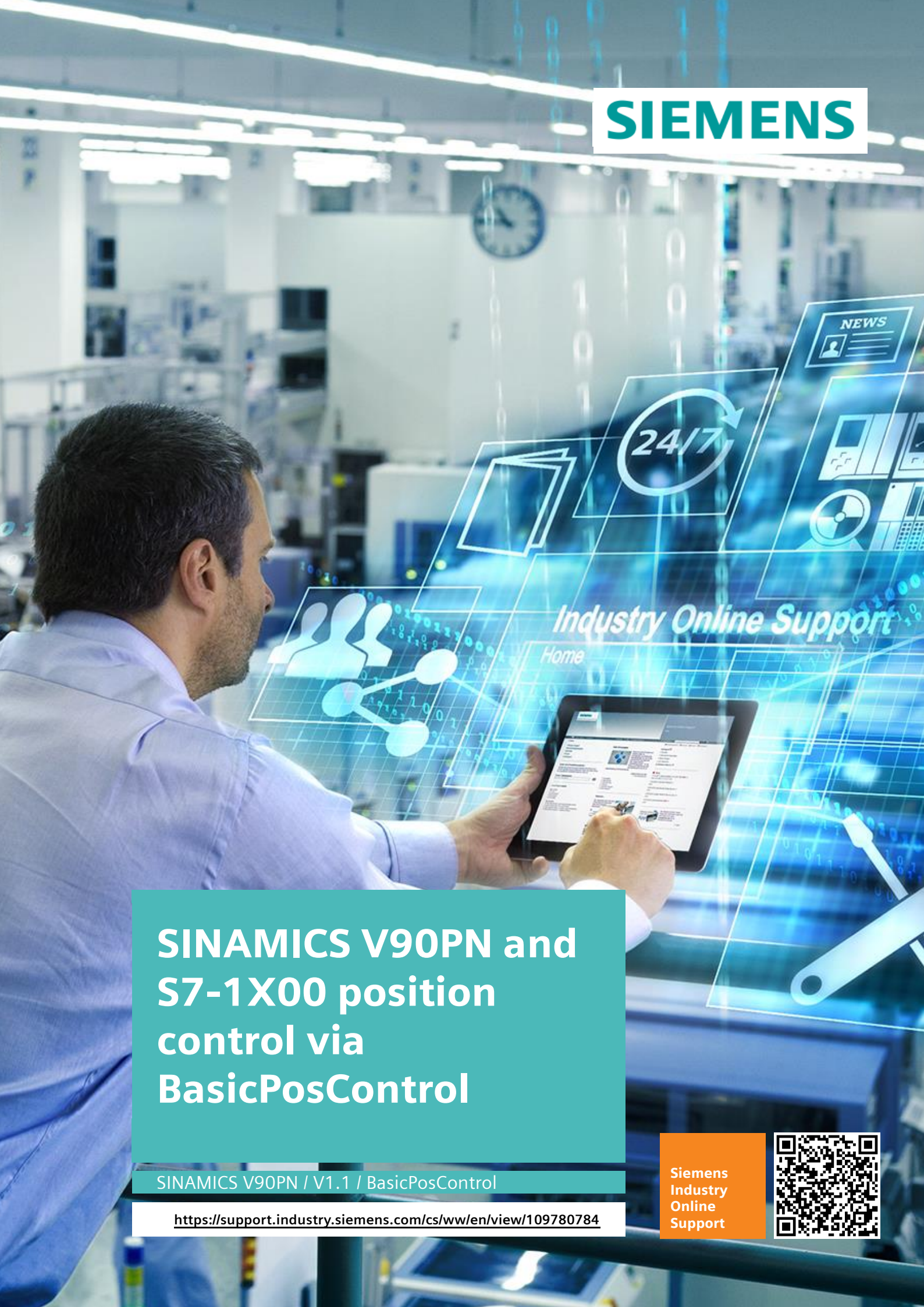

SINAMICS V90PN and S7-1X00 position control via BasicPosControl

SINAMICS V90PN / V1.1 / BasicPosControl

https://support.industry.siemens.com/cs/ww/en/view/109780784

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Table of contents

1 Task

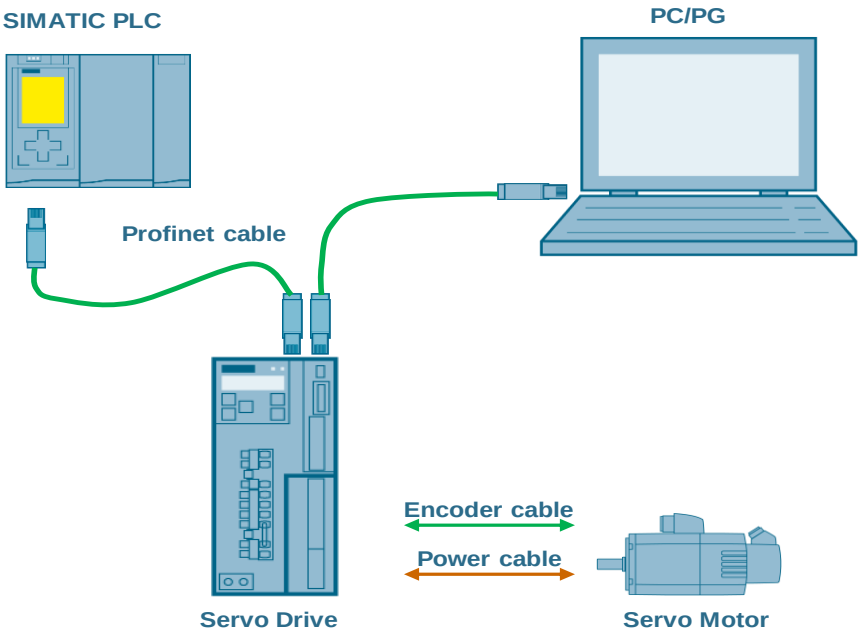
Introduction

Basic positioner (EPos) is one of the two basic control modes for SINAMICS V90 PROFINET version. In this manual, the new Technology Object “BasicPosControl” will be described in detail. This document can be used for SIMATIC S7-1200 and S7-1500. In this document the “BasicPosControl” technology object for S7-1500 will be described in detail.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



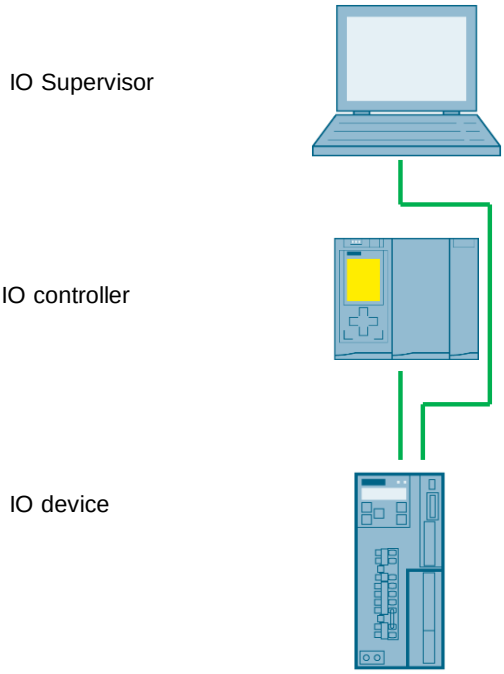
2 Solution

2.1 Solution overview

Schema Display

The following figure displays the most important components of the solution:

Figure 2-1



Delimitation

This application does not include a description of

- PROFINET communication
- SINAMICS V90 PN version
- BOP operation

Basic knowledge of these topics is assumed.

Required knowledge

Basic knowledge on TIA Portal is assumed.

2.2 Hardware and Software Components

2.2.1 Validity

This application example is valid for

- TIA Portal V17
- S7-1200/1500 CPU with PN interface
- SINAMICS V90 PN FW V10403
- SIMOTICS S-1FL6 Li motor

2.2.2 Used Components

The application was generated with the following components:

Hardware components

Table 2-1

Component	No.	Article number	Note
SIMATIC S7-1500 CPU1515TF-2 PN	1	6ES7511-2UM01-0AB0	V2.9
SINAMICS V90 PN 200V	1	6SL3210-5FB10-1UF0	0.4 kW
SIMOTICS S-1FL6 Li motor	1	1FL6024-2AF21-1AA1	0.1 kW

Standard software components

Table 2-2

Component	No.	Article number	Note
TIA Portal	1		V17
SINAMICS V-ASSISTANT	1		V1.07.01

Sample files and projects

The following list includes all files and projects that are used in this example.

Table 2-3

Component	Note
109780784_SINAMICS_V90PN_and_S7-1X00_position_control_via_TO_BasicPos_PROJ_v11.zip	TIA Project file
109780784_SINAMICS_V90PN_and_S7-1X00_position_control_via_TO_BasicPos_V-ASSIST_v11.zip	SINAMICS V-ASSISTANT Project file
109780784_SINAMICS_V90PN_and_S7-1X00_position_control_via_TO_BasicPos_DOC_v11_en.pdf	Reference document

3 Basics

3.1 Basics regarding SINAMICS V90 PN version

Supported Telegrams

When SINAMICS V90 PN is working in EPos mode, the following telegrams are supported:

- Standard telegram 7
- Standard telegram 9
- Siemens telegram 110
- Siemens telegram 111

Among these four telegrams, telegram 111 is the factory default telegram in SINAMICS V90 and also the only telegram which can be used with the technology object “BasicPosControl”. **Thus, the Siemens telegram 111 will be used in this basic application.**

Number of IO devices

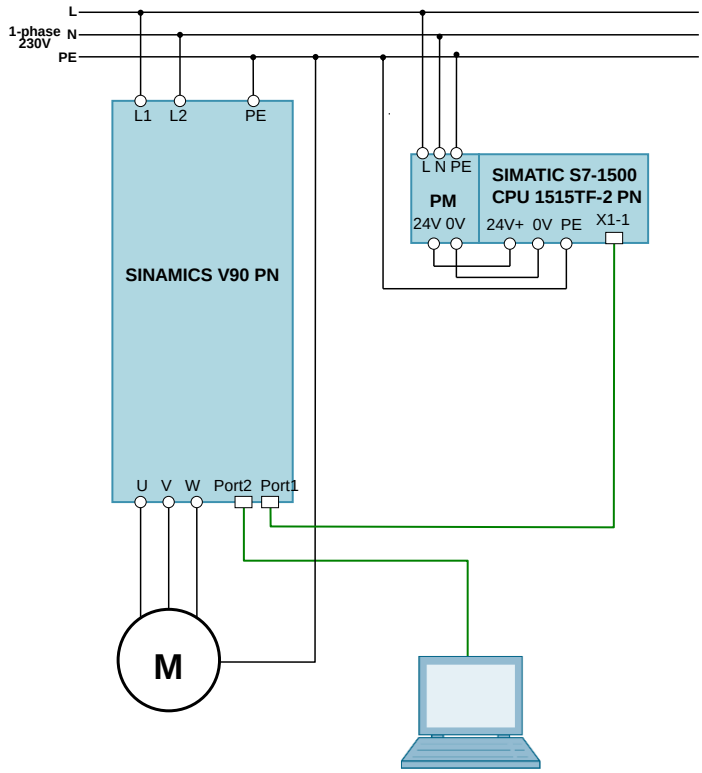
When the basic positioner (EPos mode) is used in SINAMICS V90 PN, number of IO device depends on the number of slaves supported by the controller; for example, SIMATIC S7-1200 supports maximally 16 slaves including the CPU itself.

3.2 Installation

The figure below shows the hardware configuration of the application:

CAUTION	**Wrong wiring can damage the drive!** In this application, the one phase 230V power supply is used. It is a must for you to check the supply voltage; otherwise, the drive can be damaged!

Figure 3-1

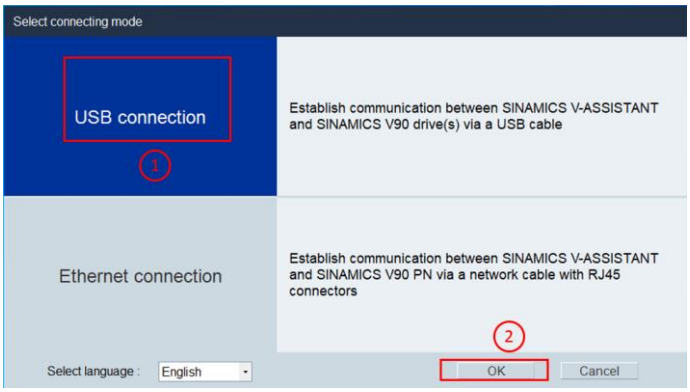
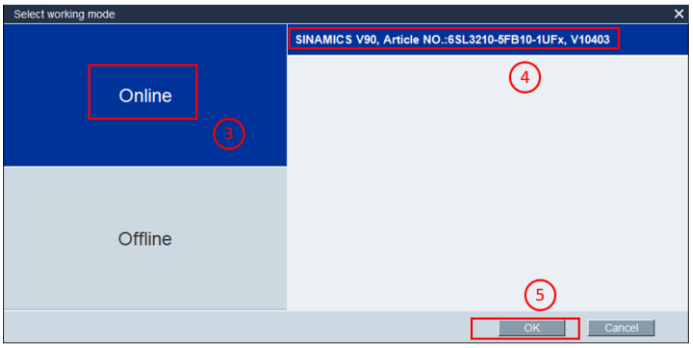
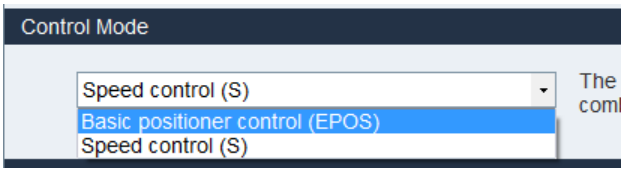


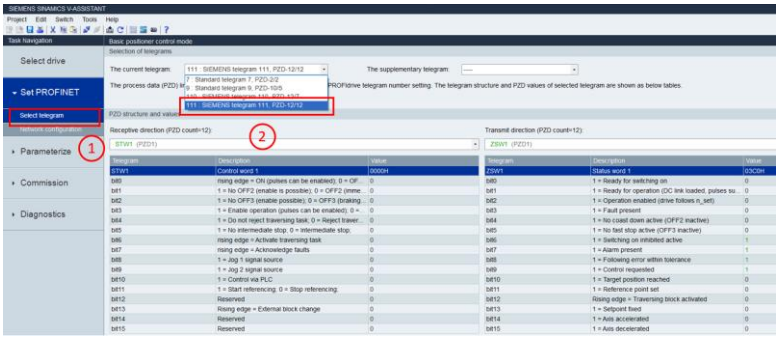
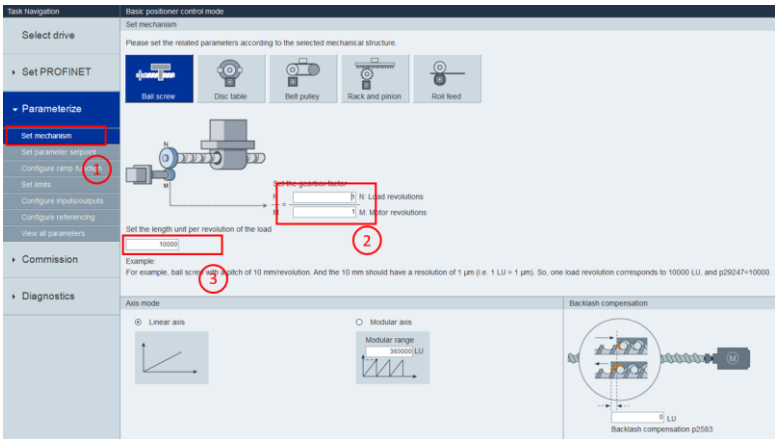
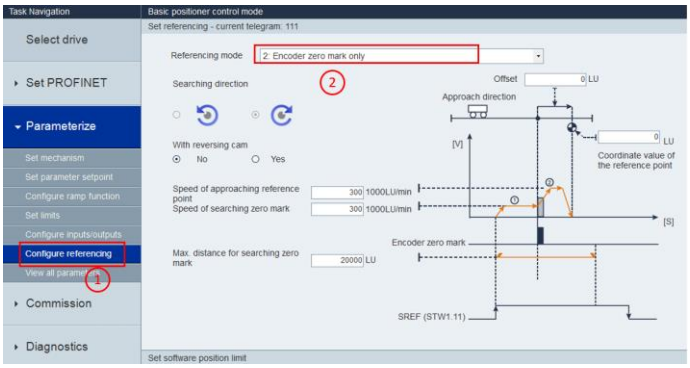
4 Configuration

In this section, the configurations from V-ASSISTANT side as well as from the TIA Portal V16 will be described in detail. The used telegram is telegram 111.

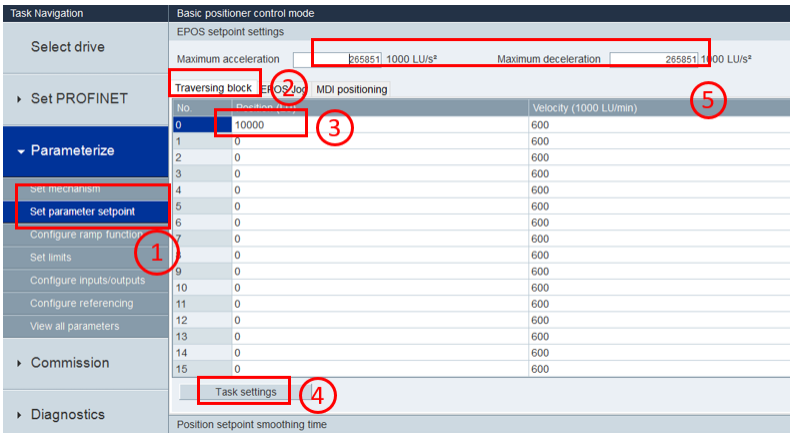
4.1 Configurations via V-ASSISTANT

Table 4-1 Configurations via V-ASSISTANT

Step	Description
1.	**Go online with V-ASSISTANT** Double-click the V-ASSISTANT icon  to start this software:  1. Select the target connecting mode. In this case select the USB connection. 2. Press OK.  3. Select the “**Online**” working mode. Normally, the online mode is the default working mode. 4. If the USB communication is okay, the drive information will be displayed. 5. Click the “**OK**” button to proceed.
2.	**Change control mode** When the V-ASSISTANT has been successfully connected to SINAMICS V90 servo drive, you need to change the control mode from S mode to EPos mode firstly:  1. Open the drop-down list. 2. Select “**Basic positioner control (EPOS)**”. **NOTICE:** Change of the control mode needs a restart of servo drive, so the parameters must be saved before drive restart.

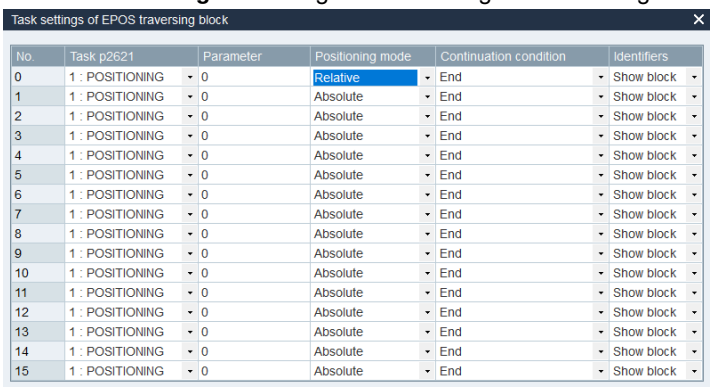
Step	Description
3.	**Configure telegram** After successfully switching to EPos mode, you can select the telegram according to actual application:  1. Click “**Select telegram**”. 2. Select a telegram from the drop-down list. In this example application document, we will keep the default telegram 111.
4.	**Configure mechanism** Set relevant mechanism parameters according to actual mechanism system:  1. Click “**Parameterize**” and then Click “**Set mechanism**”. 2. Set the gearbox. In this example, we will keep default settings. 3. Set the length unit per revolution of the load. In this example, we will keep default settings.
5.	**Configure referencing** Configure the referencing mode:  1. Click “**Parameterize**”. Then click “**Configure referencing**”. 2. Three referencing modes are available for SINAMICS V90PN working in EPos mode (**0**: Signal REF; **1**: Reference cam and encoder zero mark; **2**: Encoder zero mark only). In the example, we will use the third mode (only encoder zero mark).

Step	Description
6.	**Configure setpoint parameters** Configure setpoint parameters for EPos traversing block, EPos MDI and EPos Jog:

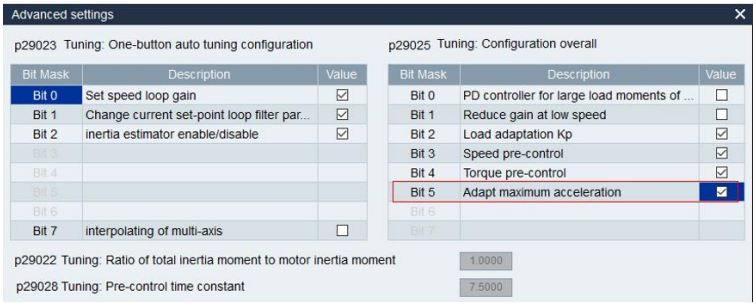


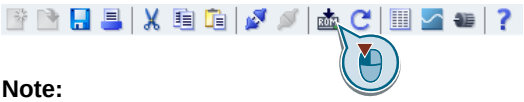
1. Click “**Set parameter setpoint**”.
2. Click to switch between the headlines of traversing block, EPos MDI and EPos Jog.
3. Input a target position for traversing block 0. In this example, we will use 10000 LU, that’s, one motor revolution according to the mechanism configuration.

   Note: in this example, we will keep the default settings for EPos Jog.
4. Click “**Task settings**” to configure task settings for traversing block 0:



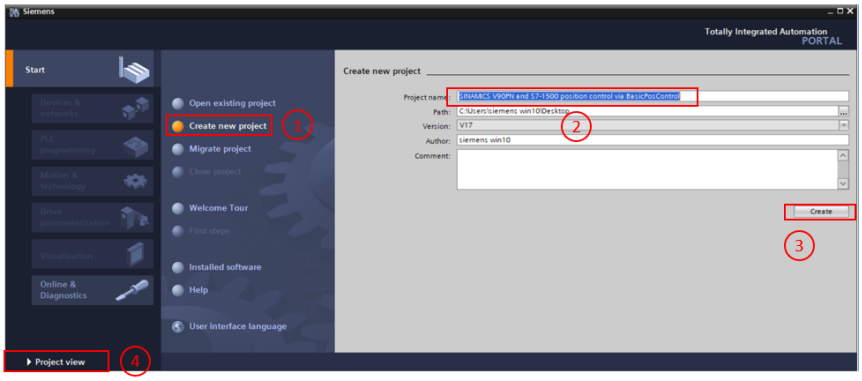
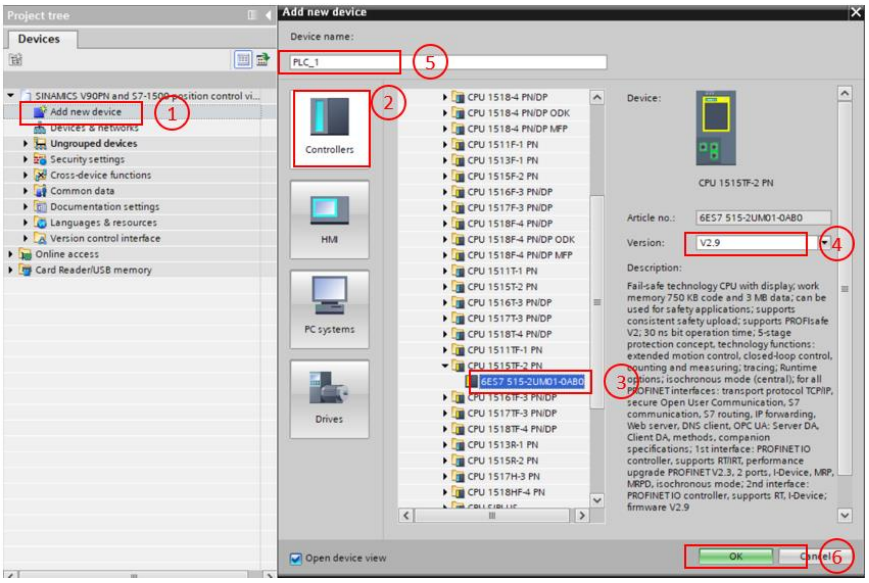
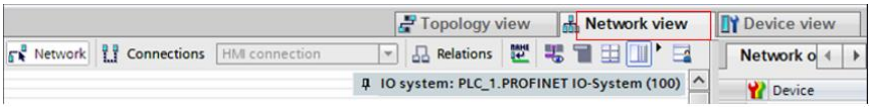
   In this example, we will use relative positioning for traversing block 0.
5. Configure maximum acceleration/deceleration time in EPos mode. These two values can be calculated automatically by activating bit5 of auto-tuning configuration in advanced setting:

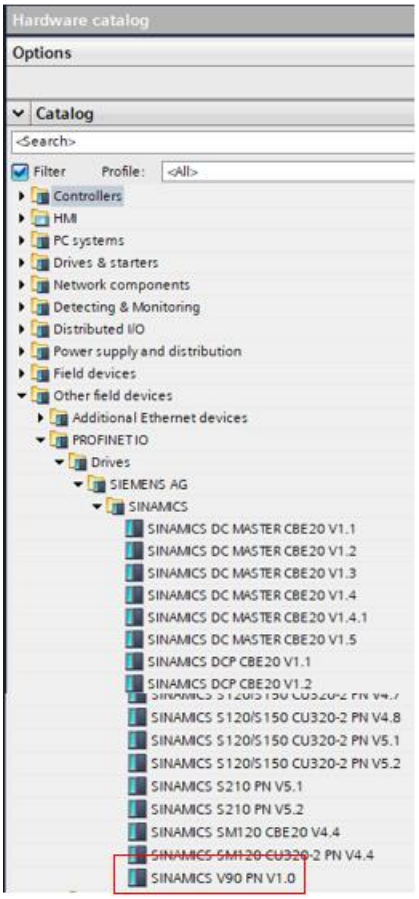
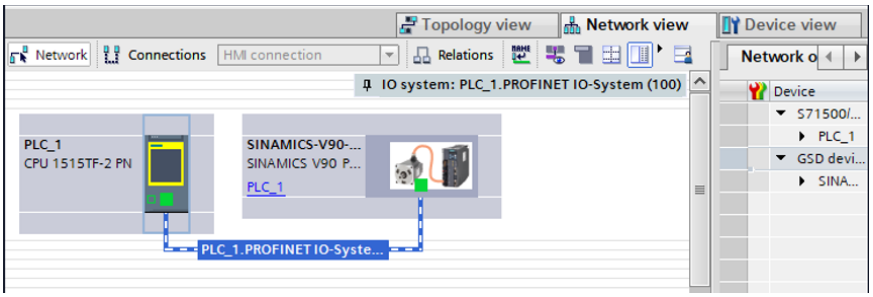


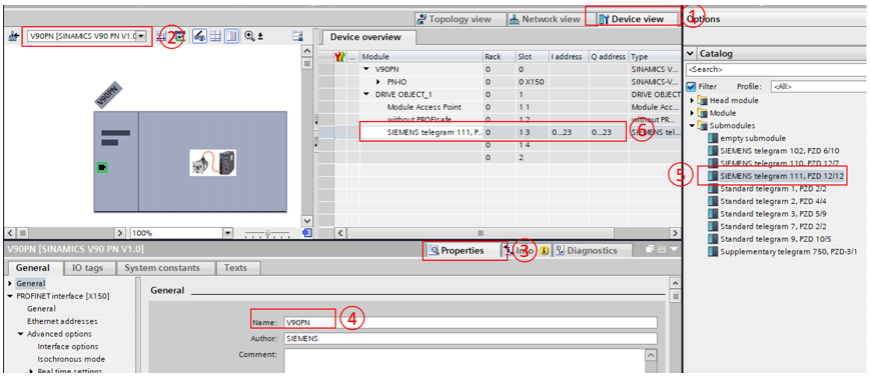
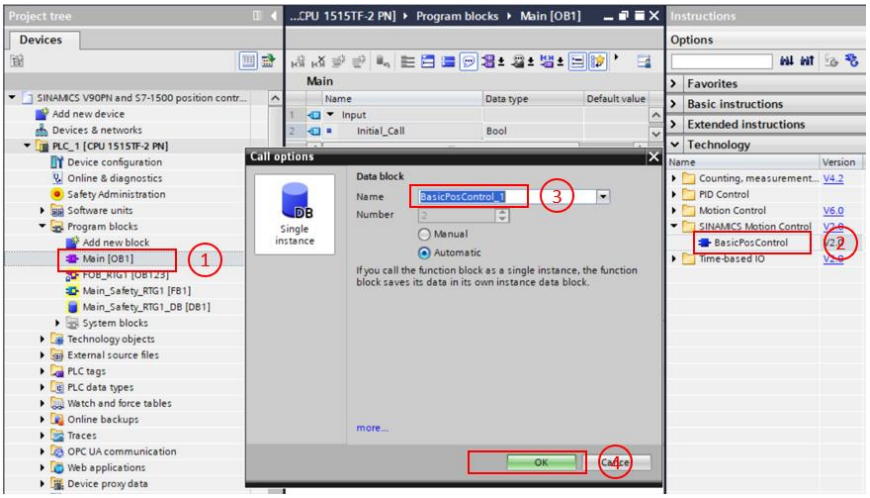
Step	Description
7.	**Save parameter settings into drive ROM** After finishing above parameter settings, we should save parameter settings into drive ROM by clicking the "**Save parameters into ROM**" button:  **Note:** You can also perform other configurations like torque limit, DI/DO, etc. according to actual application. Please refer to SINAMICS V90 PN Operating Instruction for more details: https://support.industry.siemens.com/cs/ww/en/view/109742518

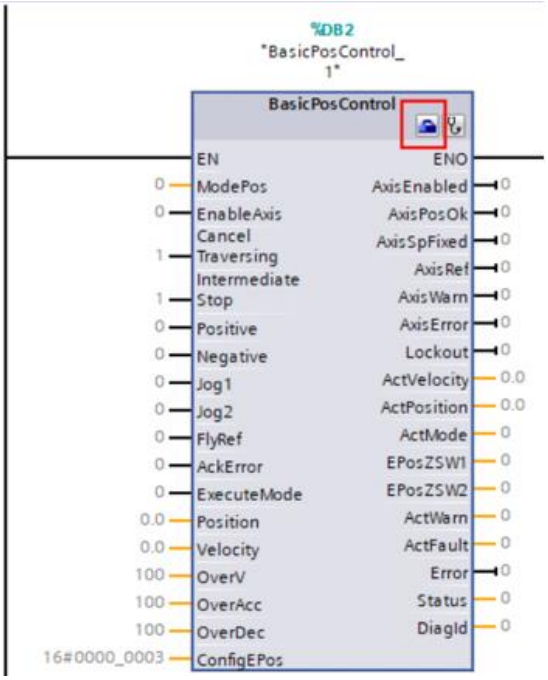
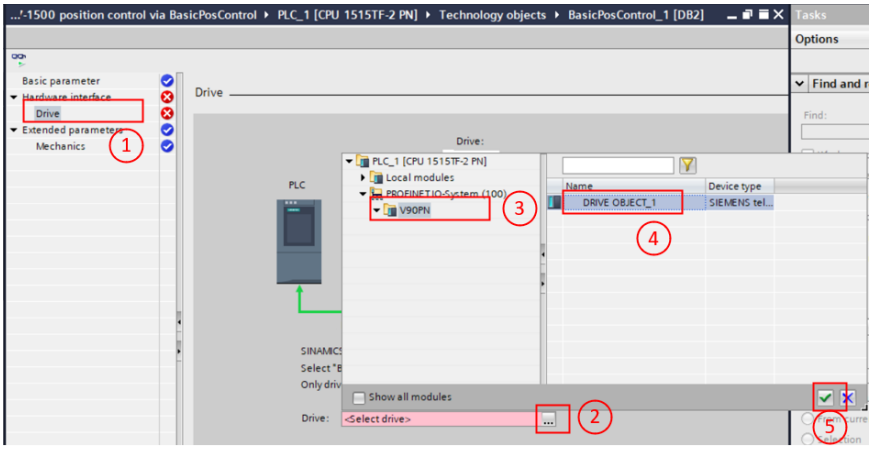
4.2 Configurations via TIA Portal V17

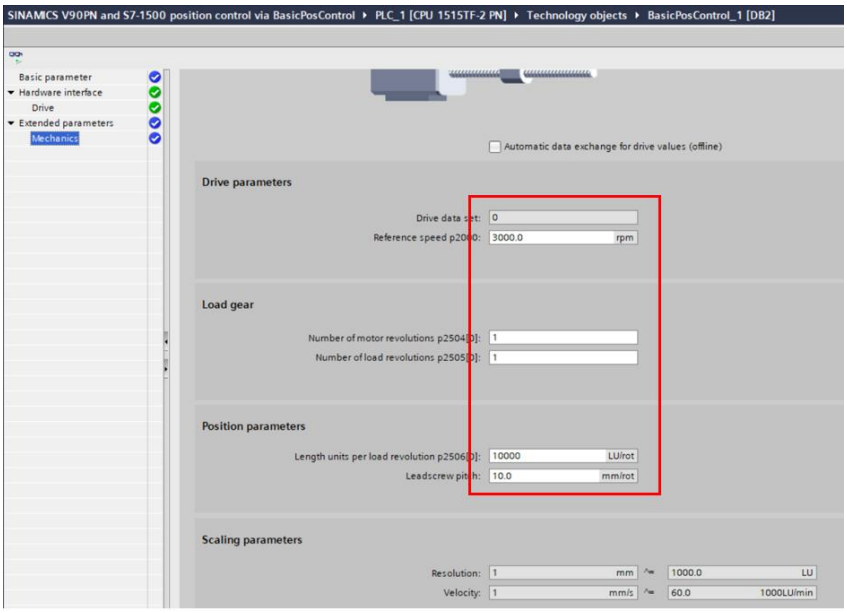
Table 4-2 Configurations via TIA Portal V17

Step	Descriptions
1.	**Create a new project** Open TIA Portal V17 and create a new project:  1. Click “**Create new project**”. 2. Input a name for this newly created project. 3. Click “**Create**” button. 4. Switch to project view.
2.	**Add PLC into project**  1. Click “**Add new device**”. 2. Select controllers. 3. Find the target PLC. 4. Select the PLC FW version. 5. Modify the device name as required. 6. Press OK to add the PLC into the project.
3.	 **Switch to network view.**

Step	Descriptions
4.	**Insert V90PN into project**  In the “**Hardware Catalog**”, click “**Other field devices**” → “**PROFINET IO**” → “**Drives**” → “**SIEMENS AG**” → “**SINAMICS**” → “**SINAMICS V90 PN V1.0**”. Double click and add the drive into the project.
5.	**Connect SINAMICS V90PN to SIMATIC PLC** Establish the connection between SINAMICS V90 PN and SIMATIC PLC: 

Step	Descriptions
6.	**Make device configurations for SINAMICS V90PN**  1. Switch wo the Device view. 2. Select the target device from the list. 3. Click the properties of the drive. 4. Modify the device name. 5. Double click to add the telegram 111 into the project. 6. Check the status of the telegram 111.
7.	**Insert the technology into the project.**  1. Double click the main block to open it. 2. Add the instructions “BasicPosControl” into the project from the technology instructions. 3. Modify the name as required. 4. Press OK to insert the technology object.

Step	Descriptions
8.	**Click the configuration button to open the configuration screen.** 
9.	**Configure the technology object.**  1. Select the drive option. 2. Click the button. 3. Select the target drive from the PROFINET IO-System (100). 4. Select the DRIVE OBJECT_1. 5. Press OK to confirm it.

Step	Descriptions
10.	**Set mechanic data.**  Configure the drive parameters, load gear ratio, the LUs per load revolution and the lead screw pitch.

5 Operation of the application

In the following paragraph, we will use the BasicPosControl instruction to perform the operations of SINAMICS V90 PN with EPos (basic positioner).

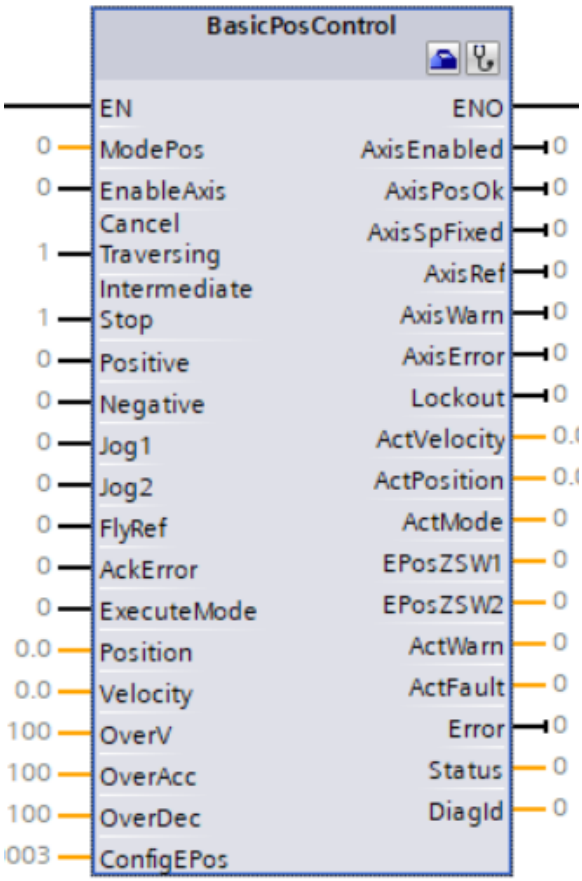
5.1.1 BasicPosControl instruction

The appropriate instance DB is automatically created with the integration of TO_Basic_Pos. This instruction can be used with SIMATIC S7-1200 and S7-1500.

This instruction can be inserted alternatively in the following OBs:

- Cyclic OB: OB1
- Cyclic interrupt OB: e.g. OB32

Figure 5-1 BasicPosControl instruction



Input interface of BasicPosControl

The input interface consists of 17 inputs with various data formats.

When the function block is first configured, the inputs are set up with initial values. An overview of the input interface is subsequently shown as follows:

Table 5-1 Input interface of BasicPosControl

Input signal	Type	Default	Meaning
ModePos	INT	0	Operating mode: 1 = relative positioning 2 = absolute positioning 3 = positioning as setup 4 = approach reference point 5 = set reference point 6 = traversing block 0~15 7 = Jog mode 8 = incremental jogging
EnableAxis	BOOL	0	Switching command: 0=OFF, 1=ON
CancelTraversing	BOOL	1	0 = reject active traversing task, 1 = do not reject
IntermediateStop	BOOL	1	0 = active traversing command is interrupted, 1 = no intermediate stop
Positive	BOOL	0	Positive direction
Negative	BOOL	0	Negative direction
Jog1	BOOL	0	Jog signal source 1
Jog2	BOOL	0	Jog signal source 2
FlyRef	BOOL	0	0 = deselect flying referencing, 1 = select flying referencing **Note:** Currently flying referencing is not supported by SINAMICS V90 PN.
AckError	BOOL	0	Acknowledging errors
ExecuteMode	BOOL	0	Activate traversing task / setpoint activate reference function
Position	LReal	0[LU]	Position setpoint in [LU] for operating mode Direct setpoint specification/MDI OR traversing block number for operating mode Traversing block. You can also configure using physical unit. The physical unit is converted to the corresponding [LU] by the technology block
Velocity	LReal	0[LU/min]	Velocity in [LU/min] for MDI operating mode. You can also configure using physical unit. The physical unit is converted to the corresponding [1000 LU/min] by the technology block
OverV	INT	100[%]	Velocity override active for all modes: 0-199%
OverAcc	INT	100[%]	Acceleration override active 0-100%
OverDec	INT	100[%]	Deceleration override active 0-100%

Input signal	Type	Default	Meaning
ConfigEPos	DWORD	3h	With this interface, the following bit functions of telegram 111 can be transmitted: Bit0 = STW1.1 (OFF2: 1 = no pulse inhibit) Bit1 = STW1.2 (OFF3: 1 = no pulse inhibit) Bit2 = EPosSTW2.14 (Software limit switch: 1 = active) Bit3 = EPosSTW2.15 (Stop output cam: 1 = active) Bit4 = EPosSTW2.11 (reserved) Bit5 = EPosSTW2.10 (reserved) Bit6 = EPosSTW2.2 (signal source reference mark) Bit7 = STW1.13 (External block change) Bit8 = EPosSTW1.12 (continuous setpoint transfer MDI: 1 = active) Bit9 = STW2.0 (reserved) Bit10 = STW2.1 (reserved) Bit11 = STW2.2 (reserved) Bit12 = STW2.3 (reserved) Bit13 = STW2.4 (reserved) Bit14 = STW2.7 (reserved) Bit15 = STW1.14 (reserved) Bit16 = STW1.15 (reserved) Bit17 = EPosSTW1.6 (reserved) Bit18 = EPosSTW1.7 (reserved) Bit19 = EPosSTW1.11 (reserved) Bit20 = EPosSTW1.13 (reserved) Bit21 = EPosSTW2.3 (reserved) Bit22 = EPosSTW2.4 (reserved) Bit23 = EPosSTW2.6 (reserved) Bit24 = EPosSTW2.7 (reserved) Bit25 = EPosSTW2.12 (reserved) Bit26 = EPosSTW2.13 (reserved) Bit27 = STW2.5 (reserved) Bit28 = STW2.6 (reserved) Bit29 = STW2.8 (travel to fixed endstop: 1 = active) Bit30 = STW2.9 (reserved)

Output signal of BasicPosControl

The output interface consists of 17 outputs with various data formats.

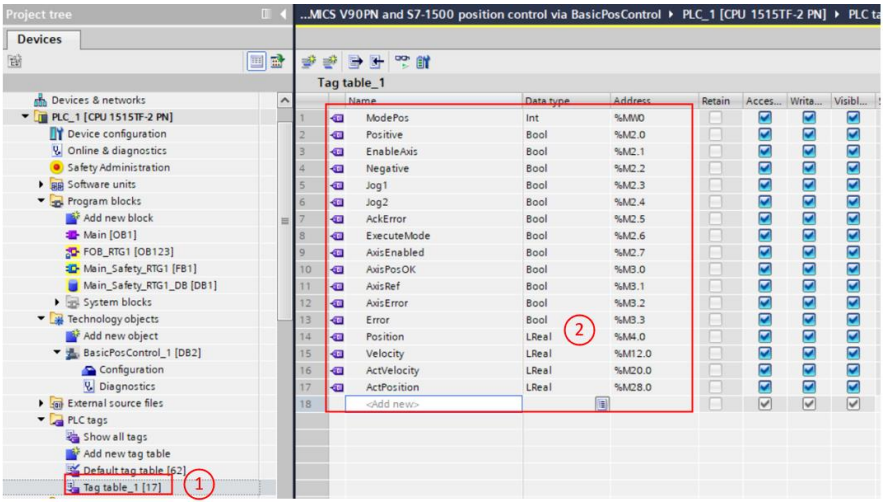
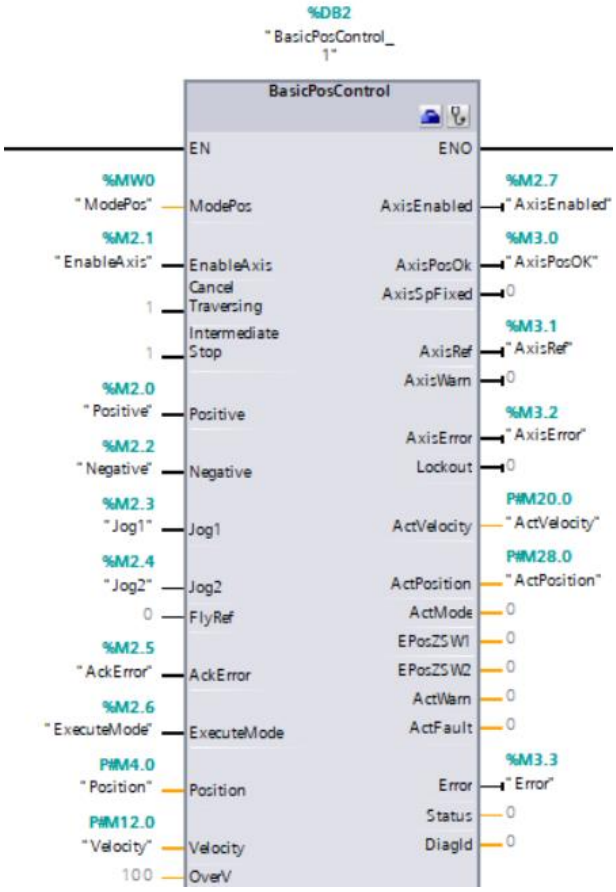
When the block is first configured, the outputs are set up with initial values. The following is an overview of the output interface:

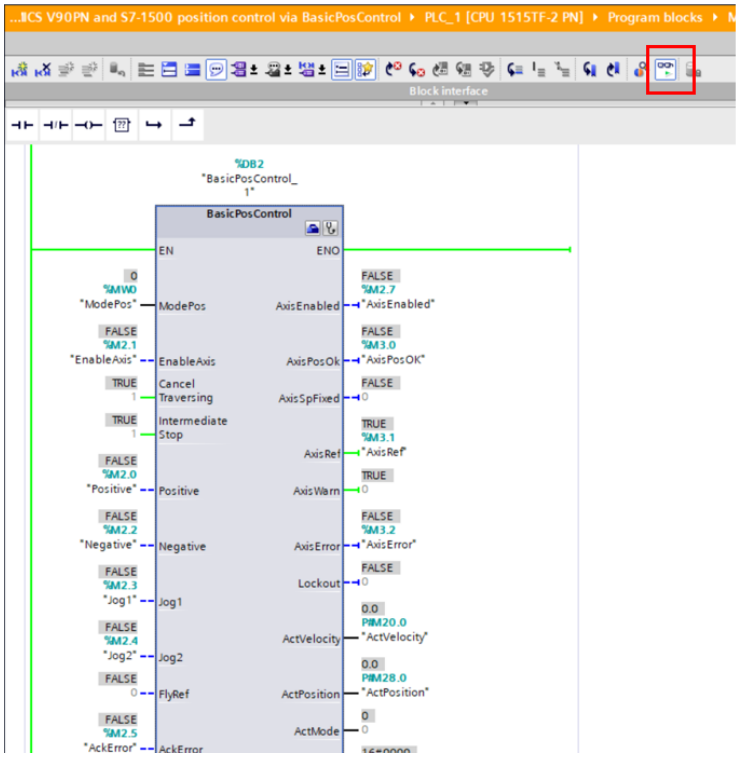
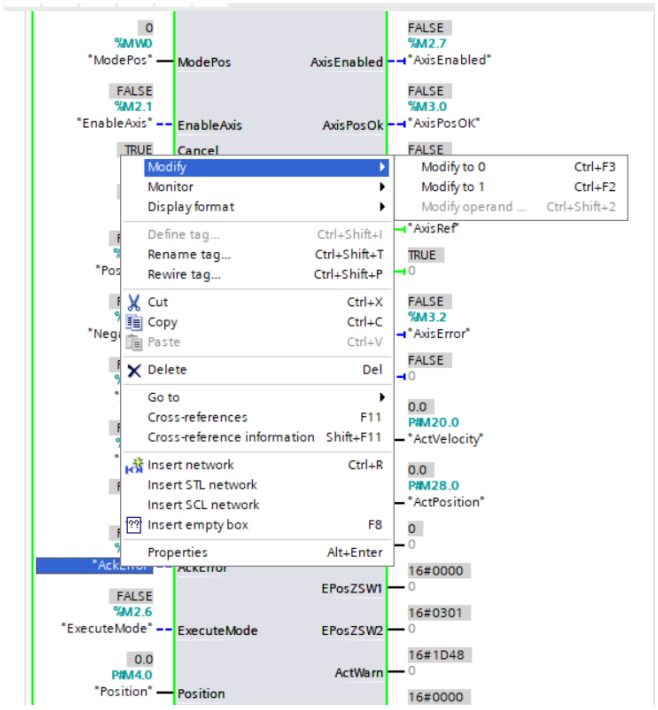
Table 5-2 Output signal of BasicPosControl

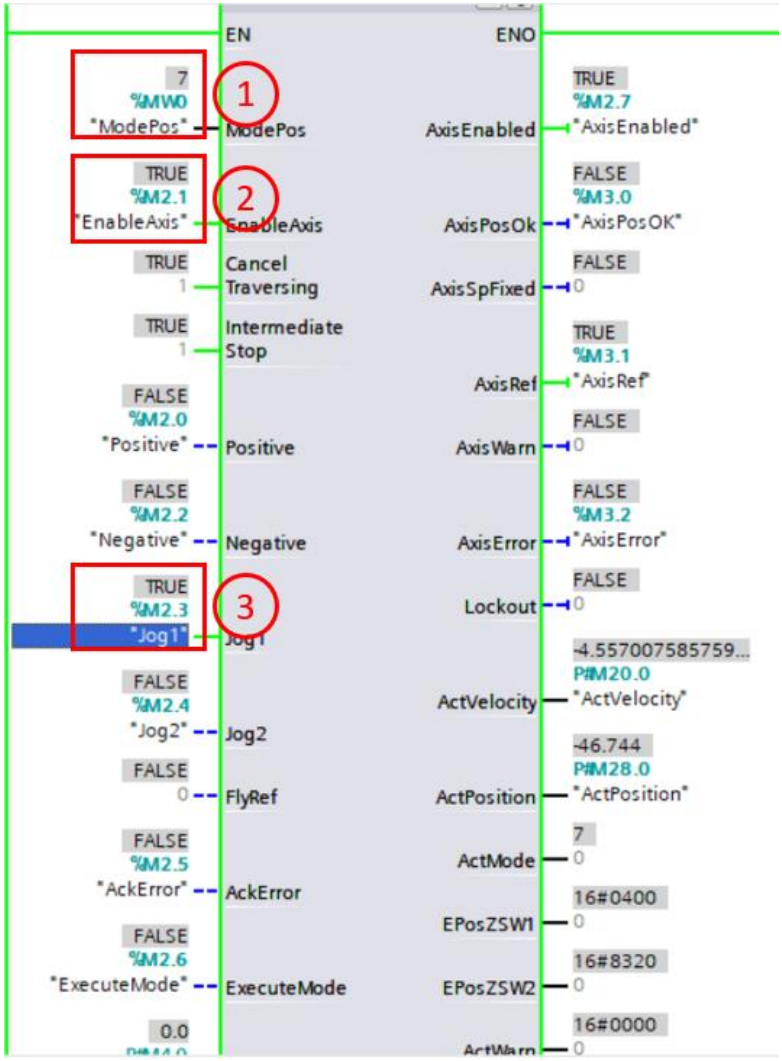
Output signal	Type	Default	Meaning
AxisEnabled	BOOL	0	Drive is ready and switched on
AxisPosOk	BOOL	0	Target position of the axis reached
AxisSpFixed	BOOL	0	1= Setpoint is stationary
AxisRef	BOOL	0	Reference point set
AxisWarn	BOOL	0	Drive has alarm
AxisError	BOOL	0	Drive has fault
Lockout	BOOL	0	Switching-on inhibit
ActcVelocity	LReal	0	Actual velocity (scaled 40000000h = 100% x p2000)
ActPosition	LReal	0[LU]	Actual position in LU
ActMode	INT	0	Currently active mode
EPosZSW1	WORD	0	Status of EPos ZSW1 (bit-granular)
EPosZSW2	WORD	0	Status of EPos ZSW2 (bit-granular)
ActWarn	WORD	0	Actual alarm number
ActFault	WORD	0	Actual fault active
Error	BOOL	0	1 = group fault active
Status	INT	0	• 16#7002: No fault – block is being executed • 16#8401: Drive fault • 16#8402: Switching-on inhibit • 16#8403: flying referencing could not be started • 16#8600: Error DPRD_DAT • 16#8601: Error DPWR_DAT • 16#8202: incorrect operating mode selected • 16#8203: incorrect setpoints parameterized • 16#8204: incorrect traversing block number selected
DiagID	WORD	0	Extended communication error → error during SFB call

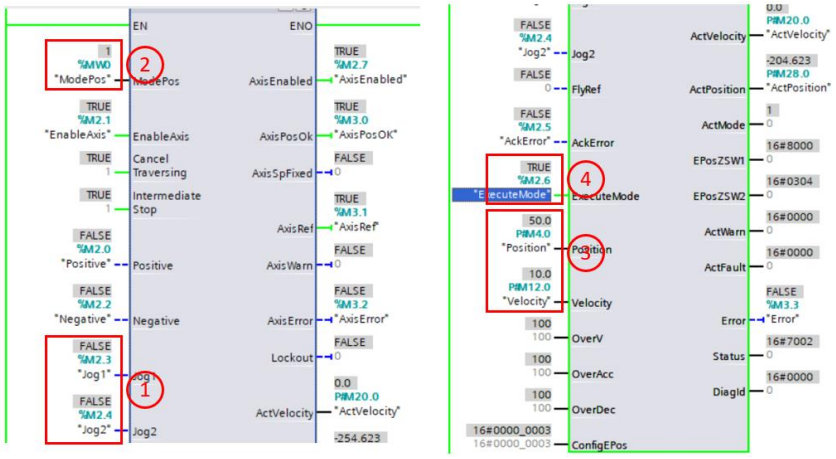
5.1.2 Operations

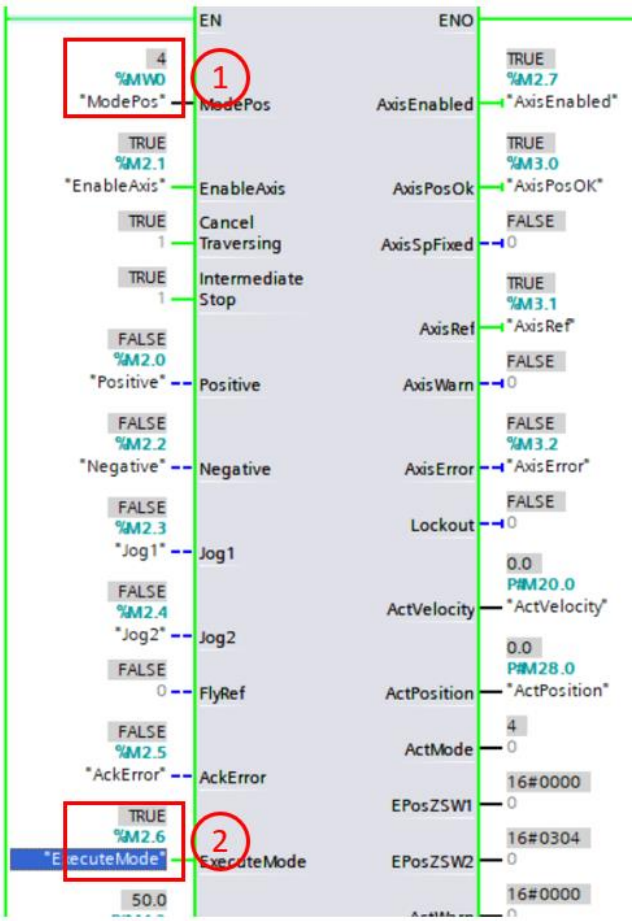
Table 5-3 Operations

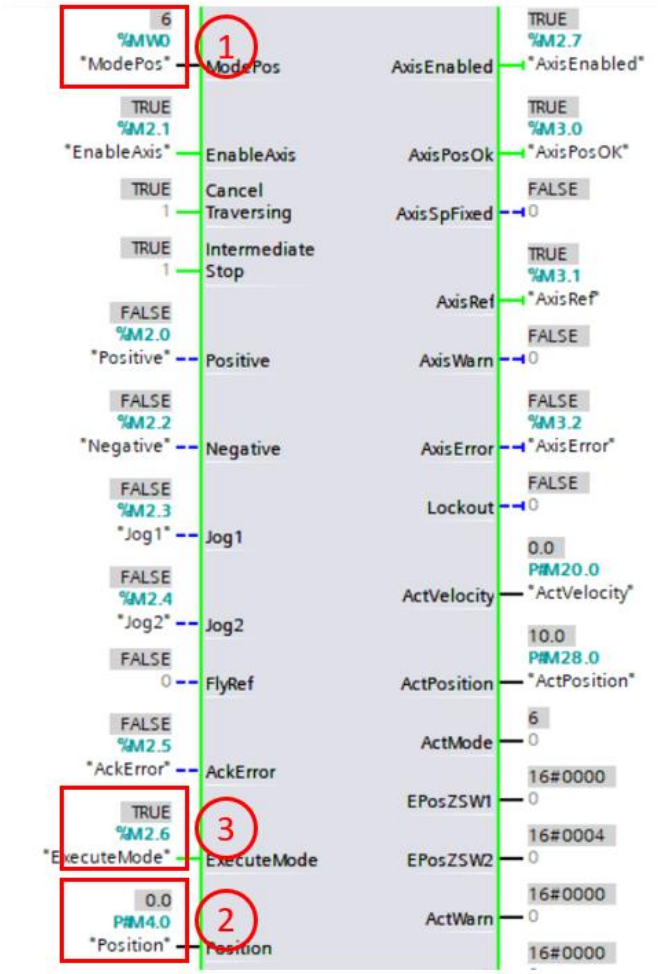
Step	Descriptions
1.	Create the PLC tags.  1. Double click the default tag table to open it. 2. Create the PLC tags.
2.	Program the PLC logic. 
3.	**Compile the project and download to PLC.**

Step	Descriptions
4.	**Activate program monitoring** 1. Switch to the view of main program. 2. Press the monitoring button to activate program monitoring. 
5.	**Clear faults** Clear faults with M2.5 (**AckEror**) = 1. 

Step	Descriptions
6.	**Jog**  1. Set operating mode (MW0) to be **7** (Jog mode). 2. Enable servo drive by setting M2.0 (**EnableAxis**) to be 1. If the drive has been successfully enabled, the output signal "**AxisEnabled**" turns to be "1". 3. Activate Jog resource 1 by setting M2.3 to be 1 or Jog resource 2 by setting M2.4 to be 1. Then, the motor starts running at -4.5mm/min that is the default setting for Jog speed.

Step	Descriptions
7.	**MDI**  1. Set M2.3 (**Jog1**) or M2.4 (**Jog2**) to be “0”. 2. Set operating mode (MW0) to be **1** (MDI: relative positioning). 3. Configure MDI (relative positioning) parameters as follows: Position = 50.0mm Velocity = 10.0mm/min 4. Trigger a rising edge to M2.6 (**ExecuteMode**) and the motor starts running for 5 revolutions at the speed of 10mm/min.

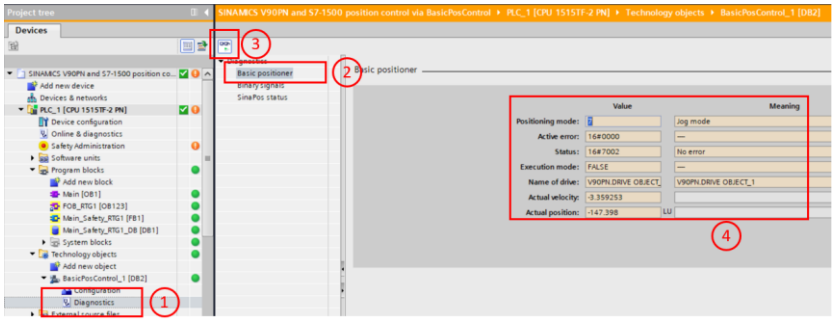
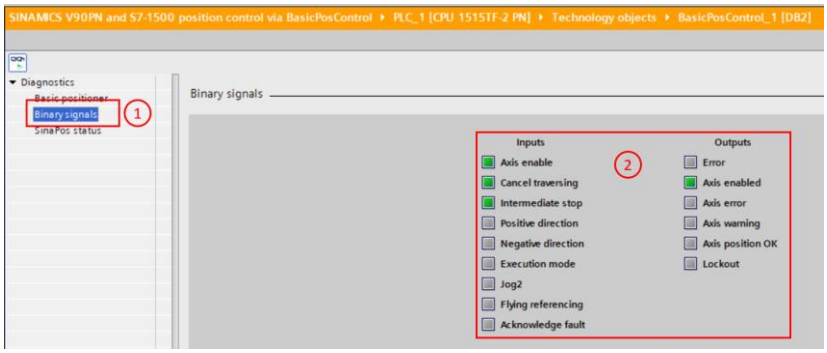
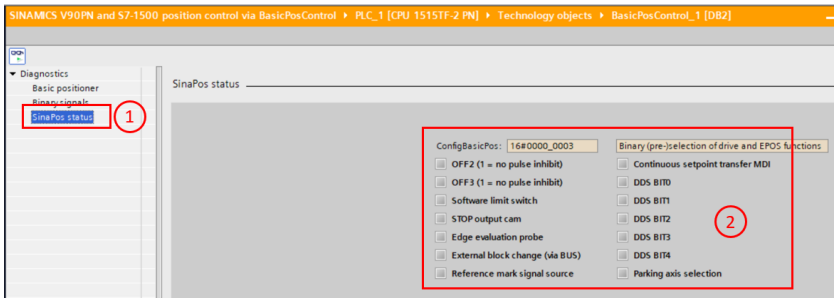
Step	Descriptions
8.	**Homing**  1. Set operating mode (MW0) to be **4** (**approach reference point**). 2. Trigger a rising edge to M2.6 (**execute mode**) and the motor starts homing as configured in SINAMICS V-ASSISTANT. In this example, the homing method of searching zero mark has been selected. When the homing operation has been done, the output signal "**AxisRef**" turns to be 1.

Step	Descriptions
9.	**Traversing block**  1. Set operating mode (MW0) to be **6** (**traversing block**). 2. Set position to be 0, which means that traversing block 0 has been selected. 3. Trigger a rising edge to M2.6 (**execute mode**) and the motor starts running according to the configurations of traversing block 0 in SINAMICS V-ASSISTANT; in this example, relative positioning of one motor revolution. When the positioning has been done, the output signal of "**ActPosition**" will display the actual position.
10.	**End operation** 1. Set M2.0 (EnableAxis) to be "0", which means the servo drive is switched to servo-off state. 2. Go offline.

5.1.3 Diagnostics

During the operation, it's able to online the technology object and diagnostic the technology object.

Table 5-4 Diagnostics

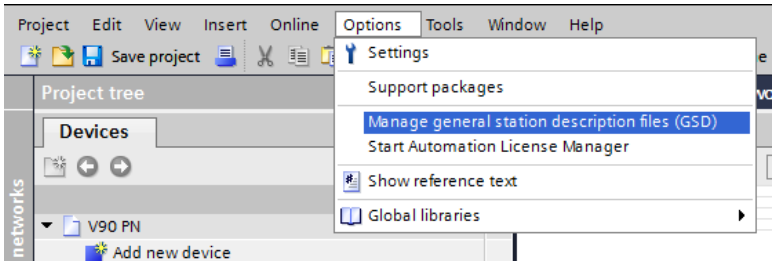
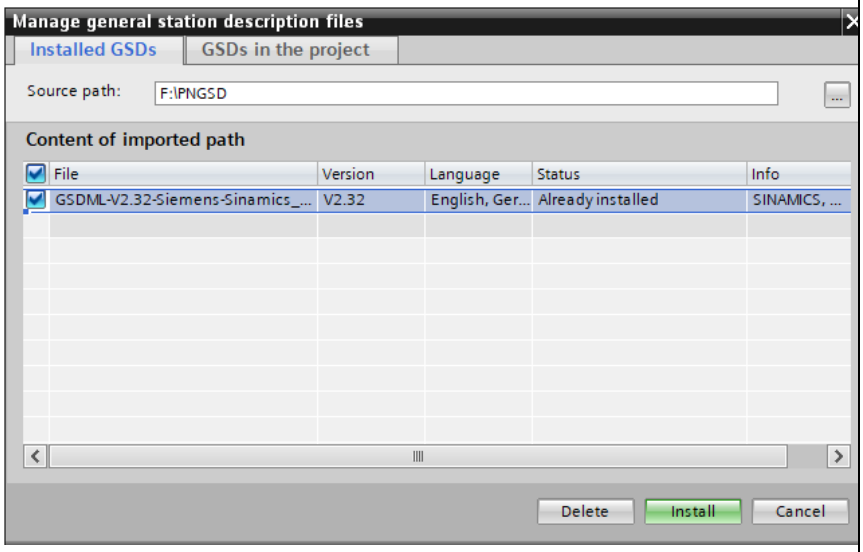
Step	Descriptions
1.	Basic Positioner  1. Double click the “Diagnostics” to open the technology object diagnostics screen. 2. Select the basic positioner item. 3. Click the monitor button to monitor the technology object. 4. Monitor the status of the basic positioner. Such as the ModePos, ActFault, Status, ExecuteMode, Name of Device, ActVelocity, and ActPosition.
2.	Binary signals  1. Switch to the Binary signals item. 2. In this screen can show the binary status of the instruction inputs and outputs.
3.	SinaPos status  1. Switch to the SinaPos status. 2. In this screen shows the status of the ConfigBasicPos input.

6 Options

Install GSD files

The GSD files installation step is shown in table 6-1.

Table 6-1

Step	Description
1.	**Install V90PN GSD file into TIA Portal** 1. Click menu "**Options**" → "**Manage general station description (GSD)**".  2. Find the GSD file and install it.  **Note:** The latest V90PN GSD file can be found from the link below: http://support.automation.siemens.com/WW/view/en/109737269

7 Appendix

7.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:

support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts.

Please send queries to Technical Support via Web form:

siemens.com/SupportRequest

SITRAIN – Digital Industry Academy

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" APP. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

7.2 Industry Mall

The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

7.3 Application support

DI MC GMC AGH MP

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Jiangning Development Zone

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China
mailto: mc_gmc_mp_asia.cn@siemens.com

7.4 Links and literature

Table 7-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109780784

7.5 Change documentation

Table 7-2

Version	Date	Modifications
V1.0	05/2020	First version
V1.1	08/2021	Upgrade the project and document from TO_BasicPos to BasicPosControl.