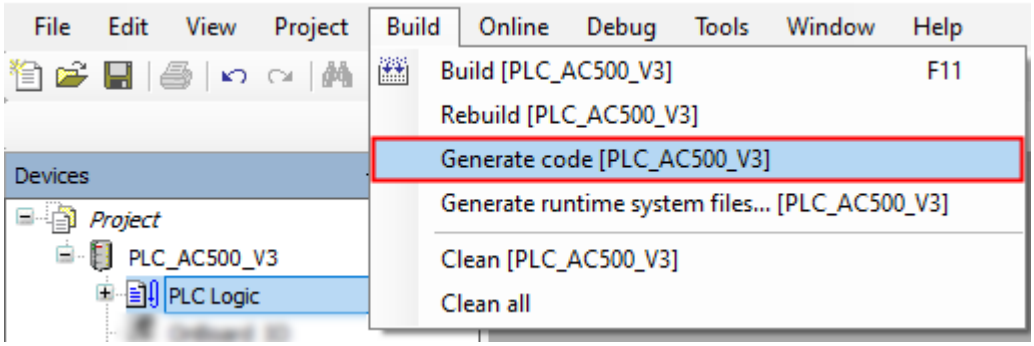


3. Select *“Module Calls”*.
4. Open *“Application”*.
5. Open *“10 POUs”* and select *“_01_Assignment_NOT”*.
6. Select *“OK”* to close the dialog.



5.4.4.3.3 Compile the project

Before logging-in to the CPU, you need to compile the complete code without any errors.

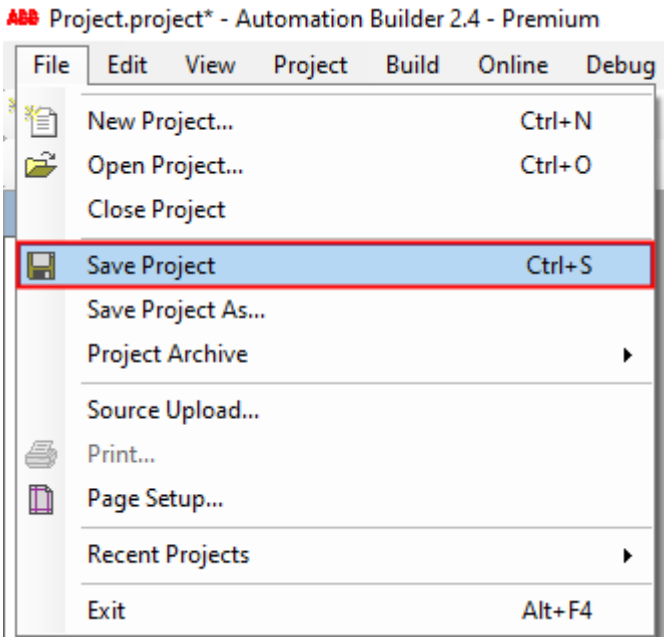


▷ Select menu *"Build ➔ Generate code"*.

⇨ The result of the compiling is shown in the *"Messages"* field at the bottom of the screen.

If you skip the compiling and select *"Login"*, the Automation Builder will automatically trigger compiling in advance to logging-in.

5.4.4.3.4 Save the project



▷ Select menu *"File ➔ Save Project"*.

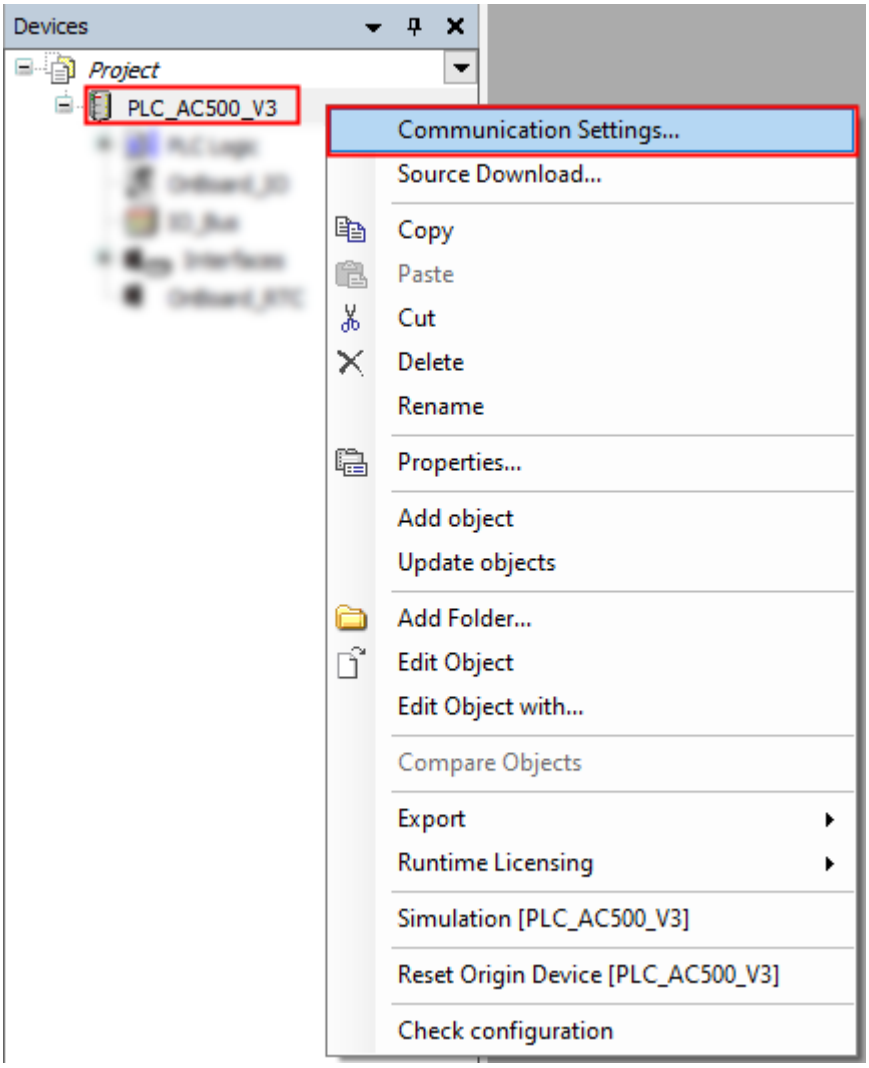
Alternatively, select the save icon in the tool bar.

Alternatively, press *[Ctrl] + [S]*.

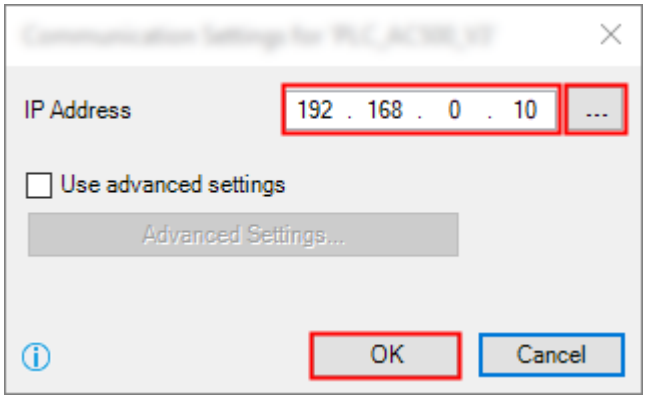
5.4.5 Set-up the communication gateway

☑ IP is configured properly ↬ *Chapter 5.2.3 "Set-up communication parameters in windows" on page 18*.

☑ CPU and PC are connected with an Ethernet cable.



1. In the Automation Builder device tree right-click *"PLC_AC500_V3"*.
2. Select *"Communication Settings"*.



3. Keep the default value in the IP address of the CPU or type in the current IP address, if differs.

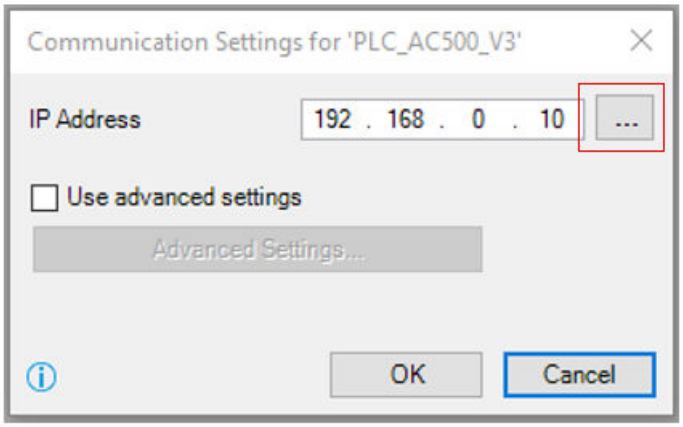
> *The standard (default) IP address of the port ETH1 is: 192.168.0.10*

4. Select *“OK”* to implement the IP address.

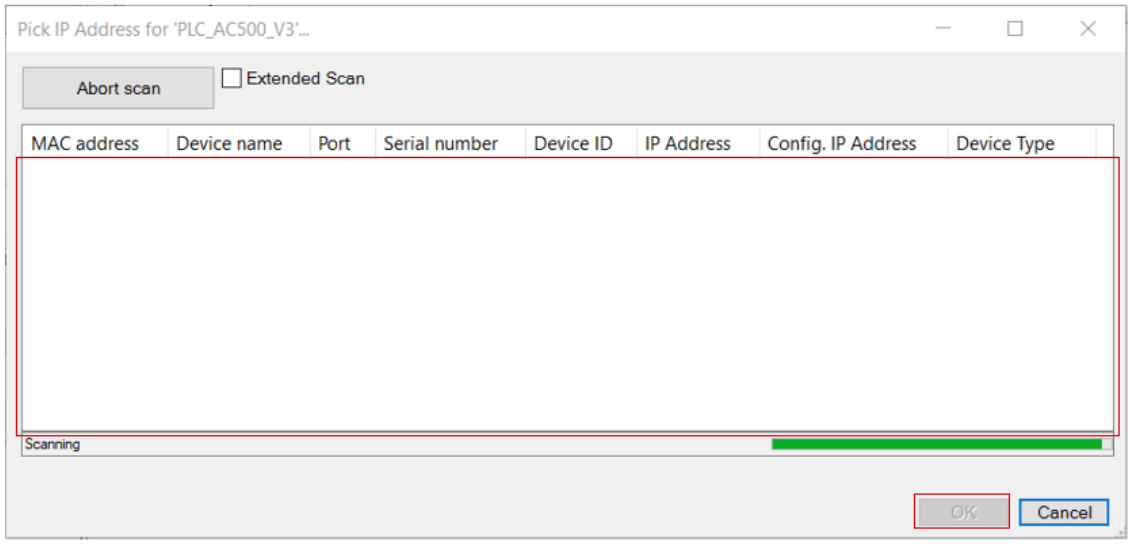
Network scan

If you need to scan the network for the CPU or if you have multiple CPUs on the same network.

1. Right-click *“PLC_AC500_V3”* in the device tree.
2. Select *“Communication Settings”*.



3. Select *“...”*.
   ⇨ *“Pick IP Address for "PLC_AC500_V3"”* opens.



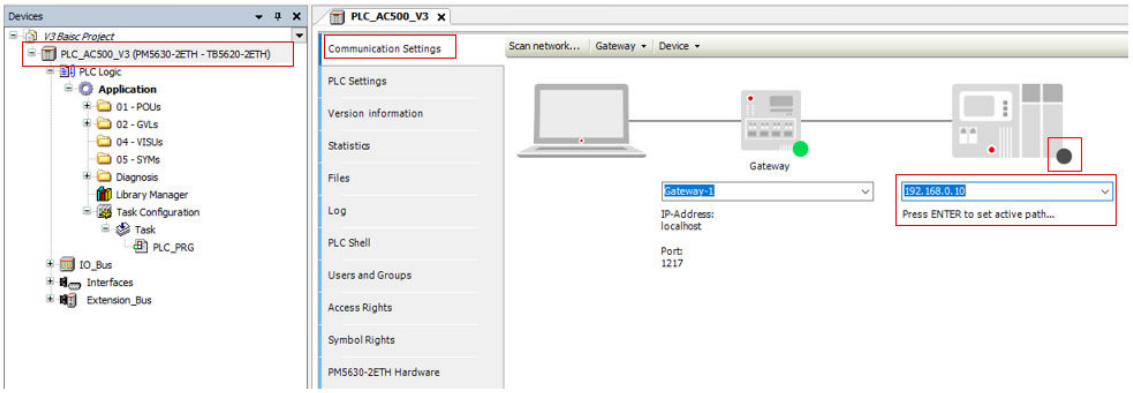
   The automatic scan runs.

   The results will appear in this field.

4. Select the CPU in the field and select *“OK”* to implement the needed communications gateway.

Check communication settings

If you need to check the communications settings or if you want to see more information about the current selected CPU.



1. Double-click *"PLC_AC500_V3"* in the device tree.
2. Select *"Communication Settings"*.
   ⇨ The selected IP address is shown.
3. If the IP address is not visible, enter the IP address manually.
4. To test the connection and/or to see the CPU information press *[Enter]* or click on the black dot next to the PLC picture.

5.4.6 AC500 V3 firmware installation and update

The PLC firmware can be updated via Automation Builder.

> *This is also necessary for commissioning AC500-eCo V3 CPUs.*

A very new CPU has no pre-installed firmware. To guarantee the authenticity of delivered AC500 firmware, V3 CPUs are delivered with a boot loader only. You need to download a valid firmware to the CPU. After download, the functionality of the CPU is given.

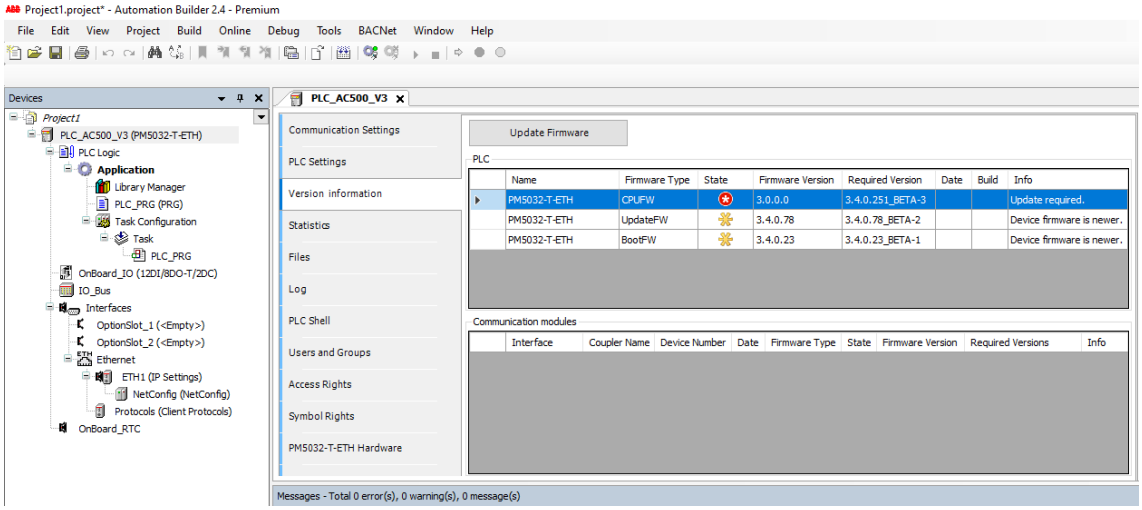
☑ An Automation Builder project with an AC500 V3 CPU is open.

☑ CPU is in "stop" mode without firmware.

☑ The power LED is ON.

☑ For new modules: IP address is set. (The default IP address is 192.168.0.10)

1. Double-click CPU *“PLC_AC500_V3”*.
2. Select *“Version information”*.



3. Select *[Update Firmware]*.

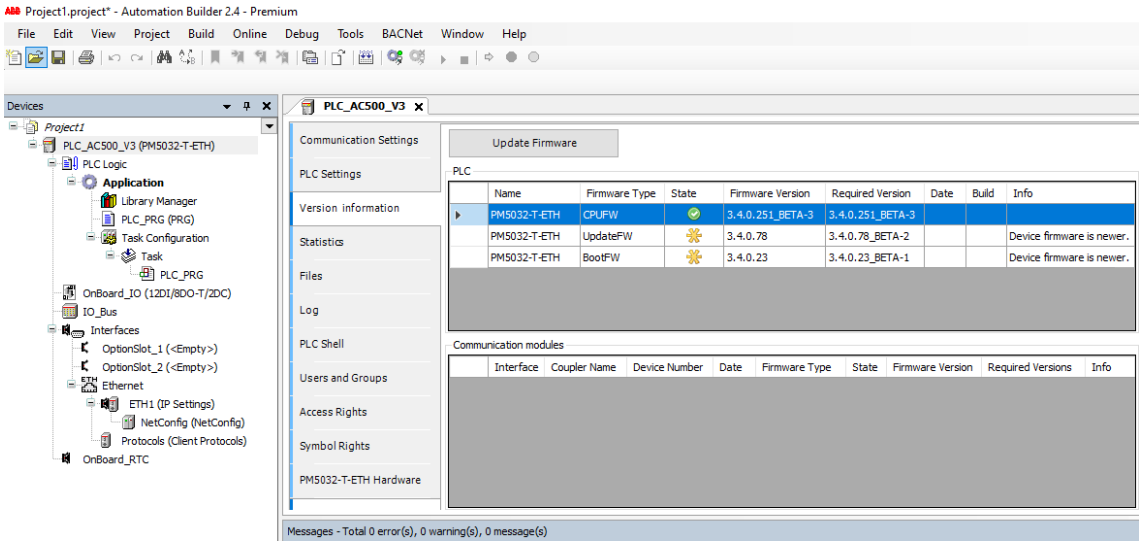
   ⇨ While the update process is running, the RUN and ERR LEDs are toggling, i.e., they are flashing alternating.

4. Wait for the PLC to finish the update.

> **NOTICE!**
> Do not disconnect the power supply during the update process! The PLC could be damaged.

5. If necessary, refresh the version information by switching to another tab and back.

   ⇨ Successful firmware update:



Behavior of LEDs during firmware update

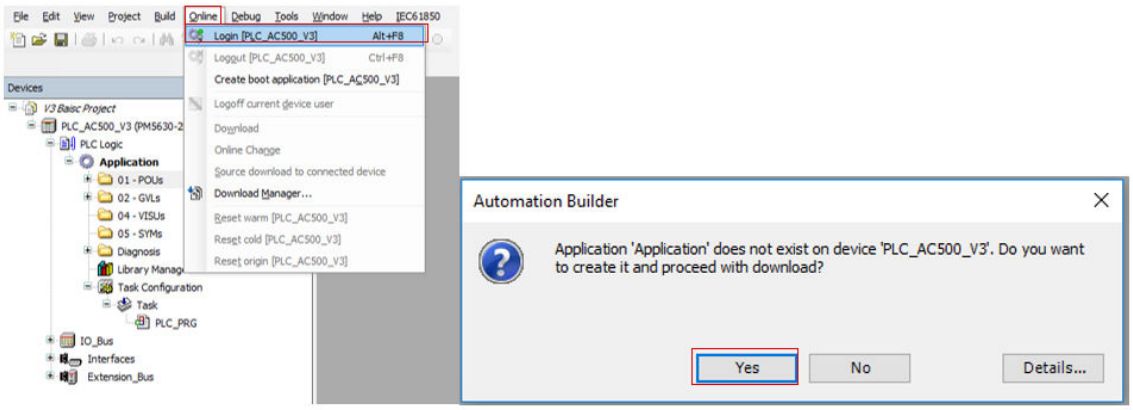
- CPU without firmware, only the power LED is on.
- While the firmware update process is running, the RUN and ERR LEDs are toggling, i.e., they are flashing alternating.

LED	LED flashes	Status
RUN and ERR	Toggling	Update pending
RUN	Flashing slow	Done successful
ERR	Flashing slow	Done failed

- CPU with installed firmware, only the power LED is on.
- If the CPU is running, then the RUN LED is on.
- If the CPU is in STOP mode, the RUN LED is off.

5.4.7 Log-in to CPU and download the program

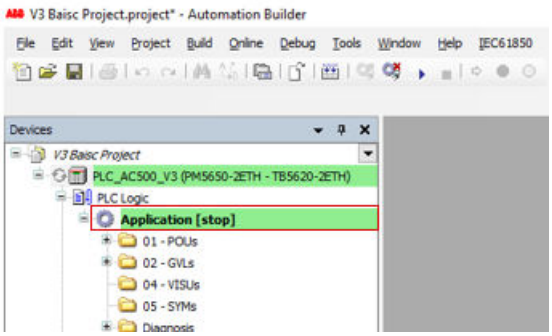
Logging-in to the CPU will load the project into the AC500 V3 CPU. The first log-in will also load the hardware set-up.



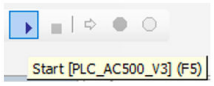
1. In the Automation Builder menu select *“Online ➔ Login [PLC_AC500_V3]”*.

   ⇨ A pop-up will appear.

2. Select *“Yes”* to download the application to the AC500V3 CPU.



   ⇨ PLC is in "stop" mode.



3. Start the PLC ↳ *Chapter 5.4.8.1 “Start the program execution” on page 45*.

Generally, if the CPU is in "run" mode, i.e. in program execution mode, a download will always cause the mode change to "stop". In stop mode the CPU is not controlling the system!

Always, after selecting the "Login" command, read carefully the dialog box text to ensure that you are aware of the CPU’s behavior after the command confirmation.

By default, a download generates following actions in the CPU:

- The project is stored in the RAM memory.
- The project is stored in the flash EEPROM, if boot application was created.

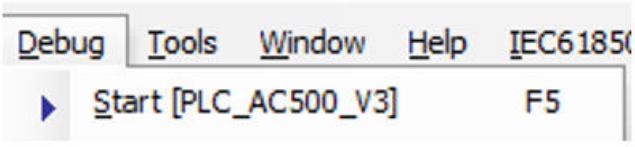
5.4.8 Test the program

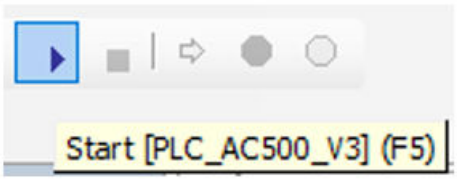
5.4.8.1 Start the program execution

☑ You are logged in the CPU.

☑ An executable project is loaded to the CPU.

☑ The CPU is in "stop" mode.





▷ Select menu *"Debug ➔ Start [PLC_AC500_V3]"*.

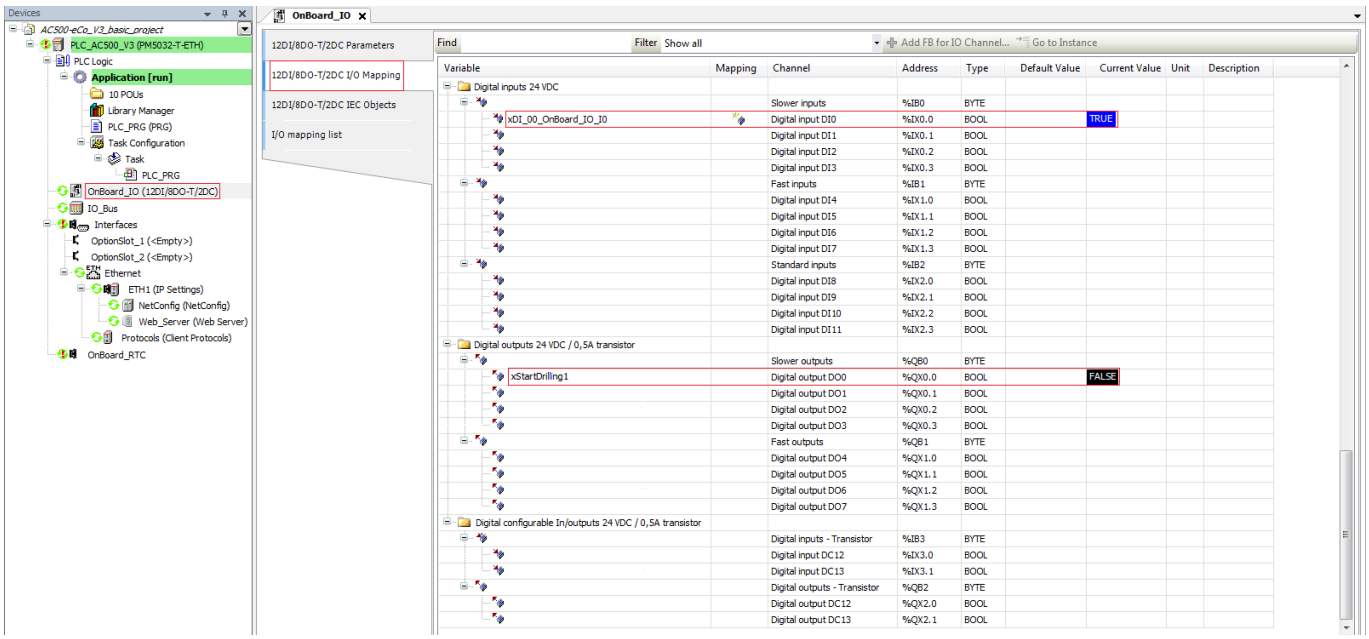
Alternatively, select the "start" icon in the tool bar.

Alternatively, press *[F5]*.

5.4.8.2 Test the function

▷ Operate the switch I1 and observe:

- The LEDs of the relevant onboard I/O inputs and outputs.
- The online status of inputs and outputs within the POU.

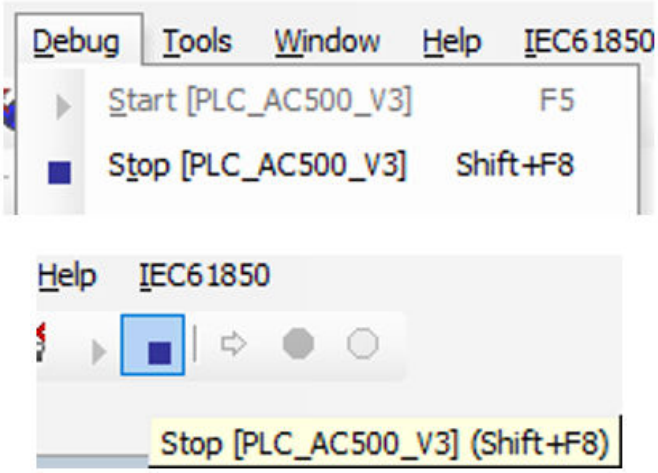


5.4.8.3 Stop the program execution

☑ You are logged in the CPU.

☑ An executable project is loaded to the CPU.

☑ The CPU is in "run" mode.



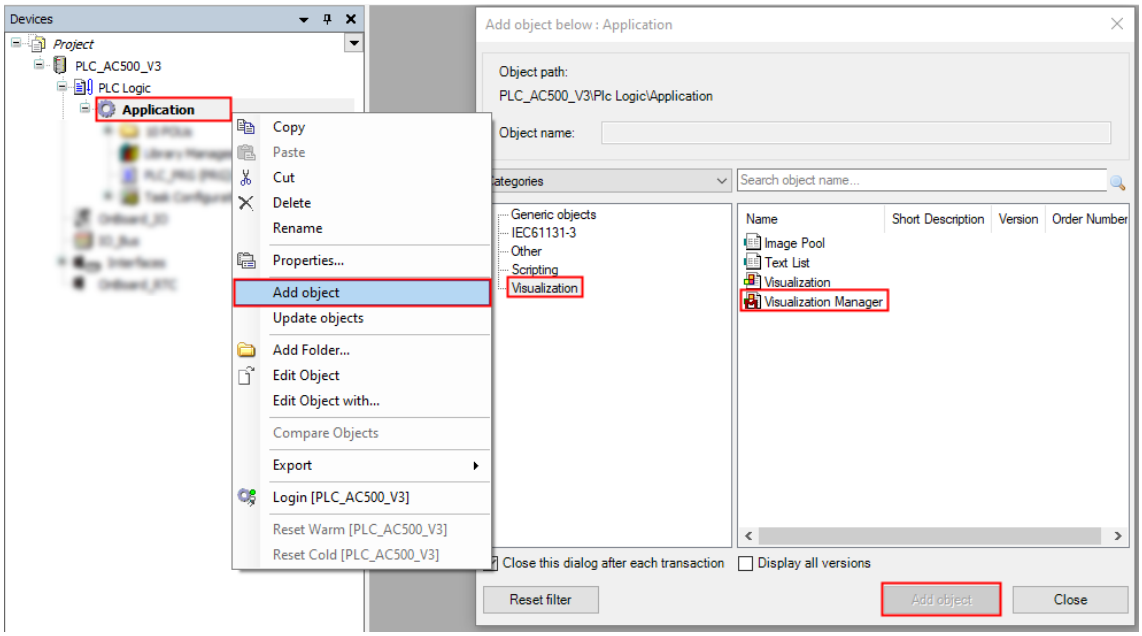
▷ Select menu *"Debug ➔ Stop [PLC_AC500_V3]"*

Alternatively, select the "stop" icon in the tool bar.

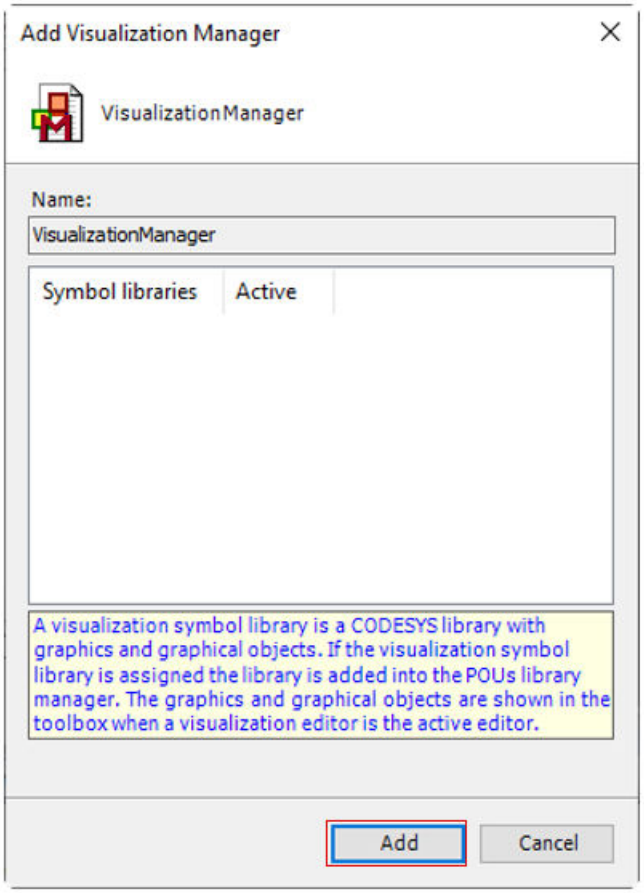
Alternatively, press *[Shift]* + *[F8]*.

5.4.9 Set-up visualization

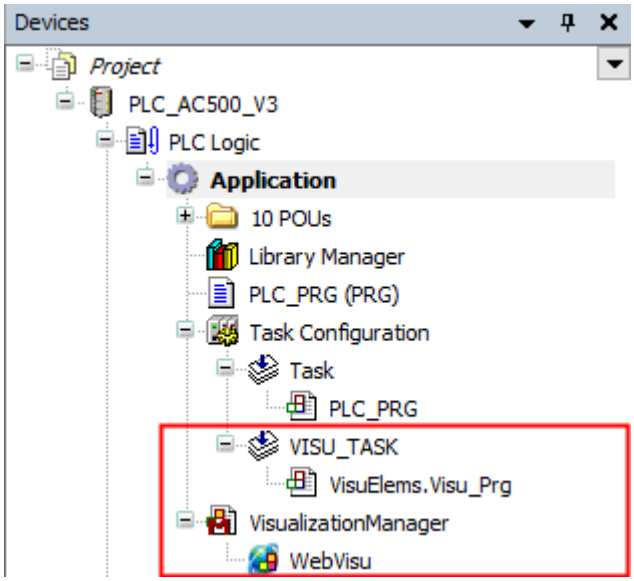
5.4.9.1 Add the VisualizationManager



1. Right-click *"Application"* in the device tree.
2. Select *"Add object"*.
3. Select *"VisualizationManager"*.
4. Select *"Add object"* to add the VisualizationManager to the project.
   ⇨ Dialog *"Add Visualization Manager"* opens.

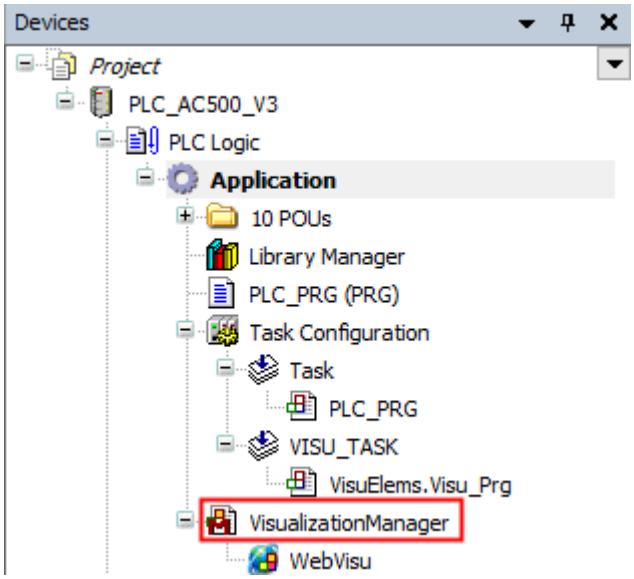


5. Select *“Add”*.

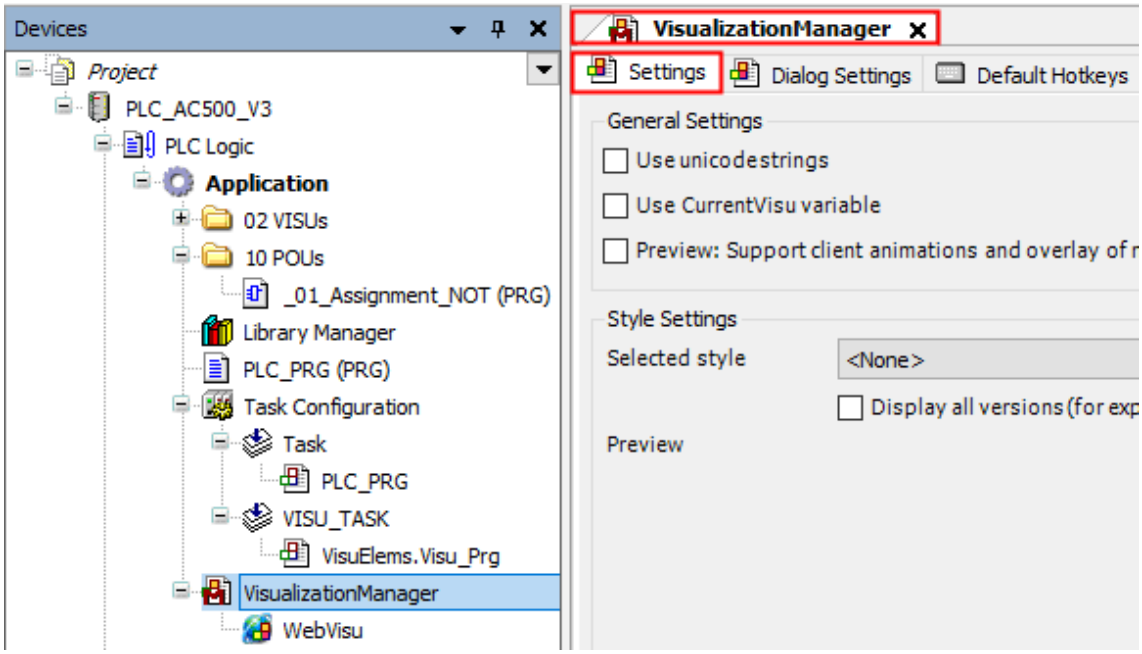


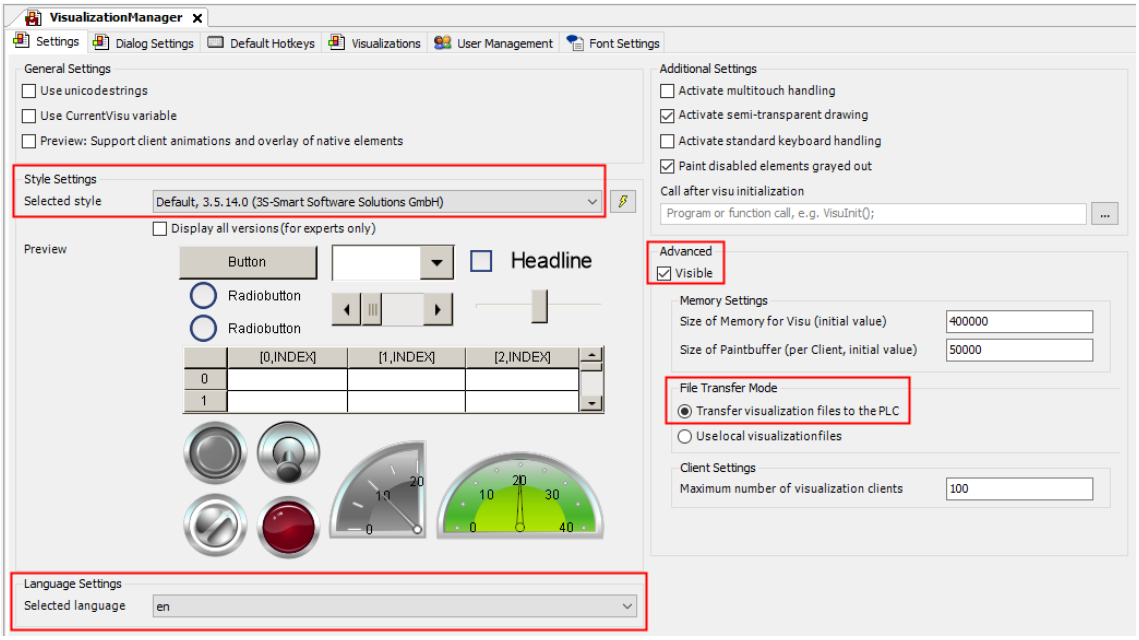
⇨ You added the objects *“VisualizationManager”* and *“VISU-TASK”* to the device tree.

5.4.9.2 Set-up the VisualizationManager



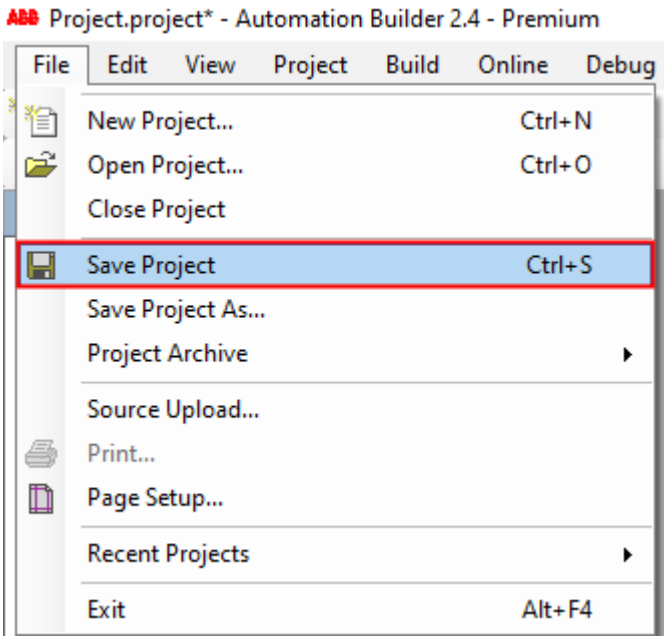
1. Double-click VisualizationManager in the device tree.
   ⇨ A tab opens in the editor view.





2. Select *“Settings”*.
3. Open the drop-down menu *“Selected style”*.
4. Select *“Default, x.x.x”* (exemplary).
5. Open the drop-down menu *“Selected language”*.
6. Select *“en”* for English language in the visualization.
7. Enable *“Visible”* for advanced settings.
8. Keep the file transfer to enable the visualization on the PLC (mandatory for web server function ↳ *Chapter 5.4.11 “Enable web visualization” on page 58*).

5.4.9.3 Save the project



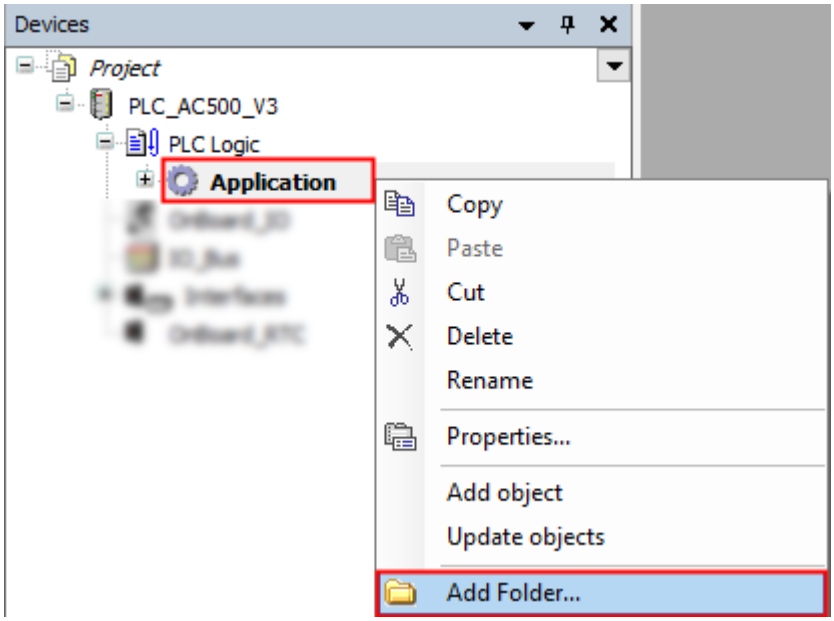
▷ Select menu *“File ➔ Save Project”*.

Alternatively, select the save icon in the tool bar.

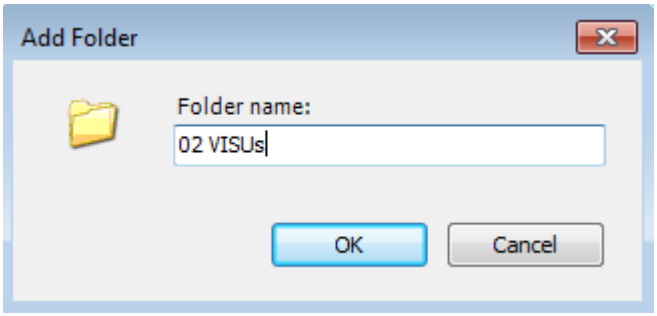
Alternatively, press *[Ctrl] + [S]*.

5.4.10 Create visualization

5.4.10.1 Add a folder for visualization screens

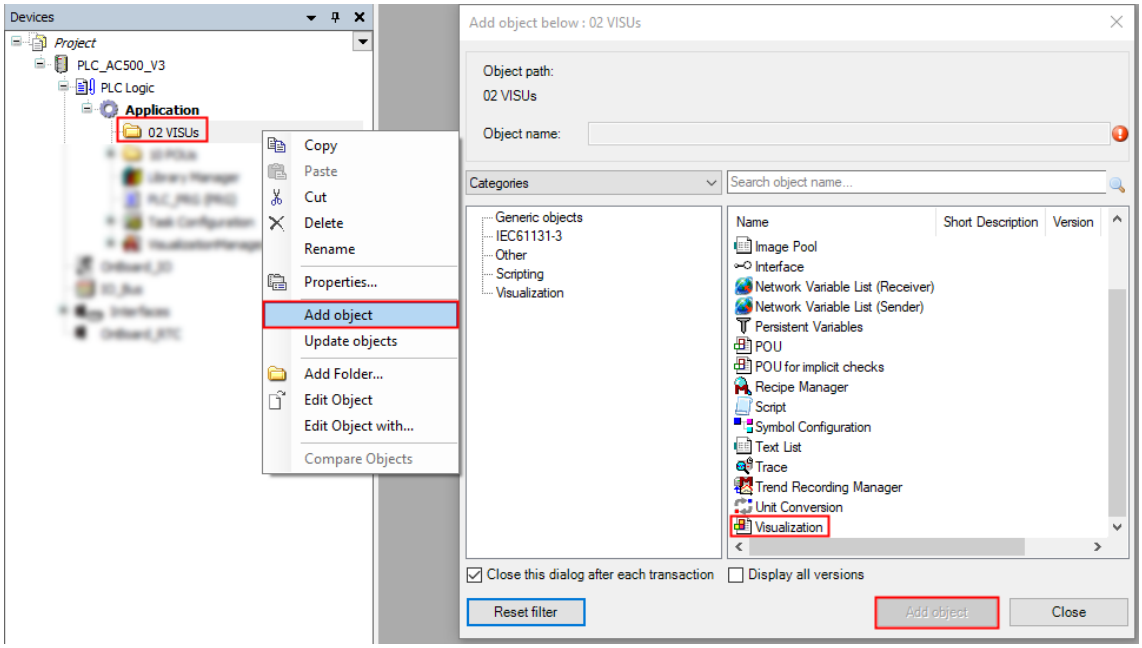


1. Right-click *“Application”* in the device tree.
2. Select *“Add Folder”*.

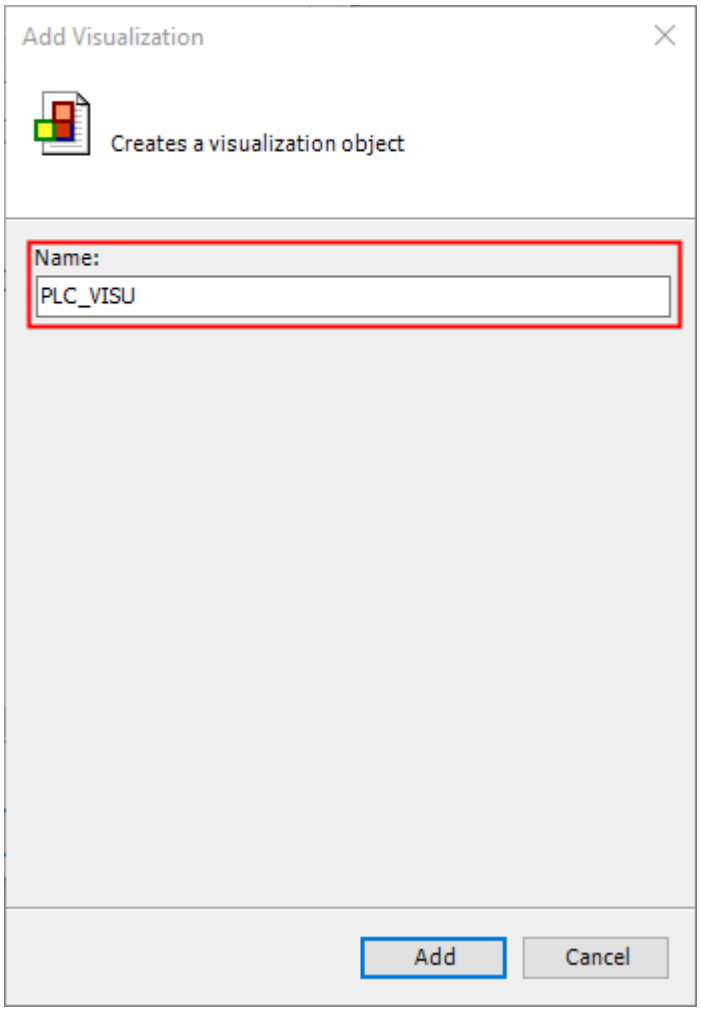


3. Type in "02 VISUs".
4. Select *“OK”* to add the folder.

5.4.10.2 Add a screen for "_01_Assignment_NOT" POU



1. Right-click *“02 VISUs”*.
2. Select *“Add object”*.
3. Select object *“Visualization”*.
4. Select *[OK]*.



5. Type in "PLC_VISU".
6. Select *“Add”*.
   ⇨ A tab opens in the editor view.

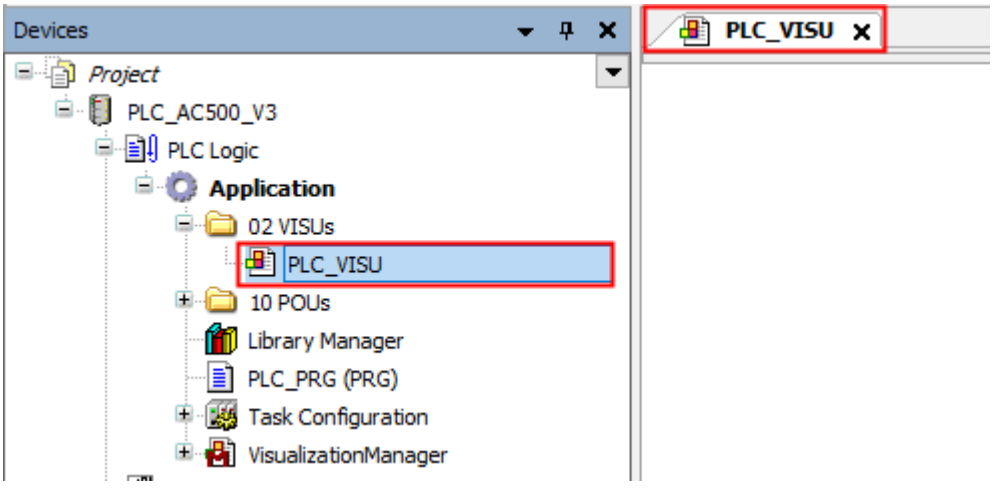


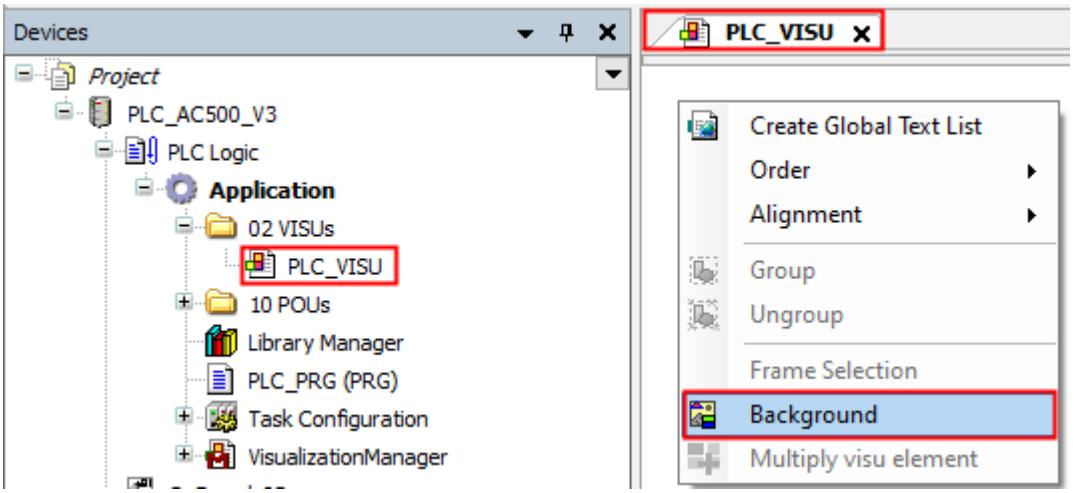
Fig. 2: PLC_VISU_tab

> *The name "PLC_VISU" has been chosen, because it is the default name for a home screen in a web visualization.*
>
> *If you have more than one visualization object in your project, it will be useful to choose another name, e.g. "_01_Assignment_NOT_v". And to choose "PLC_VISU" as a home screen to access all available visualization screens.*
>
> *The name of a visualization object can be modified afterwards.*

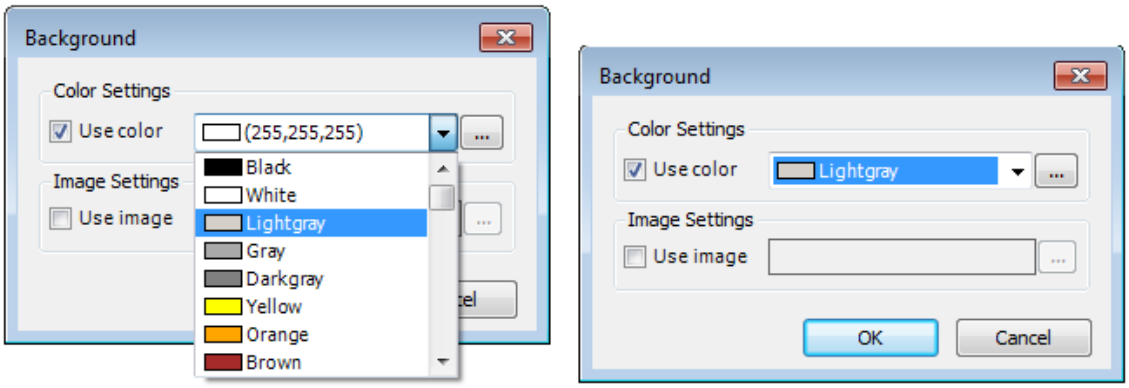
5.4.10.3 Creating and configuring of visualization

5.4.10.3.1 Change background color

1. Double-click *“PLC_VISU”* in the device tree.
   ⇨ A tab opens in the editor view.



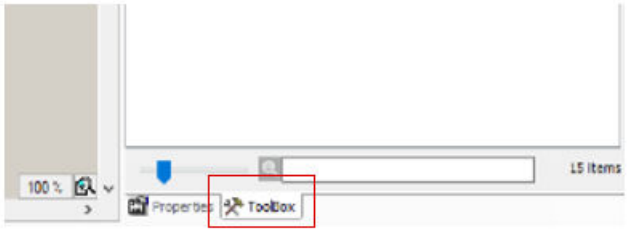
2. Right-click anywhere on the "PLC_VISU" editor page.
3. Select *“Background”*.



4. Enable the check box *“Use Color”*.
   ⇨ This enables the drop-down menu.
5. Select a color, e.g., *“Lightgray”*.
6. Select *[OK]* to add the color to "PLC_VISU".

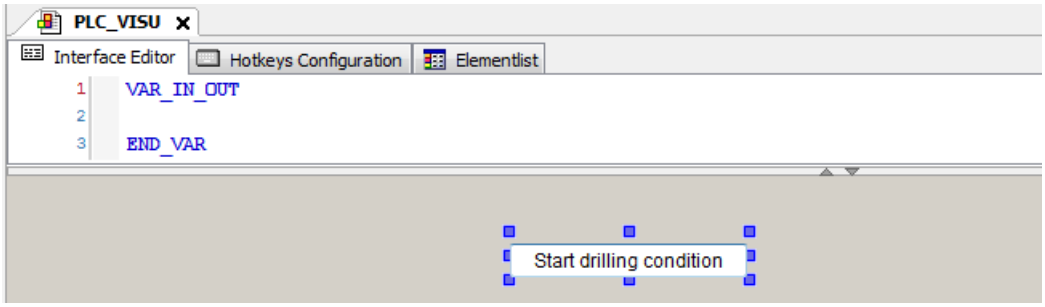
5.4.10.3.2 Add a screen title

1. Double-click on *“PLC_VISU”* in the device tree.



2. Select *“ToolBox”*.

3. Select *“Common controls”*.
4. Drag and drop *“Label”* to the page.

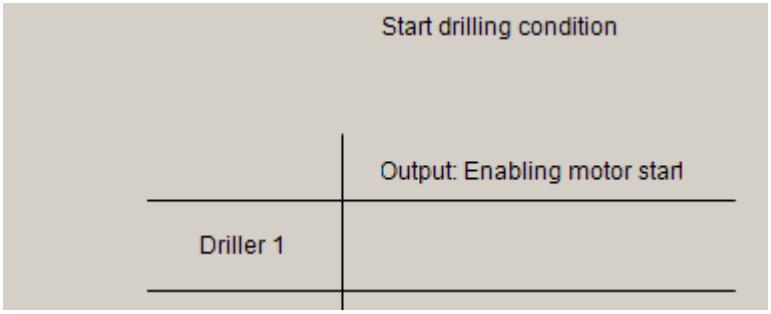


5. Type in "Start drilling condition".

5.4.10.3.3 Further lines and labels

1. Double-click on *“PLC_VISU”* in the device tree.

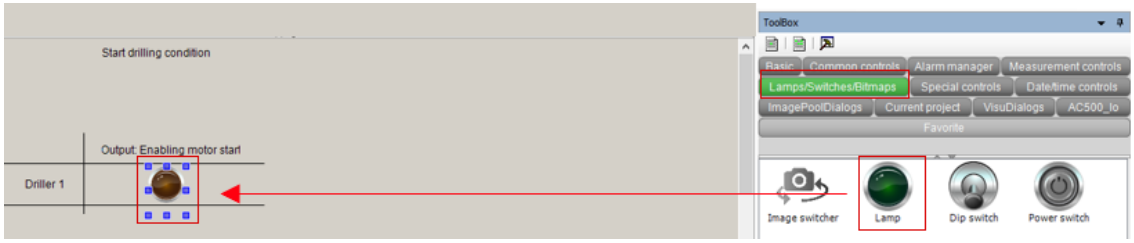
2. Select *“ToolBox”*.
3. Select *“Basic”*.
4. Drag and drop the line. Then drag the line to the needed length.



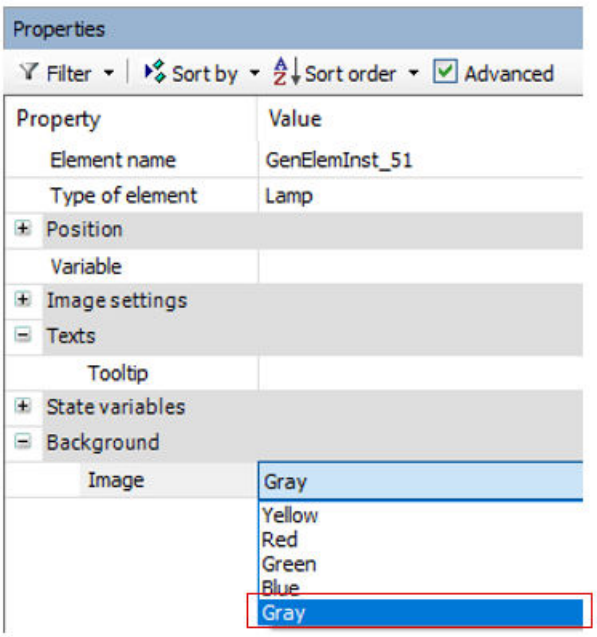
5. Follow the same procedure to create the other shapes and labels.

5.4.10.3.4 Lamp element for signal indication

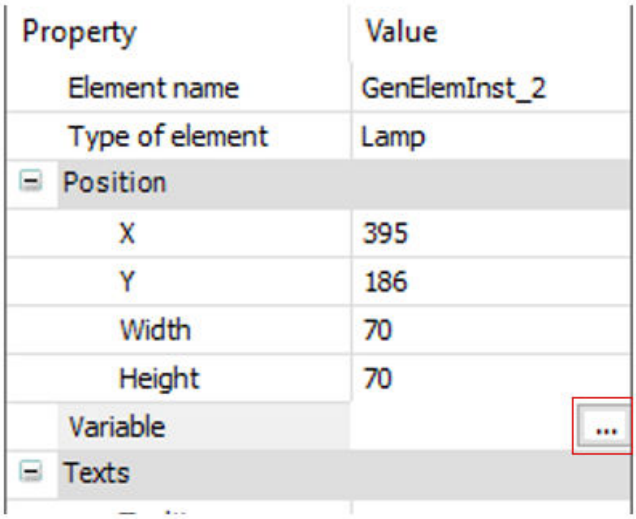
1. Double-click on *“PLC_VISU”* in the device tree.



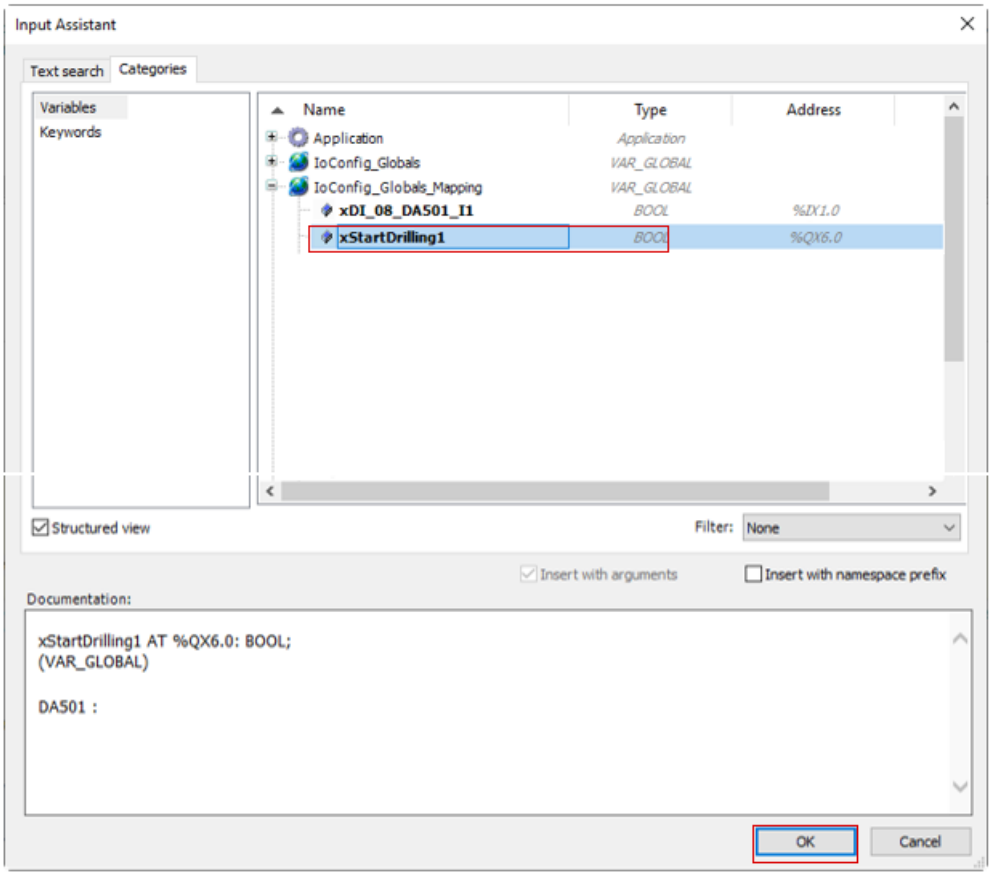
2. Select *“ToolBox”*.
3. Select *“Lamps/Switches/Bitmaps”*.
4. Drag and drop *“Lamp”* to the screen.
5. Adapt the size, if required.



6. Under *“Image”*, select *“Gray”*.



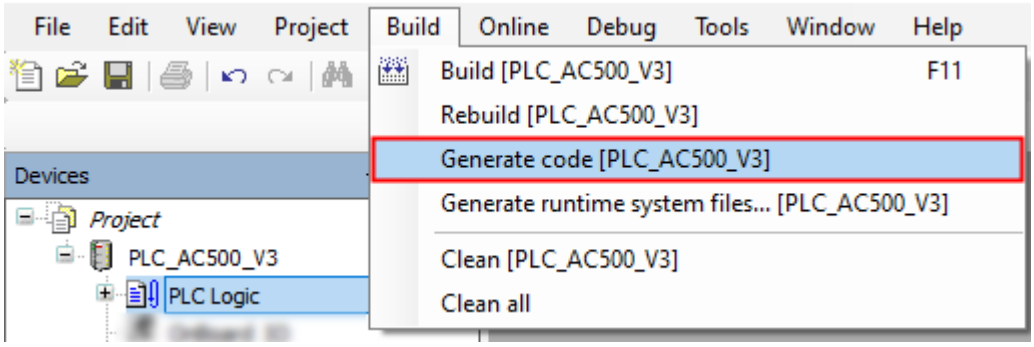
7. Double-click on *“Variable”* and select *“...”* to select a variable from the list.



8. Under *“IoConfig_Globals_Mapping”*, select *“xStartDrilling1”*.
9. Select *[OK]*.

5.4.10.3.5 Compile the project

Before logging-in to the CPU, you need to compile the complete code without any errors.

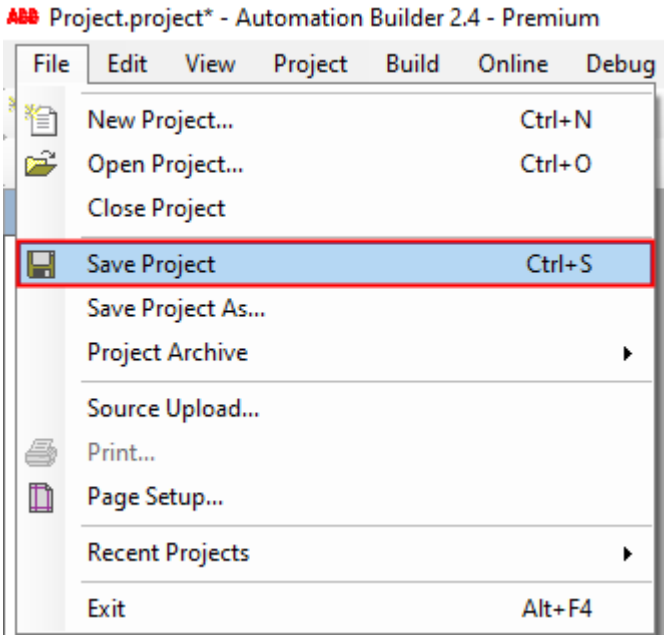


▷ Select menu *"Build ➔ Generate code"*.

⇨ The result of the compiling is shown in the *"Messages"* field at the bottom of the screen.

If you skip the compiling and select *"Login"*, the Automation Builder will automatically trigger compiling in advance to logging-in.

5.4.10.3.6 Save the project



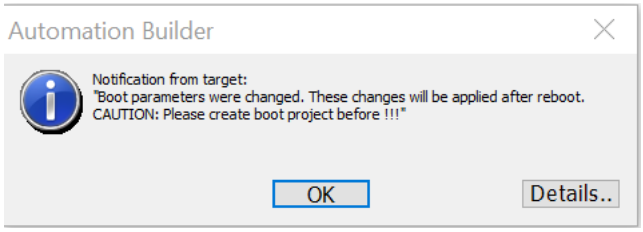
▷ Select menu *"File ➔ Save Project"*.

Alternatively, select the save icon in the tool bar.

Alternatively, press *[Ctrl]* + *[S]*.

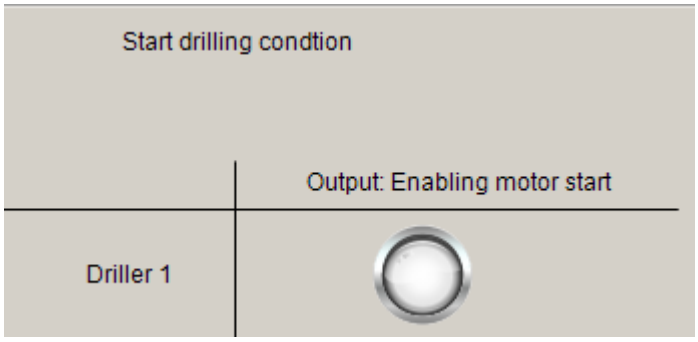
5.4.10.4 Loading the project to the CPU

1. Download the project to the CPU *as described in Chapter 5.4.7 , on page 44*.
2. Check the notification window at the end of the download. In case of message "Boot parameters were changed. These changes will be applied after reboot", a reboot of the CPU is required after creation of the boot project.



5.4.10.5 Test the program

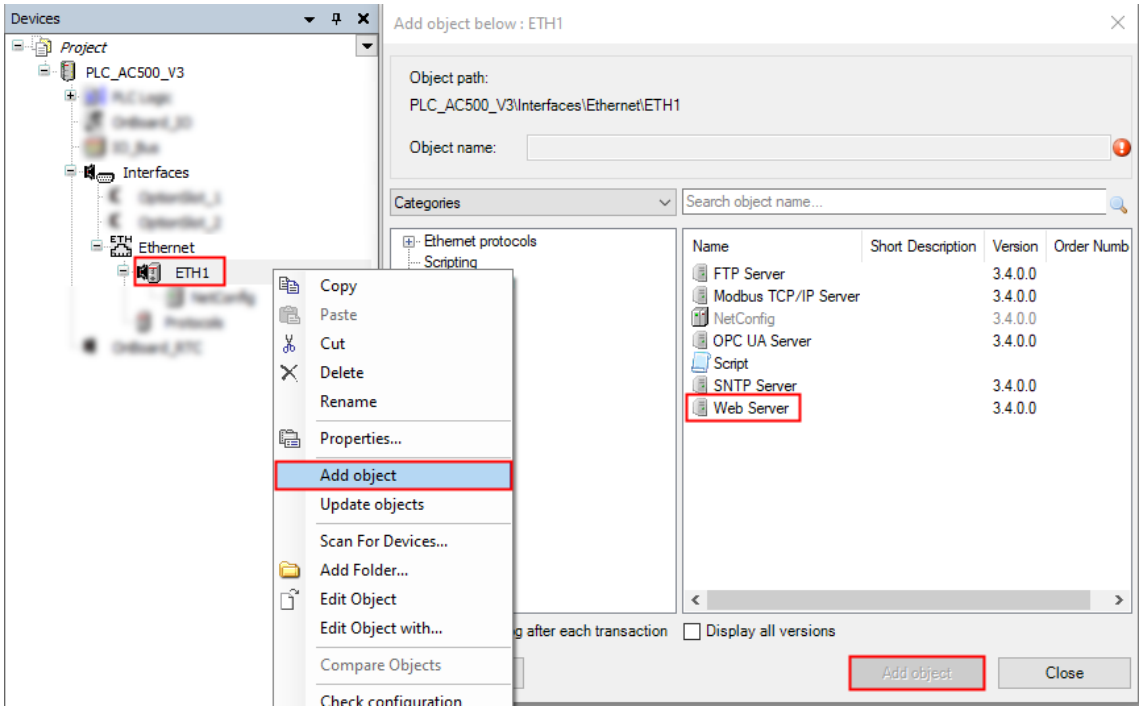
▷ Operate the switches and observe the visualization screen.



5.4.11 Enable web visualization

5.4.11.1 Add a web server object to the device tree

Ethernet ports can be configured for web server protocol. This description deals with ETH1 configuration for the webserver

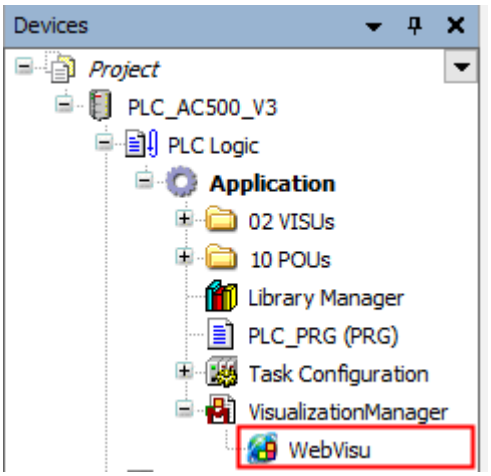


1. Right-click *“ETH1”* in the device tree.
2. Select *“Add object”*.
3. Select *“Web Server”*.

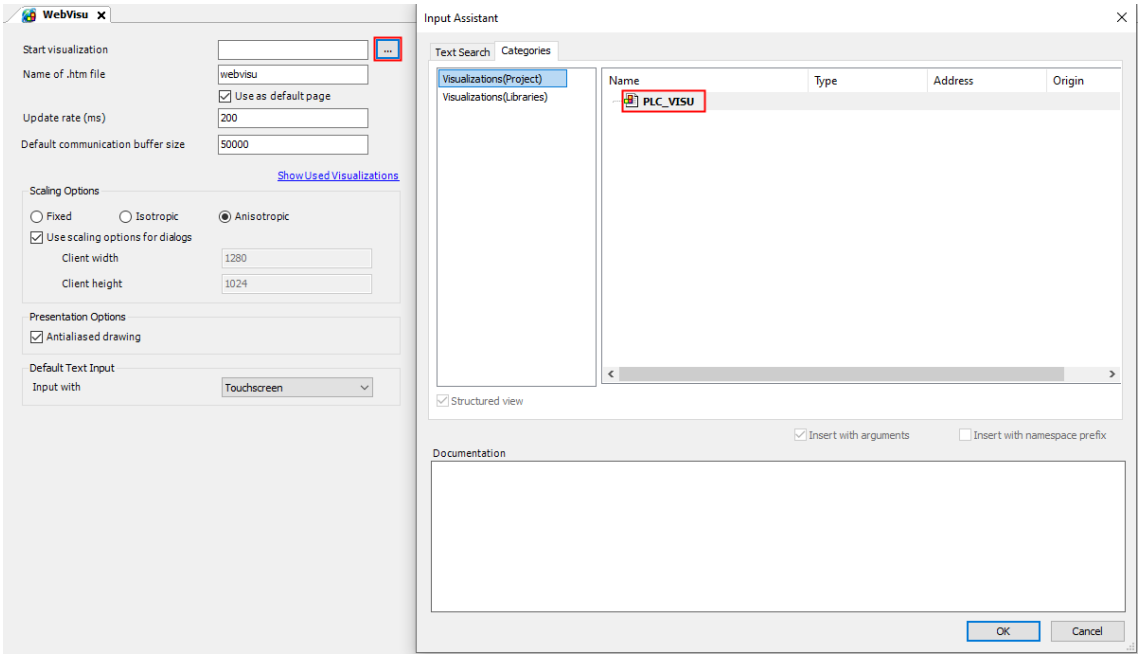
4. Select *“Add object”*.

   ⇨ You added and activated a web server on Ethernet port 1 on the AC500 V3 CPU.

5.4.11.2 Set-up the web server



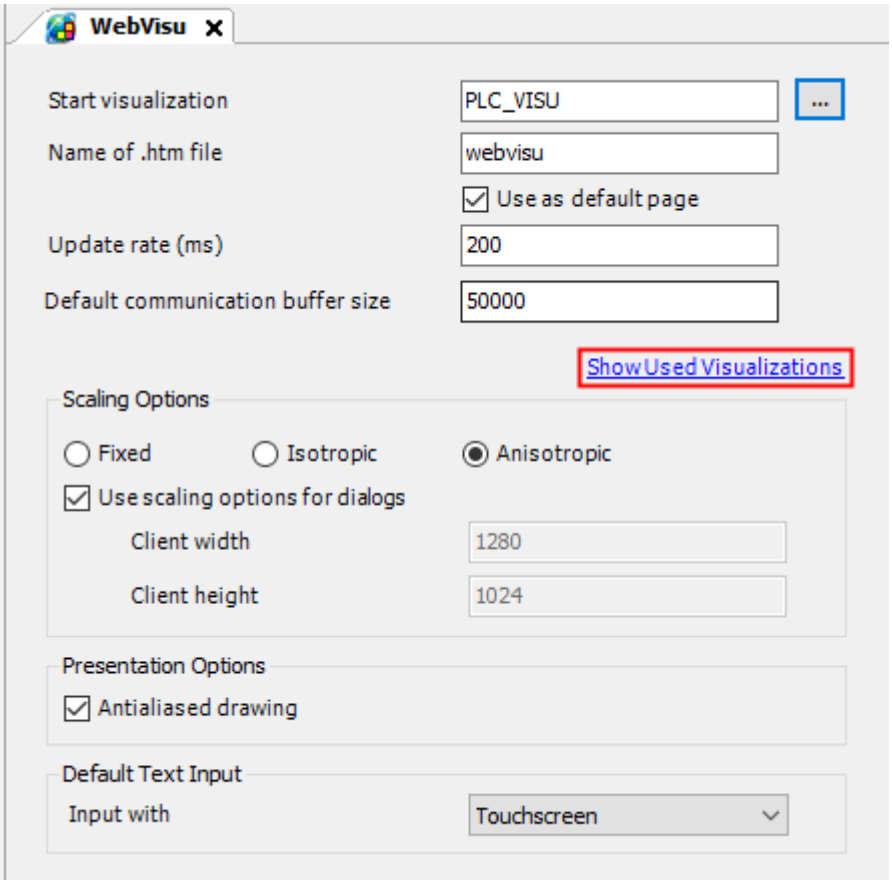
1. Double-click *“WebVisu”* in the device tree.



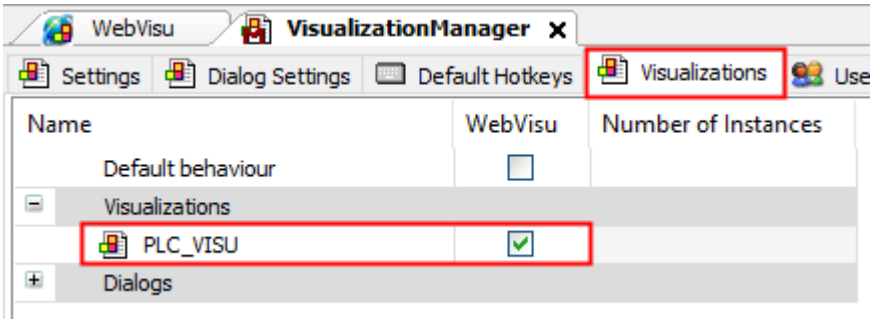
2. Under *“Start Visualization”*, select *“...”*.

   ⇨ A list opens.

3. Select the *“PLC_VISU”* screen from the list.
4. Keep all further settings with default values.



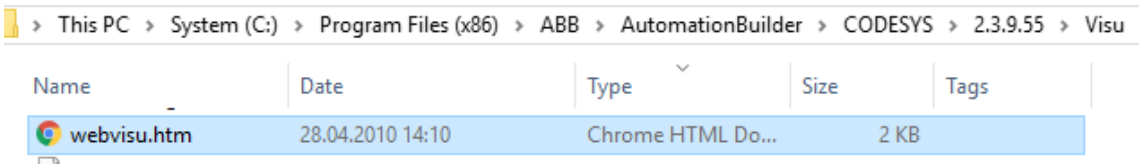
5. Select the link *"Show used visualizations"*.



⇨ The VisualizationManager editor and there the tab *"Visualizations"* opens. All screens and dialog elements created in the project are visible.

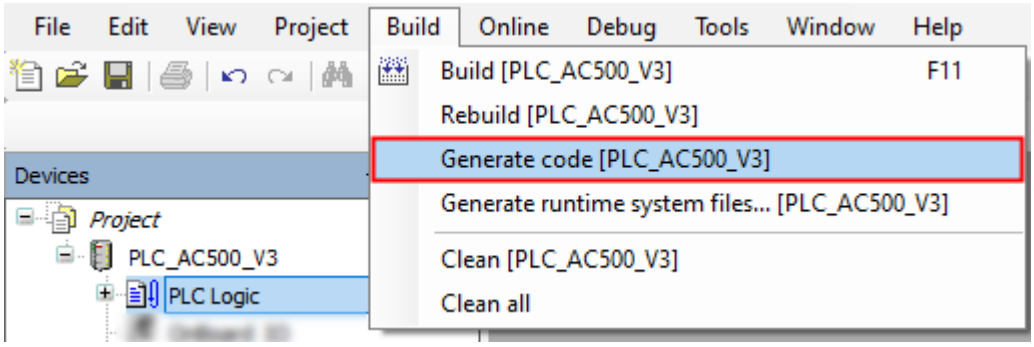
Here, you can select which screens are enabled or disabled for web visualization.

If you want to select another screen as a start visualization, you must modify the adequate parameter in the webvisu.htm file: `<param name="STARTVISU" value="PLC_VISU">`



5.4.11.3 Compile the project

Before logging-in to the CPU, you need to compile the complete code without any errors.

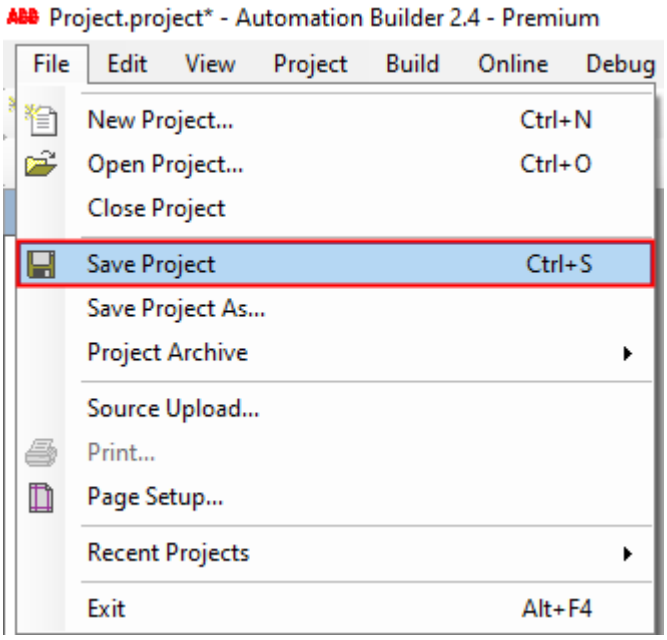


▷ Select menu *"Build ➔ Generate code"*.

⇨ The result of the compiling is shown in the *"Messages"* field at the bottom of the screen.

If you skip the compiling and select *"Login"*, the Automation Builder will automatically trigger compiling in advance to logging-in.

5.4.11.4 Save the project



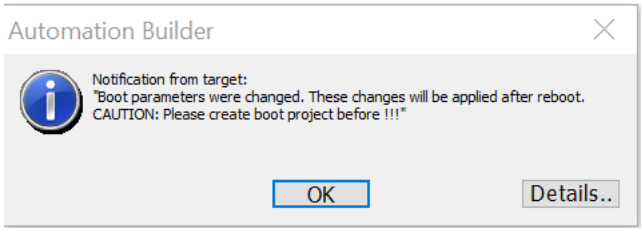
▷ Select menu *"File ➔ Save Project"*.

Alternatively, select the save icon in the tool bar.

Alternatively, press *[Ctrl]* + *[S]*.

5.4.11.5 Loading the project to the CPU

1. Download the project to the CPU *as described in Chapter 5.4.7 , on page 44*.
2. Check the notification window at the end of the download. In case of message "Boot parameters were changed. These changes will be applied after reboot", a reboot of the CPU is required after creation of the boot project.



5.4.11.6 Create a boot project

By default, after project download, the boot project is created automatically.

5.4.11.7 Rebooting the CPU

▷ Reboot the CPU by switching OFF and ON the power supply. (The parameter for web-server activation is a boot pamater which is loaded during boot of the CPU)

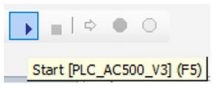
5.4.11.8 Test the web visualization

☑ You have downloaded the project and created the boot project.

☑ The CPU has been rebooted.

☑ You are logged in.

☑ CPU is in "stop" mode.



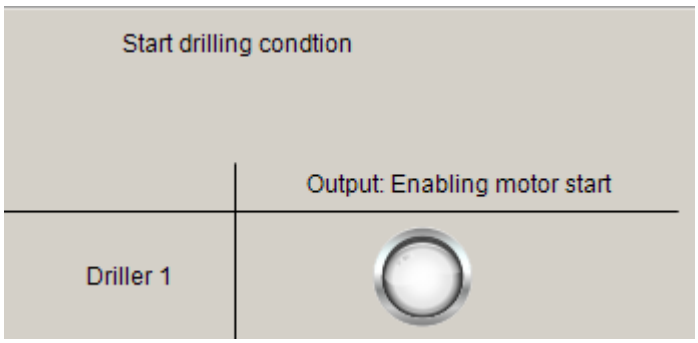
1. Start the project execution, e.g., from the tool bar.
2. Launch an internet browser.
3. Type in the URL field: *http://192.168.0.10/webvisu.htm*.

   192.168.0.10 is the IP address of CPU's ETH1 port.

   /webvisu.htm is the default htm file.

   ⇨ Web visualization will be loaded.

   The start screen "PLC_VISU" is displayed in a responsive view.



4. Test the function by operating switch I1.
5. Test the results for responsive view by changing the web browser window size.

5.4.12 Reset the CPU

Reset values and parameters In some cases, it could be required to do a CPU reset, e.g., for resetting of counter values, parameters etc.

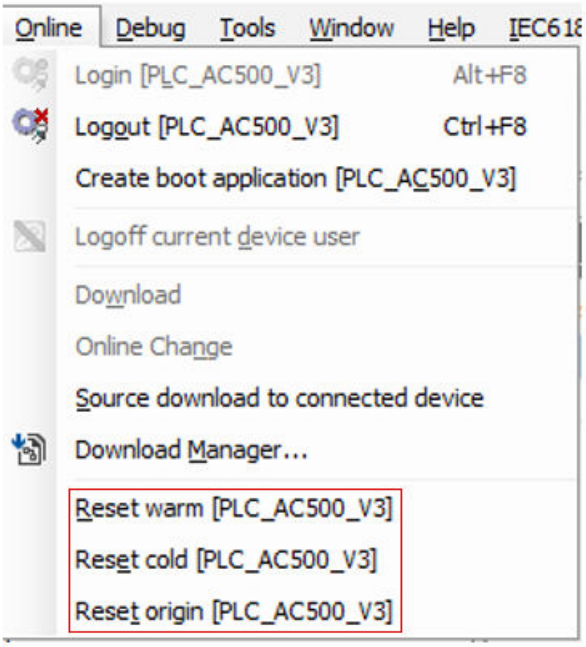


Fig. 3: Reset commands in "Online" menu

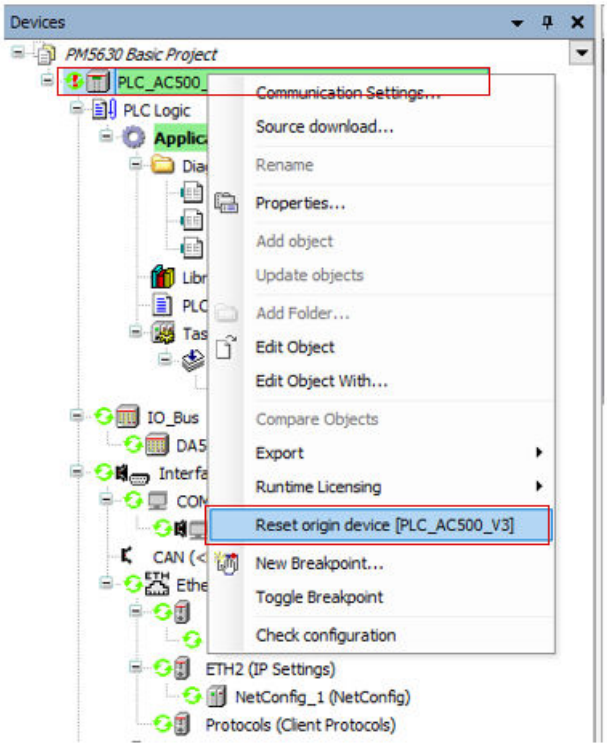
Reset warm	All variables are reset, except RETAIN PERSISTENT variables.
Reset cold	Causes initialization of all variables, except PERSISTENT variables. By recommended creation of remanent variables always with both properties: PERSISITENT and RETAIN, this command resets all variables, except PERSISTENT RETAIN variables.
Reset origin	All variables and the application project are reset.

Table 5: Behavior of variables of type VAR (local or global) and variables of type PERSISTENT RETAIN

	VAR	**VAR PERSISTENT RETAIN**
After online command *"Online change"*	no change	no change
After online command *"Download"*	initialization	no change
After online command *"Reset warm"*	initialization	no change
After online command *"Reset cold"*	initialization	no change
After online command *"Reset origin"*	initialization	initialization
After power supply off	initialization	no change

Complete reset of the CPU

To do a complete reset of the CPU thereby erasing the application from the RAM and flash EEPROM do the following.



1. Right-click the station object *"PLC_AC500_V3"* in the device tree.
2. Select *"Reset origin device [station name]"*.
   ⇨ The application is completely erased from the CPU (complete project from all memory areas).

5.5 Further information on our AC500 portfolio

- PLC homepage: *abb.com/plc*
- PLC catalog as PDF: *to.abb/SZTxDTqG*, and also as *flipbook*
- The manual for Automation Builder and all AC500 products is available via Automation Builder. Go to menu *"Help ➔ Contents"*, the manual will open.

6 Device specifications

Processor modules

This chapter lists all AC500-eCo V3 processor modules and its accessories. It contains its device specifications like technical data and installation information.

I/O modules

Information about I/O modules can be found in the *complete documentation for AC500-eCo V3* on our website.

6.1 Processor modules

6.1.1 PM50xx

The following table lists all AC500-eCo V3 CPUs with their most important properties.

Procesor modules	Global user memory	Configurable input/output	Digital inputs	Digital outputs	Power supply	Ethernet interfaces	Option slots
PM5012-T-ETH	1 MB thereof 256 kB for user program code and data dynamically allocated	-	6	4 (Transistor)	24 V DC	1	1
PM5012-R-ETH	1 MB thereof 256 kB for user program code and data dynamically allocated	-	6	4 (Relay)	24 V DC	1	1
PM5032-T-ETH	2 MB thereof 512 kB for user program code and data dynamically allocated	2 (Transistor)	12	8 (Transistor)	24 V DC	1	2
PM5032-R-ETH	2 MB thereof 512 kB for user program code and data dynamically allocated	2 (Transistor)	12	6 (Relay)	24 V DC	1	2

PM5052-T-ETH	4 MB thereof 768 kB for user program code and data dynamically allocated	2 (Transistor)	12	8 (Transistor)	24 V DC	1	3
PM5052-R-ETH	4 MB thereof 768 kB for user program code and data dynamically allocated	2 (Transistor)	12	6 (Relay)	24 V DC	1	3
PM5072-T-2ETH	8 MB thereof 1 MB for user program code and data dynamically allocated	2 (Transistor)	12	8 (Transistor)	24 V DC	2	3
PM5072-T-2ETHW *)	8 MB thereof 1 MB for user program code and data dynamically allocated	2 (Transistor)	12	8 (Transistor)	24 V DC	2	3

*) W = wide temperature

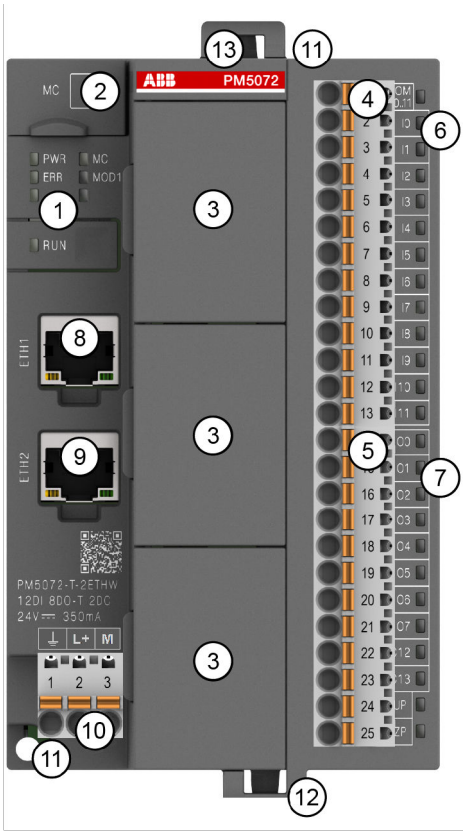


Fig. 4: Example: PM5072-T-2ETH

1 5 LEDs to display the states of the processor module (Power, Error, Run, MC, MOD1)
2 Micro memory card slot
3 Option board cover for option board slot
4 13-pin terminal block for I/O connectors
5 12-pin terminal block for I/O connectors
6 12 LEDs to display the states of the signals
7 10 LEDs to display the states of the signals
8 RJ45 female connector for Ethernet1 connection
9 RJ45 female connector for Ethernet2 connection
10 3-pin terminal block for power supply 24 V DC
11 2 holes for wall-mounting with screws
12 Cable binding
13 Cable binding accessory on the top of the housing (optional)

The processor module is shown with pluggable terminal blocks. These terminal blocks must be ordered separately.

The cable binding accessory on the top of the housing is optional. Please use TA5301-CFA accessory.

6.1.1.1 Short description

The processor modules PM50xx series are the central units of AC500-eCo V3 PLC. Their main characteristics are:

- Power supply 24 V DC
- I/O bus (not for PM5012-x-ETH)
- Real time clock (PM5012-x-ETH needs additional RTC option board)
- Option slots for extension on the CPU (1 for PM5012-x-ETH, 2 for PM5032-x-ETH, 3 for PM5052-x-ETH and PM5072-T-2ETH)
- 6 digital inputs (PM5012-x-ETH), 12 digital inputs (PM5032-x-ETH, PM5052-x-ETH, PM5072-T-2ETH)
- 4 transistor outputs (PM5012-T-ETH), 8 transistor outputs (PM5032-T-ETH, PM5052-T-ETH, PM5072-T-2ETH)
- 4 relay outputs (PM5012-R-ETH), 6 relay outputs (PM5032-R-ETH, PM5052-R-ETH)
- 2 configurable digital inputs/outputs (not for PM5012-x-ETH)

The various processor module variants differ in the following characteristics:

- Type of the digital outputs (transistor or relays)
- Ethernet interface one or two independent interfaces

All processor module variants include a micro memory card slot.

Details and technical data are provided in the technical data section *Chapter 6.1.1.8 “Technical data” on page 97*.

6.1.1.2 Assortment

Processor module	Global user memory for (PROG/ DATA/ WEB)	Allocated global user memory for user program code and data	Cycle time for 1000 instructions [ns]	Numer digital inputs	Number digital outputs	Type of digital outputs	Config-urable digital inputs/ outputs	Number of option board slots	Max. number of I/O modules on I/O-bus
PM5012-T-ETH	1 MB	256 kB	Binary: 20 Word: 50 Floating: 600	6	4	Tran-sistor	-	1	-
PM5012-R-ETH	1 MB	256 kB		6	4	Relay	-	1	-
PM5032-T-ETH	2 MB	512 kB		12	8	Tran-sistor	2	2	10 with max. 128 KB inputs/ 128kB outputs variables
PM5032-R-ETH	2 MB	512 kB		12	6	Relay	2	2	10 with max. 128 KB inputs/ 128kB outputs variables
PM5052-T-ETH	4 MB	768 kB		12	8	Tran-sistor	2	3	10

Processor module	Global user memory for (PROG/ DATA/ WEB)	Allocated global user memory for user program code and data	Cycle time for 1000 instructions [ns]	Numer digital inputs	Number digital outputs	Type of digital outputs	Config-urable digital inputs/ outputs	Number of option board slots	Max. number of I/O modules on I/O-bus
PM5052-R-ETH	4 MB	768 kB		12	6	Relay	2	3	10
PM5072-T-2ETH	8 MB	1 MB		12	8	Tran-sistor	2	3	10
PM5072-T-2ETHW	8 MB	1 MB		12	8	Tran-sistor	2	3	10

6.1.1.3 Connections and interfaces

I/O bus

The I/O bus is not available for PM5012-T-ETH and PM5012-R-ETH. I/O channel extension using option board slot only.

The I/O bus is the I/O data bus for the I/O modules. Through this bus, I/O and diagnosis data are transferred between the processor module and the I/O modules. Up to 10 I/O modules for PM5032-x-ETH (but with a limit of 128kB input/ 128kB output variables) and 10 I/O modules for PM5052-x-ETH and PM5072-T-2ETH can be added.

Option slots interface

Depending on the processor module variants, additional option board can be connected to the option slot to extend the feature of the processor module.

Serial interface

RS232 communication interface is available by using option board:

- TA5141-RS232I (isolated)
  Chapter 6.2.4 “TA5141-RS232I - RS-232 serial adapter isolated option board” on page 125

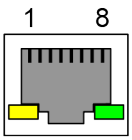
RS485 communication interface is available by using option boards:

- TA5142-RS485I (isolated)
  Chapter 6.2.5 “TA5142-RS485I - RS-485 serial adapter isolated option board” on page 128
- TA5142-RS485 (non isolated)
  Chapter 6.2.6 “TA5142-RS485 - RS-485 serial adapter non isolated option board” on page 134

Ethernet interface

The Ethernet interface is carried out via a RJ45 jack.

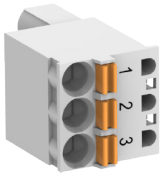
Table 6: Pin assignment of the Ethernet interface

Interface	Pin	Description	
	1	Tx+	Transmit Data +
	2	Tx-	Transmit Data -
	3	Rx+	Receive Data +
	4	NC	Not connected
	5	NC	Not connected
	6	Rx-	Receive Data -
	7	NC	Not connected
	8	NC	Not connected
	Shield	Cable shield	Functional earth

6.1.1.4 Power supply

The processor modules PM50xx can be connected to the 24 V DC supply voltage via a removable 3-pin spring terminal block or a 3-pin screw terminal block.

Table 7: Removable terminal block for the supply voltage 24 V DC

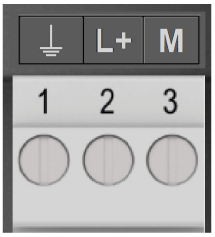
3-pin spring terminal block	3-pin screw terminal block
	

The terminal block is available as a set for AC500-eCo V3 processor modules.

Basic CPU (PM5012)		Standard CPUs (PM5032, PM5052) and Pro CPUs (PM5072)	
Spring type	**Screw type**	**Spring type**	**Screw type**
TA5211-TSPF-B	TA5211-TSCL-B	TA5212-TSPF	TA5212-TSCL

Further information on the terminal blocks concerning power supply and onboard inputs/outputs are provided under *Chapter 6.3.3 “Pluggable connectors for screw and spring connection” on page 149*.

Pin assignment

Pin Assignment	Pin	Label	Function	Description
 Terminal block inserted	1	⏚	FE	Functional earth
	2	L+	+24 V DC	Positive pin of the power supply voltage
	3	M	0 V	Negative pin of the power supply voltage

Faulty wiring on power supply terminals

CAUTION!

Risk of damaging the AC500-eCo V3 processor module and the connected modules!

Voltages > 30 V DC might damage the processor module and the connected modules.

Make sure that the supply voltage never exceeds 30 V DC.

6.1.1.5 State LEDs and operating elements

RUN/STOP button

The processor modules, PM50xx series, have a RUN/STOP button. By pressing the RUN/STOP button, the processer modules switch between RUN mode and STOP mode. By long-pressing RUN/STOP button during the processor module power on phase, the processor module will be in MOD1.

State LEDs

The processor modules PM50xx indicate their states of operation via 5 LEDs located on the upper left side of the processor module.

LED	State	Color	LED = ON	LED = OFF	LED flashing
PWR	Power supply	Green	Power supply present	Power supply missing	-
MC	Micro memory card indication	Yellow	Micro memory card is in the socket	Micro memory card is not in the socket	Micro memory card is in read/write state: any file on card is opened, means activity on card

LED	State	Color	LED = ON	LED = OFF	LED flashing
ERR	Error indication	Red	An error occurred	No errors or only warnings encountered (E4 errors). The LED behavior for the error classes 2 to 4 is configurable.	Fast flashing (4 Hz) displays together with the RUN LED a currently running firmware-upgrade or writing data to the Flash-EPROM. Slow flashing (1 Hz) alone displays shutdown of Request To Send. Medium flashing (2 Hz) alone displays at start of PLC if reboot after watchdog.
MOD1	Mode 1 indication	Yellow	Processor module is in mode 1 state	Processor module is not in mode 1 state	-
RUN	RUN/STOP state	Green	Processor module is in state RUN	Processor module is in state STOP	Fast flashing (4 Hz): The processor module is reading/ writing data from/to the memory card. If the ERR-LED is also flashing, data is being written to the Flash-EPROM.

LED	State	Color	LED = ON	LED = OFF	LED flashing
					Slow flashing (1 Hz): The firmware update from the memory card has been completed successfully or Boot project is being updated. Slow flashing (0.5 Hz) together with MOD1 LED ON: Mode1: Boot project is not loaded.
Two LEDs below “ERR” and “MOD1”	Configurable	Yellow	Configurable	Configurable	Additional two LEDs are reserved and can be controlled from IEC user code with FB PmLedSet

User configurable LEDs

The AC500-eCo V3 processor module also provides 2 LEDs below the state LEDs which can be used by user and driven by an application.

The LEDs can be used into a project and controlled using special function blocks which are contained in the PM AC500 library. The POU is PmLedSet located in folder LED control.

I/O LEDs

The processor module provides up to 10 LEDs (PM5012-x-ETH), 20 LEDs (PM5032-R-ETH, PM5052-R-ETH), or 22 LEDs (PM5032-T-ETH, PM5052-T-ETH, PM5072-T-2ETH) to display the states of the inputs and outputs.

Processor module	LED	State	Color	LED = ON	LED = OFF
PM5012-x-ETH	I0..I5	Digital input	Yellow	Input is ON	Input is OFF
	O0..O3	Transistor output	Yellow	Output is ON	Output is OFF
	NO0..NO3	Relay output	Yellow	Output is ON	Output is OFF
PM5032-x-ETH PM5052-x-ETH	I0..I11	Digital input	Yellow	Input is ON	Input is OFF
	O0..O7	Transistor output	Yellow	Output is ON	Output is OFF
	NO0..NO5	Relay output	Yellow	Output is ON	Output is OFF

Processor module	LED	State	Color	LED = ON	LED = OFF
	C12, C13	Digital configurable input/ output	Yellow	Input/Output is ON	Input/Output is OFF
PM5072-T-2ETH	I0..I11	Digital input	Yellow	Input is ON	Input is OFF
PM5072-T-2ETHW	O0..O7	Transistor output	Yellow	Output is ON	Output is OFF
	C12, C13	Digital configurable input/ output	Yellow	Input/Output is ON	Input/Output is OFF

Ethernet state LEDs

Table 8: State LEDs at Ethernet connector

LED	Color	OFF	ON	Flashing
Activity	Yellow	No activity	---	Activity
Link	Green	No link	Link	---

6.1.1.6 Diagnosis

The AC500 processor module can display various errors according to the error classes. The following error classes are possible. The reaction of the processor module is different for each type of error.

Error class	Type	Description	Example
E1 ERR-LED is ON	Fatal error	A safe function of the operating system is no longer guaranteed.	Checksum error in the system Flash or RAM error
E2 ERR-LED is ON	Severe error	The operating system is functioning without problems, but the error-free processing of the user program is no longer guaranteed.	Checksum error in the user Flash, independent of the task duration
E3 ERR-LED is ON/OFF *)	Light error	It depends on the application if the user program should be stopped by the operating system or not. The user should determine which reaction is necessary.	Flash could not be programmed, I/O module has failed
E4 ERR-LED is ON/OFF *)	Warning	Error in the periphery (e.g. I/O) which may show an impact in the future. The user should determine which reaction is necessary.	Short-circuit at an I/O module, the battery is run down or not inserted
*) The behaviour if the ERR-LED lights up at error classes E3 or E4 is configurable.			

Occurred errors can be displayed with the commands diagshow all in the PLC-Browser of Automation Builder software.

6.1.1.7 Onboard I/Os

The AC500-eCo V3 processor modules have onboard I/Os which provide several functionalities. According to the CPU type, the number or the functionality of the onboard I/Os can be different.

6.1.1.7.1 Intended purpose

Table 9: Numbers and types of the onboard I/Os

Processor module	No. and type of digital inputs	No. and type of digital outputs	No. and type of configurable inputs/ outputs
PM5012-T-ETH	6 24 V DC (one isolation group)	4 0.5 A max., transistor (one isolation group)	None
PM5012-R-ETH	6 24 V DC (one isolation group)	4 2 A max., relay (two isolation groups)	None
PM5032-T-ETH	12 24 V DC (one isolation group)	8 0.5 A max., transistor (one isolation group)	2 24 V DC input or 0.5 A max., transistor output (one isolation group)
PM5032-R-ETH	12 24 V DC (one isolation group)	6 2 A max., relay (two isolation groups)	2 24 V DC input or 0.5 A max., transistor output (one isolation group)
PM5052-T-ETH	12 24 V DC (one isolation group)	8 0.5 A max., transistor (one isolation group)	2 24 V DC input or 0.5 A max., transistor output (one isolation group)
PM5052-R-ETH	12 24 V DC (one isolation group)	6 2 A max., relay (two isolation groups)	2 24 V DC input or 0.5 A max., transistor output (one isolation group)

Processor module	No. and type of digital inputs	No. and type of digital outputs	No. and type of configurable inputs/ outputs
PM5072-T-2ETH	12 24 V DC (one isolation group)	8 0.5 A max., transistor (one isolation group)	2 24 V DC input or 0.5 A max., transistor output (one isolation group)
PM5072-T-2ETHW	12 24 V DC (one isolation group)	8 0.5 A max., transistor (one isolation group)	2 24 V DC input or 0.5 A max., transistor output (one isolation group)

6.1.1.7.2 Functionality

Parameter	Value			
	PM5012-T-ETH	**PM5012-R-ETH**	**PM5032-T-ETH** **PM5052-T-ETH** **PM5072-T-2ETH(W)**	**PM5032-R-ETH** **PM5052-R-ETH**
Digital inputs	6		12	
Functionality of digital inputs (encoder, fast counter, counter, interrupt)	**6 DI fast input 24 VDC (max. 5 kHz)** usable as ● 6 DI 24 V DC standard ● 2 channel 5 kHz encoder with frequency measurement or ● 2 channel 5 kHz encoder with frequency measurement and with touch/reset using standard DI or ● 2 fast counter (5 kHz) ● 4 DI as interrupt input with 1 dedicated interrupt task and input information		**4 DI fast input 24 VDC (max. 200 kHz)** usable as ● 4 DI 24 V DC standard or ● 4 fast counter (100 kHz) or ● 2 A/B encoder (200 kHz) with frequency measurement or ● 2 full A/B encoders 0 and 1 (200 kHz) with frequency measurement and with touch/reset using standard highspeed (5 kHz) DI ● 1 full A/B encoder 0 (200 kHz) with frequency measurement and optional with touch/reset using 2 touch/sync inputs with A/B encoder 0	
			4 DI fast input 24 V DC (5 kHz) usable as ● 4 DI 24 V DC standard or ● 4 DI as interrupt input with 1 dedicated interrupt task and input information ● 4 touch/sync inputs with A/B encoder 0 or 1	
			4 standard DI 24 V DC	
Digital outputs	4		8	6

Parameter	Value			
	PM5012-T-ETH	**PM5012-R-ETH**	**PM5032-T-ETH** **PM5052-T-ETH** **PM5072-T-2ETH(W)**	**PM5032-R-ETH** **PM5052-R-ETH**
Functionality of digital outputs	**4 fast output DO-T** 24 V DC/0.5 A (max. 5 kHz) usable as ● 4 DO-T 24 V DC/0.5 A or ● 4 PWM Note: The speed must be limited below 100 Hz. The low speed PWM can be used for heating control. ● 4 limit switch	**4 DO-R** 24 V DC / 240 V AC 2A in 2 groups	**4 fast output DO-T** 24 V DC (100 kHz) usable as ● 4 DO-T 24 V DC/0.5 A ● 4 limit/ switch outputs for encoder/ counter or ● 4 PWM (30 kHz, with 8 bit resolution, 1 µs dead-time and maximum duty 95 %) or ● 2 PTO (200 kHz) CW/CCW or Pulse/Direc-tion ● 4 PTO (PWM) 100 kHz Pulse/ Direction using standard output **4 fast output DO-T** 24 V DC/0.5 A (5 kHz) (max. 5 kHz) usable as ● 4 DO-T 24 V DC/0.5 A ● 4 limit/ switch outputs for encoder/ counter or ● 4 PWM Note: The speed must be limited below 100 Hz. The low speed PWM can be used for heating control.	**6 DO-R** 24 V DC / 240 V AC 2A in 2 groups

Parameter	Value			
	PM5012-T-ETH	**PM5012-R-ETH**	**PM5032-T-ETH** **PM5052-T-ETH** **PM5072-T-2ETH(W)**	**PM5032-R-ETH** **PM5052-R-ETH**
Digital inputs/ outputs, configurable	-	-	2	2
Functionality of digital inputs/ outputs, configurable	-	-	**2 DC 24 V DC** • 2 standard I/Os configurable	**2 DC 24 V DC** usable as • 2 DC standard (DI 24 V DC or DO-T) or • 2 PWM (30 kHz) or • 1 PTO (200 kHz) as Pulse/Direction or CW/CCW
LED displays	For signal states			
Internal power supply	Via processor module			
External power supply	Via UP and ZP terminal			

6.1.1.7.3 Electrical connection

WARNING!
Risk of death by electric shock!
Hazardous voltages can be present at the terminals of the module.

Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations at the system.

NOTICE!
Risk of damaging the PLC modules!
The PLC modules must not be removed while the plant is connected to a power supply.

Make sure that all voltage sources (supply and process voltage) are switched off before you

– connect or disconnect any signal or terminal block
– remove or replace a module.

NOTICE!

Risk of damaging the PLC modules!

Overvoltages and short circuits might damage the PLC modules.

– Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations at the system.
– Never connect any voltages or signals to reserved terminals (marked with ---). Reserved terminals may carry internal voltages.

When replacing a processor module, it is recommended to mark each wire connected to the onboard I/O terminal block before disconnecting it. This should make sure that the wires can be reconnected in the same order.

The electrical connection is carried out by using removable 12-pin and 13-pin terminal blocks.

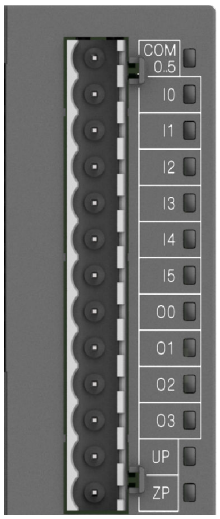


Table 10: Assignment of the terminals for PM5012-T-ETH:

Terminal	Signal	Description
1	COM 0..5	Input common for digital input signals DI0 to DI5
2	I0	Digital input signal DI0 (5 kHz)
3	I1	Digital input signal DI1 (5 kHz)
4	I2	Digital input signal DI2 (5 kHz)
5	I3	Digital input signal DI3 (5 kHz)
6	I4	Digital input signal DI4 (5 kHz)
7	I5	Digital input signal DI5 (5 kHz)
8	O0	Digital output signal DO0 (5 kHz)
9	O1	Digital output signal DO1 (5 kHz)
10	O2	Digital output signal DO2 (5 kHz)
11	O3	Digital output signal DO3 (5 kHz)
12	UP	Process supply voltage UP +24 V DC
13	ZP	Process supply voltage ZP 0 V DC

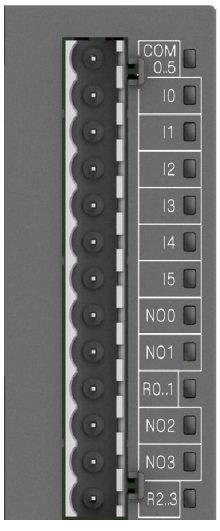


Table 11: Assignment of the terminals for PM5012-R-ETH:

Terminal	Signal	Description
1	COM 0..5	Input common for digital input signals DI0 to DI5
2	I0	Digital input signal DI0 (5 kHz)
3	I1	Digital input signal DI1 (5 kHz)
4	I2	Digital input signal DI2 (5 kHz)
5	I3	Digital input signal DI3 (5 kHz)
6	I4	Digital input signal DI4 (5 kHz)
7	I5	Digital input signal DI5 (5 kHz)
8	NO0	Normally-open relay contact of the output NO0
9	NO1	Normally-open relay contact of the output NO1
10	R0..1	Output common for signals NO0 to NO1

Terminal	Signal	Description
11	NO2	Normally-open relay contact of the output NO2
12	NO3	Normally-open relay contact of the output NO3
13	R2..3	Output common for signals NO2 to NO3

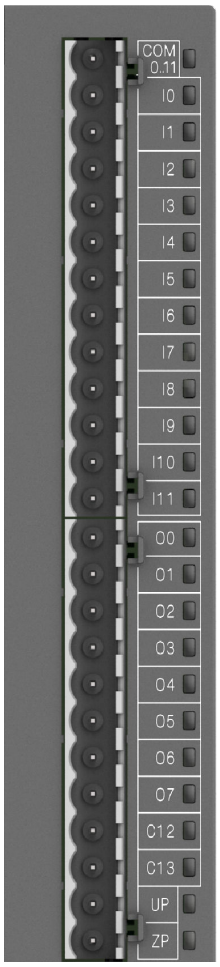


Table 12: Assignment of the terminals for PM5032-T-ETH, PM5052-T-ETH and PM5072-T-2ETH(W):

Terminal	Signal	Description
1	COM 0..11	Input common for digital input signals DI0 to DI11
2	I0	Digital input signal DI0 (5 kHz)
3	I1	Digital input signal DI1 (5 kHz)
4	I2	Digital input signal DI2 (5 kHz)
5	I3	Digital input signal DI3 (5 kHz)
6	I4	Digital input signal DI4 (100 kHz)
7	I5	Digital input signal DI5 (100 kHz)
8	I6	Digital input signal DI6 (100 kHz)
9	I7	Digital input signal DI7 (100 kHz)
10	I8	Digital input signal DI8
11	I9	Digital input signal DI9
12	I10	Digital input signal DI10
13	I11	Digital input signal DI11
14	O0	Digital output signal DO0 (5 kHz)
15	O1	Digital output signal DO1 (5 kHz)
16	O2	Digital output signal DO2 (5 kHz)
17	O3	Digital output signal DO3 (5 kHz)
18	O4	Digital output signal DO4 (100 kHz)
19	O5	Digital output signal DO5 (100 kHz)
20	O6	Digital output signal DO6 (100 kHz)
21	O7	Digital output signal DO7 (100 kHz)
22	C12	Digital input/output signal configurable DC12
23	C13	Digital input/output signal configurable DC13
24	UP	Process supply voltage UP +24 V DC
25	ZP	Process supply voltage ZP 0 V DC

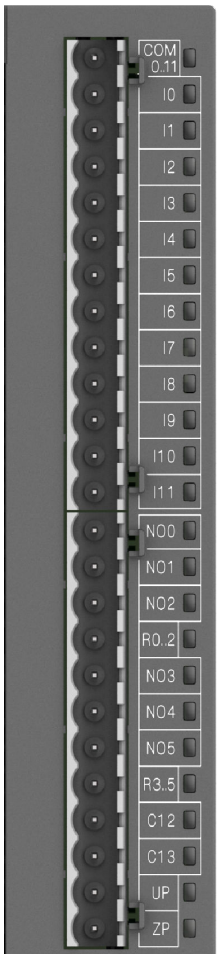
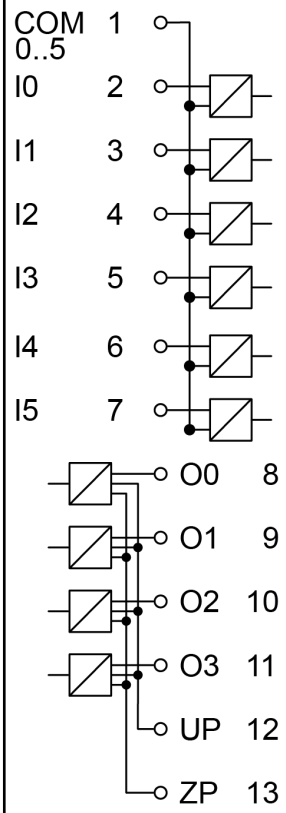
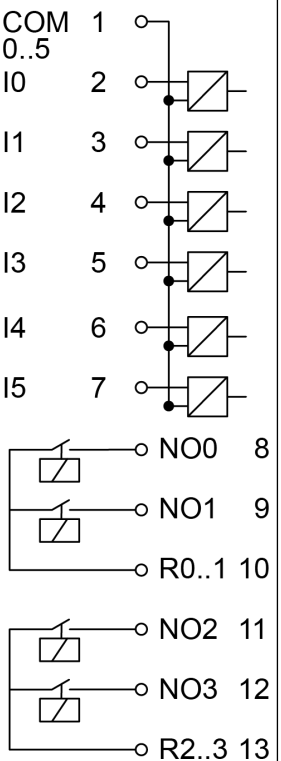
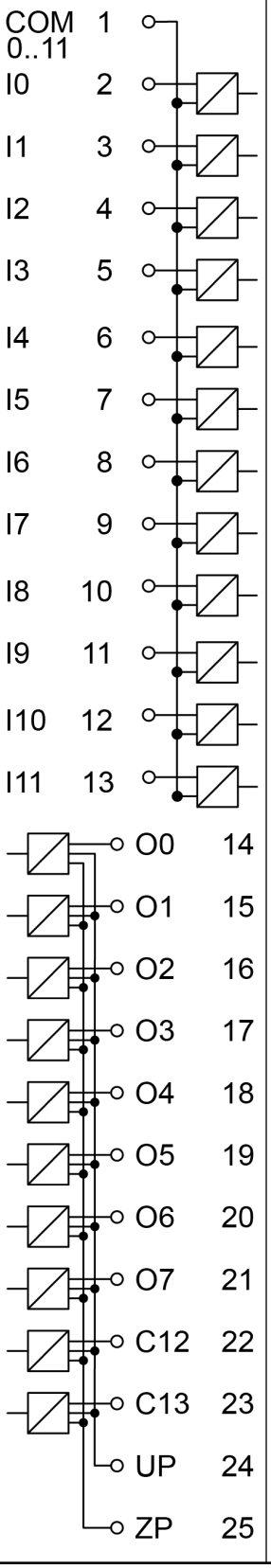
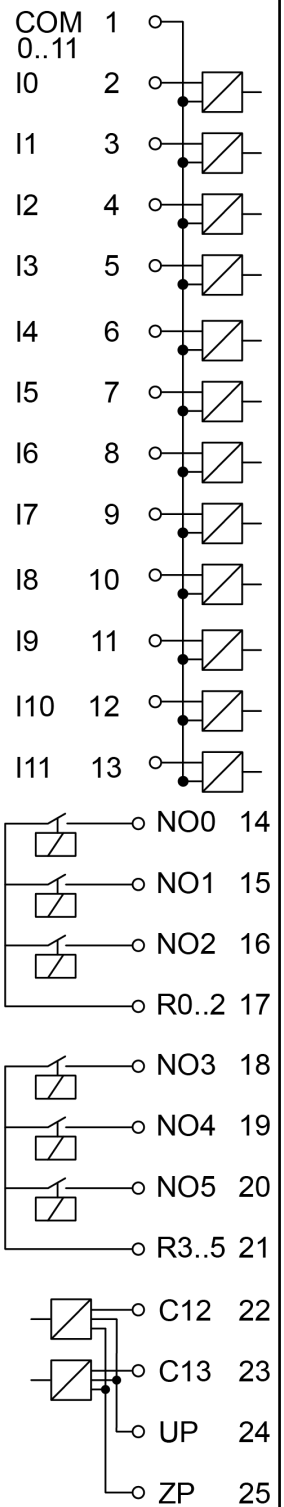


Table 13: Assignment of the terminals for PM5032-R-ETH and PM5052-R-ETH:

Terminal	Signal	Description
1	COM 0..11	Input common for digital input signals DI0 to DI11
2	I0	Digital input signal DI0 (5 kHz)
3	I1	Digital input signal DI1 (5 kHz)
4	I2	Digital input signal DI2 (5 kHz)
5	I3	Digital input signal DI3 (5 kHz)
6	I4	Digital input signal DI4 (100 kHz)
7	I5	Digital input signal DI5 (100 kHz)
8	I6	Digital input signal DI6 (100 kHz)
9	I7	Digital input signal DI7 (100 kHz)
10	I8	Digital input signal DI8
11	I9	Digital input signal DI9
12	I10	Digital input signal DI10
13	I11	Digital input signal DI11
14	NO0	Normally-open relay contact of the output NO0
15	NO1	Normally-open relay contact of the output NO1
16	NO2	Normally-open relay contact of the output NO2
17	R0..2	Output common for signals NO0 to NO2
18	NO3	Normally-open relay contact of the output NO3
19	NO4	Normally-open relay contact of the output NO4
20	NO5	Normally-open relay contact of the output NO5
21	R3..5	Output common for signals NO3 to NO5
22	C12	Digital input/output signal configurable DC12 (100 kHz, if configured as output)
23	C13	Digital input/output signal configurable DC13 (100 kHz, if configured as output)
24	UP	Process supply voltage UP +24 V DC
25	ZP	Process supply voltage ZP 0 V DC

Block diagrams The following block diagram shows the internal structure of the onboard I/Os.

PM5012-T-ETH	PM5012-R-ETH	PM5032-ETH PM5052-T-ETH PM5072-T-2ETH(W)	PM5032-R-ETH PM5052-R-ETH
			

Connection of the digital inputs

The digital inputs can be used as source inputs or as sink inputs.

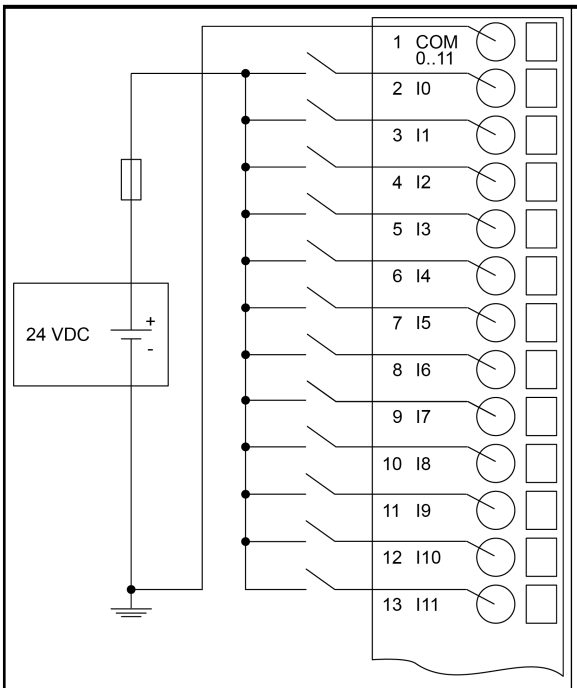
NOTICE!

Risk of malfunctions in the plant!

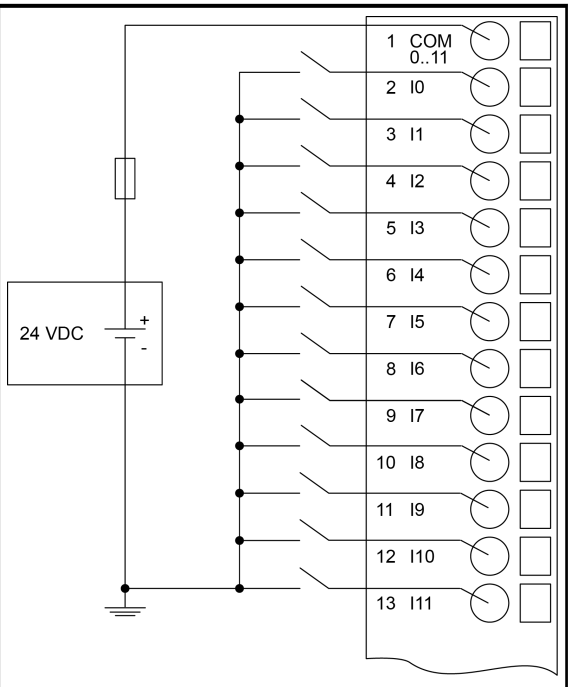
A ground closure, e. g. caused by a damaged cable insulation, can bridge switches accidentally.

Use sink inputs when possible or make sure that, in case of error, there will be no risks to persons or plant.

The following figure shows the electrical connection of the digital inputs to the PM50xx processor modules:



Electrical connection of digital inputs (sink inputs)



Electrical connection digital inputs (source inputs)

Connection of the digital transistor outputs (PM50xx-T-ETH only)

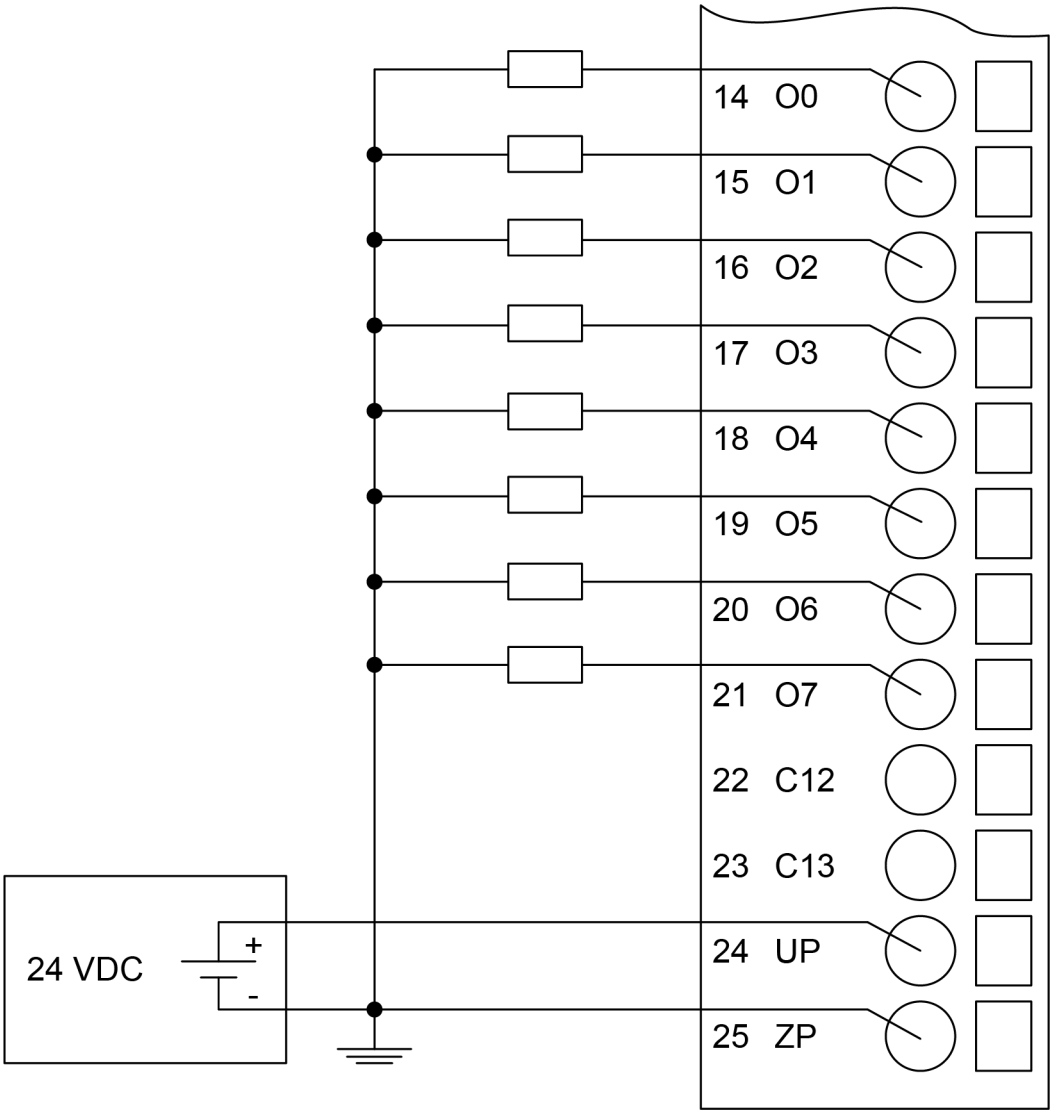


Fig. 5: Electrical connection of digital transistor outputs

CAUTION!
Risk of damaging the processor module!
The outputs are not protected against short circuit and overload.

- Never short-circuit or overload the outputs.
- Never connect the outputs to other voltages.
- Use an external 3 A fast protection fuse for the outputs.

Connection of the digital relay outputs (PM50xx-R-ETH only)

The following figures show the electrical connection of the digital relay outputs to the processor modules:

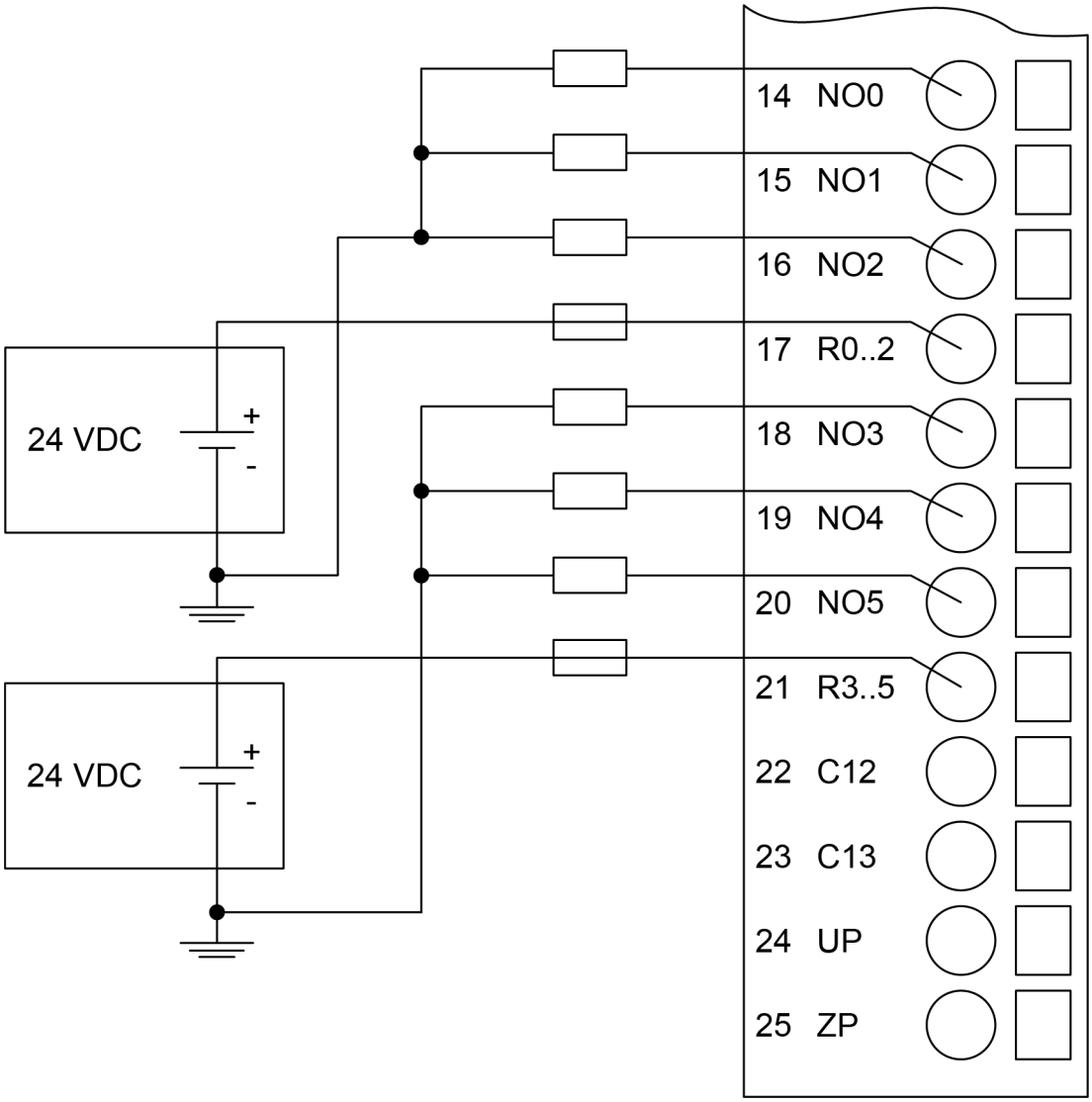


Fig. 6: Electrical connection of digital relay outputs (24 VDC)

WARNING!
Risk of death by electric shock!
Hazardous voltages can be present at the terminals of the module.

Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations at the system.

WARNING!
For screw terminals only: Danger of death by electric shock!
The IP 20 protection degree is only provided if all terminal screws are tightened.

Tighten all screws of unused load terminals of relay outputs if voltages > 24 V are connected to the relay group.

CAUTION!
Risk of damaging the processor module!
– Never short-circuit or overload the outputs.
– Never connect inductive loads without an external suppression against voltage peaks due to inductive kickback.
– Never connect voltages > 240 V. All outputs must be fed from the same phase.
– Use an external 5 A fast protection fuse for the outputs.

6.1.1.7.4 Internal data exchange

Parameter	Value
Digital inputs (bytes)	On request
Digital outputs (bytes)	On request

6.1.1.7.5 I/O configuration

The configuration data of the onboard I/Os is stored in the processor modules PM50xx. See PLC configuration:

6.1.1.7.6 Parameterization

For information about parameterization, refer to the description for onboard I/Os for processor modules PM50xx. See PLC configuration: and

6.1.1.7.7 Diagnosis

Class	Comp	Dev	Mod	Ch	Err	PS501 PLC Browser	<– Display in
Class	**Inter-face**	**Device**	**Module**	**Channel**	**Error-Identifier**	**Error message**	**Remedy**
Errors for Onboard I/O							
Light errors							
3	8	255	2	0	3	MaxWaitRun for onboard I/O module has expired, when PLC is put into RUN state	Reboot and try it again. If the error still exists, replace processor module for testing
3	8	255	3	0	26	Invalid configuration of onboard I/O module, e. g. 2 input channels are configured as fast counter and interrupt input at the same time.	Correct PLC configuration
Warnings							

Class	Comp	Dev	Mod	Ch	Err	PS501 PLC Browser	<– Display in
Class	Inter-face	Device	Module	Channel	Error-Identifier	Error message	Remedy
4	8	1	2	1	2	Invalid configuration value for PWM channel. Frequency / cycletime for the PWM channel of the 8DI+6DO and 8DI+6DO +2AI+1AO module are common and if both channels are configured for PWM, the frequency of the second channel must be set to 0.	Correct frequency
4	8	1	2	0..1	4	PWM channel frequency or cycle time too high	Correct frequency or cycle time
4	8	1	2	0..1	7	PWM channel frequency or cycle time too low	Correct frequency or cycle time
4	8	1	2	0	52	Frequency on interrupt input pin too high and interrupt events are missed	Correct frequency
4	8	255	2	0	26	PLC was put into RUN state, although a configuration error is present, because parameter Run on config fault is set to YES	Correct PLC configuration
4	8	255	0	0	43	Unspecified or internal error occured	Replace processor module

6.1.1.7.8 Displays

Table 14: States of the I/Os

LED	Status	Color	LED = ON	LED = OFF
I	Digital input	yellow	Input is ON	Input is OFF
O	Digital transistor output	yellow	Output is ON	Output is OFF
NO	Digital relay output	yellow	Relay contact is closed	Relay contact is open
C	Digital configurable input/output	yellow	Configured input/ output is ON	Configured input/ output is OFF

6.1.1.7.9 Technical data

Technical data of the digital inputs

Parameter	Value
Number of channels per module	12 transistor inputs (24 V DC)
Distribution of the channels into groups	1 group for 12 channels
Galvanic isolation	Yes, per group
Connections of the channels I0 to I11	Terminals 2 to 13
Reference potential for the channels I0 to I11	Terminal 1

Parameter		Value	
Indication of the input signals		1 yellow LED per channel; the LED is ON when the input signal is high (signal 1) and the module's logic is in operation	
Input type according to EN 61131-2		Type 1 source	Type 1 sink
Input signal range		-24 V DC	+24 V DC
Signal 0		-5 V...+3 V	-3 V...+5 V
Undefined signal		-15 V...- 5 V	+5 V...+15 V
Signal 1		-30 V...-15 V	+15 V...+30 V
Ripple with signal 0		Within -5 V...+3 V	Within -3 V...+5 V
Ripple with signal 1		Within -30 V...-15 V	Within +15 V...+30 V
Input current per channel			
	Input voltage +24 V	Typ. 4.6 mA	
	Input voltage +5 V	Typ. 0.8 mA	
	Input voltage +15 V	> 2.5 mA	
	Input voltage +30 V	< 8 mA	
Max. permissible leakage current (at 2-wire proximity switches)		1 mA	
Input delay (0->1 or 1->0)		On request	
Max. cable length			
	Shielded	500 m	
	Unshielded	300 m	

Technical data of the fast counter inputs

For AC500 devices the function "fast counter" is available in S500 I/O modules as of firmware version V1.3.

For AC500-eCo V3 devices the function "fast counter" is available in onboard I/Os of PM50xx.

The AC500-eCo V3 processor modules with onboard I/Os provide some special functionality on the digital inputs or digital outputs. Fast counter, encoder inputs, interrupt inputs or PWM/PTO outputs are available depending on the device used.

The fast counter functionality can be activated within the onboard I/O configuration.

The fast counter can work in pulse/direction mode or A/B track counter mode.

The pulse/direction counter detects the rising edge of the counter input. It will increase or decrease the count value (depending on the direction input) at every rising edge.

The A/B track counter is used to count the signal from an encoder.

The counter can count with quad phases. In the following the behavior of the A/B track counter is described.

Further information:
Operating modes of the fast counter:
Configurarion of the fast counter:

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
Fast counter					
	Useable inputs	2	2	4	4
	Fast input max. 5 kHz	DI4 ... DI5	DI4 ... DI5	-	-
	Fast input, max. 100 kHz	-	-	DI4 … DI7	DI4 … DI7

Technical data of the interrupt inputs

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
Interrupt					
	Useable inputs	4	4	4	4
	Fast input max. 5 kHz	DI0 ... DI3	DI0 ... DI3	DI0 ... DI3	DI0 ... DI3

Technical data of the Touch/Reset inputs

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
Touch/Reset					
	Useable inputs	-	-	4 together with dedicated encoder	4 together with dedicated encoder

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
	Fast input max. 5 kHz	-	-	DI0 ... DI3	DI0 ... DI3
	Fast input, max. 100 kHz	-	-	DI6 ... DI7 When using the A/B encoder on DI04...DI05 and the Touch/ Reset inputs on fast inputs	DI6 ... DI7 When using the A/B encoder on DI04...DI05 and the Touch/ Reset inputs on fast inputs

Technical data of the digital transistor outputs

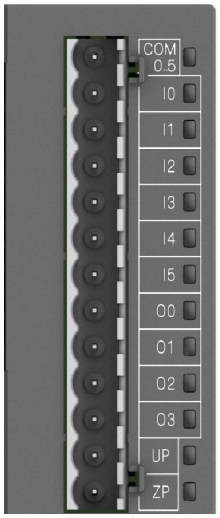


Table 15: PM5012-T-ETH

Parameter		Value
Number of channels per module		4 transistor outputs (24 V DC, 0.5 A max.)
Distribution of the channels into groups		1 group of 4 channels
Galvanic isolation		Yes, per group
Connection of the channels O0 to O3		Terminals 8 to 11
Common power supply voltage		Terminals 12 (+24 V DC, signal name UP) and 13 (0 V DC, signal name ZP)
Reference potential for the channels O0 to O7		Terminal 13 (minus pole of the process voltage, name ZP)
Indication of the output signals		1 yellow LED per channel; the LED is on when the output signal is high (signal 1)
Way of operation		Non-latching type
Min. output voltage at signal 1		UP - 0.1 V
Output delay (max. at rated load)		
	0 to 1	On request
	1 to 0	On request
Rated protection fuse (per group)		3 A
Output current		
	Rated current per channel (max.)	0.5 A at UP 24 V DC
	Rated current per group (max.)	2 A
	Rated current (all channels together, max.)	2 A
Lamp load (max.)		5 W
Max. leakage current with signal 0		On request
Demagnetization when inductive loads are switched off		Must be performed externally according to driven load specification
Switching Frequencies		
	With inductive loads	Max. 0.5 Hz
	With lamp loads	Max. 1 Hz at max. 5 W

Parameter		Value
Short-circuit-proof / Overload-proof		No
Overload message		No
Output current limitation		No
Resistance to feedback against 24 VDC		No
Connection of 2 outputs in parallel		Not possible
Max. cable length		
	Shielded	500 m
	Unshielded	150 m

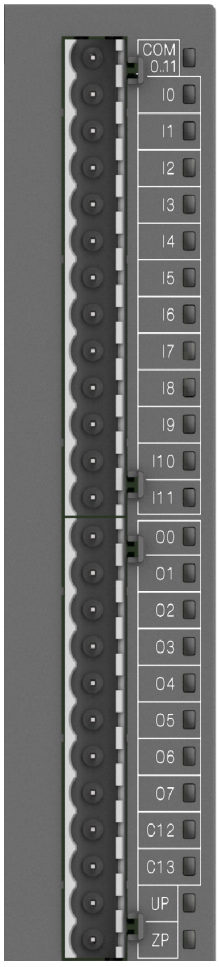


Table 16: PM5032-T-ETH, PM5072-T-2ETH and PM5072-T-2ETHW

Parameter		Value
Number of channels per module		8 transistor outputs (24 V DC, 0.5 A max.)
Distribution of the channels into groups		1 group of 8 channels
Galvanic isolation		Yes, per group
Connection of the channels O0 to O7		Terminals 14 to 21
Common power supply voltage		Terminals 24 (+24 V DC, signal name UP) and 25 (0 V DC, signal name ZP)
Reference potential for the channels O0 to O7		Terminal 25 (minus pole of the process voltage, name ZP)
Indication of the output signals		1 yellow LED per channel; the LED is on when the output signal is high (signal 1)
Way of operation		Non-latching type
Min. output voltage at signal 1		UP - 0.1 V
Output delay (max. at rated load)		
	0 to 1	On request
	1 to 0	On request
Rated protection fuse (per group)		On request
Output current		
	Rated current per channel (max.)	0.5 A at UP 24 V DC
	Rated current per group (max.)	4 A
	Rated current (all channels together, max.)	4 A
Lamp load (max.)		5 W
Max. leakage current with signal 0		0.5 mA
Demagnetization when inductive loads are switched off		Must be performed externally according to driven load specification
Switching Frequencies		
	With inductive loads	Max. 0.5 Hz
	With lamp loads	Max. 1 Hz at max. 5 W
Short-circuit-proof / Overload-proof		No
Overload message		No
Output current limitation		No
Resistance to feedback against 24 VDC		No
Connection of 2 outputs in parallel		Not possible

Parameter		Value
Max. cable length		
	Shielded	500 m
	Unshielded	150 m

Technical data of the digital relay outputs

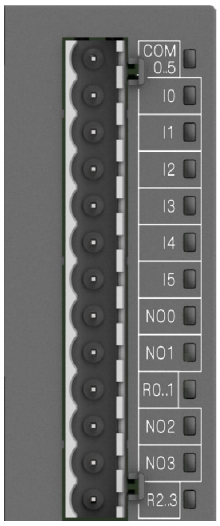


Table 17: PM5012-R-ETH

Parameter		Value
Number of channels per module		4 normally-open relay outputs
Distribution of the channels into groups		2 groups for 2 channels
Galvanic isolation		Yes, per group
Connection of the channels NO0 to NO1		Terminals 8 to 9
Connection of the channels NO2 to NO3		Terminals 11 to 12
Reference potential R0..1 for the channels NO0 to NO1		Terminal 10
Reference potential R2..3 for the channels NO2 to NO3		Terminal 13
Relay output voltage		
	Rated value	24 V DC or 100 V AC...240 V AC (-15 %, +10 %) 50Hz/60 Hz (-6 %, +4 %)
	Range	5 to 30 V DC or 5 to 250 V AC
Indication of the output signals		1 yellow LED per channel; the LED is on when the output signal is high (signal 1)
Way of operation		Non-latching type
Output delay		
	0 to 1	Typ. 10 ms
	1 to 0	Typ. 10 ms
Rated protection fuse		On request
Output current		
	Rated current per channel (max.)	2.0 A (24 V DC, 100 VAC...240 V AC, resistance, general use and pilot duty)
	Rated current per group (max.)	6 A
	Rated current (all channels together, max.)	12 A
Lamp load (max.)		200 W (240 V AC), 30 W (24 V DC)
Demagnetization when inductive loads are switched off		External demagnetization measures must be implemented when switching inductive loads.
Spark suppression with inductive AC loads		Must be performed externally according to driven load specification
Switching frequencies		
	With resistive loads	Max. 1 Hz
	With inductive loads	On request
	With lamp loads	Max. 1 Hz

Parameter		Value
Short-circuit-proof / Overload-proof		No, should be provided by an external fuse or circuit breaker
Rated protection fuse (for each channel)		5 A fast
Overload message		No
Output current limitation		No
Resistance to feedback against 24 V DC		No
Connection of 2 outputs in parallel		Not possible
Life time of relay contacts (cycles)		100,000 at rated load
Max. cable length		
	Shielded	500 m
	Unshielded	150 m

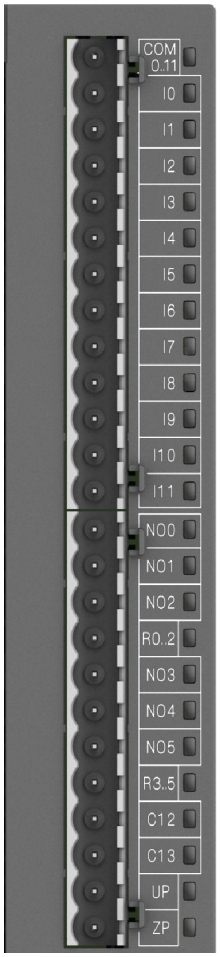


Table 18: PM5032-R-ETH and PM5052-R-ETH

Parameter		Value
Number of channels per module		6 normally-open relay outputs
Distribution of the channels into groups		2 groups for 3 channels
Galvanic isolation		Yes, per group
Connection of the channels NO0 to NO2		Terminals 14 to 16
Connection of the channels NO3 to NO5		Terminals 18 to 20
Reference potential R0..2 for the channels NO0 to NO2		Terminal 17
Reference potential R3..5 for the channels NO3 to NO5		Terminal 21
Relay output voltage		
	Rated value	24 V DC or 100 V AC...240 V AC (-15 %, +10 %) 50Hz/60 Hz (-6 %, +4 %)
	Range	5 to 30 V DC or 5 to 250 V AC
Indication of the output signals		1 yellow LED per channel; the LED is on when the output signal is high (signal 1) and the module is powered through the I/O bus
Way of operation		Non-latching type
Output delay		
	0 to 1	Typ. 10 ms
	1 to 0	Typ. 10 ms
Rated protection fuse		On request
Output current		
	Rated current per channel (max.)	2.0 A (24 V DC, 100 VAC...240 V AC, resistance, general use and pilot duty)
	Rated current per group (max.)	6 A
	Rated current (all channels together, max.)	12 A
Lamp load (max.)		200 W (240 V AC), 30 W (24 V DC)
Demagnetization when inductive loads are switched off		External demagnetization measures must be implemented when switching inductive loads.

Parameter		Value
Spark suppression with inductive AC loads		Must be performed externally according to driven load specification
Switching frequencies		
	With resistive loads	Max. 1 Hz
	With inductive loads	On request
	With lamp loads	Max. 1 Hz
Short-circuit-proof / Overload-proof		No, should be provided by an external fuse or circuit breaker
Rated protection fuse (for each channel)		5 A fast
Overload message		No
Output current limitation		No
Resistance to feedback against 24 V DC		No
Connection of 2 outputs in parallel		Not possible
Life time of relay contacts (cycles)		100,000 at rated load
Max. cable length		
	Shielded	500 m
	Unshielded	150 m

Technical data of the limit switch outputs

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
Limit switch					
	Useable outputs	4	-	8	2
	Fast output max. 5 kHz	DO0 ... DO3	-	DO0 … DO3	-
	Fast output, max. 100 kHz	-	-	DO4 … DO7	DC12 … DC13

Technical data of the PTO outputs

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
PTO					
	Useable outputs	-	-	4	1 pair of output

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
	Fast output, max. 100 kHz	-	-	DO4 … DO7 For 2 PTO 200 kHz Pulse/ Direction or Cc/Ccw modes as pair of outputs	DC12 … DC13
				DO4 … DO7 as 4 PTO Pulse outputs / Direction using fast output 5kHz DO0...DO3	

Technical data of the PWM outputs

Parameter		PM5012-T-ETH	PM5012-R-ETH	PM5032-T-ETH PM5052-T-ETH PM5072-T-2ETH	PM5032-R-ETH PM5052-R-ETH
PWM					
	Useable outputs	4	-	8	2
	Fast output max. 5 kHz	DO0 ... DO3	-	DO0 … DO3	-
	Fast output, max. 100 kHz	-	-	DO4 … DO7	DC12 … DC13

6.1.1.7.10 Ordering data

Table 19: Processor modules for AC500-eCo V3

Part no.	Description	Product life cycle phase *)
1SAP 122 600 R0072	PM5012-T-ETH, AC500-eCo V3 processor module, programmable logic controller 1 MB, 6DI/4DO-Transistor, Ethernet, 24 V DC, option slot	Active
1SAP 122 700 R0072	PM5012-R-ETH, AC500-eCo V3 processor module, programmable logic controller 1 MB, 6DI/4DO-Relay, Ethernet, 24 V DC, option slot	Active
1SAP 123 400 R0072	PM5032-T-ETH, AC500-eCo V3 processor module, programmable logic controller 2 MB, 12DI/8DO-Transistor/2DC, Ethernet, 24 V DC, 2 option slots	Active

Part no.	Description	Product life cycle phase *)
1SAP 123 500 R0072	PM5032-R-ETH, AC500-eCo V3 processor module, programmable logic controller 2 MB, 12DI/6DO-Relay/2DC, Ethernet, 24 V DC, 2x option slots	Active
1SAP 124 000 R0072	PM5052-T-ETH, AC500-eCo V3 processor module, programmable logic controller 4 MB, 12DI/8DO-Transistor/2DC, Ethernet, 24 V DC, 3 option slots	Active
1SAP 124 100 R0072	PM5052-R-ETH, AC500-eCo V3 processor module, programmable logic controller 4 MB, 12DI/6DO-Relay/2DC, Ethernet, 24 V DC, 3 option slots	Active
1SAP 124 500 R0073	PM5072-T-2ETH, AC500-eCo V3 processor module, programmable logic controller 8 MB, 12DI/8DO-Transistor/2DC, 2x Ethernet, 24 V DC, 3 option slots	Active
1SAP 124 400 R0073	PM5072-T-2ETHW, AC500-eCo V3 processor module, programmable logic controller 8 MB, 12DI/8DO-Transistor/2DC, 2x Ethernet, 24 V DC, 3 option slots, wide temperature	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

Table 20: Accessories for AC500-eCo V3

Part no.	Description
1SAP 187 000 R0001	TA5101-4DI: AC500, digital input module option board, 4DI 24 V DC, spring/cable front terminal 3.50 mm pitch
1SAP 187 000 R0002	TA5105-4DOT: AC500, digital output module option board, 4DO-T 24 V DC / 0.5 A, spring/cable front terminal 3.50 mm pitch
1SAP 187 000 R0003	TA5110-2DI2DOT: AC500, digital in/output module option board, 2DI 24 V DC, 2DO-T 24 V DC / 0.5 A, spring/cable front terminal 3.50 mm pitch
1SAP 187 200 R0001	TA5130-KNXPB: AC500, KNX address switch option board, 1 push button
1SAP 187 200 R0002	TA5131-RTC:AC500, real-time clock without battery, option board for AC500-eCo V3 Basic CPU
1SAP 187 300 R0001	TA5141-RS232I: AC500, RS-232 serial adapter isolated option board, spring/cable front terminal 3.50 mm pitch
1SAP 187 300 R0002	TA5142-RS485I: AC500, RS-485 serial adapter isolated option board, spring/cable front terminal 3.50 mm pitch
1SAP 187 300 R0003	TA5142-RS485: AC500, RS-485 serial adapter non isolated option board, spring/cable front terminal 3.50 mm pitch

Part no.	Description
1SAP 187 400 R0001	TA5211-TSCL-B: screw terminal block set for AC500-eCo V3 CPU Basic screw front, cable side 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors
1SAP 187 400 R0002	TA5211-TSPF-B: spring terminal block set for AC500-eCo V3 CPU Basic spring front, cable front 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors
1SAP 187 400 R0004	TA5212-TSCL: screw terminal block set for AC500-eCo V3 Standard and Pro CPU screw front, cable side 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors ● 1 removable 12-pin terminal block for I/O connectors
1SAP 187 400 R0005	TA5212-TSPF: spring terminal block set for AC500-eCo V3 Standard and Pro CPU spring front, cable front 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors ● 1 removable 12-pin terminal block for I/O connectors
1SAP 187 600 R0001	TA5400-SIM: input simulator (for CPU testing), 6 switches
1SAP 180 100 R0002	MC5102 - Micro memory card with SD adapter
1SAP 182 800 R0001	TA543: screw mounting accessory, 20 pieces per packing unit
1SAP 187 500 R0003	TA5301-CFA: cable fixing part accessory, 20 pieces per packing unit
Spare parts	
1SAP 187 400 R0012	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0013	TA5220-SPF6: spring terminal block, removable, 6-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0014	TA5220-SPF7: spring terminal block, removable, 7-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0015	TA5220-SPF8: spring terminal block, removable, 8-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 500 R0001	TA5300-CVR: option board cover, removable plastic part, 6 pieces per packing unit

6.1.1.8 Technical data

The system data of AC500-eCo V3 apply ↳ *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

General data

Parameter		Value			
		PM5012	**PM5032**	**PM5052**	**PM5072**
Power supply		24 V DC			
Connection of power supply		Via removable 3-pin terminal			
Current consumption from power supply (max.)					
	Transistor version	200 mA	340 mA	400 mA	420 mA
	Relay version	200 mA	340 mA	400 mA	-
Inrush current at nominal voltage		On request			
Required fuse		On request			
Max. power dissipation within the processor module					
	Transistor version	On request	On request	On request	On request
	Relay version	On request	On request	On request	-
Processor module interfaces		RS485/RS232 (optional), Ethernet			
		-	I/O bus		
Weight					
	Transistor version	280 g	300 g		360 g
	Relay version	330 g	350 g		-
Mounting position		Horizontal or vertical			

Detailed data

Parameter		Value			
		PM5012	**PM5032**	**PM5052**	**PM5072**
Global user program memory for (PROG/ DATA/WEB)		1 MB	2 MB	4 MB	8 MB
	Thereof user program code / data memory dynamically allocated	256 kB	512 kB	768 kB	1 MB
	Thereof user web server memory for web visualization max.	no web	1.5 MB	3.2 MB	7 MB
	User data memory saved in FLASH	8 kB	32 kB		100 kB
	VAR_RETAIN persistent	4 kB	16 kB		36 kB
	%MB data	4 kB	16 kB		64 kB
Data buffering		FRAM memory without battery			
Real-time clock (RTC) (no battery, supercap)		Optional with TA5131-RTC	Built in		
Min. retention time for RTC / accuracy in s/day		On request	On request	On request	On request
Programming languages		● Instruction List (IL) ● Function Block Diagram (FBD) ● Ladder Diagram (LD) ● Sequential Function Chart (SFC) ● Structured Text (ST) ● Continuous Function Chart (CFC)			

Parameter		Value			
		PM5012	**PM5032**	**PM5052**	**PM5072**
Cycle time per instructions (minimum)		PM5012	PM5032	PM5052	PM5072
	Binary	20 ns			
	Word	50 ns			
	Floating point	600 ns			
Program execution		PM5012	PM5032	PM5052	PM5072
	Cyclic min. configurable	10 ms	5 ms	2 ms	1 ms
	Time-controlled	Yes			
	Multitasking	Yes			
	Interruption	Yes			
LEDs		Power, Error, Run, MC, MOD1, States of I/Os			
RUN/STOP button		Yes			
Protection of the user program by password		On request			
Usable accessories		On request			

Data of I/Os	PM5012-x-ETH	PM5032-x-ETH	PM5052-x-ETH	PM5072-T-2ETH
Onboard digital inputs				
Channels	6 (incl. 2 counter inputs 5 kHz and 4 interrupts)	12 (incl. 4 fast counter/encoder inputs (100 kHz), 4 counter inputs (5 kHz), 4 standard inputs)		
Signal voltage	24 V DC type 1			
Onboard digital outputs				
Type of digital outputs	PM5012-T-ETH: Transistor	PM5032-T-ETH: Transistor	PM5052-T-ETH: Transistor	PM5072-T-2ETH: Transistor
	PM5012-R-ETH: Relay	PM5032-R-ETH: Relay	PM5052-R-ETH: Relay	-
Channels for transistor version	4 (5 kHz standard and PWM)	8 (incl. 4 fast outputs for standard or 4 PWM/2 PTO (100 kHz), 4 standard outputs (5 kHz))		
Channels digital input/output configurable (valid for both PLC version relais or transistor)	-	2 Relay version: The DC channels can be used as 1 PTO/2 PWM (100 kHz) or standard digital inputs/outputs Transistor version: The DC channels can only be used as standard digital inputs/outputs		2 Transistor version: The DC channels can only be used as standard digital inputs/outputs
Rated voltage transistor	24 V DC			
Nominal current per transistor channel	0.5 A resistive			

Data of I/Os	PM5012-x-ETH	PM5032-x-ETH	PM5052-x-ETH	PM5072-T-2ETH
Channels for relay version	4	6		-
Rated voltage relay	240 V AC			-
Nominal current per relay channel	2 A resistive			-
Analog inputs	Optional			
Analog outputs	Optional			
Number of option board slots	1	2	3	3
Usage of option board	Each slot can be used for all type of existing option boards, same option board for serial interface or digital/analog I/O extension can be used on several slot per CPU. Note: RTC option board is only for PM5012 possible.			
KNX address switch	No			TA5130-KNXPB only on 1 slot
Real-time clock (RTC)	TA5131-RTC	No		
Serial interface	TA5141-RS232I, TA5142-RS485/TA5142-RS485I			
Digital in/out channels	TA5101-4DI, TA5105-4DOT, TA5110-2DI2DOT			
Analog in/out channels	TA5120-2AI-UI, TA5122-2AI-TC, TA5123-2AI-RTD, TA5126-2AO-UI			
Max. number of I/O modules on I/O bus	0	10		
Digital inputs	Onboard I/O only	128 B	1 kB	
Digital outputs		128 B	1 kB	
Number of decentralized inputs and outputs	Depending on the fieldbus used			
Internal interfaces				
Serial COMx	Optional, use a dedicated serial interface option board (up to 1)	Optional, use a dedicated serial interface option board (up to 2)	Optional, use a dedicated serial interface option board (up to 3)	
	Modbus RTU Master/Slave, ASCII			
Ethernet interface RJ45	1			2 Independent with switch functionality
Ethernet functions	Programming, TCP/IP, UDP/IP, DHCP, PING, network variables, and other listed below			
Modbus TCP/IP client/server	Yes 8 / 3	Yes 13 / 8	Yes 20 / 10	Yes 30 / 15
SNTP client/ server	No	Yes		

Data of I/Os	PM5012-x-ETH	PM5032-x-ETH	PM5052-x-ETH	PM5072-T-2ETH
HTTPs and Web-Visu number of connections	No	Yes 1	Yes 2	Yes 4
FTPs number of connections	No	Yes 1	Yes 2	
OPC UA server number of free tags	No	Yes 125	Yes 250	Yes 1000
MQTT and JSON library	No	Yes		
OPC DA server	Yes			
IEC 60870-5-104 telecontrol protocol	No			Yes Substation only, 5 connections max., only 1x Ethernet supported
Licensed protocols (runtime protocol per CPU)				
BACnet IP B-BC	No			Yes (max. 1000 object variables)
KNXIP	No			Yes (max. 1000 object variables)
IEC 61850 MMS server/goose pub/sub	No			Yes (max. 1000 data attributes)
EthernetIP adapter/scanner	No	Yes (in preparation)		

6.1.1.9 Ordering Data

Table 21: Processor modules for AC500-eCo V3

Part no.	Description	Product life cycle phase *)
1SAP 122 600 R0072	PM5012-T-ETH, AC500-eCo V3 processor module, programmable logic controller 1 MB, 6DI/4DO-Transistor, Ethernet, 24 V DC, option slot	Active
1SAP 122 700 R0072	PM5012-R-ETH, AC500-eCo V3 processor module, programmable logic controller 1 MB, 6DI/4DO-Relay, Ethernet, 24 V DC, option slot	Active
1SAP 123 400 R0072	PM5032-T-ETH, AC500-eCo V3 processor module, programmable logic controller 2 MB, 12DI/8DO-Transistor/2DC, Ethernet, 24 V DC, 2 option slots	Active

Part no.	Description	Product life cycle phase *)
1SAP 123 500 R0072	PM5032-R-ETH, AC500-eCo V3 processor module, programmable logic controller 2 MB, 12DI/6DO-Relay/2DC, Ethernet, 24 V DC, 2x option slots	Active
1SAP 124 000 R0072	PM5052-T-ETH, AC500-eCo V3 processor module, programmable logic controller 4 MB, 12DI/8DO-Transistor/2DC, Ethernet, 24 V DC, 3 option slots	Active
1SAP 124 100 R0072	PM5052-R-ETH, AC500-eCo V3 processor module, programmable logic controller 4 MB, 12DI/6DO-Relay/2DC, Ethernet, 24 V DC, 3 option slots	Active
1SAP 124 500 R0073	PM5072-T-2ETH, AC500-eCo V3 processor module, programmable logic controller 8 MB, 12DI/8DO-Transistor/2DC, 2x Ethernet, 24 V DC, 3 option slots	Active
1SAP 124 400 R0073	PM5072-T-2ETHW, AC500-eCo V3 processor module, programmable logic controller 8 MB, 12DI/8DO-Transistor/2DC, 2x Ethernet, 24 V DC, 3 option slots, wide temperature	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

Table 22: Accessories for AC500-eCo V3

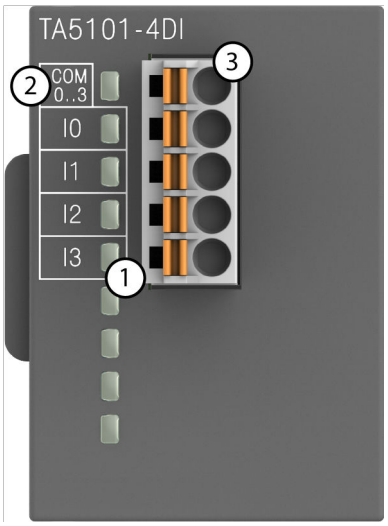
Part no.	Description
1SAP 187 000 R0001	TA5101-4DI: AC500, digital input module option board, 4DI 24 V DC, spring/cable front terminal 3.50 mm pitch
1SAP 187 000 R0002	TA5105-4DOT: AC500, digital output module option board, 4DO-T 24 V DC / 0.5 A, spring/cable front terminal 3.50 mm pitch
1SAP 187 000 R0003	TA5110-2DI2DOT: AC500, digital in/output module option board, 2DI 24 V DC, 2DO-T 24 V DC / 0.5 A, spring/cable front terminal 3.50 mm pitch
1SAP 187 200 R0001	TA5130-KNXPB: AC500, KNX address switch option board, 1 push button
1SAP 187 200 R0002	TA5131-RTC:AC500, real-time clock without battery, option board for AC500-eCo V3 Basic CPU
1SAP 187 300 R0001	TA5141-RS232I: AC500, RS-232 serial adapter isolated option board, spring/cable front terminal 3.50 mm pitch
1SAP 187 300 R0002	TA5142-RS485I: AC500, RS-485 serial adapter isolated option board, spring/cable front terminal 3.50 mm pitch
1SAP 187 300 R0003	TA5142-RS485: AC500, RS-485 serial adapter non isolated option board, spring/cable front terminal 3.50 mm pitch

Part no.	Description
1SAP 187 400 R0001	TA5211-TSCL-B: screw terminal block set for AC500-eCo V3 CPU Basic screw front, cable side 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors
1SAP 187 400 R0002	TA5211-TSPF-B: spring terminal block set for AC500-eCo V3 CPU Basic spring front, cable front 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors
1SAP 187 400 R0004	TA5212-TSCL: screw terminal block set for AC500-eCo V3 Standard and Pro CPU screw front, cable side 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors ● 1 removable 12-pin terminal block for I/O connectors
1SAP 187 400 R0005	TA5212-TSPF: spring terminal block set for AC500-eCo V3 Standard and Pro CPU spring front, cable front 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors ● 1 removable 12-pin terminal block for I/O connectors
1SAP 187 600 R0001	TA5400-SIM: input simulator (for CPU testing), 6 switches
1SAP 180 100 R0002	MC5102 - Micro memory card with SD adapter
1SAP 182 800 R0001	TA543: screw mounting accessory, 20 pieces per packing unit
1SAP 187 500 R0003	TA5301-CFA: cable fixing part accessory, 20 pieces per packing unit
Spare parts	
1SAP 187 400 R0012	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0013	TA5220-SPF6: spring terminal block, removable, 6-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0014	TA5220-SPF7: spring terminal block, removable, 7-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0015	TA5220-SPF8: spring terminal block, removable, 8-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 500 R0001	TA5300-CVR: option board cover, removable plastic part, 6 pieces per packing unit

6.2 Option boards

6.2.1 TA5101-4DI - Digital input module option board

- 4 digital inputs 24 V DC (I0 to I3) in 1 group
- Module-wise electrically isolated



1 4 yellow LEDs to display the signal states of the inputs I0 to I3
2 Allocation of signal name
3 5-pin terminal block for input signals

6.2.1.1 Intended purpose

The device is used as an optional I/O extension module for AC500-eCo V3 CPUs (PM50x2).

The inputs are group-wise electrically isolated from each other.

All other circuitry of the module is electrically isolated from the inputs.

6.2.1.2 Functionality

Parameter	Value
LED displays	For signal states
Internal power supply	Via internal CPU connection
External power supply	Not necessary

6.2.1.3 Electrical connection

For a detailed description of the mounting, disassembly and electrical connection of the module, please refer to the system assembly chapter.

The electrical connection is carried out by using a removable 5-pin terminal block. For more information, please refer to the chapter terminal blocks for AC500-eCo V3 system. The terminal blocks are included in the module's scope of delivery and additional terminal blocks as spare parts can be ordered separately.

The following block diagram shows the internal construction of the digital inputs:

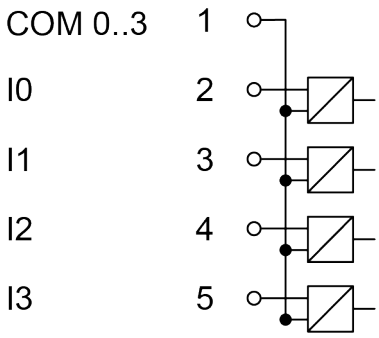


Table 23: Assignment of the terminals:

Terminal	Signal	Description
1	COM 0..3	Input common for signals I0 to I3
2	I0	Input signal I0
3	I1	Input signal I1
4	I2	Input signal I2
5	I3	Input signal I3

The internal power supply voltage for the module's circuitry is carried out via the connection to CPU. Thus, the current consumption from 24 V DC power supply at the terminals L+ and M of the CPU module increases by 10 mA per TA5101-4DI.

An external power supply connection is not needed.

WARNING!

Removal/Insertion under power

The devices are not designed for removal or insertion under power. Because of unforeseeable consequences, it is not allowed to plug or unplug devices with the power being ON.

Make sure that all voltage sources (supply and process voltage) are switched off before you

– connect or disconnect any signal or terminal block
– remove, mount or replace a module.

Disconnecting any powered devices while energized in a hazardous location could result in an electric arc, which could create a flammable ignition resulting in fire or explosion.

Make sure that power is removed and that the area has been thoroughly checked to ensure that flammable materials are not present prior to proceeding.

The devices must not be opened when in operation. The same applies to the network interfaces.

NOTICE!

Risk of damaging the PLC modules!

Overvoltages and short circuits might damage the PLC modules.

– Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations at the system.
– Never connect any voltages or signals to reserved terminals (marked with "NC"). Reserved terminals may carry internal voltages.

The digital inputs can be used as source inputs or as sink inputs.

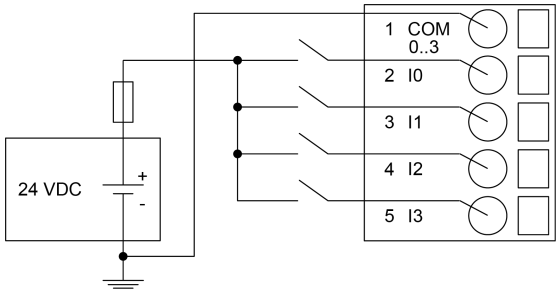
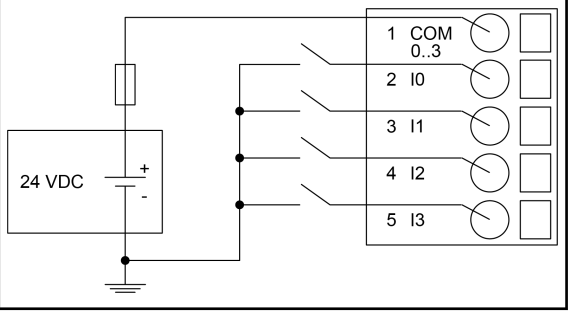
NOTICE!

Risk of malfunctions in the plant!

A ground closure, e. g. caused by a damaged cable insulation, can bridge switches accidentally.

Use sink inputs when possible or make sure that, in case of error, there will be no risks to persons or plant.

The following figure shows the electrical connection of the digital input module TA5101-4DI:

Sink inputs of TA5101-4DI	Source inputs of TA5101-4DI
	

The module provides several diagnosis functions, see Diagnosis *Chapter 6.2.1.6 “Diagnosis” on page 107*.

The meaning of the LEDs is described in the section State LEDs *Chapter 6.2.1.7 “State LEDs” on page 108*.

6.2.1.4 I/O configuration

The module itself does not store configuration data. It receives its parameterization data from the CPU module during power-up of the system.

Hence, replacing optional modules is possible without any re-parameterization via software.

6.2.1.5 Parameterization

The arrangement of the parameter data is performed with Automation Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Name	Value	Internal Value	Internal Value , Type	Default	Min.	Max.	EDS Slot Index
Module ID	Internal	6105	WORD	6105 0x17D9	0	65535	xx01
Ignore module	No Yes	0 1	BYTE	No (0x00)			
Parameter length [1])	Internal	1 - CPU	BYTE	0	0	255	xx02 [2])

[1]) the module has no additional user-configurable parameters

[2]) Value is hexadecimal: HighByte is slot (xx: 0...7), LowByte is index (1...n)

GSD file:

Ext_User_Prm_Data_Len =	0x03
Ext_User_Prm_Data_Const(0) =	0xDA, 0x17, 0x00;

6.2.1.6 Diagnosis

Class	Comp	Dev	Mod	Ch	Err	PS501 PLC Browser	<− Display in	
Class	**Interface**	**Device**	**Module**	**Channel**	**Error Identifier**	**Error message**		**Remedy**
	[1])	**[2])**	**[3])**	**[4])**				
Module error								
3	14	1...10	31	31	19	Checksum error in the I/O module		Replace I/O module
	11 / 12	ADR	1...10					
3	14	1...10	31	31	43	Internal error in the module		Replace I/O module
	11 / 12	ADR	1...10					
3	14	1...10	31	31	9	Overflow diagnosis buffer		Restart
	11 / 12	ADR	1...10					
3	14	1...10	31	31	26	Parameter error		Check master
	11 / 12	ADR	1...10					

Remarks:

[1])	In AC500 the following interface identifier applies: 14 = I/O bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The PNIO diagnosis block does not contain this identifier.
[2])	With "Device" the following allocation applies: 31 = module itself, 1...10 = decentralized communication interface module 1...10, ADR = hardware address (e. g. of the DC551-CS31)

[3])	With "Module" the following allocation applies depending on the master: Module error: I/O bus or PNIO: 31 = module itself; COM1/COM2: 1...10 = expansion 1...10
[4])	In case of module errors, with channel "31 = module itself" is output.

6.2.1.7 State LEDs

LED	State	Color	LED = OFF	LED = ON
Inputs I0...I3	Digital input	Yellow	Input is OFF	Input is ON

6.2.1.8 Technical data

The system data of AC500-eCo V3 apply *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

Parameter	Value
Galvanic isolation	Yes, between the input group and the rest of the module
Isolated groups	1 (4 channels per group)
Current consumption from 24 V DC power supply at the L+ and M terminals of the CPU	Ca. 10 mA
Max. power dissipation within the module	0.8 W
Weight	Ca. 110 g
Mounting position	Horizontal or vertical
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

6.2.1.8.1 Technical data of the digital inputs

Parameter	Value	
Number of channels per module	4 inputs 24 V DC	
Distribution of the channels into groups	1 (4 channels per group)	
Connections of the channels I0 to I3	Terminals 2 to 5	
Reference potential for the channels I0 to I3	Terminal 1 (plus or negative pole of the process supply voltage, signal name COM 0..3)	
Indication of the input signals	1 yellow LED per channel; the LED is ON when the input signal is high (signal 1). The module is powered through the CPU connection.	
Monitoring point of input indicator	LED is part of the input circuitry	
Input type according to EN 61131-2	Type 1 source	Type 1 sink
Input signal range	-24 V DC	+24 V DC

Parameter		Value	
	Signal 0	-5 V...+3 V	-3 V...+5 V
	Undefined signal	-15 V...-5 V	+5 V...+15 V
	Signal 1	-30 V...-15 V	+15 V...+30 V
Input current per channel			
	Input voltage 24 V	Typ. 5 mA	
	Input voltage 5 V	Typ. 1 mA	
	Input voltage 14 V		
	Input voltage 15 V	< 3 mA	
	Input voltage 27 V		
	Input voltage 30 V	< 7 mA	
Max. permissible leakage current (at 2-wire proximity switches)		1 mA	
Input delay (0->1 or 1->0)		Typ. 8 ms	
Input data length		1 byte	
Max. cable length			
	Shielded	500 m	
	Unshielded	300 m	

6.2.1.9 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 187 000 R0001	TA5101-4DI: AC500, digital input module option board, 4DI 24 V DC, spring/cable front terminal 3.50 mm pitch	Active
Spare parts		
1SAP 187 400 R0012 **)	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 6 pieces per packing unit	Active

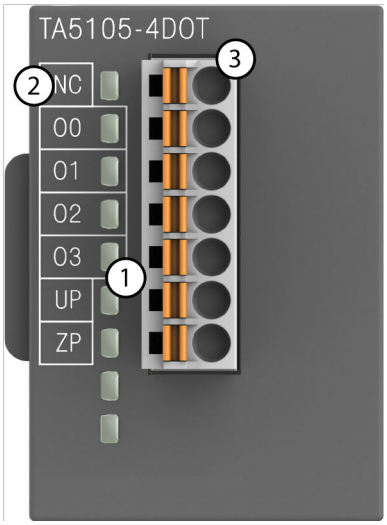
**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

***) The needed spring terminal block is always delivered with the option board.*

The terminal block listed in the table is for spare part only if needed.

6.2.2 TA5105-4DOT - Digital output module option board

- 4 digital outputs 24 V DC (O0 to O3) in 1 group
- Module-wise electrically isolated



1 4 yellow LEDs to display the signal states of the inputs O0 to O3
2 Allocation of signal name
3 7-pin terminal block for output signals

6.2.2.1 Intended purpose

The device is used as an optional I/O extension module for AC500-eCo V3 CPUs (PM50x2).

The outputs are group-wise electrically isolated from each other.

All other circuitry of the module is electrically isolated from the outputs.

6.2.2.2 Functionality

Parameter	Value
LED displays	For signal states
Internal power supply	Via internal CPU connection
External power supply	Via the terminals ZP and UP (process supply voltage 24 V DC)

6.2.2.3 Electrical connection

For a detailed description of the mounting, disassembly and electrical connection of the module, please refer to the system assembly chapter.

The electrical connection is carried out by using a removable 7-pin terminal block. For more information, please refer to the chapter terminal blocks for AC500-eCo V3 system. The terminal blocks are included in the module's scope of delivery and additional terminal blocks as spare parts can be ordered separately.

The following block diagram shows the internal construction of the digital outputs:

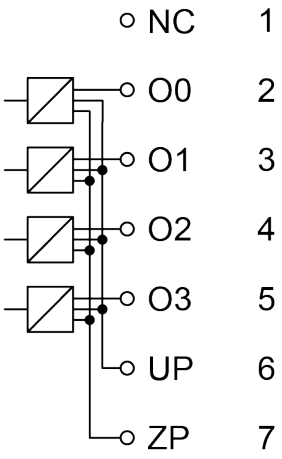


Table 24: Assignment of the terminals:

Terminal	Signal	Description
1	NC	Not connected
2	O0	Output signal O0
3	O1	Output signal O1
4	O2	Output signal O2
5	O3	Output signal O3
6	UP	Process supply voltage UP +24 V DC
7	ZP	Process supply voltage ZP 0 V DC

The internal power supply voltage for the module's circuitry is carried out via the connection to CPU. Thus, the current consumption from 24 V DC power supply at the terminals L+ and M of the CPU module increases by 10 mA per TA5105-4DOT.

The external power supply connection is carried out via the UP (+24 V DC) and ZP (0 V DC) terminals.

WARNING!

Removal/Insertion under power

The devices are not designed for removal or insertion under power. Because of unforeseeable consequences, it is not allowed to plug or unplug devices with the power being ON.

Make sure that all voltage sources (supply and process voltage) are switched off before you

– connect or disconnect any signal or terminal block
– remove, mount or replace a module.

Disconnecting any powered devices while energized in a hazardous location could result in an electric arc, which could create a flammable ignition resulting in fire or explosion.

Make sure that power is removed and that the area has been thoroughly checked to ensure that flammable materials are not present prior to proceeding.

The devices must not be opened when in operation. The same applies to the network interfaces.

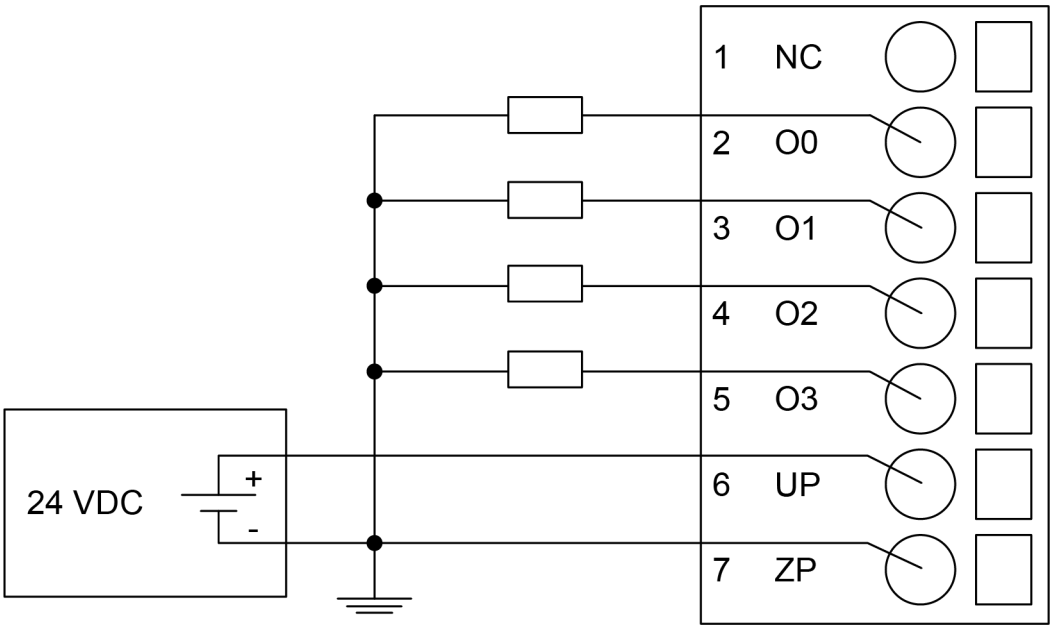
NOTICE!

Risk of damaging the PLC modules!

Overvoltages and short circuits might damage the PLC modules.

– Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations at the system.
– Never connect any voltages or signals to reserved terminals (marked with "NC"). Reserved terminals may carry internal voltages.

The following figure shows the electrical connection of the digital output module TA5105-4DOT:



NOTICE!

Risk of malfunctions in the plant!

Only if L+/M of the CPU is available and the outputs are already configured in the AB program, then as soon as the UP/ZP is available, the outputs will switch on.

This must be considered in the planning of the application.

NOTICE!

Risk of damaging the I/O module!

The outputs are not protected against short circuits and overload.

– Never short-circuit or overload the outputs.
– Never connect the outputs to other voltages.
– Use an external 3 A fast-protection fuse for the outputs.

The module provides several diagnosis functions, see Diagnosis *Chapter 6.2.2.6 “Diagnosis” on page 113*.

The meaning of the LEDs is described in the section State LEDs *Chapter 6.2.2.7 “State LEDs” on page 114*.

6.2.2.4 I/O configuration

The module itself does not store configuration data. It receives its parameterization data from the CPU module during power-up of the system.

Hence, replacing optional modules is possible without any re-parameterization via software.

6.2.2.5 Parameterization

The arrangement of the parameter data is performed with Automation Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Name	Value	Internal Value	Internal Value , Type	Default	Min.	Max.	EDS Slot Index
Module ID	Internal	6105 [1])	WORD	6120 0x17E8	0	65535	xx01
Ignore module	No Yes	0 1	BYTE	No (0x00)			
Parameter length	Internal	1 - CPU	BYTE	0	0	255	xx02 [2])

[1]) with CS31 and addresses smaller than 70, the value is increased by 1

[2]) Value is hexadecimal: HighByte is slot (xx: 0...7), LowByte is index (1...n)

GSD file:

Ext_User_Prm_Data_Len =	0x03
Ext_User_Prm_Data_Const(0) =	0xE9, 0x17, 0x00;

6.2.2.6 Diagnosis

Class	Comp	Dev	Mod	Ch	Err	PS501 PLC Browser	<− Display in	
Class	**Interface**	**Device**	**Module**	**Channel**	**Error Identifier**	**Error message**		**Remedy**
	[1])	**[2])**	**[3])**	**[4])**				
Module error								
3	14	1...10	31	31	19	Checksum error in the I/O module		Replace I/O module
	11 / 12	ADR	1...10					
3	14	1...10	31	31	43	Internal error in the module		Replace I/O module
	11 / 12	ADR	1...10					
3	14	1...10	31	31	9	Overflow diagnosis buffer		Restart
	11 / 12	ADR	1...10					

Class	Comp	Dev	Mod	Ch	Err	PS501 PLC Browser	<– Display in
Class	**Interface**	**Device**	**Module**	**Channel**	**Error Identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
3	14	1...10	31	31	26	Parameter error	Check master
	11 / 12	ADR	1...10				

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The PNIO diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = module itself, 1...10 = decentralized communication interface module 1...10, ADR = hardware address (e. g. of the DC551-CS31)
3)	With "Module" the following allocation applies depending on the master: Module error: I/O bus or PNIO: 31 = module itself; COM1/COM2: 1...10 = expansion 1...10
4)	In case of module errors, with channel "31 = module itself" is output.

6.2.2.7 State LEDs

LED	State	Color	LED = OFF	LED = ON
Outputs O0...O3	Digital output	Yellow	Output is OFF	Output is ON (The output voltage (normally 24 VDC) is only displayed if UP/ZP and L+/M (supply voltages for the module) are switched ON)

6.2.2.8 Technical data

The system data of AC500-eCo V3 apply ↪ *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

Parameter		Value
Process supply voltage UP		
	Connections	Terminal 6 for UP (+24 V DC) and terminal 7 for ZP (0 V DC)

Parameter		Value
	Rated value	24 V DC
	Current consumption via UP terminal	5 mA + max. 0.5 A per output
	Max. ripple	5 %
	Inrush current	0.000002 A^2s
	Protection against reversed voltage	Yes
	Rated protection fuse for UP	Recommended; the outputs must be protected by an 3 A fast fuse
Current consumption from 24 V DC power supply at the L+/M terminals of the CPU		Ca. 10 mA
Galvanic isolation		Yes, between the output group and the rest of the module
Isolated groups		1 (4 channels per group)
Surge-voltage (max.)		35 V DC for 0.5 s
Max. power dissipation within the module		0.5 W
Weight		Ca. 115 g
Mounting position		Horizontal or vertical
Cooling		The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

6.2.2.8.1 Technical data of the digital outputs

Parameter		Value
Number of channels per module		4 transistor outputs (24 V DC, 0.5 A max.)
Distribution of the channels into groups		1 (4 channels per group)
Connection of the channels O0 to O3		Terminals 2 to 5
Common power supply voltage		Terminal 6 (positive pole of the process voltage, signal name UP)
Reference potential for the channels O0 to O3		Terminal 7 (negative pole of the process voltage, signal name ZP)
Indication of the output signals		1 yellow LED per channel; the LED is on when the output signal is high (signal 1). Only internal logic is powered from CPU. Outputs are powered from UP/ZP terminals.
Way of operation		Non-latching type
Min. output voltage at signal 1		UP - 0.1 V
Output delay (max. at rated load)		
	0 to 1	50 µs
	1 to 0	200 µs
Output data length		1 byte
Output current		
	Rated current per channel (max.)	0.5 A at UP 24 VDC
	Rated current per group (max.)	2 A (4 channels * 0.5 A)

Parameter		Value
	Lamp load (max.)	5 W
Max. leakage current with signal 0		0.5 mA
Output type		Non-protected
Protection type		External fuse on each channel
Rated protection fuse (for each channel)		3 A fast
Demagnetization when inductive loads are switched off		Must be performed externally according to driven load specification
Switching Frequencies		
	With inductive loads	Max. 0.5 Hz
	With lamp loads	Max. 11 Hz at max. 5 W
Short-circuit-proof / Overload-proof		No
	Overload message	No
	Output current limitation	No
	Resistance to feedback against 24 V DC	No
Connection of 2 outputs in parallel		Not possible
Max. cable length		
	Shielded	500 m
	Unshielded	150 m

6.2.2.9 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 187 000 R0002	TA5105-4DOT: AC500, digital output module option board, 4DO-T 24 VDC / 0.5 A, spring/cable front terminal 3.50 mm pitch	Active
Spare parts		
1SAP 187 400 R0014 **)	TA5220-SPF7: spring terminal block, removable, 7-pin, spring front, cable front, 6 pieces per packing unit	Active

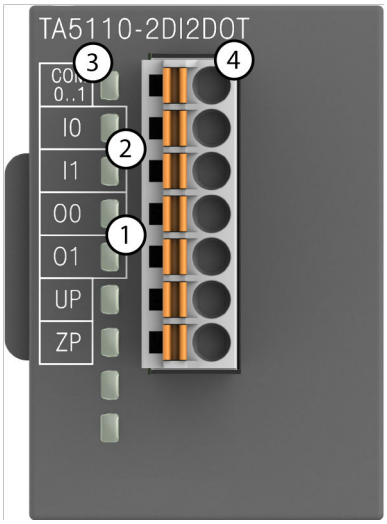
*) *Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

**) *The needed spring terminal block is always delivered with the option board.*

The terminal block listed in the table is for spare part only if needed.

6.2.3 TA5110-2DI2DOT - Digital input/output module option board

- 2 digital inputs 24 V DC (I0 to I1) in 1 group
- 2 digital transistor outputs 24 V DC (O0 to O1) in 1 group
- Group-wise electrically isolated



1 2 yellow LEDs to display the signal states of the outputs O0 to O1
2 2 yellow LEDs to display the signal states of the inputs I0 to I1
3 Allocation of signal name
4 7-pin terminal block for input/output signals

6.2.3.1 Intended purpose

The device is used as an optional I/O extension module for AC500-eCo V3 CPUs (PM50x2).

The inputs and outputs are group-wise electrically isolated from each other.

All other circuitry of the module is electrically isolated from the inputs.

6.2.3.2 Functionality

Parameter	Value
LED displays	For signal states
Internal power supply	Via internal CPU connection
External power supply	Via the terminals ZP and UP (process voltage 24 V DC)

6.2.3.3 Electrical connection

For a detailed description of the mounting, disassembly and electrical connection of the module, please refer to the system assembly chapter.

The electrical connection is carried out by using a removable 7-pin terminal block. For more information, please refer to the chapter terminal blocks for AC500-eCo V3 system. The terminal blocks are included in the module's scope of delivery and additional terminal blocks as spare parts can be ordered separately.

The following block diagram shows the internal construction of the digital inputs and outputs:

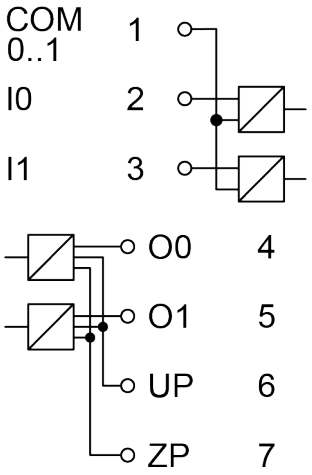


Table 25: Assignment of the terminals:

Terminal	Signal	Description
1	COM 0..1	Input common for signals I0 to I1
2	I0	Input signal I0
3	I1	Input signal I1
4	O0	Output signal O0
5	O1	Output signal O1
6	UP	Process supply voltage UP +24 V DC
7	ZP	Process supply voltage ZP 0 V DC

The internal power supply voltage for the module's circuitry is carried out via the connection to CPU. Thus, the current consumption from 24 V DC power supply at the terminals L+ and M of the CPU module increases by 10 mA per TA5110-2DI2DOT.

The external power supply connection is carried out via the UP (+24 V DC) and ZP (0 V DC) terminals.

WARNING!

Removal/Insertion under power

The devices are not designed for removal or insertion under power. Because of unforeseeable consequences, it is not allowed to plug or unplug devices with the power being ON.

Make sure that all voltage sources (supply and process voltage) are switched off before you

– connect or disconnect any signal or terminal block
– remove, mount or replace a module.

Disconnecting any powered devices while energized in a hazardous location could result in an electric arc, which could create a flammable ignition resulting in fire or explosion.

Make sure that power is removed and that the area has been thoroughly checked to ensure that flammable materials are not present prior to proceeding.

The devices must not be opened when in operation. The same applies to the network interfaces.

NOTICE!

Risk of damaging the PLC modules!

Overvoltages and short circuits might damage the PLC modules.

– Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations at the system.
– Never connect any voltages or signals to reserved terminals (marked with "NC"). Reserved terminals may carry internal voltages.

The digital inputs can be used as source inputs or as sink inputs.

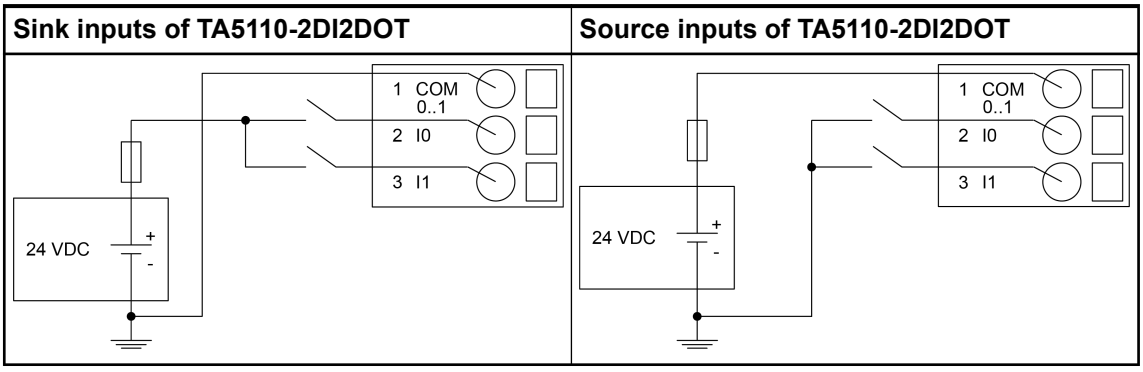
NOTICE!

Risk of malfunctions in the plant!

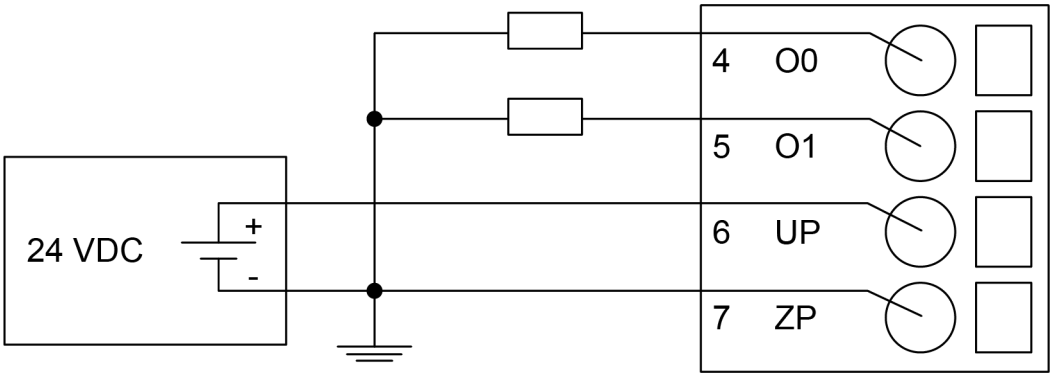
A ground closure, e. g. caused by a damaged cable insulation, can bridge switches accidentally.

Use sink inputs when possible or make sure that, in case of error, there will be no risks to persons or plant.

The following figure shows the electrical connection for inputs of the digital input/output module TA5110-2DI2DOT:



The following figure shows the electrical connection for outputs of the digital input/output module TA5110-2DI2DOT:



NOTICE!

Risk of malfunctions in the plant!

Only if L+/M of the CPU is available and the outputs are already configured in the AB program, then as soon as the UP/ZP is available, the outputs will switch on.

This must be considered in the planning of the application.

NOTICE!

Risk of damaging the I/O module!

The outputs are not protected against short circuits and overload.

- Never short-circuit or overload the outputs.
- Never connect the outputs to other voltages.
- Use an external 3 A fast-protection fuse for the outputs.

The module provides several diagnosis functions, see Diagnosis *Chapter 6.2.3.6 “Diagnosis” on page 121*.

The meaning of the LEDs is described in the section State LEDs *Chapter 6.2.3.7 “State LEDs” on page 122*.

6.2.3.4 I/O configuration

The module itself does not store configuration data. It receives its parameterization data from the CPU module during power-up of the system.

Hence, replacing optional modules is possible without any re-parameterization via software.

If the external power supply voltage via UP/ZP terminals fails, the I/O module loses its configuration data. The whole station has to be switched off and on again to re-configure the module.

6.2.3.5 Parameterization

The arrangement of the parameter data is performed with Automation Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Name	Value	Internal Value	Internal Value , Type	Default	Min.	Max.	EDS Slot Index
Module ID	Internal	6135 [1])	WORD	6135 0x17F7	0	65535	xx01
Ignore module	No Yes	0 1	BYTE	No (0x00)			
Parameter length	Internal	1	BYTE	0	0	255	xx02 [2])

[1]) with CS31 and addresses smaller than 70, the value is increased by 1

[2]) Value is hexadecimal: HighByte is slot (xx: 0...7), LowByte is index (1...n)

GSD file:

Ext_User_Prm_Data_Len =	0x03
Ext_User_Prm_Data_Const(0) =	0xF8, 0x17, 0x00,\
(0) =	0x01;

6.2.3.6 Diagnosis

Class	**Comp**	**Dev**	**Mod**	**Ch**	**Err**	**PS501 PLC Browser**	**<− Display in**
Class	**Interface**	**Device**	**Module**	**Channel**	**Error Identifier**	**Error message**	**Remedy**
	[1])	**[2])**	**[3])**	**[4])**			
Module error							
3	14	1...10	31	31	19	Checksum error in the I/O module	Replace I/O module
	11 / 12	ADR	1...10				
3	14	1...10	31	31	43	Internal error in the module	Replace I/O module
	11 / 12	ADR	1...10				
3	14	1...10	31	31	9	Overflow diagnosis buffer	Restart
	11 / 12	ADR	1...10				
3	14	1...10	31	31	26	Parameter error	Check master
	11 / 12	ADR	1...10				

Remarks:

[1])	In AC500 the following interface identifier applies: 14 = I/O bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The PNIO diagnosis block does not contain this identifier.
[2])	With "Device" the following allocation applies: 31 = module itself, 1...10 = decentralized communication interface module 1...10, ADR = hardware address (e. g. of the DC551-CS31)
[3])	With "Module" the following allocation applies depending on the master: Module error: I/O bus or PNIO: 31 = module itself; COM1/COM2: 1...10 = expansion 1...10
[4])	In case of module errors, with channel "31 = module itself" is output.

6.2.3.7 State LEDs

LED	State	Color	LED = OFF	LED = ON
Inputs I0...I1	Digital input	Yellow	Input is OFF	Input is ON
Outputs O0...O1	Digital output	Yellow	Output is OFF	Output is ON

6.2.3.8 Technical data

The system data of AC500-eCo V3 apply *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

Parameter		Value
Process supply voltage UP		
	Connections	Terminal 6 for UP (+24 V DC) and terminal 7 for ZP (0 VDC)
	Rated value	24 V DC
	Current consumption via UP terminal	5 mA + max. 0.5 A per output
	Max. ripple	5 %
	Inrush current	0.000002 A^2s
	Protection against reversed voltage	Yes
	Rated protection fuse for UP	Recommended; the outputs must be protected by an 3 A fast fuse
Current consumption from 24 V DC power supply at the L+/M terminals of the CPU		Ca. 10 mA
Galvanic isolation		Yes, between the input group and the output group and the rest of the module
Isolated groups		2 groups (1 group for 2 input channels, 1 group for 2 output channels)
Surge-voltage (max.)		35 V DC for 0.5 s
Max. power dissipation within the module		0.7 W
Weight		ca. 120 g
Mounting position		Horizontal or vertical
Cooling		The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

6.2.3.8.1 Technical data of the digital inputs

Parameter	Value
Number of channels per module	2
Distribution of the channels into groups	1 group for 2 channels
Connections of the channels I0 to I1	Terminals 2 to 3
Reference potential for the channels I0 to I1	Terminal 1

Parameter		Value	
Indication of the input signals		1 yellow LED per channel; the LED is ON when the input signal is high (signal 1)	
Monitoring point of input indicator		LED It is not part of input circuit (its controlled by processor side, not process side)	
Input type according to EN 61131-2		Type 1 source	Type 1 sink
Input signal range		-24 V DC	+24 V DC
Signal 0		-5 V...+3 V	-3 V...+5 V
Undefined signal		-15 V...+ 5 V	+5 V...+15 V
Signal 1		-30 V...-15 V	+15 V...+30 V
Ripple with signal 0		-5 V...+3 V	-3 V...+5 V
Ripple with signal 1		-30 V...-15 V	+15 V...+30 V
Input current per channel			
	Input voltage +24 V	Typ. 5 mA	
	Input voltage +5 V	Typ. 1 mA	
	Input voltage +15 V	< 3 mA	
	Input voltage +30 V	< 7 mA	
Max. permissible leakage current (at 2-wire proximity switches)		1 mA	
Input delay (0->1 or 1->0)		Typ. 8 ms	
Input data length		1 byte	
Max. cable length			
	Shielded	500 m	
	Unshielded	300 m	

6.2.3.8.2 Technical data of the digital outputs

Parameter	Value
Number of channels per module	2 transistor outputs (24 V DC, 0.5 A max.)
Distribution of the channels into groups	1 group of 2 channels
Connection of the channels O0 to O1	Terminals 4 to 5
Reference potential for the channels O0 to O17	Terminal 7 (negative pole of the process voltage, name ZP)
Common power supply voltage	Terminal 6 (positive pole of the process voltage, name UP)
Indication of the output signals	1 yellow LED per channel; the LED is on when the output signal is high (signal 1) and the module is powered via the I/O bus
Monitoring point of output indicator	Controlled together with transistor
Way of operation	Non-latching type
Min. output voltage at signal 1	UP - 0.1 V

Parameter		Value
Output delay		
	0 to 1	50 µs
	1 to 0	200 µs
Output data length		1 byte
Output current		
	Rated current per channel (max.)	0.5 A at UP 24 V DC
	Rated current per group (max.)	1 A
	Rated current (all channels together, max.)	1 A
	Lamp load (max.)	5 W
	Max. leakage current with signal 0	0.5 mA
Output type		Non-protected
Protection type		External fuse on each channel
Rated protection fuse (for each channel)		3 A fast
Demagnetization when inductive loads are switched off		Must be performed externally according to driven load specification
Switching Frequencies		
	With inductive loads	Max. 0.5 Hz
	With lamp loads	Max. 11 Hz at max. 5 W
Short-circuit-proof / Overload-proof		No
	Overload message	No
	Output current limitation	No
	Resistance to feedback against 24 VDC	No
Connection of 2 outputs in parallel		Not possible
Max. cable length		
	Shielded	500 m
	Unshielded	150 m

6.2.3.9 Ordering data

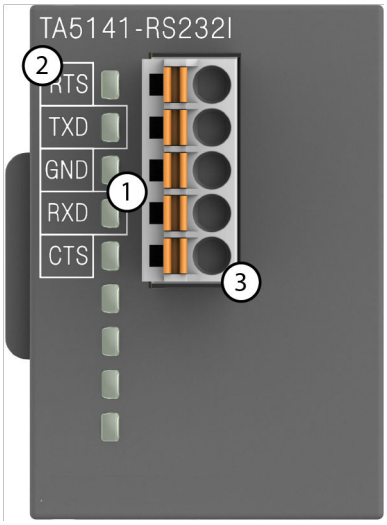
Part no.	Description	Product life cycle phase *)
1SAP 187 000 R0003	TA5110-2DI2DOT: AC500, digital in/ output module option board, 2DI 24 V DC, 2DO-T 24 VDC / 0.5 A, spring/ cable front terminal 3.50 mm pitch	Active
Spare parts		
1SAP 187 400 R0014 **)	TA5220-SPF7: spring terminal block, removable, 7-pin, spring front, cable front, 6 pieces per packing unit	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

***) The needed spring terminal block is always delivered with the option board.*

The terminal block listed in the table is for spare part only if needed.

6.2.4 TA5141-RS232I - RS-232 serial adapter isolated option board



1 2 LEDs for communication state display (TxD and RxD)
2 Allocation of signal name
3 5-pin terminal block for communication interface

6.2.4.1 Intended purpose

Serial communication option board TA5141-RS232I is equipped with 1 RS-232 serial interface with handshake.

6.2.4.2 Electrical connection

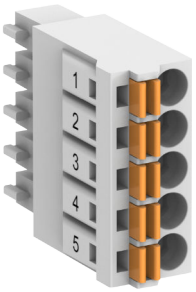
6.2.4.2.1 Serial interfaces

NOTICE!

Damage to the serial communication interface by using 5-pin terminal block of the TA5101-4DI!

If the 5-pin terminal block of the TA5101-4DI option board is plugged into a serial communication option board TA5141-RS232I, TA5142-RS485I or TA5142-RS485, the communication interface will be damaged by the 24 V.

Please do not confuse the 5-pin terminal block of the TA5101-4DI with the 5-pin terminal block for serial communication interface of TA5141-RS232I, TA5142-RS485I or TA5142-RS485.

Serial interface	Pin	Signal	Description
	1	RTS	Request To Send DCE is ready to accept data from the DTE
	2	TxD	Transmit data (output)
	3	GND	Common Ground
	4	RxD	Receive data (input)
	5	CTS	Clear To Send (input) DCE is ready to accept data from the DTE

Cable length

The maximum possible cable length of a serial connection subnet within a segment depends on the transmission rate.

RS-232 for point-to-point connection:

Parameter	Value
Transmission rate	9.6 kbit/s to 115.2 kbit/s
Maximum cable length	On request

6.2.4.3 State LEDs

Signal	Color	State	Description
TxD	Yellow	ON (blinking)	Transmitting
RxD	Yellow	ON (blinking)	Receiving

6.2.4.4 Technical data

The system data of AC500-eCo V3 apply *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

Parameter	Value
Protocol	Programmable with Automation Builder e.g. Modbus RTU / CAA SerialCom via serial interfaces
Interface	Serial interface
Serial interface standard	EIA RS-232
Potential separation	Yes, from the CPU, 500 V DC
Serial interface parameters	Configurable via software
Modes of operation	Data exchange
Transmission rate	9.6 kbit/s to 115.2 kbit/s
Protocol	Programmable

Parameter	Value
Interface connector	5-pin terminal block, male
Usable CPUs	PM50x2
Ambient temperature	see: System data AC500-eCo V3
Internal power supply	Via internal CPU connection
Additional current consumption from 24 V DC power supply at CPU	Max. 25 mA
Weight	Ca. 150 g

6.2.4.5 Ordering data

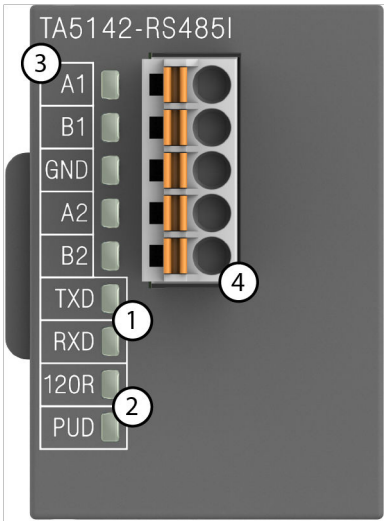
Part no.	Description	Product life cycle phase *)
1SAP 187 300 R0001	TA5141-RS232I: AC500, RS-232 serial adapter isolated option board, spring/cable front terminal, 3.50 mm pitch	Active
Spare parts		
1SAP 187 400 R0012 **)	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 3.5 mm pitch, 6 pieces per packing unit	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

***) The needed spring terminal block is always delivered with the option board.*

The terminal block listed in the table is for spare part only if needed.

6.2.5 TA5142-RS485I - RS-485 serial adapter isolated option board



1 2 LEDs for communication state display (TxD and RxD)
2 2 LEDs for termination state display
3 Allocation of signal name
4 5-pin terminal block for communication interface

6.2.5.1 Intended purpose

Serial communication option board TA5142-RS485I is equipped with 1 RS-485 (2-wire half-duplex) serial interface which can be used for communication via Modbus RTU or CAA SerialCom.

Bus terminations are built-in and configurable.

6.2.5.2 Electrical connection

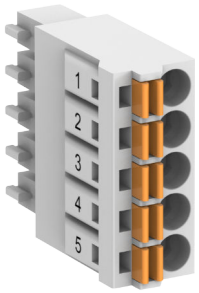
6.2.5.2.1 Seriel interfaces

NOTICE!

Damage to the serial communication interface by using 5-pin terminal block of the TA5101-4DI!

If the 5-pin terminal block of the TA5101-4DI option board is plugged into a serial communication option board TA5141-RS232I, TA5142-RS485I or TA5142-RS485, the communication interface will be damaged by the 24 V.

Please do not confuse the 5-pin terminal block of the TA5101-4DI with the 5-pin terminal block for serial communication interface of TA5141-RS232I, TA5142-RS485I or TA5142-RS485.

Serial interface	Pin	Signal
	1	A1
	2	B1
	3	GND
	4	A2
	5	B2

Protocols

No.	Protocol	Description
1	Modbus	Modbus RTU, master or slave
2	CAA SerialCom	Support for blocks contained in the CAA_SerialCom.lib library

Bus cable

Bus line	
Construction	2 cores, twisted, with common shield
Conductor cross section	> 0.22 mm² (24 AWG)
Twisting rate	> 10 per meter (symmetrically twisted)
Core insulation	Polyethylene (PE)
Resistance per core	< 100 Ω/km
Characteristic impedance	ca. 120 Ω (100 Ω...150 Ω)
Capacitance between the cores	< 55 nF/km (if higher, the max. bus length must be reduced)
Terminating resistors	120 Ω ¼ W at both line ends
Remarks	Commonly used telephone cables with PE insulation and a core diameter of > 0.8 mm are usually sufficient.
	Cables with PVC core insulation and core diameter of 0.8 mm can be used up to a length of approx. 250 m. In this case, the bus terminating resistor is approx. 100 Ω.

Cable length

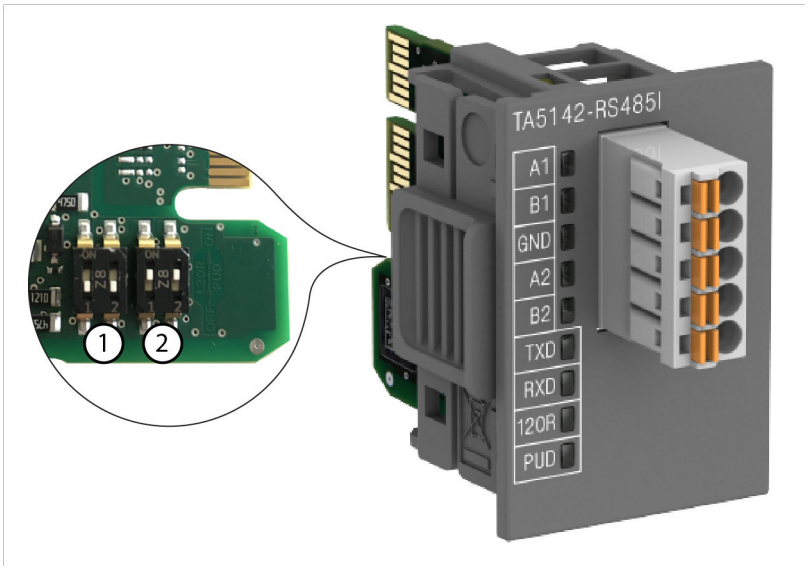
The maximum possible cable length of a serial connection subnet within a segment depends on the transmission rate.

RS-485 for point-to-point or bus connection:

Parameter	Value
Transmission rate	9.6 kbit/s to 115.2 kbit/s
Maximum cable length	On request

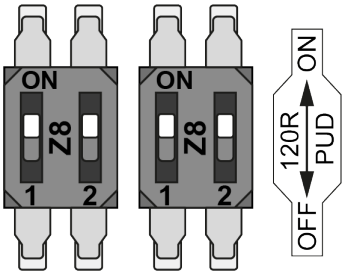
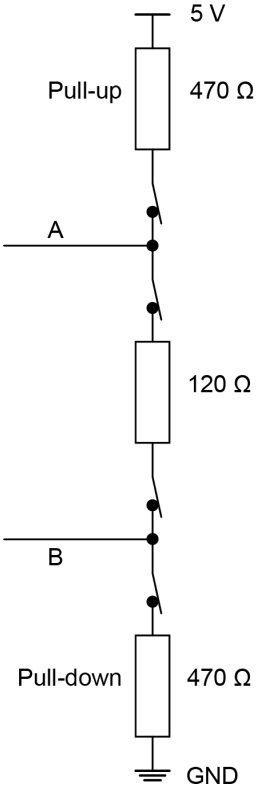
Bus termination

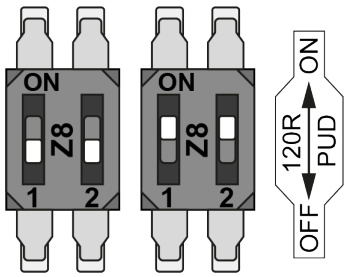
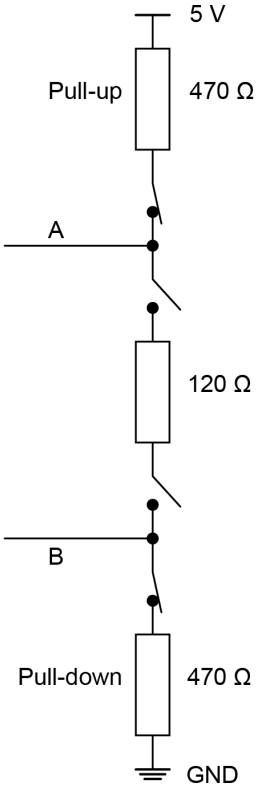
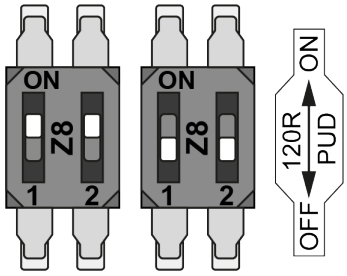
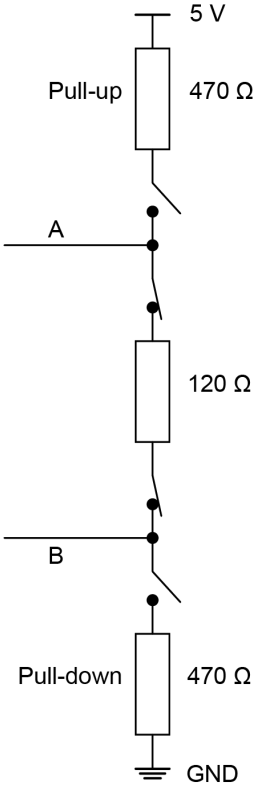
The line ends of the bus segment must be equipped with bus termination resistors. These resistors are integrated in the module TA5142-RS485I. The pull-up and pull-down settings must also be made on the circuit board of the module.

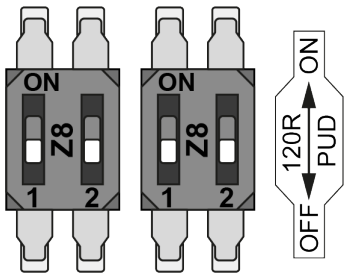
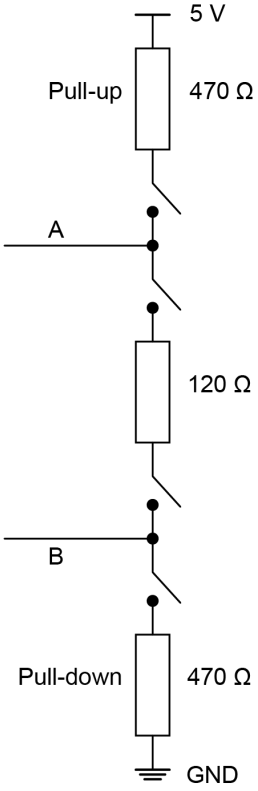


1 Termination resistance settings
2 Pull-up and pull-down settings

The configuration is shown in the table below:

Settings on the module	State of LEDs	Internal wiring diagram	Description
			Master at the bus line end, pull-up and pull-down activated, bus termination 120 Ω

Settings on the module	State of LEDs	Internal wiring diagram	Description
			Master within the bus line, pull-up and pull-down activated
			Slave at the bus line end, bus termination 120 Ω

Settings on the module	State of LEDs	Internal wiring diagram	Description
			Slave within the bus line

6.2.5.3 State LEDs

	Signal	Color	State	Description
	TxD	Yellow	ON (blinking)	Transmitting
	RxD	Yellow	ON (blinking)	Receiving
	120R	Yellow	ON	Bus termination
	PUD	Yellow	ON	Pull-up / Pull-down

6.2.5.4 Technical data

The system data of AC500-eCo V3 apply *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

Parameter	Value
Protocol	Programmable with Automation Builder e.g. Modbus RTU / CAA_SerialCom via serial interfaces
Interface	Serial interface

Parameter	Value
Serial interface standard	EIA RS-485
Potential separation	Yes, from the CPU, 500 V DC
Serial interface parameters	Configurable via software
Modes of operation	Data exchange
Transmission rate	9.6 kbit/s to 115.2 kbit/s
Protocol	Programmable
Interface connector	5-pin terminal block, male
Usable CPUs	PM50x2
Ambient temperature	see: System data AC500-eCo V3
Internal power supply	Via internal CPU connection
Additional current consumption from 24 V DC power supply at CPU	Max. 25 mA
Weight	Ca. 150 g

6.2.5.5 Ordering data

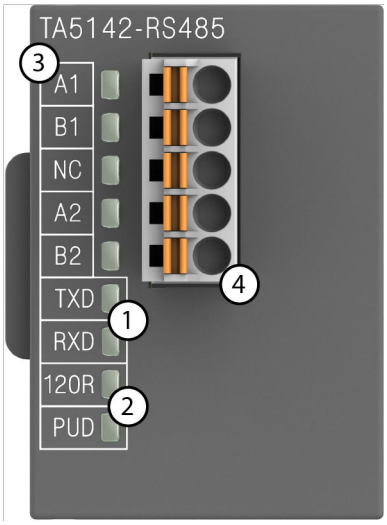
Part no.	Description	Product life cycle phase *)
1SAP 187 300 R0002	TA5142-RS485I: AC500, RS-485 serial adapter isolated option board, spring/cable front terminal, 3.50 mm pitch	Active
Spare parts		
1SAP 187 400 R0012 **)	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 3.5 mm pitch, 6 pieces per packing unit	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

***) The needed spring terminal block is always delivered with the option board.*

The terminal block listed in the table is for spare part only if needed.

6.2.6 TA5142-RS485 - RS-485 serial adapter non isolated option board



1 2 LEDs for communication state display (TxD and RxD)
2 2 LEDs for termination state display
3 Allocation of signal name
4 5-pin terminal block for communication interface

6.2.6.1 Intended purpose

Serial communication option board TA5142-RS485 is equipped with 1 RS-485 (2-wire half-duplex) serial interface which can be used for communication via Modbus RTU or CAA SerialCom.

Bus terminations are built-in and configurable.

6.2.6.2 Electrical connection

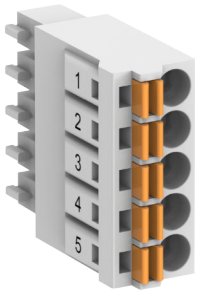
6.2.6.2.1 Seriel interfaces

NOTICE!

Damage to the serial communication interface by using 5-pin terminal block of the TA5101-4DI!

If the 5-pin terminal block of the TA5101-4DI option board is plugged into a serial communication option board TA5141-RS232I, TA5142-RS485I or TA5142-RS485, the communication interface will be damaged by the 24 V.

Please do not confuse the 5-pin terminal block of the TA5101-4DI with the 5-pin terminal block for serial communication interface of TA5141-RS232I, TA5142-RS485I or TA5142-RS485.

Serial interface	Pin	Signal
	1	A1
	2	B1
	3	NC (not connected)
	4	A2
	5	B2

Protocols

No.	Protocol	Description
1	Modbus	Modbus RTU, master or slave
2	CAA SerialCom	Support for blocks contained in the CAA_SerialCom.lib library

Bus cable

Bus line	
Construction	2 cores, twisted, with common shield
Conductor cross section	> 0.22 mm² (24 AWG)
Twisting rate	> 10 per meter (symmetrically twisted)
Core insulation	Polyethylene (PE)
Resistance per core	< 100 Ω/km
Characteristic impedance	ca. 120 Ω (100 Ω...150 Ω)
Capacitance between the cores	< 55 nF/km (if higher, the max. bus length must be reduced)
Terminating resistors	120 Ω ¼ W at both line ends
Remarks	Commonly used telephone cables with PE insulation and a core diameter of > 0.8 mm are usually sufficient.
	Cables with PVC core insulation and core diameter of 0.8 mm can be used up to a length of approx. 250 m. In this case, the bus terminating resistor is approx. 100 Ω.

Cable length

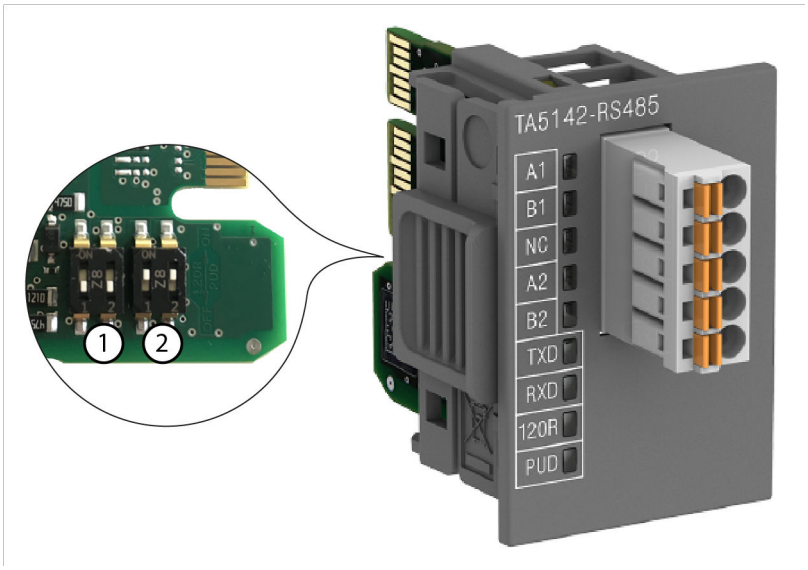
The maximum possible cable length of a serial connection subnet within a segment depends on the transmission rate.

RS-485 for point-to-point or bus connection:

Parameter	Value
Transmission rate	9.6 kbit/s to 115.2 kbit/s
Maximum cable length	On request

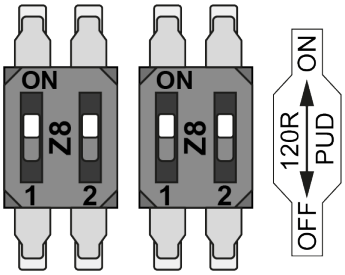
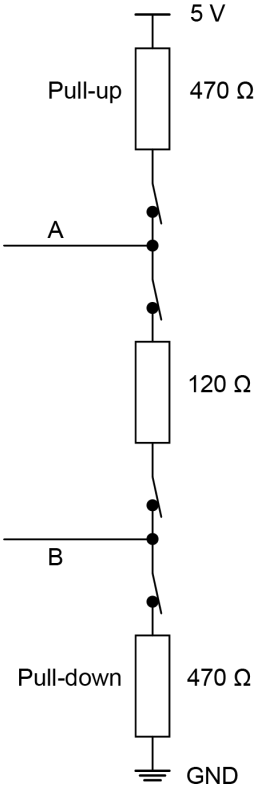
Bus termination

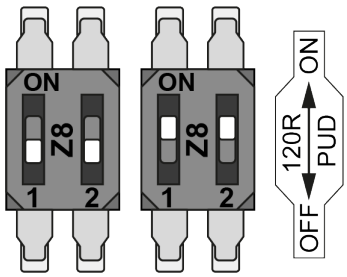
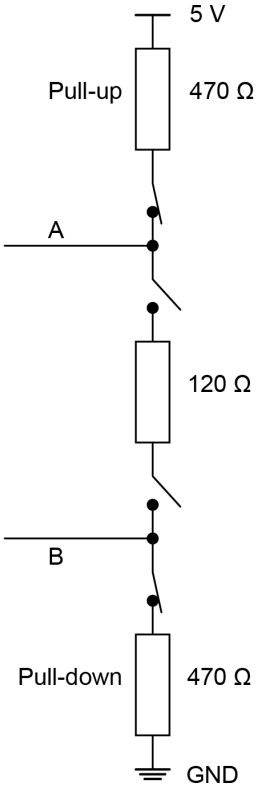
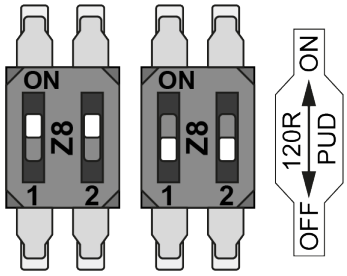
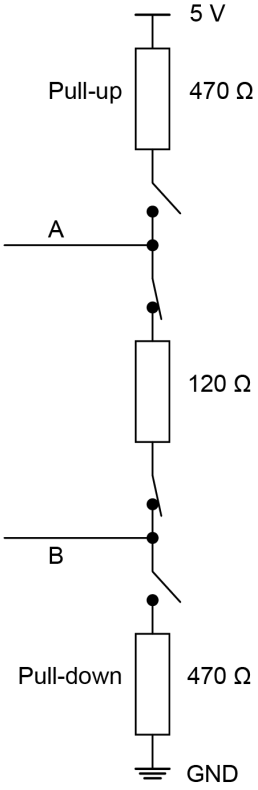
The line ends of the bus segment must be equipped with bus termination resistors. These resistors are integrated in the module TA5142-RS485. The pull-up and pull-down settings must also be made on the circuit board of the module.

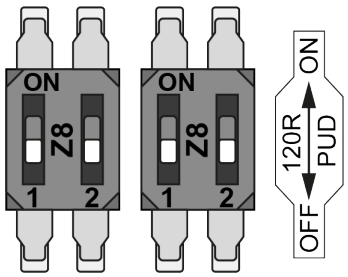
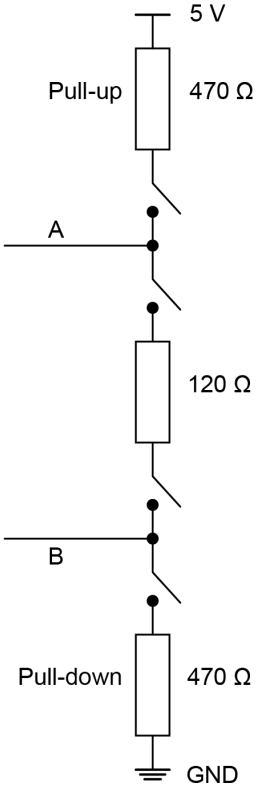


1 Termination resistance settings
2 Pull-up and pull-down settings

The configuration is shown in the table below:

Settings on the module	State of LEDs	Internal wiring diagram	Description
			Master at the bus line end, pull-up and pull-down activated, bus termination 120 Ω

Settings on the module	State of LEDs	Internal wiring diagram	Description
			Master within the bus line, pull-up and pull-down activated
			Slave at the bus line end, bus termination 120 Ω

Settings on the module	State of LEDs	Internal wiring diagram	Description
			Slave within the bus line

6.2.6.3 State LEDs

	Signal	Color	State	Description
	TxD	Yellow	ON (blinking)	Transmitting
	RxD	Yellow	ON (blinking)	Receiving
	120R	Yellow	ON	Bus termination
	PUD	Yellow	ON	Pull-up / Pull-down

6.2.6.4 Technical data

The system data of AC500-eCo V3 apply *Chapter 6.4 “System data AC500-eCo V3” on page 154*

Only additional details are therefore documented below.

Parameter	Value
Protocol	Programmable with Automation Builder e.g. Modbus RTU / CAA_SerialCom via serial interfaces
Interface	Serial interface

Parameter	Value
Serial interface standard	EIA RS-485
Potential separation	No
Serial interface parameters	Configurable via software
Modes of operation	Programming or data exchange
Transmission rate	9.6 kbit/s to 115.2 kbit/s
Protocol	Programmable
Interface connector	5-pin terminal block, male
Usable CPUs	PM50x2
Ambient temperature	see: System data AC500-eCo V3
Internal power supply	Via internal CPU connection
Additional current consumption from 24 V DC power supply at CPU	Max. 25 mA
Weight	Ca. 150 g

6.2.6.5 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 187 300 R0003	TA5142-RS485: AC500, RS-485 serial adapter non isolated option board, spring/cable front terminal, 3.50 mm pitch	Active
Spare parts		
1SAP 187 400 R0012 **)	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 3.5 mm pitch, 6 pieces per packing unit	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

***) The needed spring terminal block is always delivered with the option board.*

The terminal block listed in the table is for spare part only if needed.

6.2.7 TA5131-RTC option board for real time clock

1 TA5131-RTC option board

6.2.7.1 Intended purpose

This option board is only for the basic CPUs PM5012-T-ETH and PM5012-R-ETH.

All other AC500-eCo V3 CPUs have the real-time clock already integrated.

Information can be found in the chapter system technology: see

6.2.7.2 Functionality

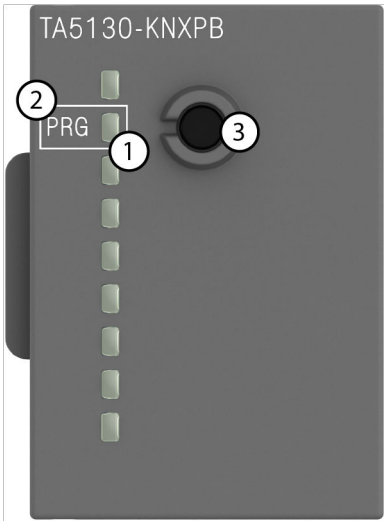
Information can be found in the chapter system technology: see

6.2.7.3 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 187 200 R0002	TA5131-RTC:AC500, real-time clock without battery, option board for AC500-eCo V3 Basic CPU	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

6.2.8 TA5130-KNXPB option board for KNX address switch



1 State LED
2 Allocation of signal name
3 Connector

6.2.8.1 Intended purpose

This option board is only intended to be used with PM5072-T-2ETH(W).

This option board can only be used once on one slot at a time!

The option board is not supported by other AC500-eCo V3 PLCs.

Information can be found in the chapter system technology: see

6.2.8.2 Functionality

Information can be found in the chapter system technology: see

6.2.8.3 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 187 200 R0001	TA5130-KNXPB: AC500, KNX address switch option board, 1 push button	Active

*) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.

6.3 Accessories

6.3.1 MC5102 - micro memory card with micro memory card adapter

- Secure digital card
- Solid state flash memory storage

1 Micro memory card
2 Micro memory card adapter

Memory card overview

All AC500-eCo V3 processor modules have a micro memory card slot.

All other processor modules (AC500 V2, AC500-eCo V2 and AC500 V3) have a memory card slot.

When using the micro memory card for memory card slots in SD size, the supplied micro memory card adapter is required.

Using MC5102 memory card with AC500 V2 or AC500-eCo V2 requires the firmware as of 2.5.x.

Properties and applications		MC502 [1])	MC5102		MC5141
			without micro memory card adapter	with micro memory card adapter	
Memory card		x	-		x
Micro memory card		-	x		-
AC500 V2					
	Standard application	x	-	x	(x) [3])
	XC application	x	-	-	x
AC500 V3					

Properties and applications		MC502 [1])	MC5102		MC5141
			without micro memory card adapter	with micro memory card adapter	
	Standard application	x	-	x	(x) [3])
	XC application	x	-	-	x
AC500-eCo V2 [2])					
	Standard application	x	-	x	-
AC500-eCo V3					
	Standard application	-	x	-	-

[1]) The memory card MC5102 is in status Classic. Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.

[2]) A MC503 memory card adapter is required for AC500-eCo V2 processor modules.

[3]) It is possible to use the MC5141 memory card, but the MC5102 memory card is preferred.

Purpose

The MC5102 micro memory card is prohibited for XC applications. The MC5102 micro memory card can only be used for standard applications with AC500 V3 or AC500-eCo V3.

The micro memory card is used to back-up user data and store user programs or project source codes as well as to update the internal CPU firmware. The processor modules can be operated with and without micro memory card.

Processor modules are supplied without micro memory card. It therefore must be ordered separately.

The micro memory card can be read on a PC with a standard memory card reader. Processor modules are equipped with a memory card reader.

For AC500 V3 the MC5102 micro memory card has to be used **with** the micro memory card adapter for memory card slot.

For AC500-eCo V3 processor modules the MC5102 micro memory card has to be used **without** the micro memory card adapter. All AC500-eCo V3 processor modules have a micro memory card slot.

The micro memory card has a write protect switch. In the position "LOCK", the card can only be read.

The use of other micro memory cards than MC5102 micro memory card is prohibited. ABB is not responsible nor liable for consequences resulting from use of unapproved memory cards.

Extension of the memory card function

Memory cards contain firmware and application.

Visualizations and all related objects (like text lists) are also added to the memory card.

Export boot project and firmware to the memory card .

Insert the micro memory card

AC500-eCo V3

Unpack the micro memory card and insert it into the micro memory card slot of the processor module PM50xx until locked:

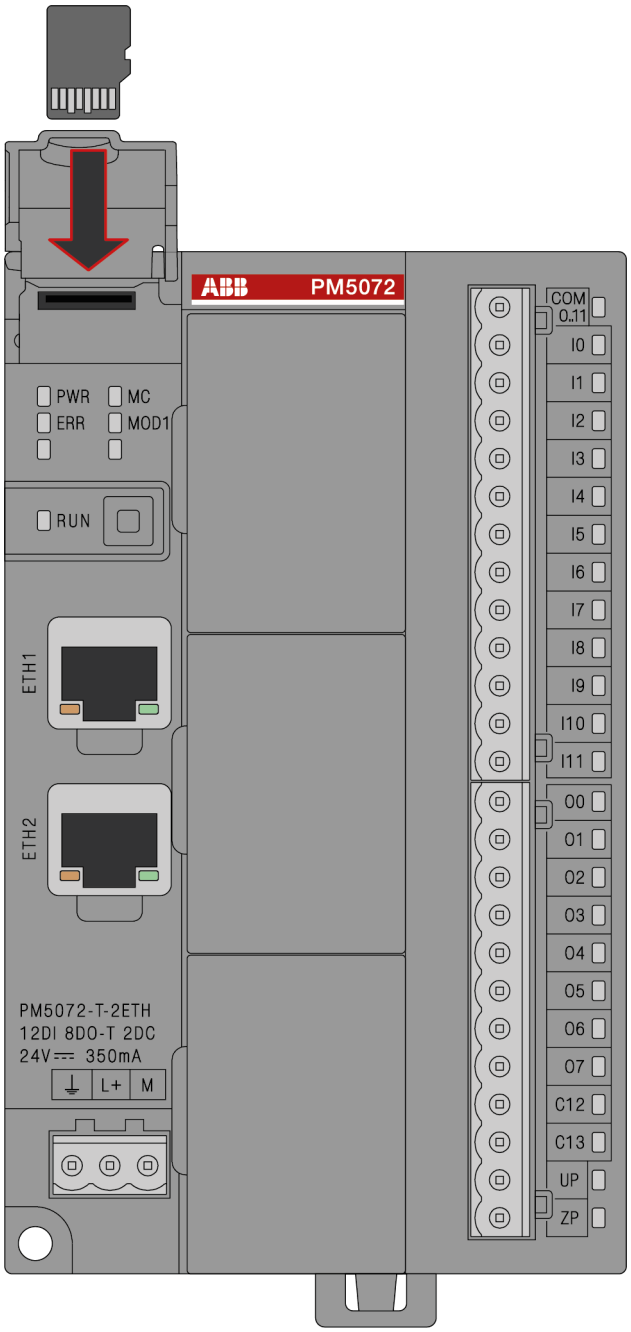


Fig. 7: Insertion: PM50xx

AC500 V3

Unpack the micro memory card and insert it into the supplied micro memory card adapter. Insert the micro memory card adapter with integrated micro memory card into the memory card slot of the processor module until locked:

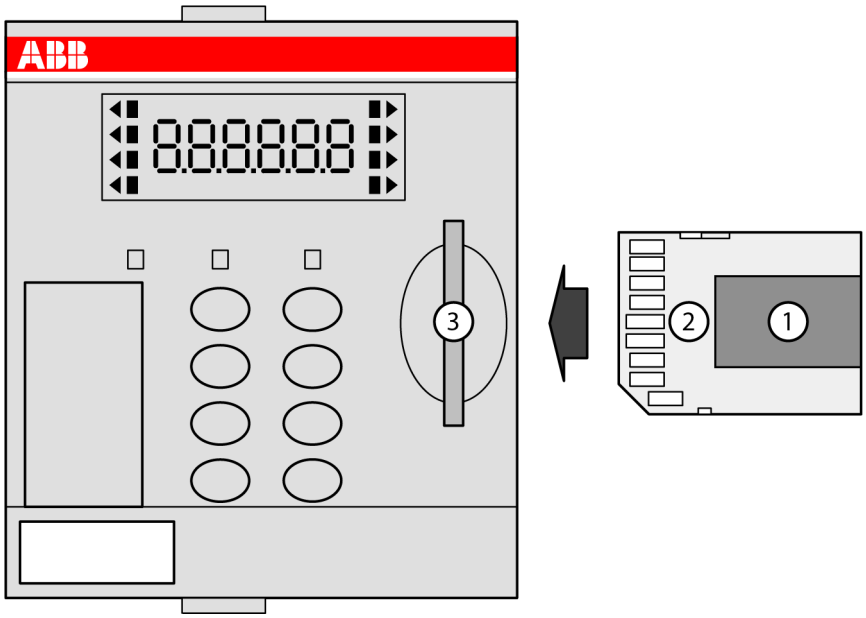


Fig. 8: Insertion: PM56xx

1 MC5102 micro memory card
2 Micro memory card adapter
Slot for memory card

Remove the micro memory card

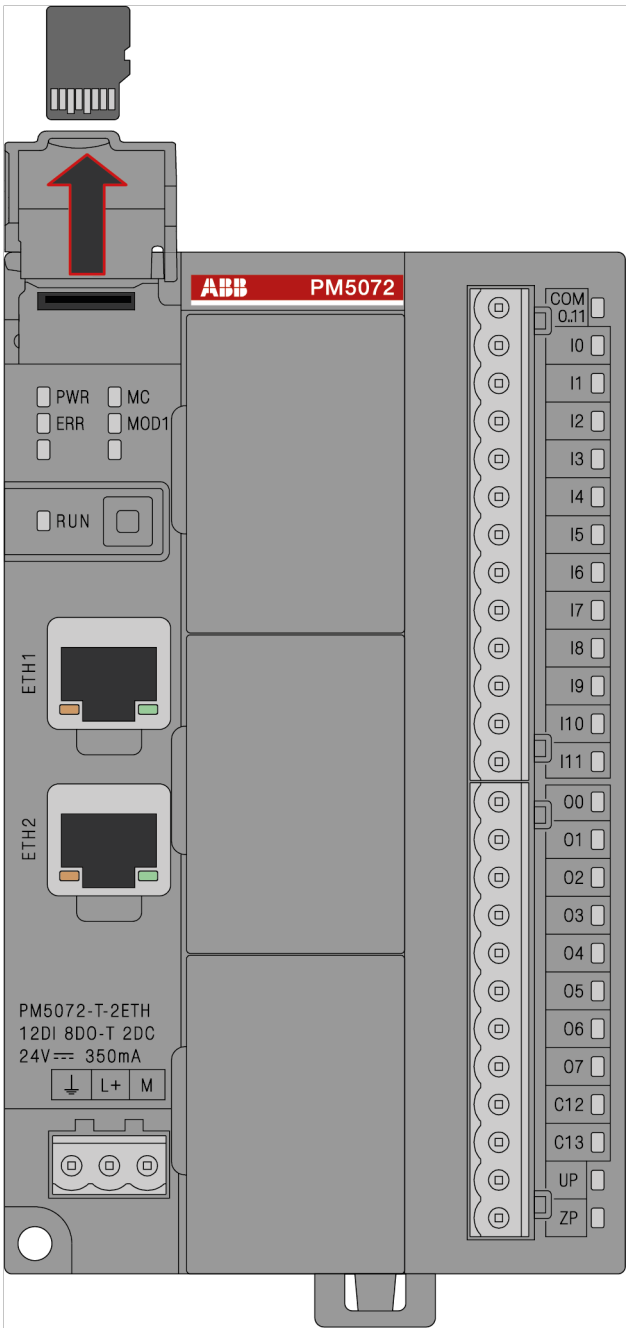
NOTICE!

Removal of the micro memory card

Do not remove the micro memory card during access. Remove only when the RUN LED does not blink. Otherwise the micro memory card and/or files on it might get corrupted and/or normal PLC operation might be disturbed.

AC500-eCo V3

To remove the micro memory card, push on the micro memory card until it moves forward. By this, the micro memory card is unlocked and can be removed.



AC500 V3

To remove the micro memory card adapter with the integrated micro memory card, push on the micro memory card adapter until it moves forward. By this, the micro memory card adapter is unlocked and can be removed.

Technical data

Parameter	Value
Memory capacity	Up to 8 GB, for exactly size see type plate
Temperature range	-20 °C...+85 °C
No. of writing cycles	On request
No. of reading cycles	On request
Data safety	On request
Write protect switch	Yes, at the edge of the micro memory card

Parameter	Value
Weight	0.25 g
Dimensions	15 mm x 11 mm x 0.7 mm

It is not possible to use 100 % of a device's memory space. About 10 % of the total available space must remain unused at any time to maintain normal device operation.

Further information on using the micro memory card in AC500 PLCs is provided in the chapter .

Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 180 100 R0002	MC5102, micro memory card with micro memory card adapter	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

For XC applications withAC500 V3 the MC5102 micro memory card is prohibited. Use the MC5141 memory card.

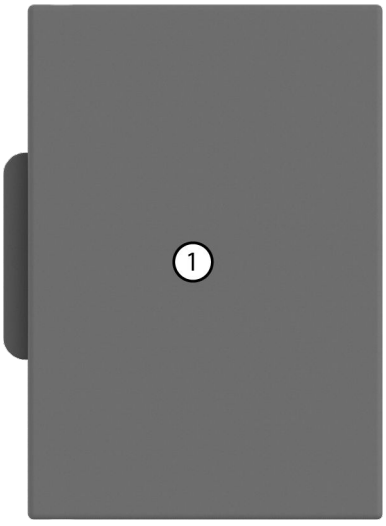
*For standard applications with AC500 V3 use the MC5102 micro memory card **with** micro memory card adapter for memory card slot.*

*For standard applications with AC500-eCo V3 use the MC5102 micro memory card **without** miro memory card adapter for micro memory card slot. All AC500-eCo V3 processor modules have a micro memory card slot.*

6.3.2 TA5300-CVR Option board cover for option slot

Intended purpose

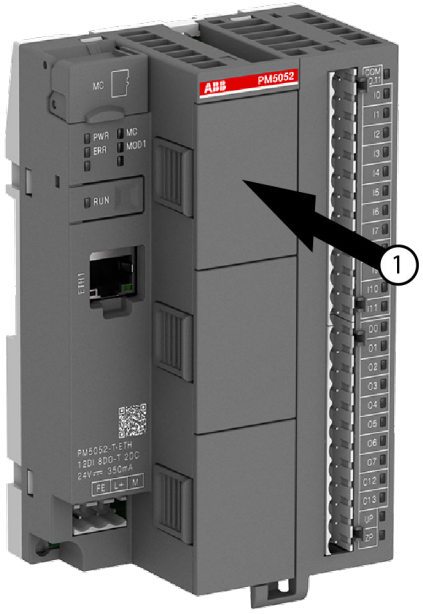
Option board covers for PM50xx processor modules are necessary to protect not used option slots.



1 TA5300-CVR Option board cover

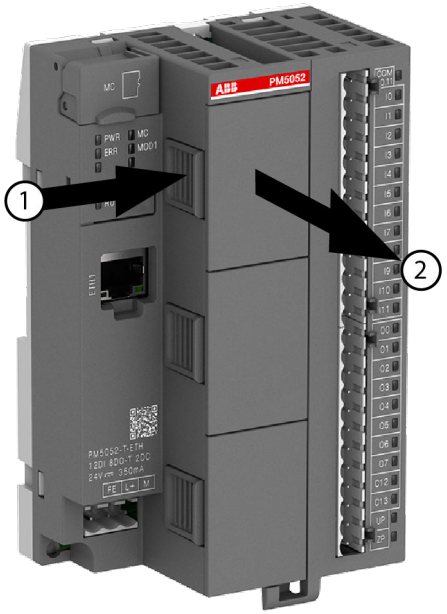
The AC500-eCo V3 are delivered with all slot covered with option board cover.
The cover have to be removed before inserting an option board.
The TA5300-CVR is intended only for spare parts

Inserting of the option board cover



1. Press on the option board cover to insert it in the not used option slot of the processor module PM50xx.
2. The option board cover must click into the not used option slot.

Removing of the option board cover



1. Press the side of the inserted option board cover.
2. At the same time, pull the optin board cover out of the option slot of the processor module PM50xx.

Technical data

Parameter	Value
Weight	On request
Dimensions	On request

Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 187 500 R0001	TA5300-CVR: option board cover, removable plastic part, 6 pieces per packing unit	Active

*) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.

6.3.3 Pluggable connectors for screw and spring connection

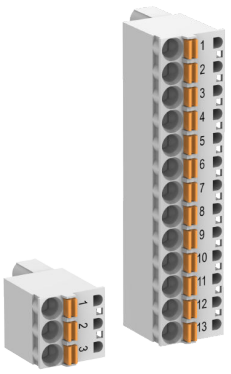
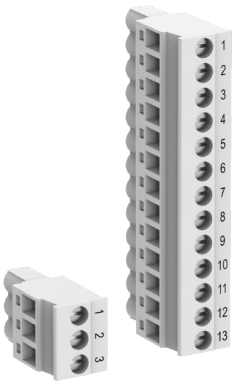
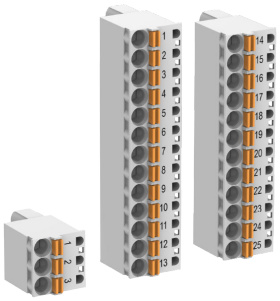
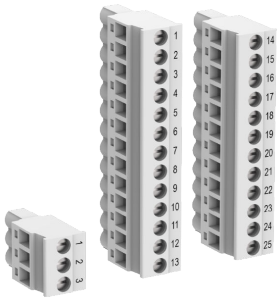
Intended purpose

Removable terminal blocks are used for power supply and for I/O connectors on AC500-eCo V3 processor modules.

For the AC500-eCo V3 **basic CPU** a 3-pin terminal block for power supply and a 13-pin terminal block for I/O connectors are used.

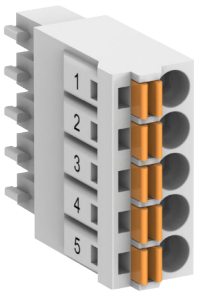
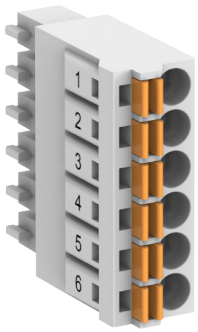
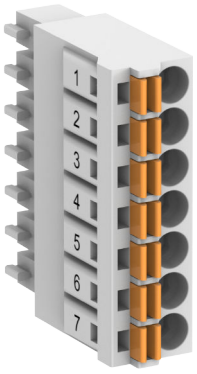
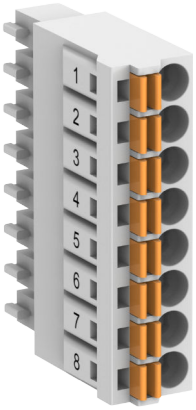
For the AC500-eCo V3 **standard and pro CPUs** a 3-pin terminal block for power supply, a 13-pin terminal block and a 12-pin terminal block for I/O connectors are used.

For all CPUs there is a screw type and a spring type version available.

Basic CPU		**Standard and pro CPUs**	
Spring type **TA5211-TSPF-B**	**Screw type** **TA5211-TSCL-B**	**Spring type** **TA5212-TSPF**	**Screw type** **TA5212-TSCL**
			

For option boards there are different removable terminal blocks in spring version available.

The following spare parts are available (depending on the number of pins).

Spring type			
TA5220-SPF5	**TA5220-SPF6**	**TA5220-SPF7**	**TA5220-SPF8**
			

Technical data

Table 26: Screw type terminal block for power supply

Parameter		**Value**
Type		
	TA5211-TSCL-B	Removable 3-pin terminal block:
	TA5212-TSCL	screw front/cable side 5.00 mm pitch
Usage		Power supply for AC500-eCo V3 processor modules

Parameter		Value
Conductor cross section		
	Solid	0.2 mm²...2.5 mm²
Stripped conductor end		7 mm
Fastening torque		0.5 Nm
Degree of protection		IP20
Dimensions		
	3-pin terminal block	On request
Weight		
	3-pin terminal block	On request

Table 27: Spring type terminal block for power supply

Parameter		Value
Type		
	TA5211-TSPF-B	Removable 3-pin terminal block:
	TA5212-TSPF	spring front/cable front 5.00 mm pitch
Usage		Power supply for AC500-eCo V3 processor modules
Conductor cross section		
	Solid	0.2 mm²...2.5 mm²
Stripped conductor end		11 mm
Degree of protection		IP20
Dimensions		
	3-pin terminal block	On request
Weight		
	3-pin terminal block	On request

Table 28: Screw type terminal block for onboard I/Os

Parameter		Value
Type		
	TA5211-TSCL-B	Removable 13-pin terminal block: screw front/cable side 5.00 mm pitch
	TA5212-TSCL	Removable 13-pin and 12-pin terminal block: screw front/cable side 5.00 mm pitch
Usage		Onboard I/Os for AC500-eCo V3 processor modules
Conductor cross section		
	Solid	0.2 mm²...2.5 mm²
Stripped conductor end		7 mm
Fastening torque		0.5 Nm
Degree of protection		IP20
Dimensions		

Parameter		Value
	13-pin terminal block	On request
	12-pin terminal block	On request
Weight		
	13-pin terminal block	On request
	12-pin terminal block	On request

Table 29: Spring type terminal block for onboard I/Os

Parameter		Value
Type		
	TA5211-TSPF-B	Removable 13-pin terminal block: spring front/cable front 5.00 mm pitch
	TA5212-TSPF	Removable 13-pin and 12-pin terminal block: spring front/cable front 5.00 mm pitch
Usage		Onboard I/Os for AC500-eCo V3 processor modules
Conductor cross section		
	Solid	0.2 mm^2...2.5 mm^2
Stripped conductor end		11 mm
Degree of protection		IP20
Dimensions		
	13-pin terminal block	On request
	12-pin terminal block	On request
Weight		
	13-pin terminal block	On request
	12-pin terminal block	On request

Table 30: Spring type terminal block for option boards

Parameter		Value
Type		
	TA5220-SPF5	Removable 5-pin terminal block: spring front, cable front 3.50 mm pitch
	TA5220-SPF6	Removable 6-pin terminal block: spring front, cable front 3.50 mm pitch
	TA5220-SPF7	Removable 7-pin terminal block: spring front, cable front 3.50 mm pitch
	TA5220-SPF8	Removable 8-pin terminal block: spring front, cable front 3.50 mm pitch
Usage		Connectors for AC500-eCo V3 option boards
Conductor cross section		
	Solid	0.2 mm^2...1.5 mm^2

Parameter		Value
Stripped conductor end		8 mm...10 mm
Degree of protection		IP20
Dimensions		
	5-pin terminal block	On request
	6-pin terminal block	On request
	7-pin terminal block	On request
	8-pin terminal block	On request
Weight		
	5-pin terminal block	On request
	6-pin terminal block	On request
	7-pin terminal block	On request
	8-pin terminal block	On request

Ordering data

Part no.	Description
1SAP 187 400 R0001	TA5211-TSCL-B: screw terminal block set for AC500-eCo V3 CPU Basic screw front, cable side 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors
1SAP 187 400 R0002	TA5211-TSPF-B: spring terminal block set for AC500-eCo V3 CPU Basic spring front, cable front 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors
1SAP 187 400 R0004	TA5212-TSCL: screw terminal block set for AC500-eCo V3 Standard and Pro CPU screw front, cable side 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors ● 1 removable 12-pin terminal block for I/O connectors
1SAP 187 400 R0005	TA5212-TSPF: spring terminal block set for AC500-eCo V3 Standard and Pro CPU spring front, cable front 5.00 mm pitch ● 1 removable 3-pin terminal block for power supply ● 1 removable 13-pin terminal block for I/O connectors ● 1 removable 12-pin terminal block for I/O connectors
Spare parts	
1SAP 187 400 R0012	TA5220-SPF5: spring terminal block, removable, 5-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0013	TA5220-SPF6: spring terminal block, removable, 6-pin, spring front, cable front, 6 pieces per packing unit

Part no.	Description
1SAP 187 400 R0014	TA5220-SPF7: spring terminal block, removable, 7-pin, spring front, cable front, 6 pieces per packing unit
1SAP 187 400 R0015	TA5220-SPF8: spring terminal block, removable, 8-pin, spring front, cable front, 6 pieces per packing unit

6.4 System data AC500-eCo V3

6.4.1 Environmental conditions

Table 31: Process and supply voltage

Parameter		Value
Voltage		24 V (-15 %, +20 %)
Protection against reverse polarity		Yes
Allowed interruptions of power supply, according to EN 61131-2		
	DC supply	Interruption < 10 ms, time between 2 interruptions > 1 s, PS2

NOTICE!
Exceeding the maximum power supply voltage (> 30 VDC) for process or supply voltages could lead to unrecoverable damage of the system. The system could be destroyed.

Parameter			Value			
			PM5012	PM5032	PM5052	PM5072
Temperature						
	Operating					
		Horizontal mounting				
			Standard temperature range	0 °C...+55 °C	0 °C...+60 °C	
			Wide temperature range	-		-20 °C...+70 °C
		Vertical mounting (output load reduced to 50 % per group)				
			Standard temperature range	0 °C...+40 °C		
			Wide temperature range	-		-20 °C...+40 °C
	Storage		-40 °C...+70 °C			
	Transport		-40 °C...+70 °C			
Humidity			Max. 95 %, without condensation			
Air pressure						
	Operating		> 800 hPa / < 2000 m			
	Storage		> 660 hPa / < 3500 m			

6.4.2 Creepage distances and clearances

The creepage distances and clearances meet the requirements of the overvoltage category II, pollution degree 2.

6.4.3 Insulation test voltages, routine test

According to EN 61131-2

Parameter	Value	
Relay circuit against other circuitry	1350 V	AC 2 s or
	1900 V	DC 2 s
24 V circuits against other circuitry	350 V	AC 2 s or
	500 V	DC 2s
COM interfaces, electrically isolated	350 V	AC 2 s or
	500 V	DC 2s
Ethernet	350 V	AC 2 s or
	500 V	DC 2s

6.4.4 Power supply units

For the supply of the modules, power supply units according to PELV specifications must be used.

6.4.5 Electromagnetic compatibility

Electromagnetic Compatibility		
Device suitable for:		
	Industrial applications	Yes
	Domestic applications	No
Immunity against electrostatic discharge (ESD):		According to IEC 61000-4-2, zone B, criterion A
	Electrostatic voltage in case of air discharge	8 kV
	Electrostatic voltage in case of contact discharge	6 kV
	ESD with communication connectors	In order to prevent operating malfunctions, it is recommended, that the operating personnel discharge themselves prior to touching communication connectors or perform other suitable measures to reduce effects of electrostatic discharges.
Immunity against the influence of radiated (CW radiated):		According to IEC 61000-4-3, zone B, criterion A
	Test field strength	10 V/m

Electromagnetic Compatibility		
Immunity against transient interference voltages (burst):		According to IEC 61000-4-4, zone B, criterion B
	Supply voltage units (DC)	2 kV
	Digital inputs/outputs (24 VDC)	1 kV
	Digital inputs/outputs (120 VAC...240 VAC)	Relay 2 kV
	Ethernet	1 kV
Immunity against the influence of line-conducted interferences (CW conducted):		According to IEC 61000-4-6, zone B, criterion A
	Test voltage	20 V pass A
	High energy surges	According to IEC 61000-4-5, zone B, criterion B
	Power supply DC	1 kV CM / 0.5 kV DM [1])
	DC I/O supply	1 kV CM / 0.5 kV DM [1])
	Buses, shielded	ETH
	AC I/O unshielded [2])	1 kV DM [1])
	I/O analog, I/O DC unshielded [2])	1 kV CM [1])
	Radiation (radio disturbance)	According to IEC 55011, group 1, class A

[1]) CM = Common Mode, DM = Differential Mode

[2]) When DC I/O inputs are used with AC voltage, external filters limiting high energy surges to 1 kV CM / 0.5 DM are required to meet requirements according IEC 61131-2.

6.4.6 Mechanical data

Parameter	**Value**
Mounting	Horizontal
Degree of protection	IP 20 (if all terminal screws are tightened)
Housing	Classification V0 according to UL 94
Vibration resistance acc. to EN 61131-2	all three axes (DIN rail mounting) 5 Hz...8.4 Hz, continuous 3.5 mm 8.4 Hz...150 Hz, continuous 1 g
Shock test	All three axes 15 g, 11 ms, half-sinusoidal
Mounting of the modules:	
DIN rail according to DIN EN 50022	35 mm, depth 7.5 mm or 15 mm
Mounting with screws	Screws with a diameter of 4 mm
Fastening torque	1.2 Nm

6.4.7 Approvals and certifications

Information on approvals and certificates can be found in the corresponding chapter of the *Main catalog, PLC Automation*.

6.5 Installation

6.5.1 Mechanical dimensions

6.5.1.1 Switchgear cabinet assembly

Information on EMC-conforming assembly and construction is provided within the overall functions section.

PLC enclosure

NOTICE!

PLC damage due to wrong enclosures

Due to their construction (degree of protection IP 20 according to EN 60529) and their connection technology, the devices are suitable only for operation in enclosed switchgear cabinets.

To protect PLCs against:

- unauthorized access,
- dusting and pollution,
- moisture and wetness and
- mechanical damage,

switchgear cabinet IP54 for common dry factory floor environment is suitable.

Maintain spacing from:

- enclosure walls
- wireways
- adjacent equipment

Allow a minimum of 20 mm clearance on all sides. This provides ventilation and electrical isolation.

It is recommended to mount the modules on an earthed mounting plate, or an earthed DIN rail, independent of the mounting location.

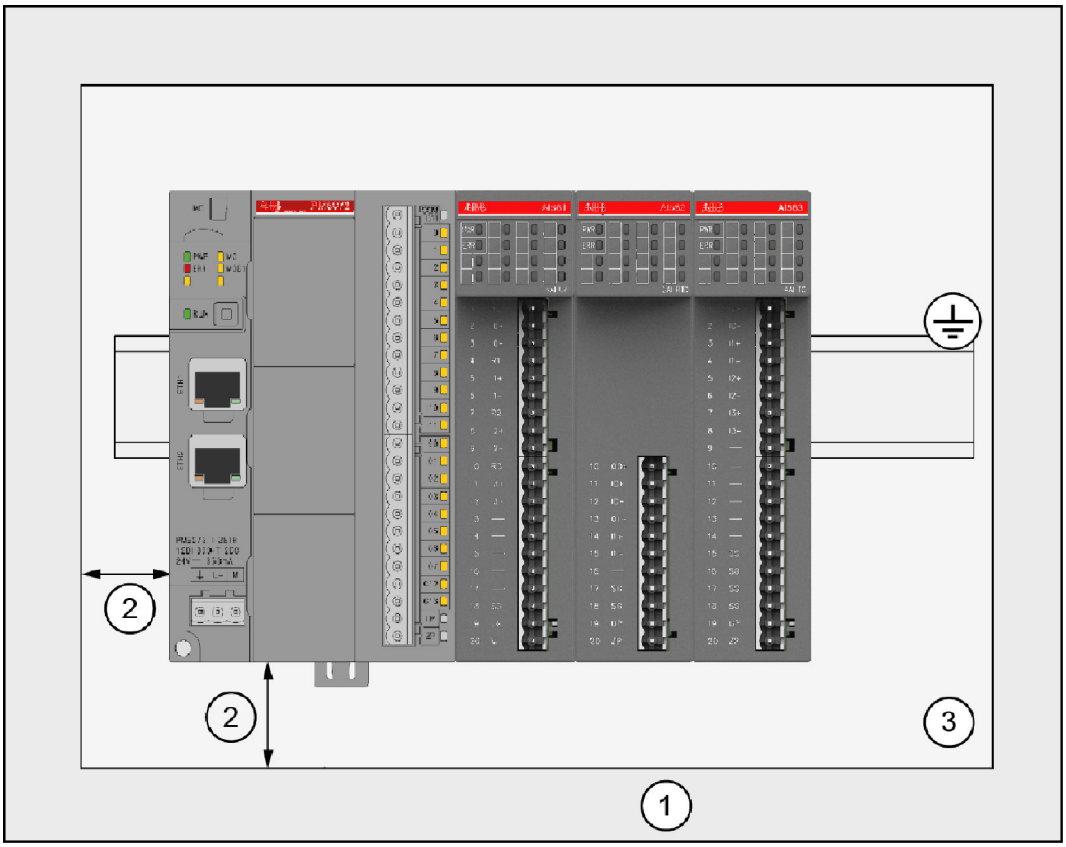


Fig. 9: Installation of AC500-eCo V3 CPU/S500 modules in a switch-gear cabinet

1 Cable duct
2 Distance from cable duct ≥20 mm
3 Mounting plate, earthed

NOTICE!

Horizontal mounting is highly recommended.

Vertical mounting is possible, however, derating consideration should be made to avoid problems with poor air circulation and overheating.

By vertical mounting, always place an end-stop terminal block (e.g. type BADL, P/N: 1SNA399903R0200) on the bottom and on the top of the modules to properly secure the modules.

By high vibration applications and horizontal mounting, we also recommend to place end-stop terminals at the right and left side of the device to properly secure the modules, e.g. type BADL, P/N: 1SNA399903R0200.

6.5.1.2 Mechanical dimensions AC500-eCo V3

All mechanical dimensions are given in millimeters and inches. The value in brackets is the inch-value.

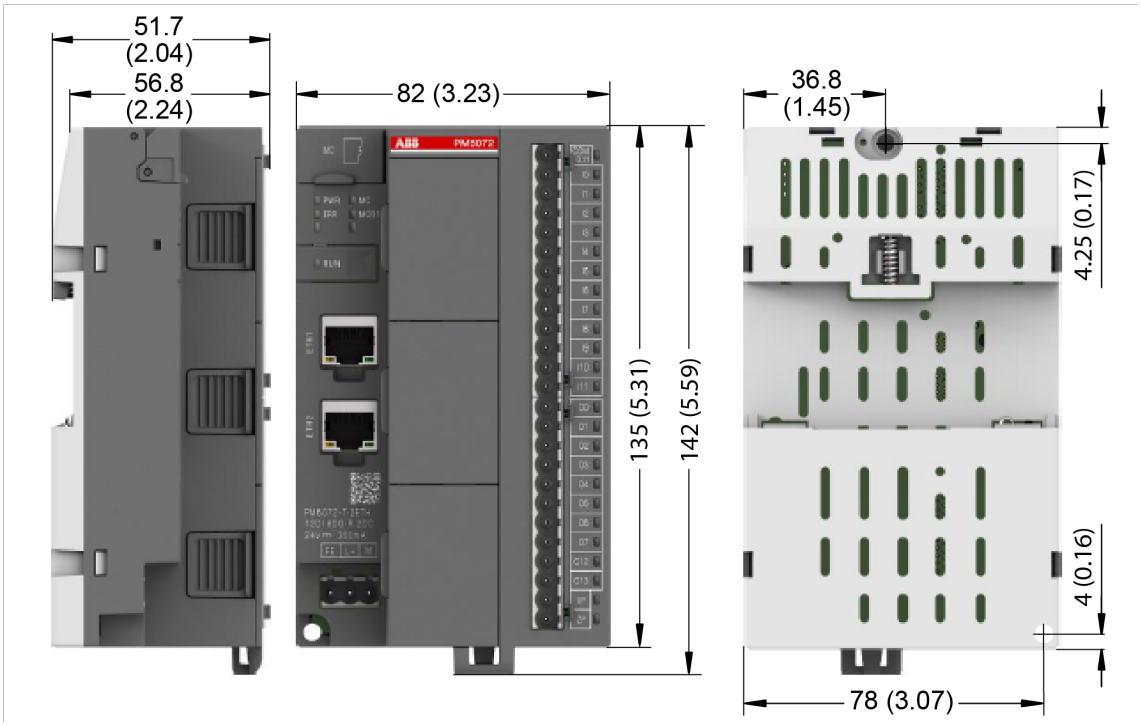


Fig. 10: Side, front and back view

6.5.1.3 Mechanical dimensions S500-eCo

> *All mechanical dimensions are given in millimeters and inches. The value in brackets is the inch-value.*

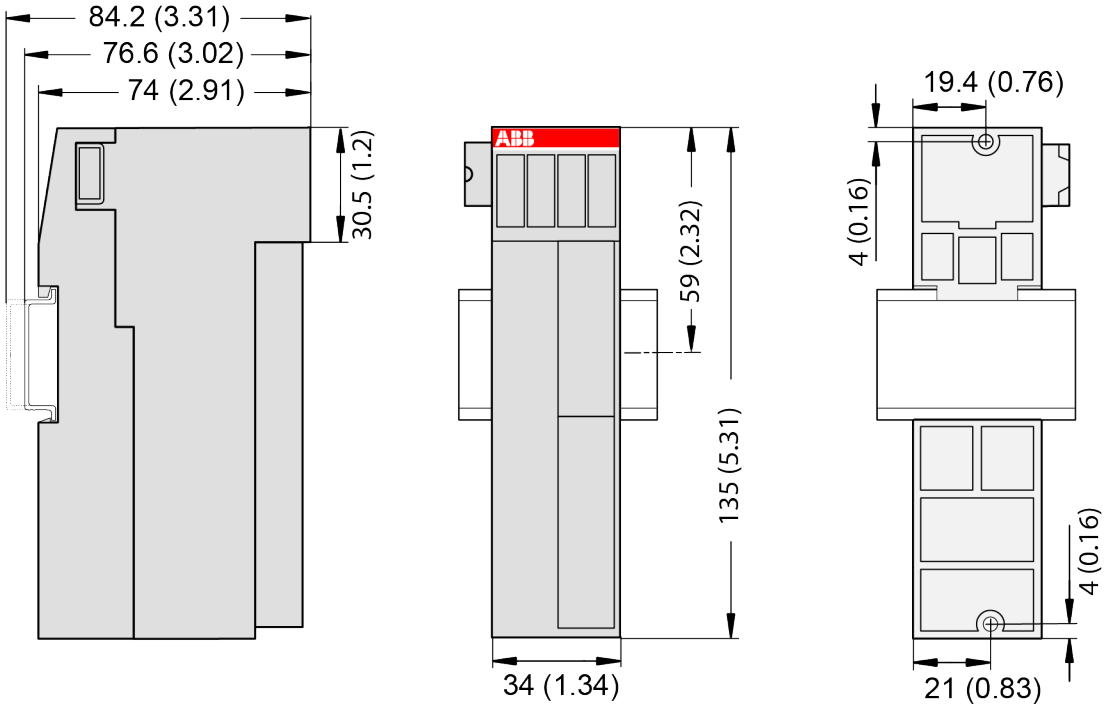


Fig. 11: Side, front and back view

6.5.2 Mounting and demounting

The control system is designed to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded.

During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the controller. Debris that falls into the controller could cause damage while the controller is energized.

All devices are grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate stell DIN rail to assure proper grounding. The use of other DIN rail materials (e.g. aluminium, plastic, etc.) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding.

6.5.2.1 Mounting and demounting of S500-eCo I/O modules

S500-eCo I/O-modules can be mounted either on a DIN rail or with screws on a metal plate.

Mounting I/O modules on a DIN rail

NOTICE!

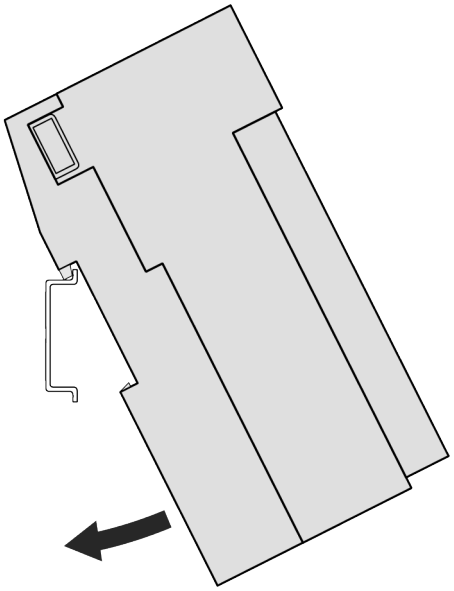
Risk of function faults!

The S500-eCo I/O modules are earthed via the DIN rail.

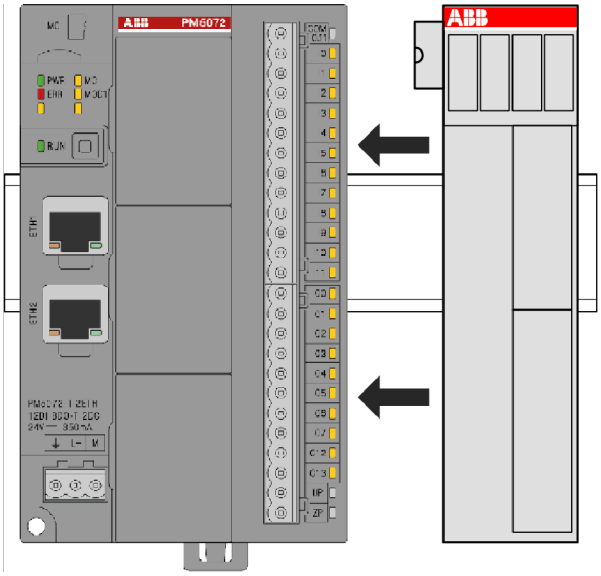
The DIN rail must be included into the earthing concept of the plant.

Use only metal screws.

1. Mount I/O module at the top of the DIN rail, then snap it in below.

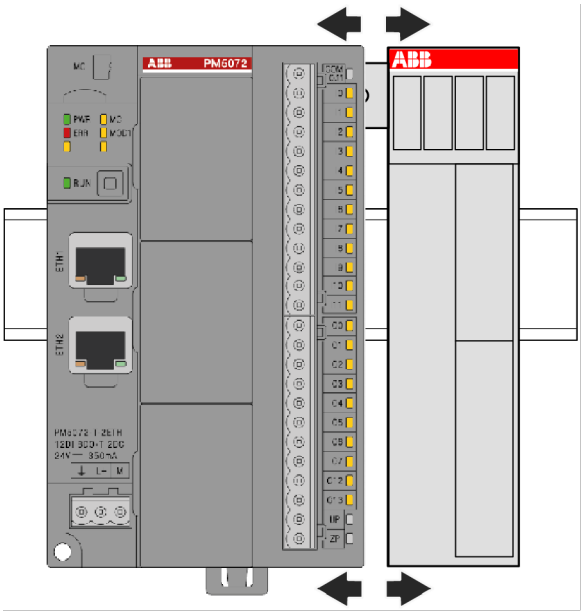


2. Attach I/O module by hand to an other module. The serial I/O bus is connected automatically.

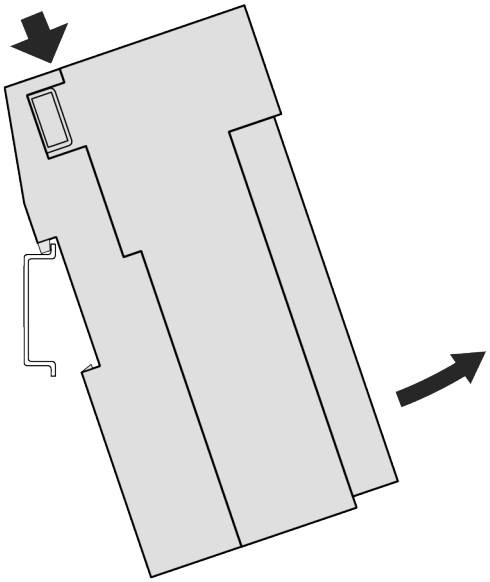


Demounting I/O modules mounted on a DIN rail

1. Remove I/O module by hand if connected.



2. While pressing down I/O module pull it away from DIN rail.

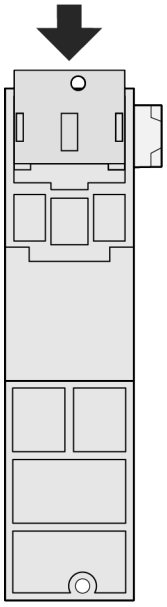


Mounting I/O modules on a metal plate

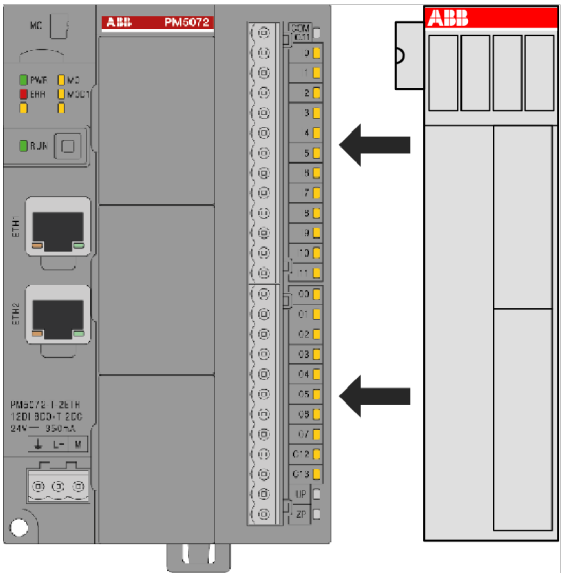
NOTICE!
Risk of function faults!
Missing electrical contact by isolating screws or washers!
Use metal screws on the metal plate.
The metal plate must be included into the earthing concept of the plant.
Do NOT use isolating washers!

One TA566 wall mounting accessory Chapter 6.5.4.2 “ TA566 - Wall mounting accessory” on page 168 is needed per S500-eCo I/O module.

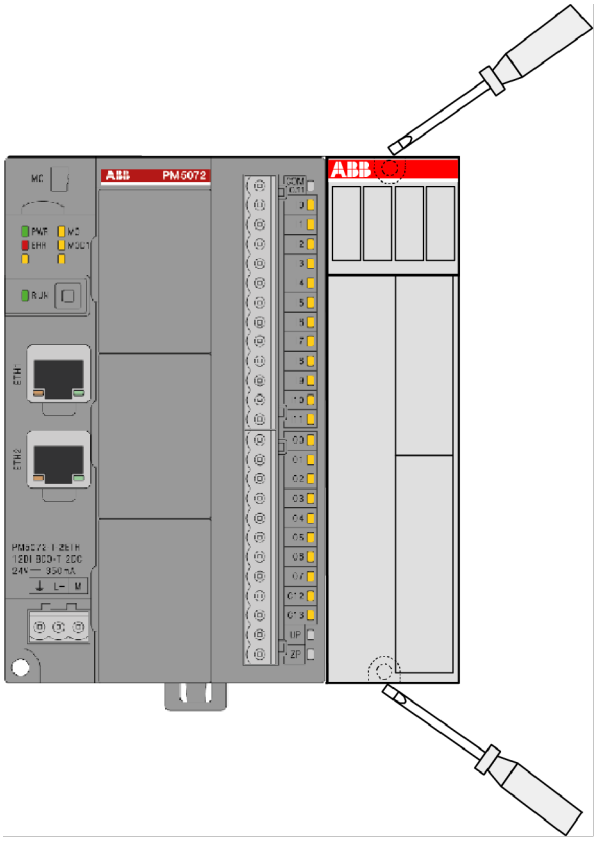
1. Snap in the TA566 at the back side of the I/O module.



2. Attach the I/O module by hand to an other module. The serial I/O bus is connected automatically.

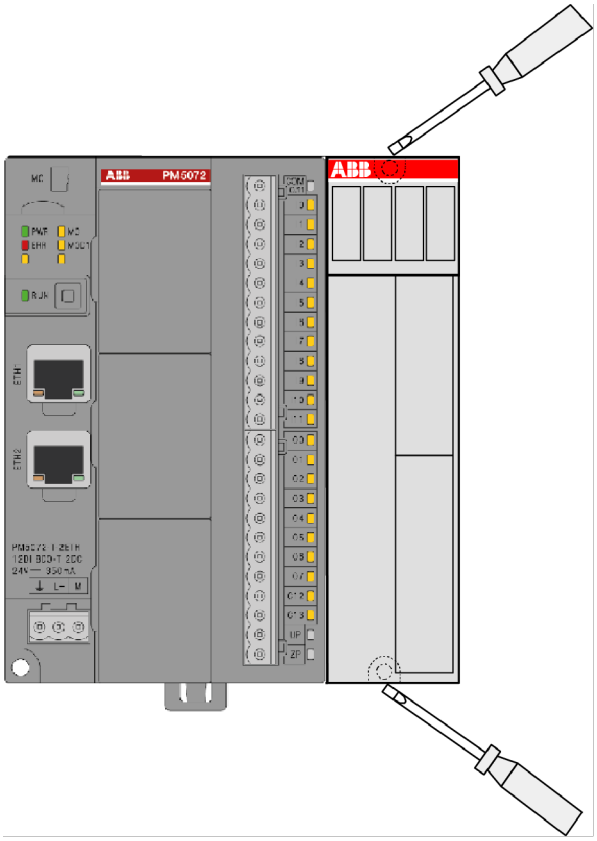


3. Fasten the I/O module with two screws (max. diameter: 4 mm) to the metal plate.

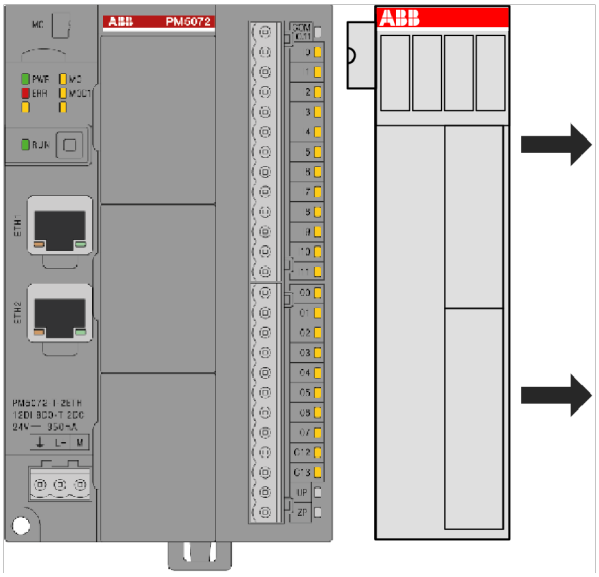


Demounting I/O modules mounted on a metal plate

1. Remove the 2 screws.



2. Remove the I/O module from the connected module by hand.



6.5.3 Connection and wiring

For detailed information such as technical data of your mounted devices (AC500 product family) refer to the hardware device specification of the appropriate device.

NOTICE!

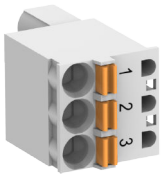
Attention:

All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 VDC.

6.5.3.1 Power supply

The processor modules PM50xx can be connected to the 24 VDC supply voltage via a removable 3-pin spring terminal block or a 3-pin screw terminal block.

Table 32: Removable terminal block for the supply voltage 24 VDC

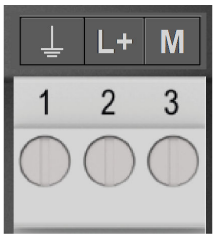
3-pin spring terminal block	3-pin screw terminal block
	

The terminal block is available as a set for AC500-eCo V3 processor modules.

Basic CPU		**Standard and pro CPUs**	
Spring type	**Screw type**	**Spring type**	**Screw type**
TA5211-TSPF-B	TA5211-TSCL-B	TA5212-TSPF	TA5212-TSCL

Further information on the terminal blocks concerning power supply and onboard inputs/outputs are provided under *Chapter 6.3.3 “Pluggable connectors for screw and spring connection” on page 149*.

Pin assignment

Pin Assignment	Pin	Label	Function	Description
 Terminal block inserted	1	⏚	FE	Functional earth
	2	L+	+24 VDC	Positive pin of the power supply voltage
	3	M	0 V	Negative pin of the power supply voltage

Faulty wiring on power supply terminals

CAUTION!

Risk of damaging the AC500-eCo V3 processor module and the connected modules!

Voltages > 30 VDC might damage the processor module and the connected modules.

Make sure that the supply voltage never exceeds 30 VDC.

CAUTION!

Risk of damaging the AC500-eCo V3 processor module!

Excess currents at 24 VDC output (24 VDC processor module variant) will damage the processor module.

Use an appropriate fuse *"General data" on page 98* within 24 VDC input connection.

6.5.3.2 Processor module interfaces

I/O bus

The I/O bus is not available for PM5012-T-ETH and PM5012-R-ETH. I/O channel extension using option board slot only.

The I/O bus is the I/O data bus for the I/O modules. Through this bus, I/O and diagnosis data are transferred between the processor module and the I/O modules. Up to 10 I/O modules for PM5032-x-ETH (but with a limit of 128kB input/ 128KB output variables) and 10 I/O modules for PM5052-x-ETH and PM5072-T-2ETH can be added.

Option slots interface

Depending on the processor module variants, additional option board can be connected to the option slot to extend the feature of the processor module.

Serial interface

RS232 communication interface is available by using option board:

- TA5141-RS232I (isolated)
  Chapter 6.2.4 "TA5141-RS232I - RS-232 serial adapter isolated option board" on page 125

RS485 communication interface is available by using option boards:

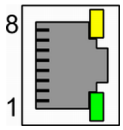
- TA5142-RS485I (isolated)
  Chapter 6.2.5 "TA5142-RS485I - RS-485 serial adapter isolated option board" on page 128
- TA5142-RS485 (non isolated)
  Chapter 6.2.6 "TA5142-RS485 - RS-485 serial adapter non isolated option board" on page 134

6.5.3.2.1 Ethernet

Ethernet is also used for Modbus TCP connection.

Ethernet interface

The Ethernet interface is carried out via a RJ45 jack. The pin assignment of the Ethernet interface:

Interface	Pin	Description	
	1	Tx+	Transmit Data +
	2	Tx-	Transmit Data -
	3	Rx+	Receive Data +
	4	NC	Not connected
	5	NC	Not connected
	6	Rx-	Receive Data -
	7	NC	Not connected
	8	NC	Not connected
	Shield	Cable shield	Functional earth

6.5.3.2.2 Modbus RTU connection details

6.5.4 Handling of accessories

This section only describes accessories that are frequently used for system assembly, connection and construction. A description of all additional accessories that can be used to supplement AC500 system can be found in the Hardware PLC device description.

6.5.4.1 TA543 - Wall mounting accessory

Intended Purpose

The TA543 screw mounting accessory is used for mounting the processor module PM50xx without DIN rail.

Handling Instruction

TA543 must be snapped on the backside of PM50xx .

Technical Data

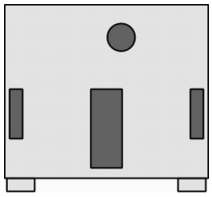
Parameter	Value
Weight	5 g
Dimensions	12 mm x 8.5 mm x 10 mm

Ordering Data

Part no.	Description	Product life cycle phase *)
1SAP 182 800 R0001	TA543, screw mounting accessory for PM595	Active

*) For planning and commissioning of new installations use modules in Active status only.

6.5.4.2 TA566 - Wall mounting accessory



Intended purpose

The TA566 wall mounting accessory is used for mounting S500-eCo I/O modules without DIN rail.

Handling instruction

The TA566 is snapped into the back side of the device's housing *“Mounting I/O modules on a metal plate” on page 162*.

Technical data

Parameter	Value
Weight	5 g
Dimensions	29 mm x 28 mm x 5 mm

Ordering data

Part no.	Description	Product life cycle phase *)
1TNE 968 901 R3107	TA566, wall mounting accessory, 100 pieces	Active

*) For planning and commissioning of new installations use modules in Active status only.

7 Software handling and programming

In this manual you will find information about motion application with AC500-eCo V3 ↳ *Chapter 8 “Simple motion” on page 170*.

All further software related information, like handling of and configuration in engineering suite Automation Builder, system behavior, programming with an IEC 61131-3 editor, other function block libraries and diagnosis are not part of this document. It can be found in the *complete documentation for AC500-eCo V3* on our website. For an easy access to the complete documentation refer to chapters *“About this document ➔ Documentation structure”* and *“About this document ➔ Your tasks - documentation from the user's point of view”*.

8 Simple motion

8.1 Introduction

The AC500-eCo V3 PLC provide several HW and SW features allowing to realize some motion application.

Specific fast onboard I/O and dedicated SW library function blocks (simple motion) are available and can manage up to 2x Axis on the CPU.

The simple Motion capability is based on a library for the onboard I/O and some motion control blocks allowing point-to-point or velocity control.

All the AC500-eCo V3 PLC from Basic, Standard or Pro type offer dedicated feature according to their performance classes.

	Basic		**Standard**		**Pro**
	PM5012-x-ETH		**PM5032-x-ETH / PM5052-x-ETH**		**PM5072-T-2ETH**
	Relay outputs	**Transistor outputs**	**Relay outputs**	**Transistor outputs**	**Transistor outputs**
HSC - High-speed counter	Up to 2 (5 kHz)		Up to 4 (100 kHz)		
Frequency measurement	Up to 2 (5 kHz)		Up to 2 (200 kHz)		
A / B Encoder	1 A/B simple encoder (5 kHz) with sync/reset		Up to 2 A/B encoder 200 kHz with sync/reset inputs		
Interrupt inputs	Up to 4		Up to 4		
PTO - pulse-train output	-		1 Pulse/ Direction or CW/CCW both mode with 200 kHz	Up to 2 Pulse/Direction or CW/CCW both mode with 200 kHz	
				Up to 4 Pulse/Direction with 100 kHz using fast Output channels for Pulse and standard outputs for direction on SW motion function bloc	
PWM - pulse-width modulation	-	Up to 4 (100 Hz)	Up to 2 (30 kHz)	Up to 4 (30 kHz)	
Limit switches	-		Up to 2	Up to 8	

8.2 Hardware components for motion control

8.2.1 Basic CPU – PM5012-R-ETH and PM5012-T-ETH

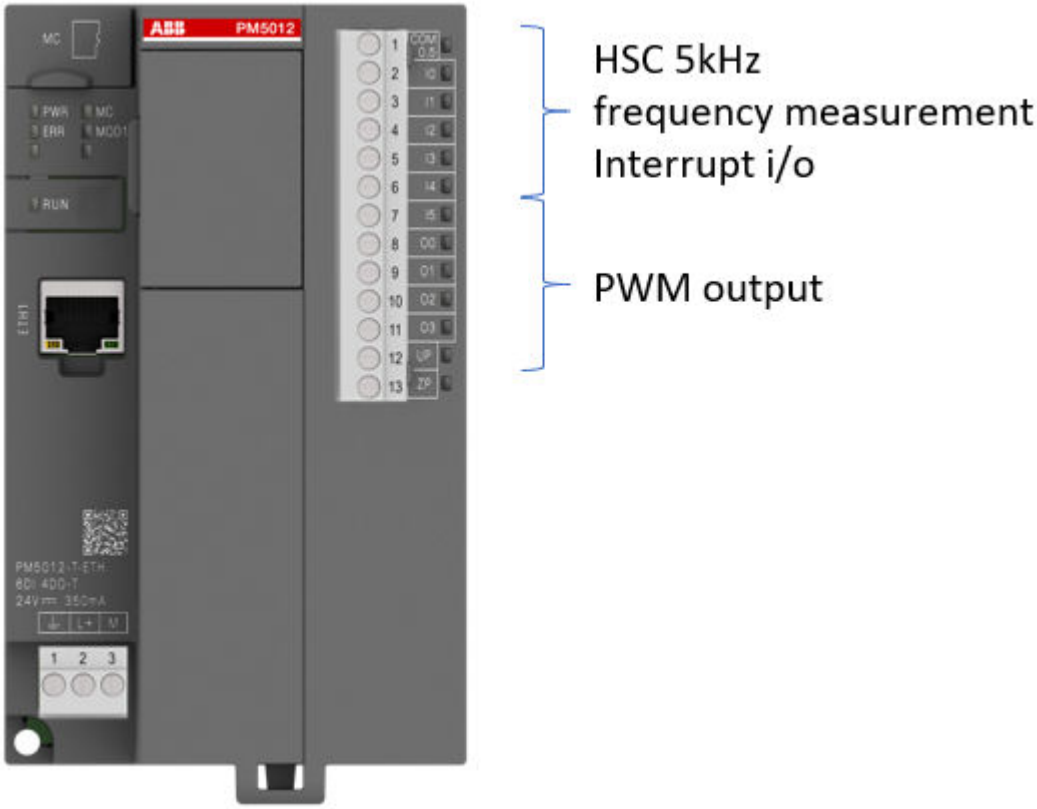


Fig. 12: Example: PM5012-T-ETH

8.2.2 Standard and Pro CPU - PM5032-x-ETH / PM5052-x-ETH / PM5072-T-2ETH

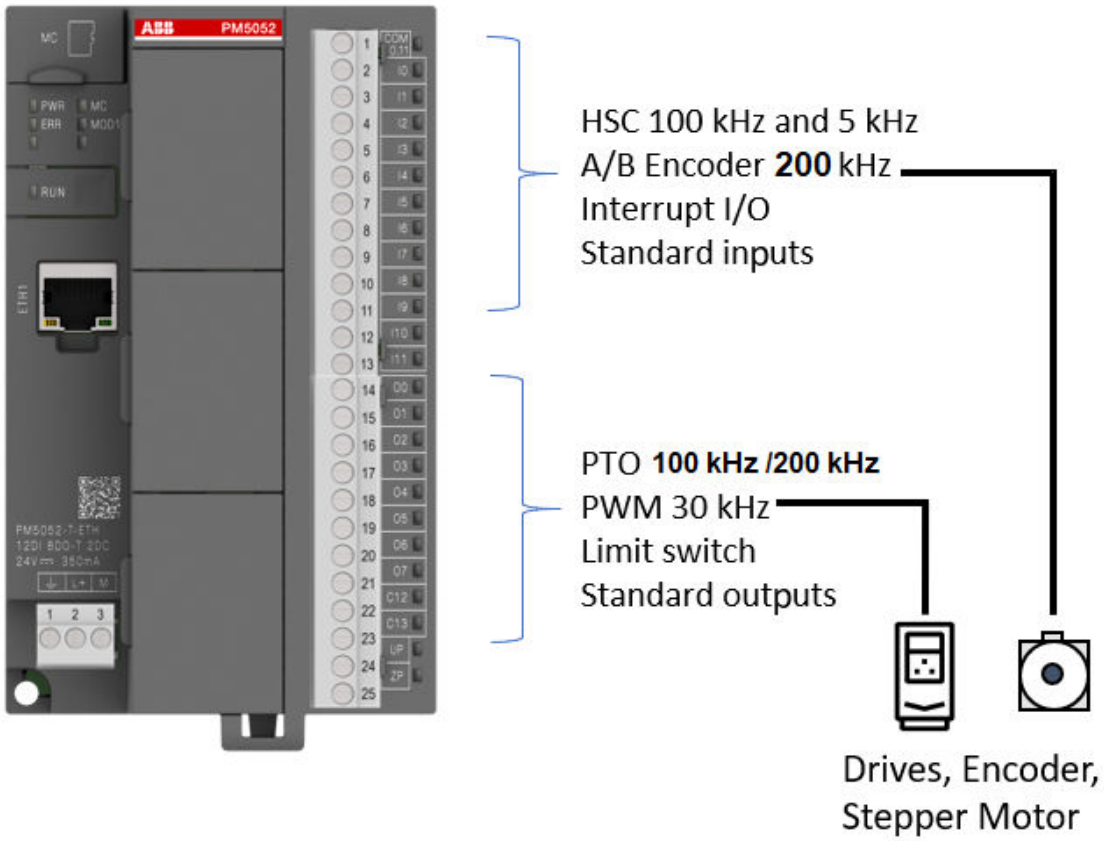


Fig. 13: Example: PM5052-T-ETH

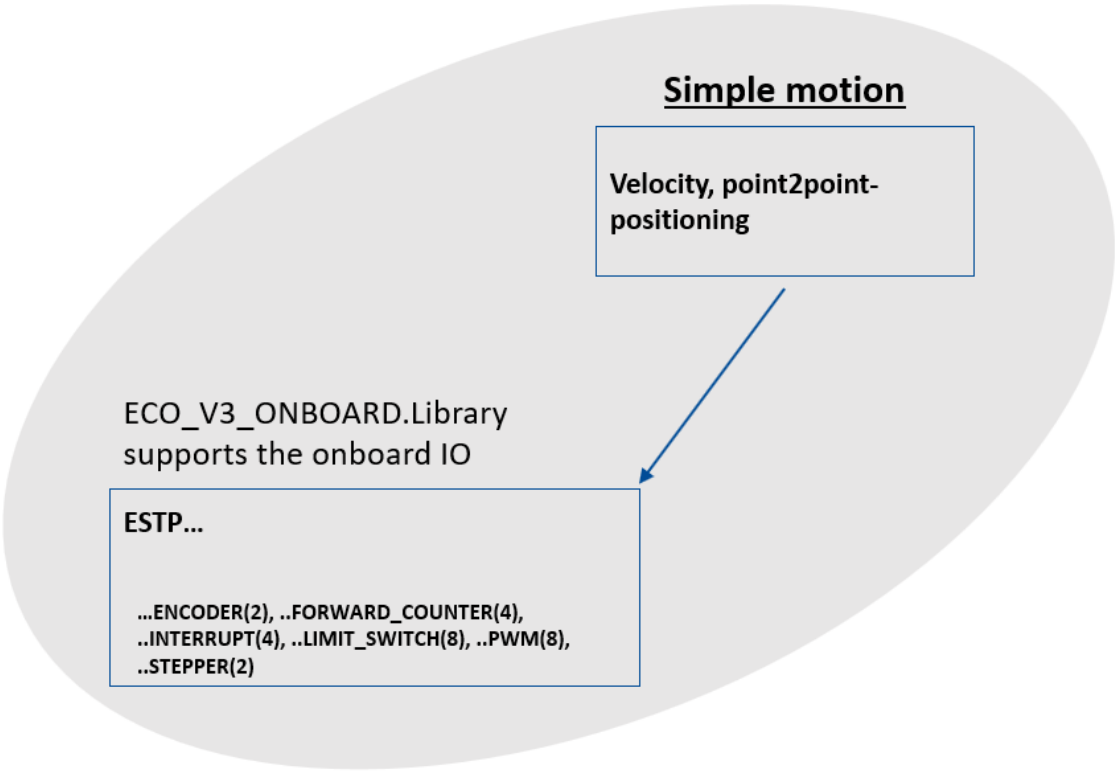
For PLC with relay outputs, the input features are identical.

The digital configurable inputs/outputs can be used for PTO/PWM functions.

8.3 System technology

The following chapters describe the system technology of the AC500-eCo V3 using motion examples.

The simple motion set of function blocks is standard part of the system libraries for AC500-eCo V3.



8.3.1 Use the onboard I/Os as encoder with A and B signals

8.3.1.1 Parameter configuration

The onboard I/O accept encoder signal A and B. When configure the encoder track A, the encoder track B will be automatically inserted.

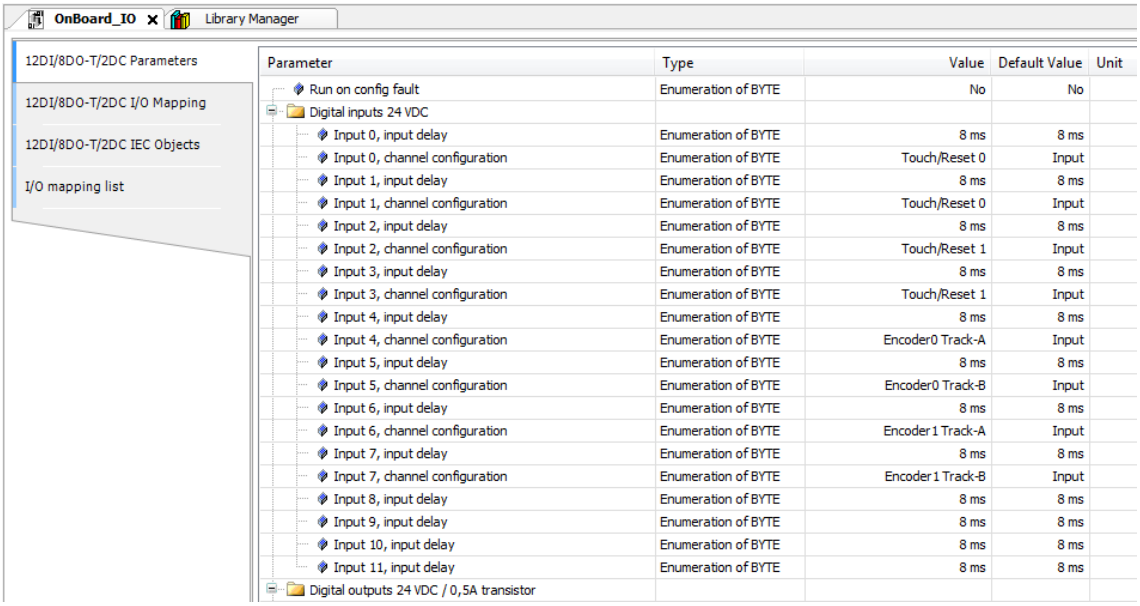
The user can configure the following input channel as encoder input.

- *"Encoder 0 Track – A"*: Input channel 4
- *"Encoder 0 Track – B"*: Input channel 5
- *"Encoder 1 Track – A"*: Input channel 6
- *"Encoder 1 Track – B"*: Input channel 7

After configuring the encoder input channel, the user can configure the touch/reset for the respective encoder channel.

See also the following chapter: .

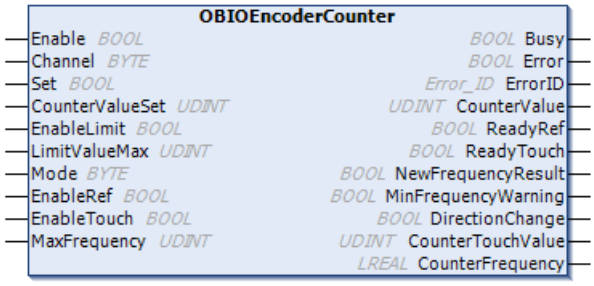
E.g. PM50x2-T-xETH with 2x A/B encoders with Touch/Reset on I0..I3



Parameter	Type	Value	Default Value	Unit
Run on config fault	Enumeration of BYTE	No	No	
Digital inputs 24 VDC				
Input 0, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 0, channel configuration	Enumeration of BYTE	Touch/Reset 0	Input	
Input 1, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 1, channel configuration	Enumeration of BYTE	Touch/Reset 0	Input	
Input 2, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 2, channel configuration	Enumeration of BYTE	Touch/Reset 1	Input	
Input 3, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 3, channel configuration	Enumeration of BYTE	Touch/Reset 1	Input	
Input 4, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 4, channel configuration	Enumeration of BYTE	Encoder0 Track-A	Input	
Input 5, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 5, channel configuration	Enumeration of BYTE	Encoder0 Track-B	Input	
Input 6, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 6, channel configuration	Enumeration of BYTE	Encoder1 Track-A	Input	
Input 7, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 7, channel configuration	Enumeration of BYTE	Encoder1 Track-B	Input	
Input 8, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 9, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 10, input delay	Enumeration of BYTE	8 ms	8 ms	
Input 11, input delay	Enumeration of BYTE	8 ms	8 ms	
Digital outputs 24 VDC / 0,5A transistor				

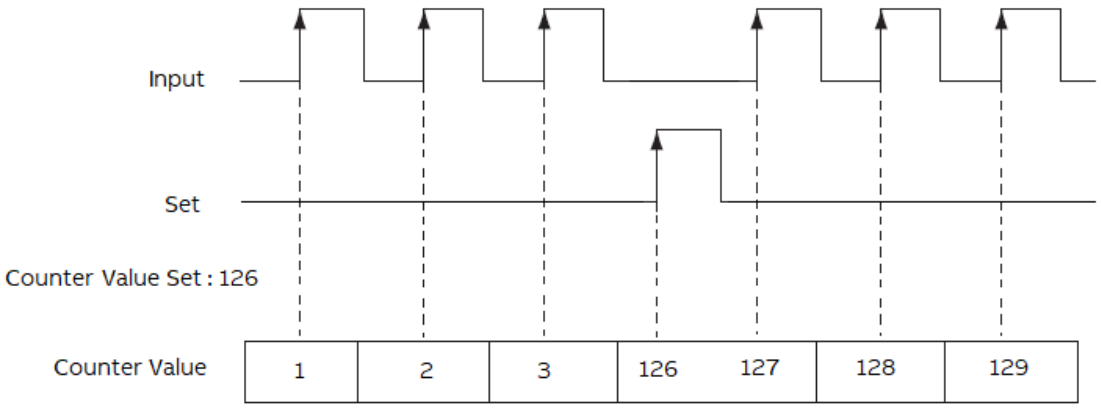
8.3.1.2 Function block

OBIOEncoder Counter



If *"Enable"* is TRUE, the *"OBIOEncoderCounter"* instruction increments the counter by one base on the input.

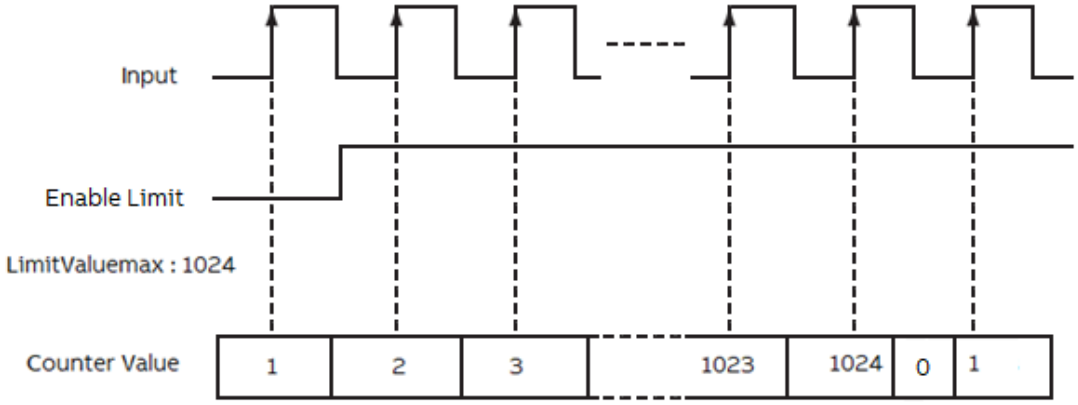
If *"Set"* bit is TRUE, the *"OBIOEncoderCounter"* instruction moves the *"CounterValueSet"* to the *"CounterValue"*.



If *"Enable"* is TRUE, the *"OBIOEncoderCounter"* instruction increments the counter by one based on the input.

If *"EnableLimit"* bit is TRUE, the accumulated value continues incrementing.

After *"CounterValue"* reaches the *"LimitValueMax"*, the *"OBIOEncoderCounter"* instruction writes 0 to the *"CounterValue"*.



"Encoder Counter Mode": 0 = *"90° Mode"*.

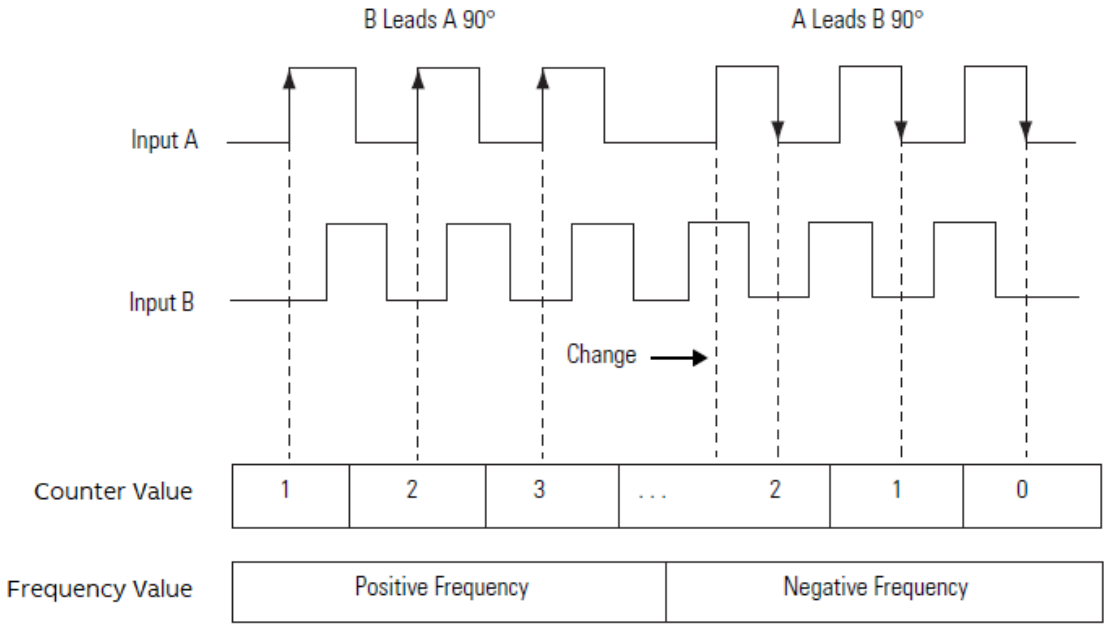
In this encoder counter mode, an increasing count results when input B is 90° ahead of input A.

The count is initiated on the rising edge of input A, and the direction of the encoder is clockwise (positive).

The module produces a decreasing count when input A is 90° ahead of Input B.

The count is initiated on the falling edge of input A, and the direction is counterclockwise (negative).

By monitoring both the number of pulses and the phase relationships of input A and B, you can accurately determine the position and direction of the rotation.



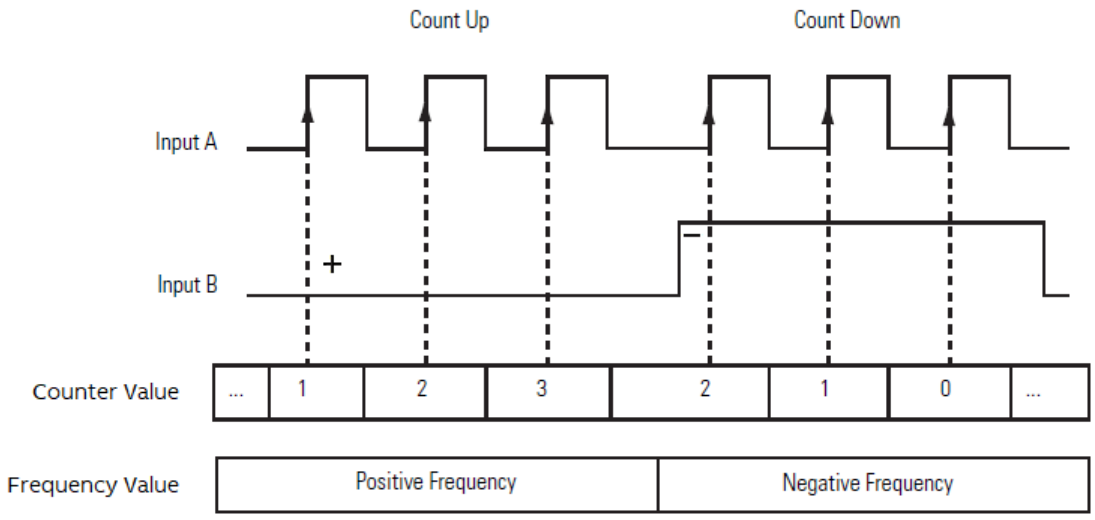
"Encoder Counter Mode": 1 = *"Pulse/Direction"*.

In this encoder counter mode, the count increases or decreases based on the state of input B, which can be a random signal.

If input B is high, the counter will count down.

If input B is low the counter counts up.

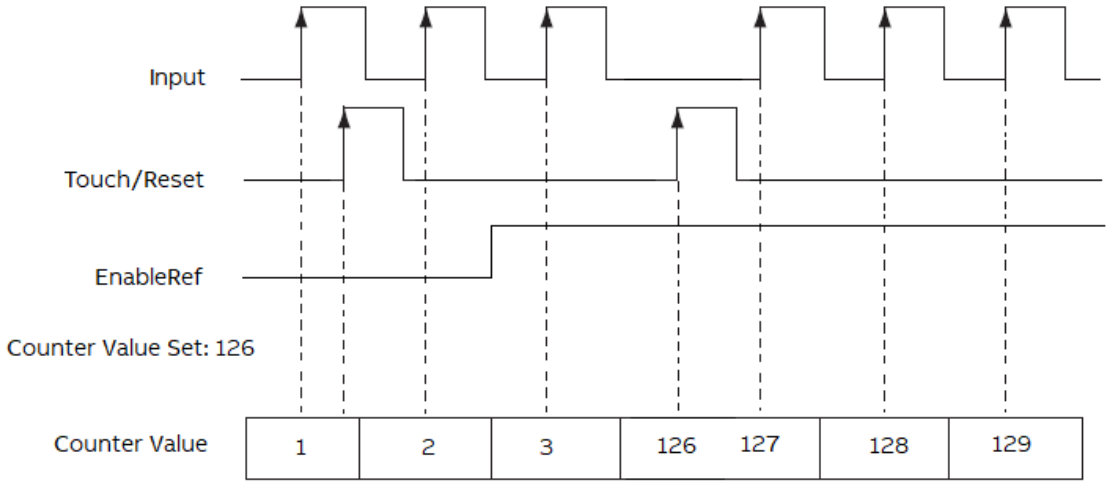
Counting is done on the leading edge of input A.



If *"Enable"* is TRUE, the *"OBIOEncoderCounter"* instruction increments the counter by one based on the input.

If *"EnableRef"* bit is TRUE, the *"OBIOEncoderCounter"* instruction is ready to receive the touch/reset input.

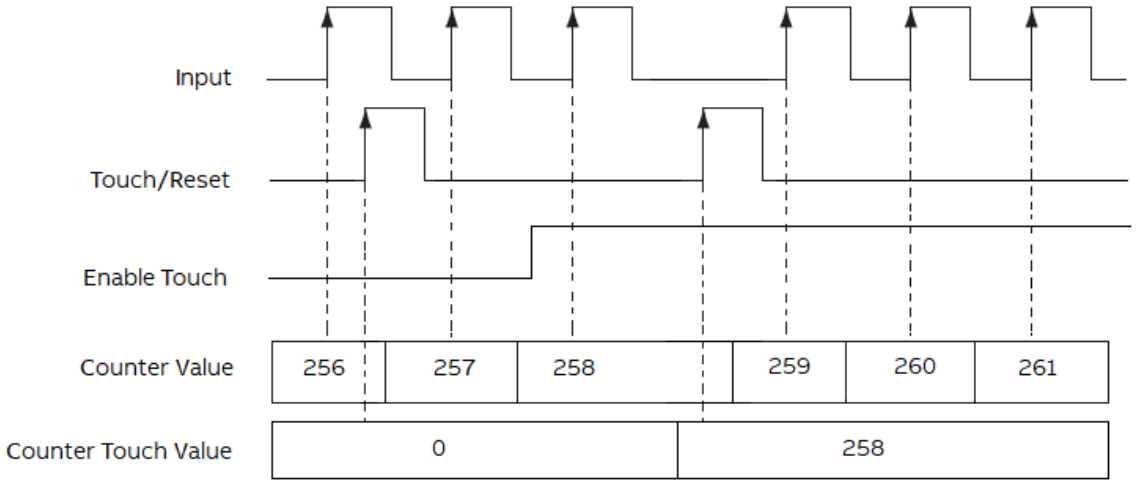
If the *"Touch/Reset"* input is TRUE, the current *"CounterValue"* will be replaced by the *"CounterValueSet"*.



If *"Enable"* is TRUE, the *"OBIOEncoderCounter"* instruction increments the counter by one based on the input.

If *"EnableTouch"* bit is TRUE, the *"OBIOEncoderCounter"* instruction is ready to receive the *"Touch/Reset"* input.

If the *"Touch/Reset"* input is TRUE, the current *"CounterValue"* will be captured and written to the *"CounterTouchValue"*.



8.3.2 Use the onboard I/Os as forward counter

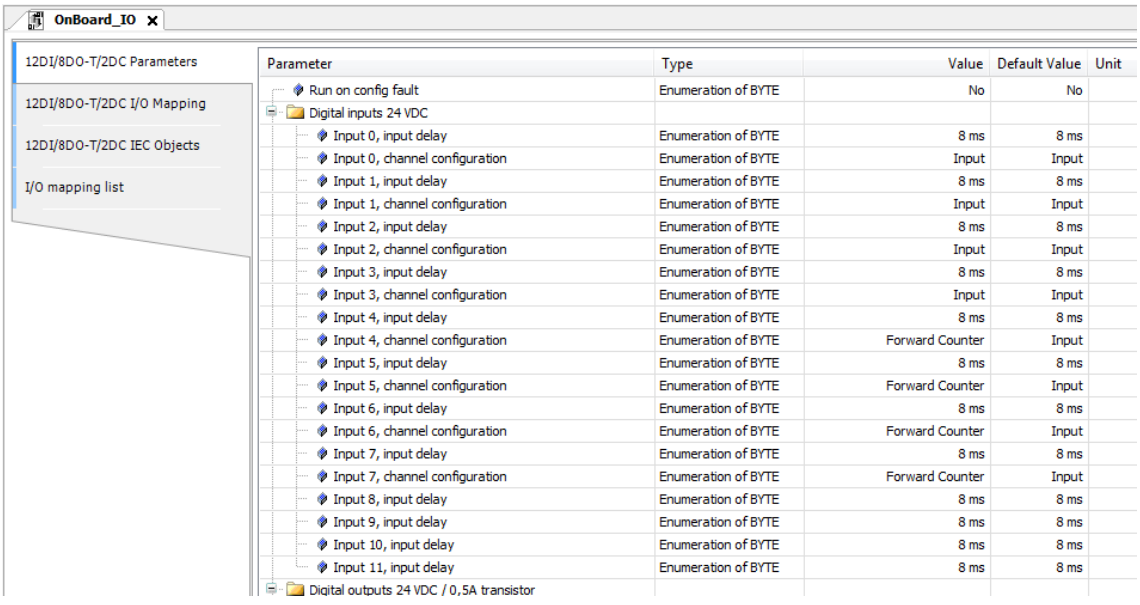
8.3.2.1 Parameter configuration

The Onboard I/O accept pulse input as forward counter.

User can configure the following input channel as forward counter.

- *"Forward Counter 0"*: Input channel 4
- *"Forward Counter 1"*: Input channel 5
- *"Forward Counter 2"*: Input channel 6
- *"Forward Counter 3"*: Input channel 7

E.g. PM50x2-x-xETH with forward counter on fast inputs I4…I7



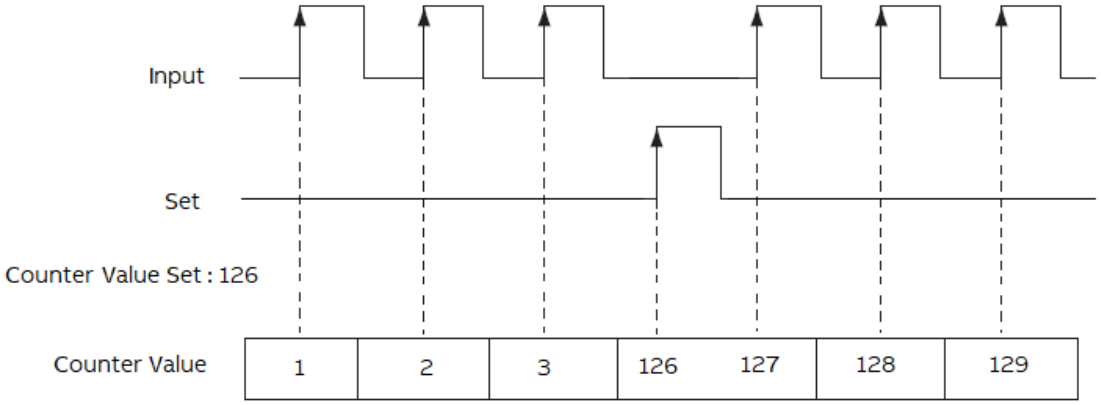
See also the following chapter:

8.3.2.2 Function block

OBIOForward Counter

If *"Enable"* is TRUE, the *"OBIOForwardCounter"* instruction increments the counter by one based on the input.

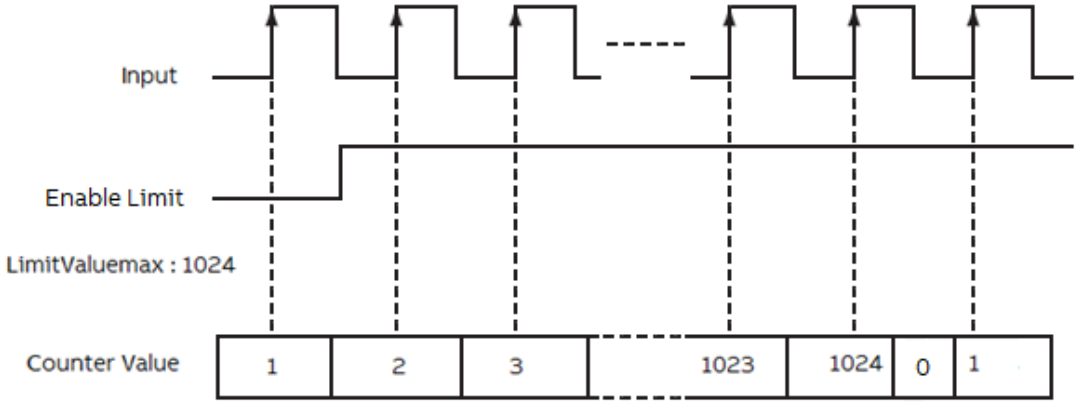
If *"Set"* bit is TRUE, the *"OBIOForwardCounter"* instruction moves the *"CounterSetValue"* to the *"CounterValue"*.



If *"Enable"* is TRUE, the *"OBIOForwardCounter"* instruction increments the counter by one based on the input.

If *"EnableLimit"* bit is TRUE, the accumulated value continues incrementing.

After *"CounterValue"* reaches the *"LimitValueMax"*, the *"OBIOForwardCounter"* instruction writes 0 to the *"CounterValue"*.



8.3.3 Use the onboard I/Os as interrupt input with dedicated interrupt task

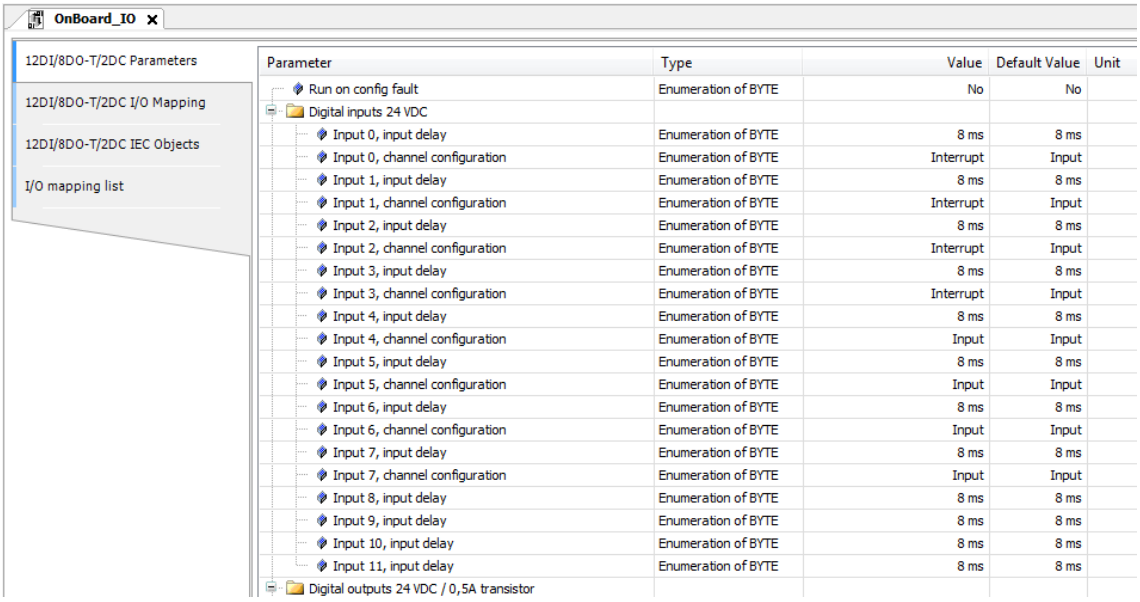
8.3.3.1 Parameter configuration

The onboard I/O input can be configured as interrupt input to trigger the interrupt task.

The user can configure the following input channel as interrupt input.

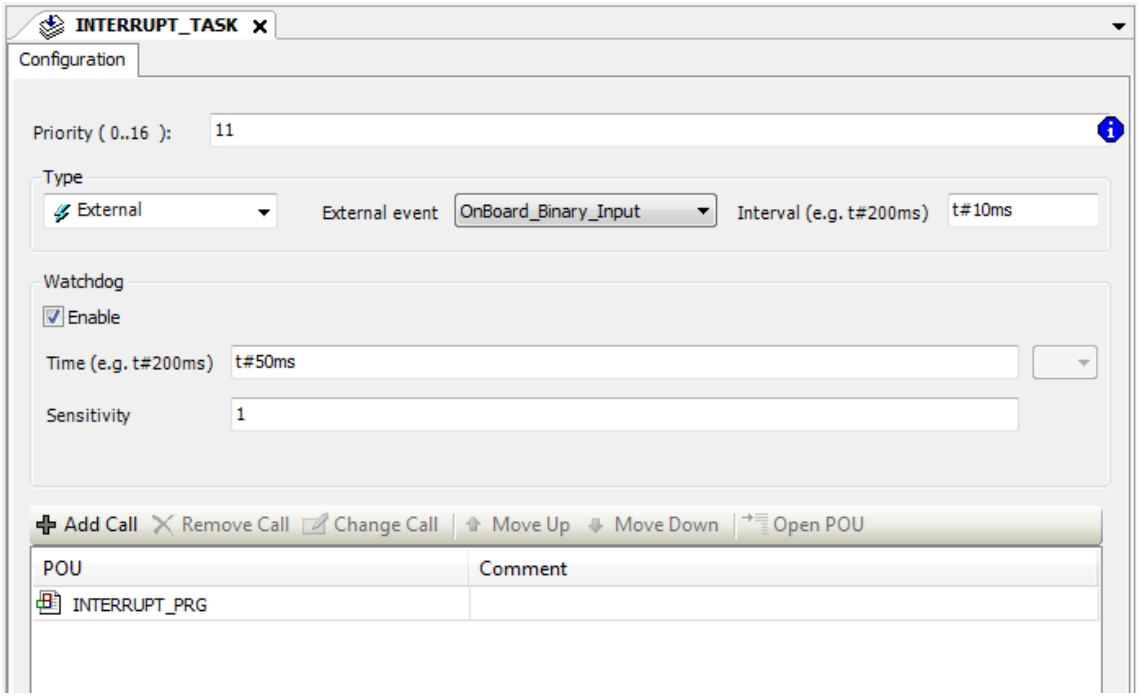
- Interrupt input 0 : Input Channel 0
- Interrupt input 1 : Input Channel 1
- Interrupt input 2 : Input Channel 2
- Interrupt input 3 : Input Channel 3

E.g. PM50x2-x-xETH with interrupt inputs on digital inputs I0…I3

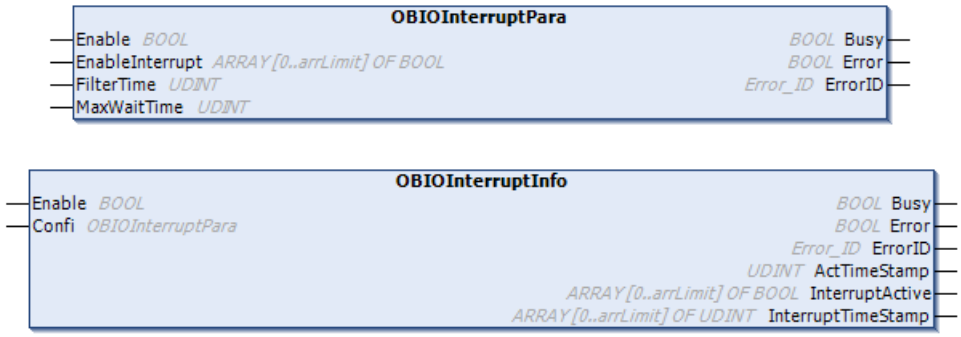


See also the following chapter:

After configuring the parameter, the user need to create a new task with the *“Type”* set to *“External”* and the *“External event”* set to *“OnBoard_Binary_Input”*.



8.3.3.2 Function block



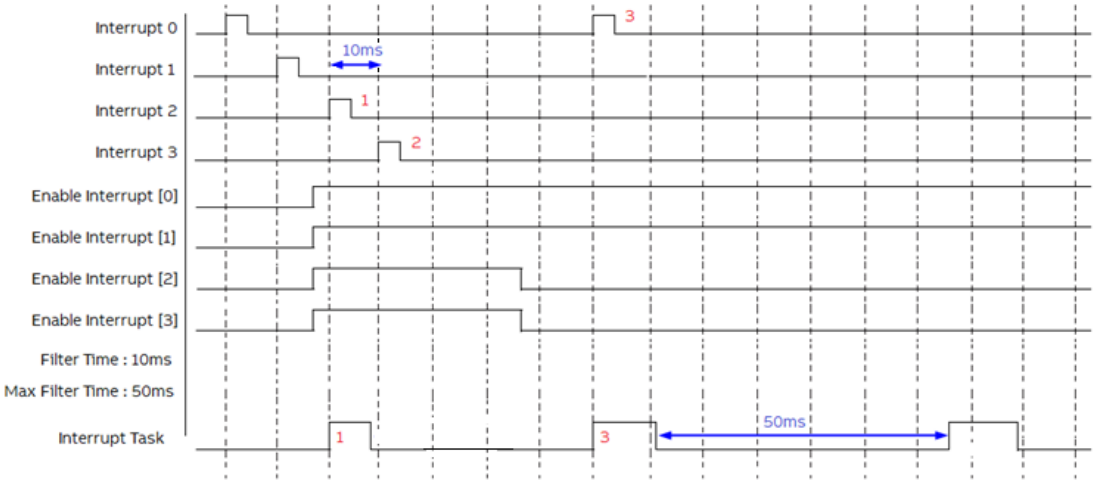
The *"OBIOInterruptPara"* instruction is configured for 4 interrupt inputs.

if *"EnableInterrupt"* bit is TRUE, the *"OBIOInterruptInfo"* instruction is ready to receive the interrupt input.

If the interrupt input is TRUE, the interrupt task will be executed.

If the second interrupt is TRUE with the interval less than 10 ms (as set), the execution of the interrupt task will be ignored.

If no interrupt occurred in 50 ms (as set), the interrupt task is executed automatically.

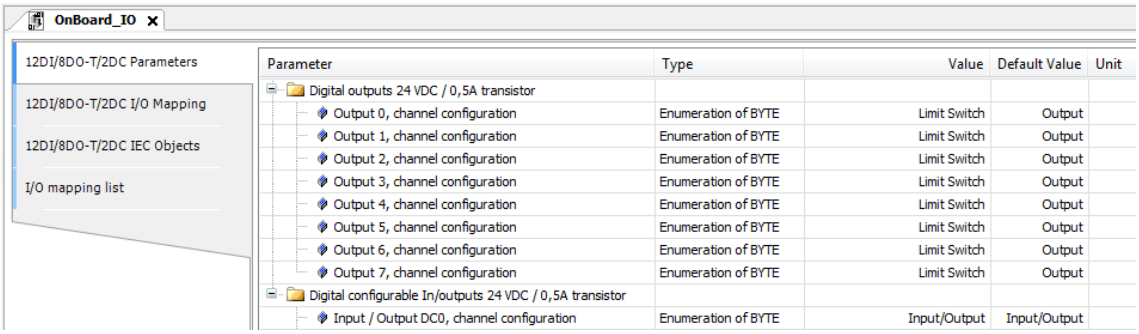


8.3.4 Use the onboard I/Os as output limit switch

8.3.4.1 Parameter configuration

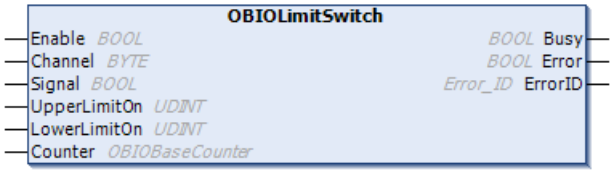
Thje user can configure the following output channel as limit switch.

- *"LimitSwitch 0"*: Output channel 0
- *"LimitSwitch 1"*: Output channel 1
- *"LimitSwitch 2"*: Output channel 2
- *"LimitSwitch 3"*: Output channel 3
- *"LimitSwitch 4"*: Output channel 4
- *"LimitSwitch 5"*: Output channel 5
- *"LimitSwitch 6"*: Output channel 6
- *"LimitSwitch 7"*: Output channel 7

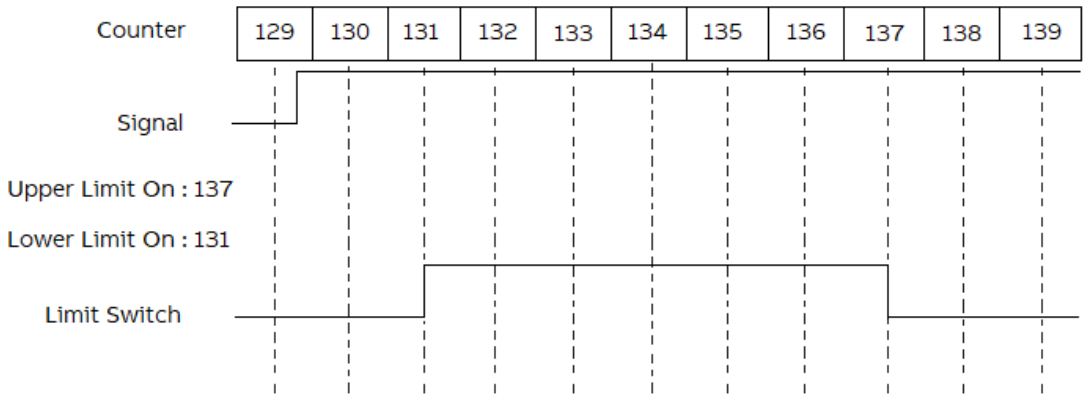


See also the following chapter:

8.3.4.2 Function block



If the counter value reaches the *"LowerLimitOn"* preset, it will write to the LimitSwitch output based on the signal until the *"UpperLimitOn"* preset is reached.



8.3.5 Use the onboard I/Os as PTO (pulse-train output) with 100 kHz frequency (max. 2 PTO using PTO HW channels)

8.3.5.1 Parameter configuration

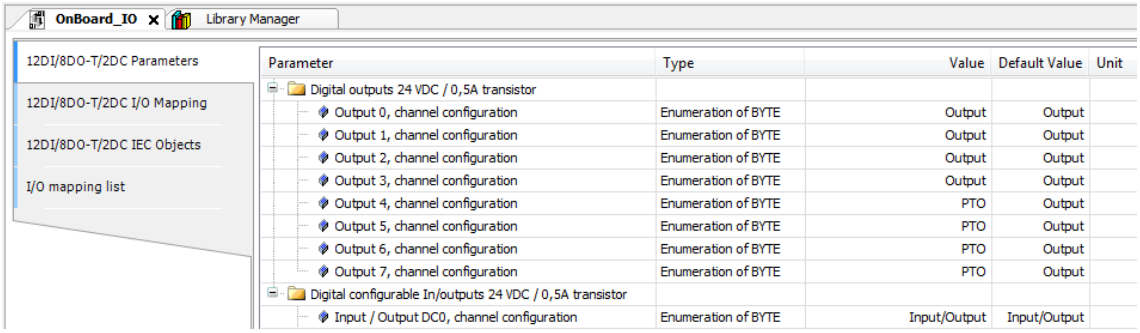
The user can configure the following output channels as PTO (pulse-train output).

- *"PTO"*: Output channel 4
- *"PTO"*: Output channel 5
- *"PTO"*: Output channel 6
- *"PTO"*: Output channel 7

If the user configures the output 4 as PTO, the output 5 is automatically configured as PTO.

If the user configures the output 6 as PTO, the output 7 is automatically configured as PTO.

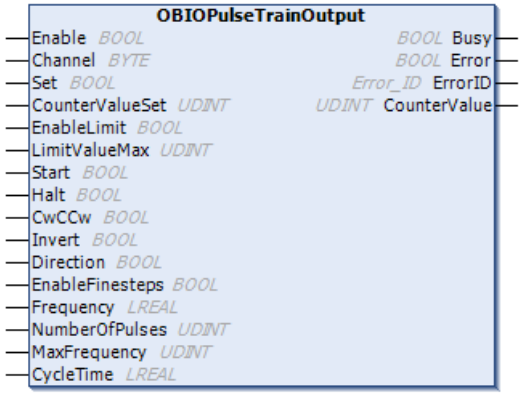
The input *“CwCCw”* of the function block *“OBIOPulseTrainOutput”* determines the output 5 and 7 as *“CounterClockWise”* or *“Direction”* if it is set as PTO.



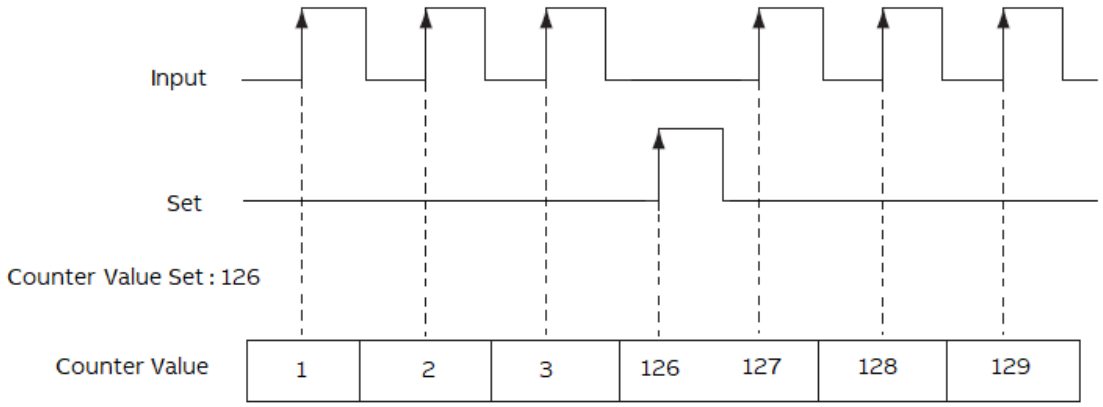
Parameter	Type	Value	Default Value	Unit
Digital outputs 24 VDC / 0,5A transistor				
Output 0, channel configuration	Enumeration of BYTE	Output	Output	
Output 1, channel configuration	Enumeration of BYTE	Output	Output	
Output 2, channel configuration	Enumeration of BYTE	Output	Output	
Output 3, channel configuration	Enumeration of BYTE	Output	Output	
Output 4, channel configuration	Enumeration of BYTE	PTO	Output	
Output 5, channel configuration	Enumeration of BYTE	PTO	Output	
Output 6, channel configuration	Enumeration of BYTE	PTO	Output	
Output 7, channel configuration	Enumeration of BYTE	PTO	Output	
Digital configurable In/outputs 24 VDC / 0,5A transistor				
Input / Output DC0, channel configuration	Enumeration of BYTE	Input/Output	Input/Output	

See also the following chapter:

8.3.5.2 Function block

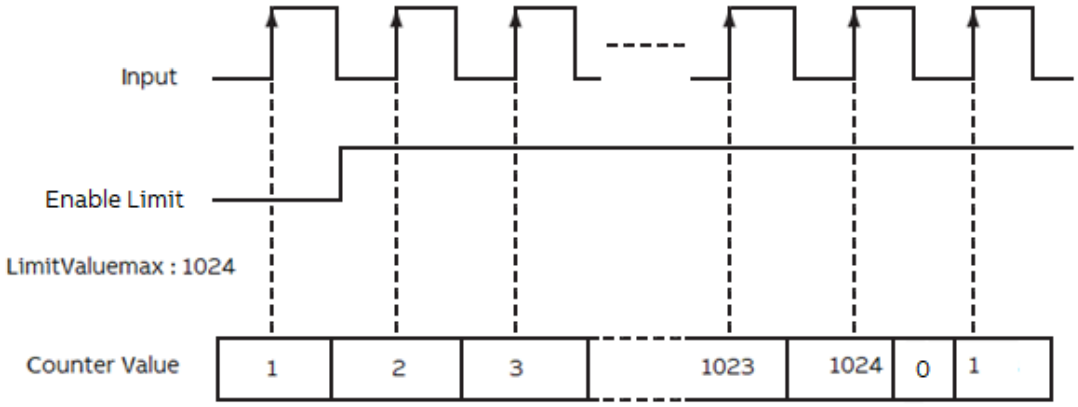


If *“Set”* bit is TRUE, the instruction moves the *“CounterSetValue”* to the *“CounterValue”*.

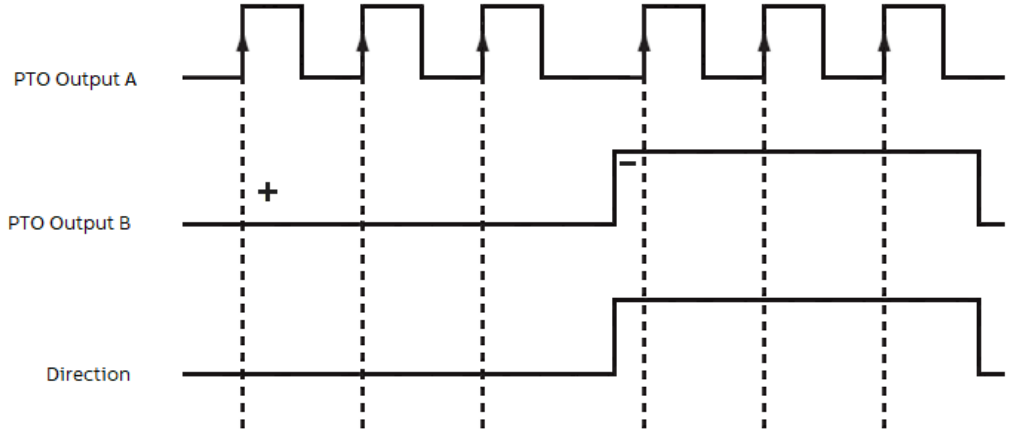


If *“EnableLimit”* bit is TRUE, the accumulated value continues incrementing.

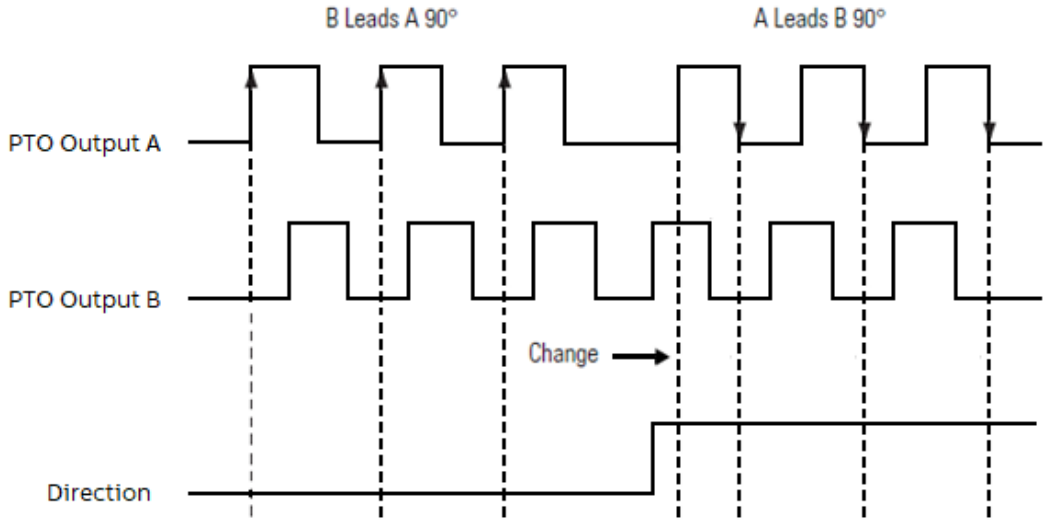
After *“CounterValue”* reaches the *“LimitValueMax”*, the instruction writes 0 to the *“CounterValue”*.



If the input *"CwCCw"* of the *"OBIOPulseTrainOutput"* is set to FALSE, the PTO output channel B is toggled based on the direction.



If the input *"CwCCw"* of the *"OBIOPulseTrainOutput"* is set to TRUE. The PTO output channel A will lead by 90° or PTO output channel B will lead by 90° depending on direction.



8.3.6 Use the onboard I/Os as PTO (pulse-train output) with 200 kHz frequency (max. 2 PTO using PTO HW channels) and Simple Motion OBIOMotionPTO function block

8.3.6.1 Parameter configuration

> *Only the Standard and Pro processor modules can be used with PTO outputs. The Basic processor modules PM5012 do not have PTO outputs.*
>
> *The available PTO outputs can be used as PTO with Pulse/Direction or PTO with CW/CCW mode when the channels have been configured as PTO outputs.*

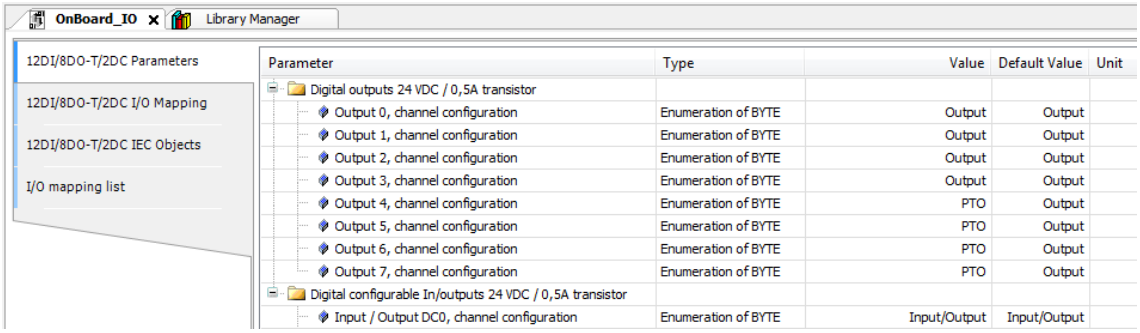
The user can configure the following output channels as PTO (pulse-train output).

- *"PTO"*: Output channel 4
- *"PTO"*: Output channel 5
- *"PTO"*: Output channel 6
- *"PTO"*: Output channel 7

If the user configures the output 4 as PTO, the output 5 is automatically configured as PTO.

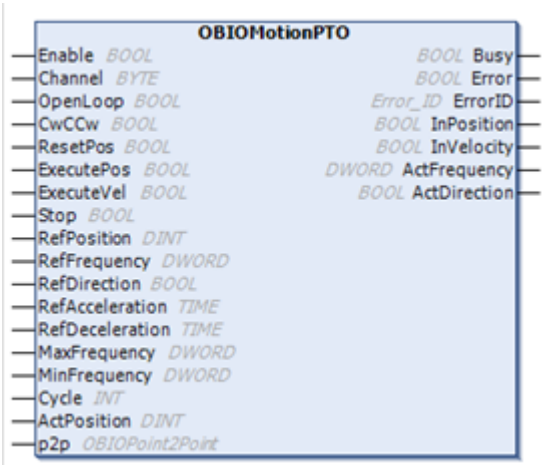
If the user configures the output 6 as PTO, the output 7 is automatically configured as PTO.

The input *"CwCCw"* of the function block *"OBIOPulseTrainOutput"* determines the output 5 and 7 as *"CounterClockWise"* or *"Direction"* if it is set as PTO.

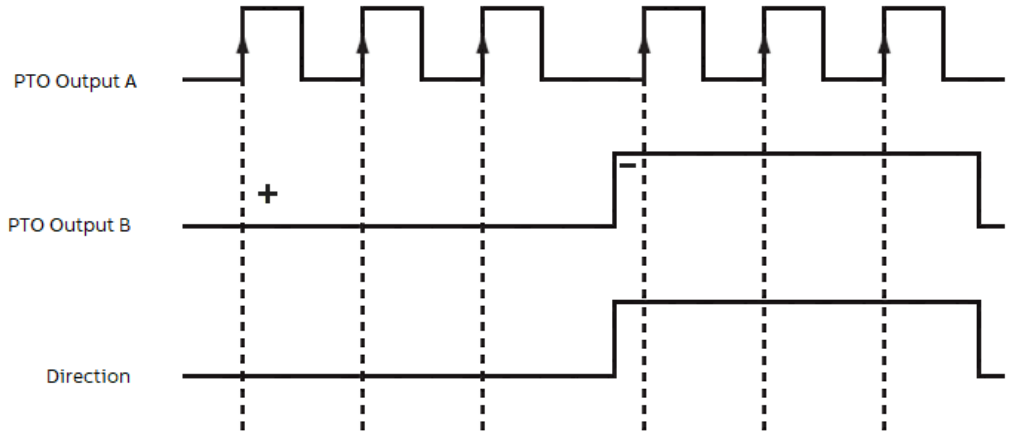


> *See also the following chapter:*

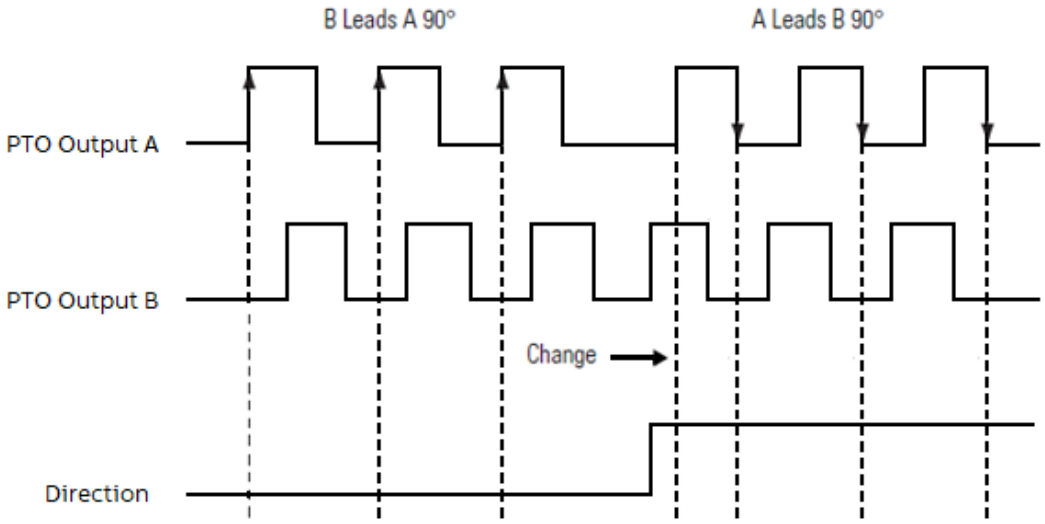
8.3.6.2 Function block



If the input *"CwCCw"* of the *"OBIOMotionPTO"* is set to FALSE, the PTO output channel B is toggled based on the direction.



If the input *"CwCCw"* of the *"OBIOMotionPTO"* is set to TRUE. The PTO output channel A will lead by 90° or PTO output channel B will lead by 90° depending on direction.



8.3.7 Use the onboard I/Os as PTO (pulse-train output) with 100 kHz frequency (Max. 4 PTO using PWM HW channels) and Simple Motion OBIOMotionPWM function bloc

8.3.7.1 Parameter configuration

It is possible to have also up to 4 PTO channels only with Pulse/Direction mode on the AC500-eCo V3 CPU by using the fast outputs O4…O7 configured as PWM outputs and using a specific Motion function block and standard outputs for direction channel.

Only the Standard and Pro processor modules can be used with PTO (PWM) outputs. The Basic processor modules PM5012 do not have PTO outputs.

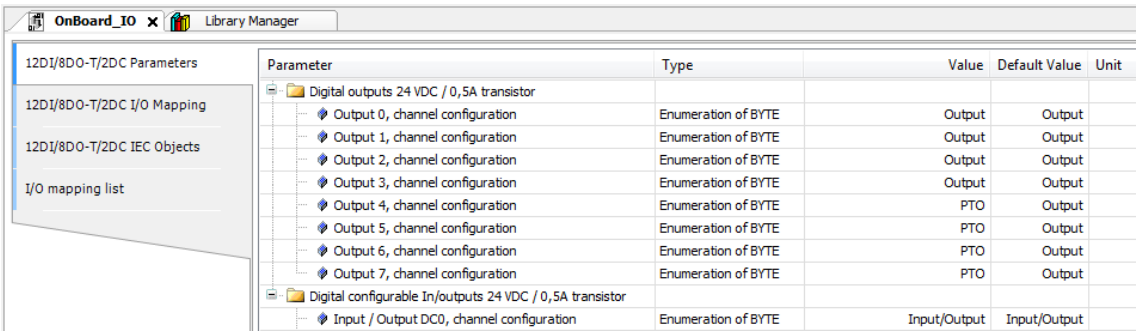
The available software PTO outputs can be used as PTO with Pulse/Direction or PTO with CW/CCW mode when the channels have been configured as PWM outputs.

The user must configure the following output channels as PWM outputs and use the *"OBIOMotionPWM"* function block.

- *"PWM"*: Output channel 4
- *"PWM"*: Output channel 5
- *"PWM"*: Output channel 6
- *"PWM"*: Output channel 7

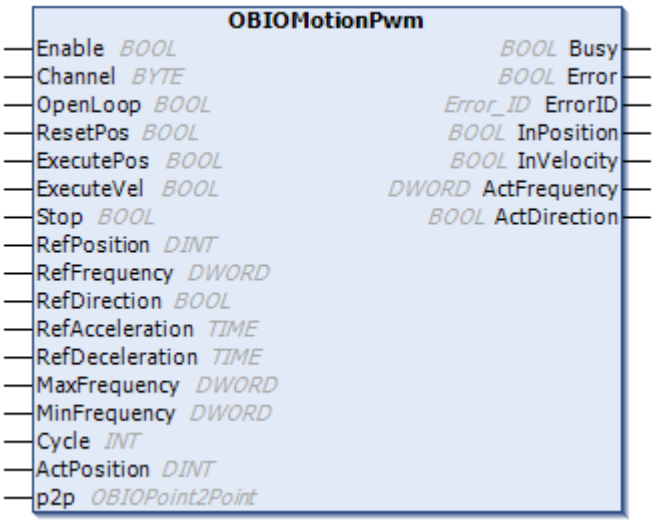
If the user configures the output 4...7 as PWM using the *"OBIOMotionPWM"* function block, up to four Software PTO can be realized offering then only the Pulse/Direction mode.

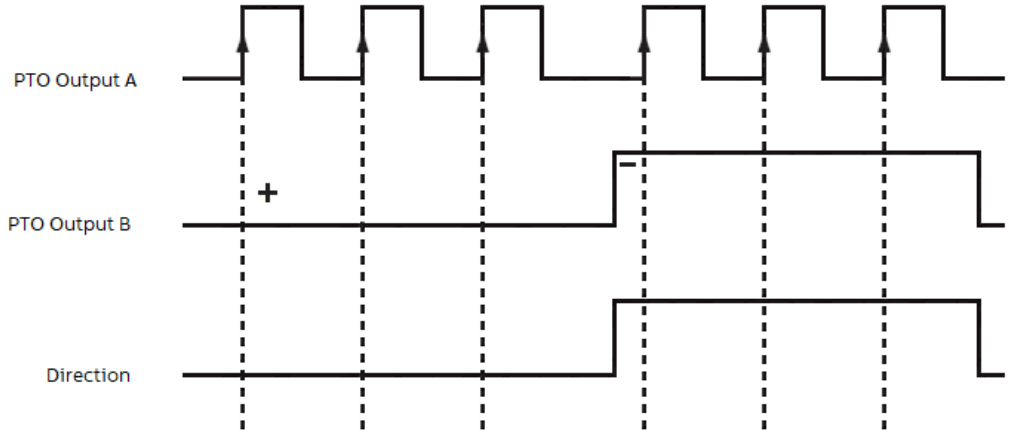
The Pulse output will always use the fast output channels O4…O7 and the direction output of the function block can be assigned to any other output e.g. O0…O3 or also outputs from a S500 I/O module.



See also the following chapter:

8.3.7.2 Function block



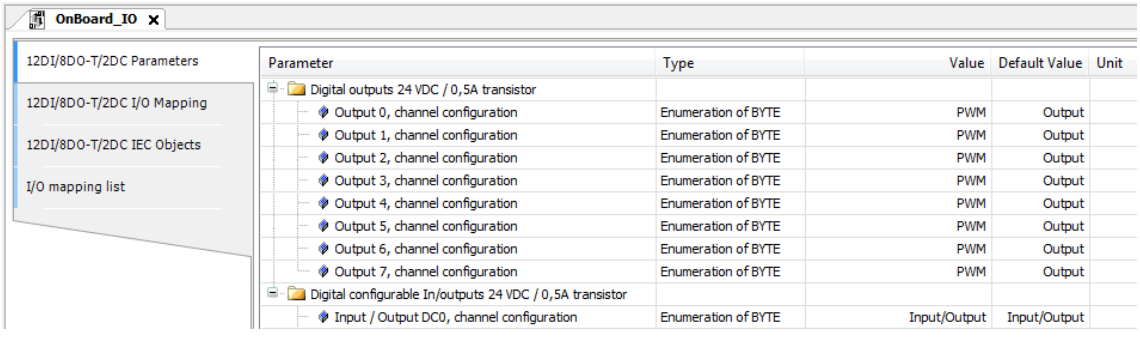


8.3.8 Use the onboard I/Os as output PWM (pulse-width modulation)

8.3.8.1 Parameter configuration

The user can configure the following output channels as PWM (pulse-width modulation).

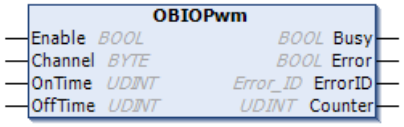
- *"PWM 0"*: Output channel 0
- *"PWM 1"*: Output channel 1
- *"PWM 2"*: Output channel 2
- *"PWM 3"*: Output channel 3
- *"PWM 4"*: Output channel 4
- *"PWM 5"*: Output channel 5
- *"PWM 6"*: Output channel 6
- *"PWM 7"*: Output channel 7



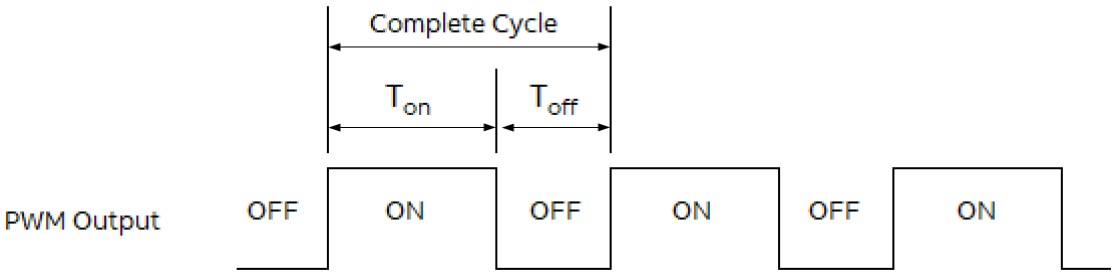
Parameter	Type	Value	Default Value	Unit
Digital outputs 24 VDC / 0,5A transistor				
Output 0, channel configuration	Enumeration of BYTE	PWM	Output	
Output 1, channel configuration	Enumeration of BYTE	PWM	Output	
Output 2, channel configuration	Enumeration of BYTE	PWM	Output	
Output 3, channel configuration	Enumeration of BYTE	PWM	Output	
Output 4, channel configuration	Enumeration of BYTE	PWM	Output	
Output 5, channel configuration	Enumeration of BYTE	PWM	Output	
Output 6, channel configuration	Enumeration of BYTE	PWM	Output	
Output 7, channel configuration	Enumeration of BYTE	PWM	Output	
Digital configurable In/outputs 24 VDC / 0,5A transistor				
Input / Output DC0, channel configuration	Enumeration of BYTE	Input/Output	Input/Output	

See also the following chapter:

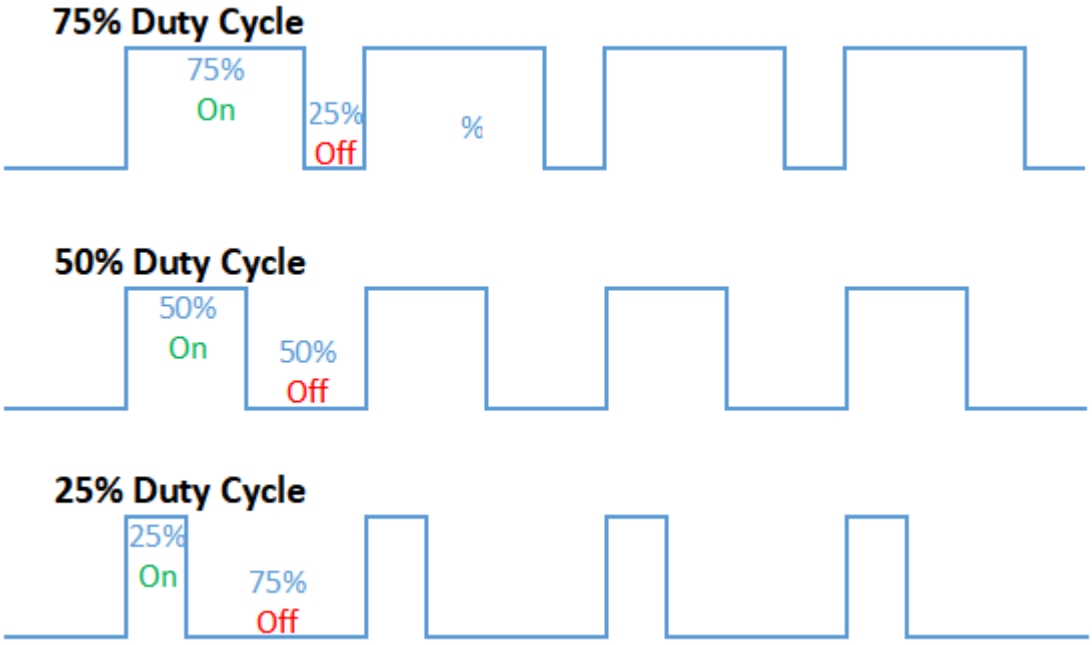
8.3.8.2 Function block



The complete cycle of the *"PWM"* is based on the *"OnTime"* and *"OffTime"*.



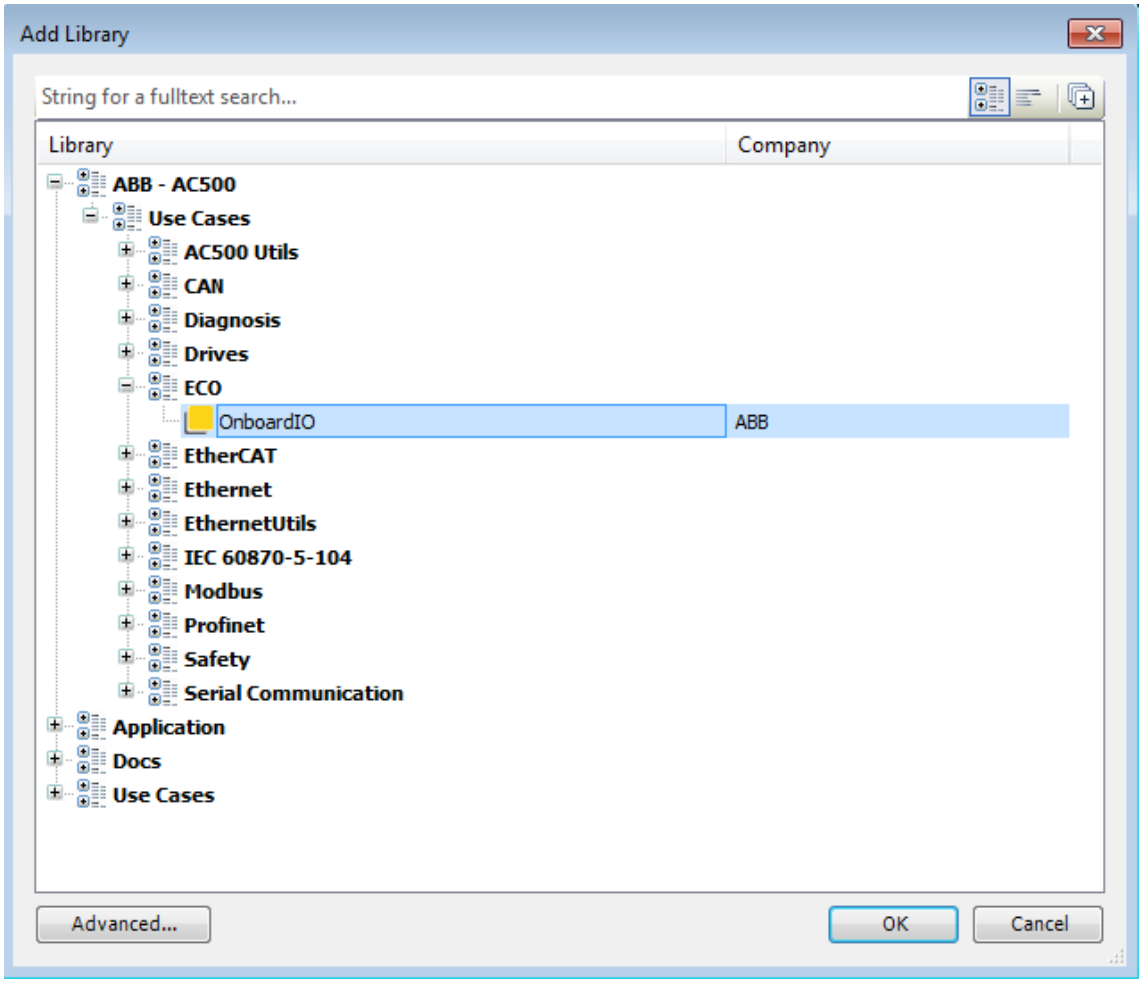
The duty cycle ratio of the *"PWM"* is based on the formula = T_{on} / (T_{on} + T_{off}).



8.4 Function block description

Function block descriptions of all V3 libraries are available in the library manager.

1. Under *"Application"* open *"Library Manager"*.
2. Select *"Add Library"*.



⇨ A list of all available libraries is displayed.

Libraries in folder *"ABB - AC500"* are created by ABB and tested in combination with Automation Builder.

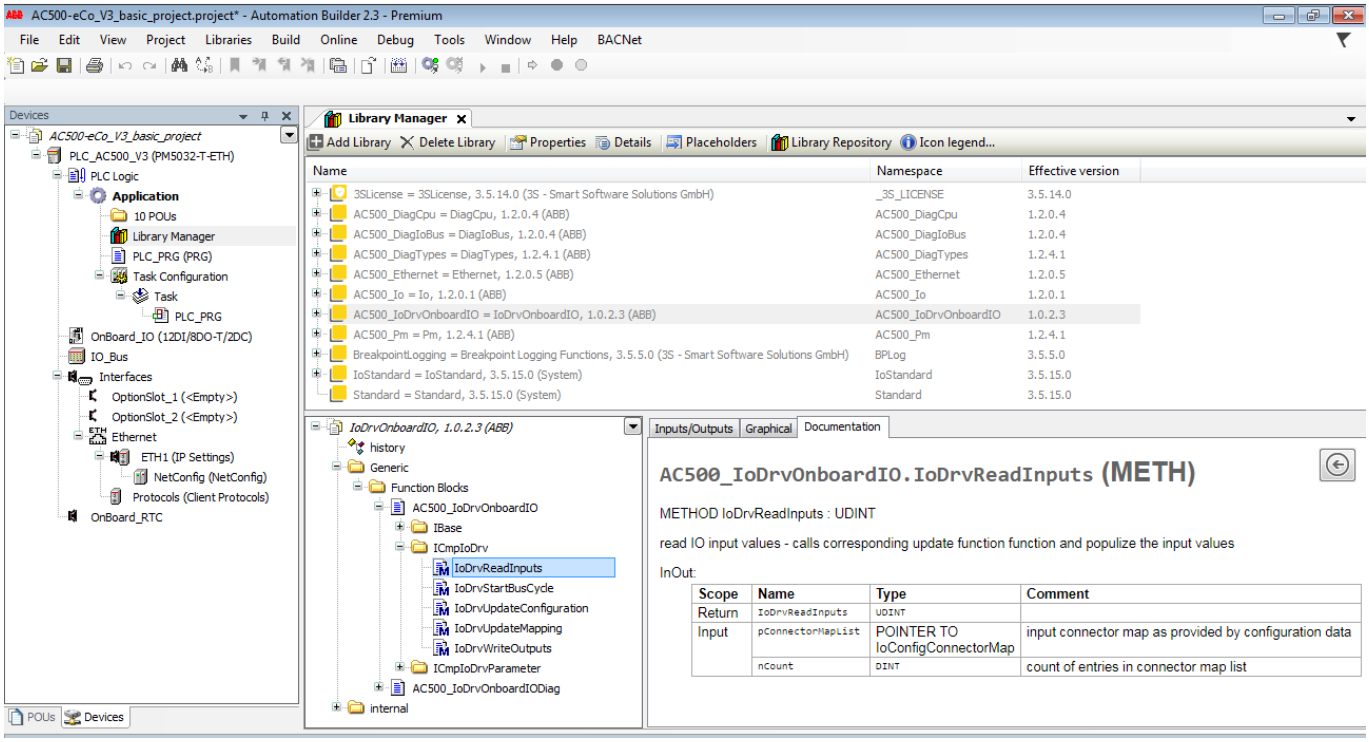
We recommend to use libraries of subfolder *"Use Cases"* for your project.

Libraries in subfolder *"Intern"* are necessary for internal procedures.

All 3S libraries distributed with Automation Builder are required by ABB libraries and have been tested in combination with AC500 and Automation Builder. Additional 3S libraries that are not distributed with Automation Builder can easily be added. There are no known major issues with using them, however, be aware that they are not tested by ABB.

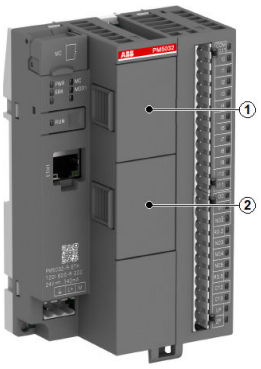
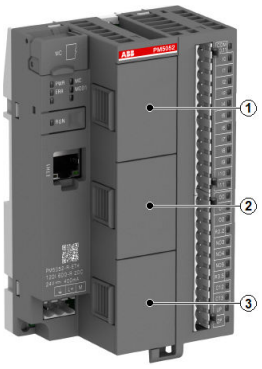
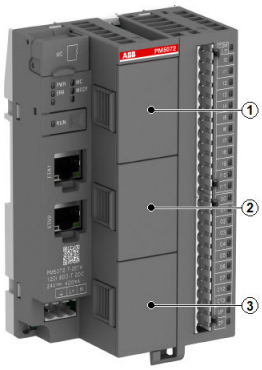
3. Add a library.
4. Choose the added library in Library Manager to access the documentation.

The function block description is shown as an example as follows.



8.5 AC500-eCo V3 option board slots for processor modules PM50xx

Depending on the processor module type, up to three option board slots are available on the CPU for different purpose like digital or analog I/O extension, serial interface or special module for specific functionality.

Option board slots	Basic CPU	Standard CPU		Pro CPU
	PM5012-x-ETH	PM5032-x-ETH	PM5052-x-ETH	PM5072-T-2ETH
Figure • 1: Slot 1 • 2: Slot 2 • 3: Slot 3				
Option board slot 1	X	X	X	X
Option board slot 2	-	X	X	X
Option board slot 3	-	-	X	X

Usable option boards onAC500-eCo V3	Basic CPU	Standard CPU		Pro CPU
	PM5012-x-ETH	PM5032-x-ETH	PM5052-x-ETH	PM5072-T-2ETH
TA5130-KNXPB	-	-	-	X [1])
TA5131-RTC	X[1])	-	-	-

Usable option boards onAC500-eCo V3	Basic CPU	Standard CPU		Pro CPU
	PM5012-x-ETH	PM5032-x-ETH	PM5052-x-ETH	PM5072-T-2ETH
TA5101-4DI	X	X	X	X
TA5105-4DOT	X	X	X	X
TA5110-2DI2DOT	X	X	X	X
TA5120-2AI-UI [2])	X	X	X	X
TA5122-2AI-TC [2])	X	X	X	X
TA5123-2AI-RTD [2])	X	X	X	X
TA5126-2AO-UI [2])	X	X	X	X
TA5141-RS232I	X	X	X	X
TA5142-RS485I	X	X	X	X
TA5142-RS485	X	X	X	X

[1]) Can be used only once per CPU

[2]) In preparation, not yet available

The option board slots are not affected to one type of option board and they can be plugged and used on each slot. The only limitation is the number of slot available on the processor module. The following types of option board are available, all type can be mixed on all the slots.

8.5.1 Option board for serial interface extension

Always needed for serial communication like Modbus RTU. Selection and configuration can be found into the PLC Configuration V3 documentation part:

Part no.	Description
1SAP 187 300 R0001	TA5141-RS232I: AC500, RS-232 serial adapter isolated option board, spring/cable front terminal 3.50 mm pitch
1SAP 187 300 R0002	TA5142-RS485I: AC500, RS-485 serial adapter isolated option board, spring/cable front terminal 3.50 mm pitch
1SAP 187 300 R0003	TA5142-RS485: AC500, RS-485 serial adapter non isolated option board, spring/cable front terminal 3.50 mm pitch

8.5.2 Option board for digital I/O extension

Selection and configuration can be found into the PLC Configuration V3 documentation part:

Part no.	Description
1SAP 187 000 R0001	TA5101-4DI: AC500, digital input module option board, 4DI 24 VDC, spring/cable front terminal 3.50 mm pitch
1SAP 187 000 R0002	TA5105-4DOT: AC500, digital output module option board, 4DO-T 24 VDC / 0.5 A, spring/cable front terminal 3.50 mm pitch
1SAP 187 000 R0003	TA5110-2DI2DOT: AC500, digital in/output module option board, 2DI 24 VDC, 2DO-T 24 VDC / 0.5 A, spring/cable front terminal 3.50 mm pitch

8.6 Option board for specific function

The TA5130-KNXPB can only be used on AC500-eCo V3 processor modules Pro PM5072-T-ETH(W).

The TA5131-RTC can only be used on AC500-eCo V3 processor modules Basic PM5012-x-ETH.

These two option boards can only be used once on one slot at a time!

Part no.	Description
1SAP 187 200 R0001	TA5130-KNXPB: AC500, KNX address switch option board, 1 push button
1SAP 187 200 R0002	TA5131-RTC:AC500, real-time clock without battery, option board for AC500-eCo V3 Basic CPU

9 Contact ABB

If you have questions on Automation Builder software you receive further information on *http://www.abb.com/automationbuilder*.

If you have questions on a PLC product you receive further information on *http://www.abb.com/plc*.

If you have questions on any ABB product you receive further contact information for your specific device in the ABB global sales contact directory:*http://www.abb.com/contacts*.

Service - control engineering

ABB operates a technical support center to assist in the case of problems.

- Consultation by phone (helpline)
- Failure analysis and removal at the machine/installation

In order to provide the customer with qualified assistance, customers are requested to provide the following:

- All required application documentation and information.
- Access (if required) to the system being examined.
- Assign key individuals to assist as required.

For inquiries and orders, please contact:

ABB Automation Products GmbH

Eppelheimer Str. 82

69123 Heidelberg, Germany

Global sales contact: *https://new.abb.com/plc*

Phone technical support: +49 6221 701-1444

E-Mail: plc.support@de.abb.com

Repair services and replacement devices

The following services are covered by our activities:

- Delivery of replacement devices
- Repair of defective devices and systems

Please contact your responsible sales office for your inquiry.

Seminars/Workshops

ABB also offers seminars and workshops to support you in planning, commissioning and operation of AC500 devices. If desired, we offer seminars at the customer's facility.

If necessary, it is also possible to arrange the seminar contents according to the customer's wishes. Depending on the special requirements, the training can be held in Heidelberg or at any other location favored by the customer. We are pleased to prepare an individual offer for you according to your special requirements.

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