FB EncoderAdjustment to setup absolute encoder in SINAMICS via TIA PORTAL

SINAMICS / S,G,V / communication / function block

https://support.industry.siemens.com/cs/ww/en/view/109760317

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Table of contents

Legal information **2**

1 Task **4**

1.1 Overview 4
1.2 Requirements 4

2 Solution **5**

2.1 Overview of the overall solution 5
2.2 Description of the core functionality 6
2.3 Minimum requirements for the hardware/software 8
2.4 Hardware and software components used 8
2.5 Memory requirement of the blocks 8

3 Function block EncoderAdjustment (FB38000) **9**

3.1.1 Input interface of EncoderAdjustment 10
3.1.2 Output interface of EncoderAdjustment 10
3.1.3 Absolute encoder adjustment 10
3.1.4 Troubleshooting function block EncoderAdjustment 11

4 Usage **13**

4.1 Example for determining the Axis Number 13
4.1.1 STARTER 13
4.1.2 TIA-Portal 14
4.1.3 V-Assistant 16
4.1.4 Set Axis Number for the Block 16
4.2 Example for determining the hardware identification number 16
4.3 Adding the block library to TIA Portal V14 18

5 FAQ **20**

5.1 The Encoder Adjustment is not working, although I checked all fault codes? 20
5.2 The Encoder Adjustment is not working anymore, although it worked before? 20

6 Appendix **21**

6.1 Service and support 21
6.2 Links and literature 22
6.3 Change documentation 22

1 Task

1.1 Overview

The EncoderAdjustment function block is used to adjust the absolute encoder by setting the reference point coordinate for EPos (p2599) to the SINAMICS drive and then saving this parametrization.

The supported communication paths are intended for PROFIBUS and PROFINET bus systems.

To process the data, the data exchange between a SIMATIC S7 controller and a SINAMICS drive is performed via **acyclic** communication to adjust the parameters.

1.2 Requirements

- SINAMTIC S7-CPUs: S7-1200/1500(T)
- The block can be used for a SINAMICS drive S120, SINAMICS S110, G120 or SINAMICS V90 converter system.

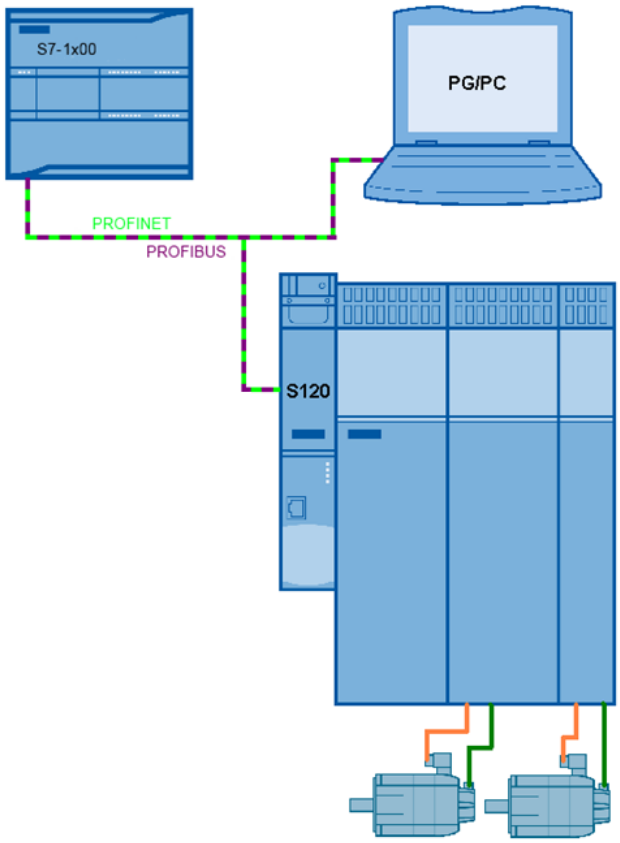
2 Solution

2.1 Overview of the overall solution

Schematic

The following schematic diagram shows the most important components of the solution:

Fig. 2-1



Design

The configuration of the function blocks is performed in the TIA Portal as of V14 SP1.

The configuration and parameter settings for the drives are realized as follows:

1. For SINAMICS S120, using Startdrive S V14SP1 (or GSD and STARTER 4.x).
2. For SINAMICS G120, using Startdrive G V14SP1 (or GSD and STARTER 4.x).
3. For SINAMICS V90PN using the V-Assistant and corresponding GSDXML.

Benefits

This software package offers you the following advantages:

- simple absolute encoder adjustment using the SIMATIC S7 PLC
- the block can be intuitively interconnected
- preconfigured function and data block
- modular software package that can be adapted by the customer

Demarcation

This block documentation does not contain a description of

- The drive commissioning / optimization / EPos commissioning
- The commissioning / selection of the PG/PC interface

Knowledge required

Basic knowledge of TIA Portal and commissioning of SINAMICS drives with EPos (basic positioner) in Startdrive (STARTER) / V-Assistant.

2.2 Description of the core functionality

The acyclic communication block EncoderAdjustment (FB38000) provides a predefined interface to simplify the absolute encoder adjustment for EPos axis.

The user has to specify only the reference point value, the desired encoder and execute the task. The job processing is performed autonomously after it's started.

The external (logic) connection of the function blocks must be performed by the user. This includes, for example the axis number, the encoder number and the reference point number.

General state diagram for the acyclic block EncoderAdjustment (FB38000)

Fig. 2-2

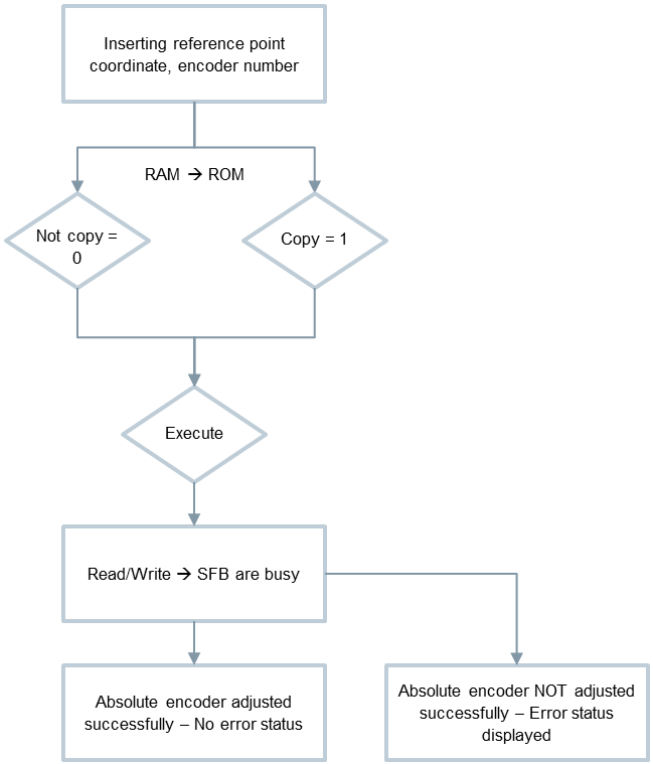


Table 2-1

Action	Note
Entry of reference point coordinate, encoder number	Entry in the intended area of the instance data block
Copy parameters from RAM to ROM	False = 0, True = 1
Execute the job	Edge from 0 → 1
Evaluation of the job response	With incorrect jobs, there is an error status in the outputs "Status" and "DiagId"

2.3 Minimum requirements for the hardware/software

Notice

- The block / library can only be used in TIA Portal V14 SP1 or more recent
- For S7-1200 at least the firmware Version 4.1 is required.
- For S7-1500 at least the firmware Version 2.0 is required.

2.4 Hardware and software components used

The blocks were created and tested with the following components:

Hardware components

Table 2-2

Component	Qty.	Order number	Note
S7-1200 CPU CPU 1212C DC/DC/DC	1	6ES7-212-1AE40-0X80	FW 4.1 or higher
S7-1500 CPU CPU 1517TF-3 PN/DP	1	6ES7-517-3UP00-0AB0	FW 2.0 or higher

Standard software components

Table 2-3

Component	Qty.	Order number	Note
STEP 7 Professional V14 SP1	1	6ES7822-1AA04-0YA5	

2.5 Memory requirement of the blocks

S7-1200:

Table 2-4

Block	Load memory	Work memory
EncoderAdjustment	60326 bytes	4109 bytes

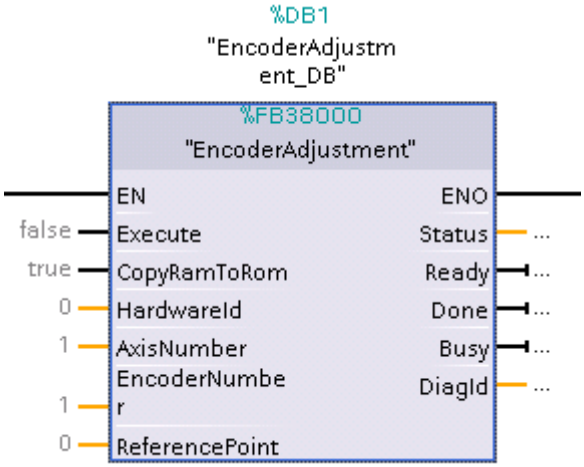
S7-1500:

Table 2-5

Block	Load memory	Work memory
EncoderAdjustment	58216 bytes	4037 bytes

3 Function block EncoderAdjustment (FB38000)

Fig. 3-1



Description

The appropriate instance DB is automatically created with the integration of EncoderAdjustment (FB38000).

It can be used in the following CPUs: S7-1200/1500(T).

Calling OBs

The block can be inserted alternatively in the following OBs:

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

Called blocks

RDREC/SFB52

WRRECSFB53

Function description

With the function block, the absolute encoder can be adjusted and afterwards, the parameterization can be saved into the ROM of the SINAMICS drive.

Note The data access is using data block 47 according to the PROFIdrive profile.

After setting the reference point coordinate to be adjusted into the encoder from the SINAMICS drive specified as the “Reference point”, the calibration is started by the edge-triggered "Execute" input.

3.1.1 Input interface of EncoderAdjustment

Table 3-1

Input signal	Type	Default	Meaning
Execute	BOOL	0	Executes the job (0 = no job; 1= starts and performs the job)
CopyRamToRom	BOOL	1	Copies parameters from RAM to ROM after the adjustment results successful
HardwareId	HW IO	0	Hardware ID of the access points module/actual value telegram slot/diagnostics address of the axis or drive (see Chapter 4.2)
AxisNumber	INT	1	Axis number / axis ID for multi-axis system (see Chapter 4.1)
EncoderNumber	INT	1	Allows to select specific encoder in the project (1 = encoder_1; 2 = encoder_2; 3 = encoder_3)
ReferencePoint	DINT	0[LU]	EPOS - reference point coordinate. This value is set as the actual axis position after referencing or adjustment

3.1.2 Output interface of EncoderAdjustment

Table 3-2

Output signal	Type	Default	Meaning
Status	WORD	0	Feedback signal from EncoderAdjustment task processing (see Table 3.3)
Ready	BOOL	0	Feedback signal to integrate in the LAcycCom environment; 1 = job completed or job interrupted (for one cycle)
Done	BOOL	0	Edge change from 0→1 indicates that the job has been completed If “CopyRamToRom” = 1 the Edge change occurs after the Save Process is finished
Busy	BOOL	0	1= indicates that the job is being processed
DiagId	WORD	0	Extended communication error → error during SFB call

3.1.3 Absolute encoder adjustment

When "Execute" is changed from"0→1" the block reads the input values, sets the reference point coordinate (p2599) to the SINAMICS drive and requests the absolute encoder adjustment.

While this action is being performed the "Busy" bit is set to "1".

If the parameter to be set is faulty or the job could not be completed, then the associated parameter error numbers are read out and entered in the structure. At the same time the appropriate error is displayed in the output “Status”.

After a successful encoder adjustment, the drive parameters are saved (RAM→ROM), and the task is terminated with the edge change "1→0" of the "Busy" bit and "0→1" of the "Done" bit.

3.1.4 Troubleshooting function block EncoderAdjustment

The Profidrive errors that occur temporarily during communication with the SINAMICS drive are determined and the action to be executed is repeated.

- During an active SFB error, status errors 8007 (for WRREC) or 8008 (for RDREC) are set, and an output is made in “DiagId”. The faults caused by the SFB calls do not have to be acknowledged. As soon as these faults have been resolved, and a new job started, the outputs and status are withdrawn.
- If an incorrect value is entered at the "ReferencePoint" input, this value is not considered and the status error is set and displayed in the "Status" output.
- Further, status errors are set if a task could not be completed. These errors are displayed in the “Status” output as word.

Evaluating the Status output

Table 3-3

Status	Bedeutung
Alarms	
16#7000	Initial state/end state - no errors
16#7001	Sending read assignment for reading parameter p2507_1
16#7002	Receiving read assignment 1
16#7003	Evaluating read data 1
16#7004	Resetting tuning of absolute encoder
16#7005	Sending read assignment for reading parameter p2507_2
16#7006	Receiving read assignment 2
16#7007	Evaluating read data 2
16#7008	Setting reference point coordinate
16#7009	Sending read assignment for reading parameter p2507_3
16#7010	Receiving read assignment 3
16#7011	Evaluating read data 3
16#7012	Starting tuning of absolute encoder
16#7013	Sending read assignment for reading parameter p2507_4
16#7014	Receiving read assignment 4
16#7015	Evaluating read data 4
16#7016	Copying RAM to ROM
16#7017	Sending read assignment for reading parameter p971_5
16#7018	Receiving read assignment 5 / State of the Save Process
16#7019	Evaluating read data 5 / Evaluating the State of the Save Process
Faults	
16#8000	Error: canceled resource when active
16#8001	Error: read assignment not successful
16#8002	Error: job reference wrong in answer
16#8003	Error: tuning absolute encoder failed
16#8004	Error: wrong value for parameter p2507
16#8005	Error: SINAMICS is not ready for tuning absolute encoder
16#8006	Error: wrong reference point coordinate in p2599
16#8007	Error: in function block WRREC (check DiagId)

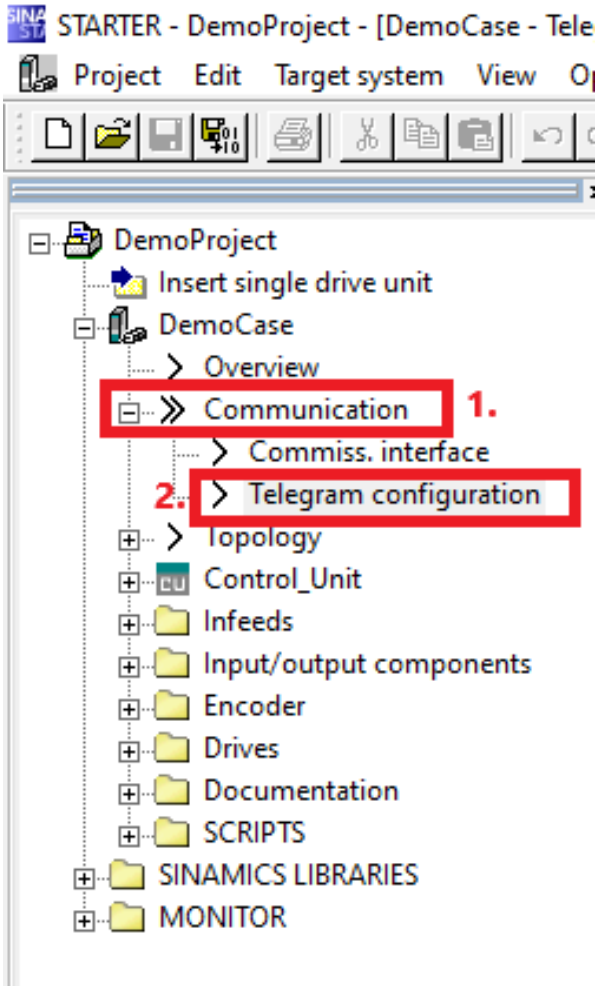
Status	Bedeutung
16#8008	Error: in function block RDREC (check DiagId)

4 Usage

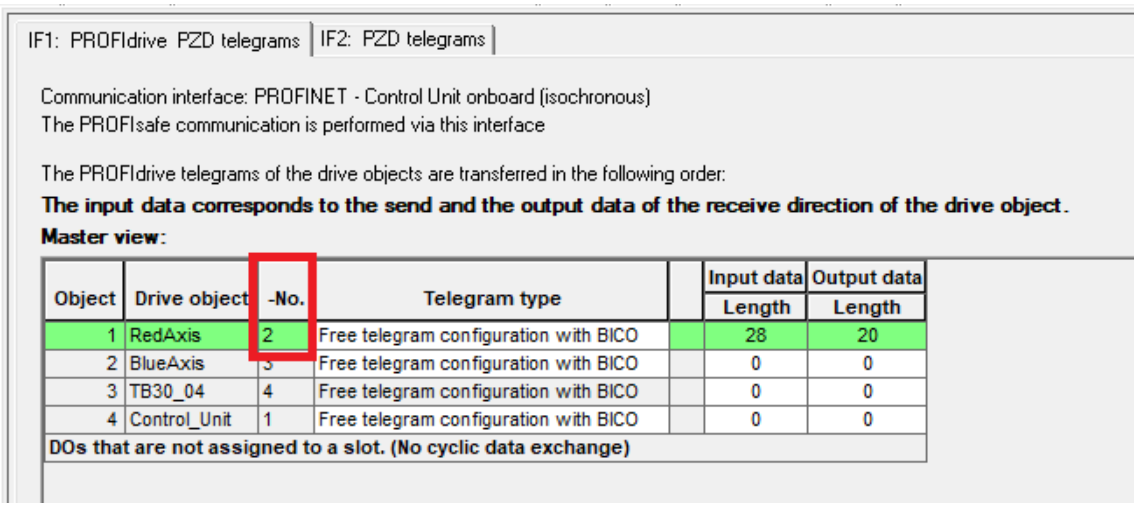
4.1 Example for determining the Axis Number

4.1.1 STARTER

1. Open your existing project in STARTER
2. Navigate to Telegram configuration



3. You will find the Axis Number in the third column named “-No.”



IF1: PROFIdrive PZD telegrams | IF2: PZD telegrams

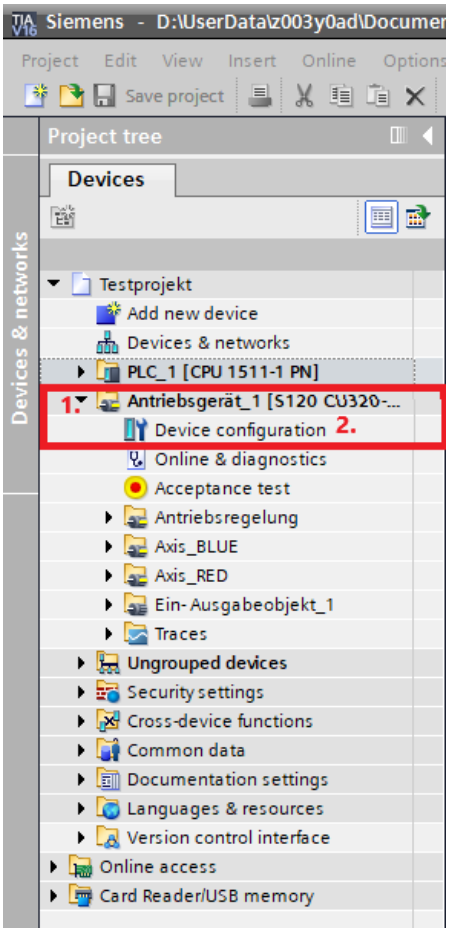
Communication interface: PROFINET - Control Unit onboard (isochronous)
The PROFIsafe communication is performed via this interface

The PROFIdrive telegrams of the drive objects are transferred in the following order:
The input data corresponds to the send and the output data of the receive direction of the drive object.
Master view:

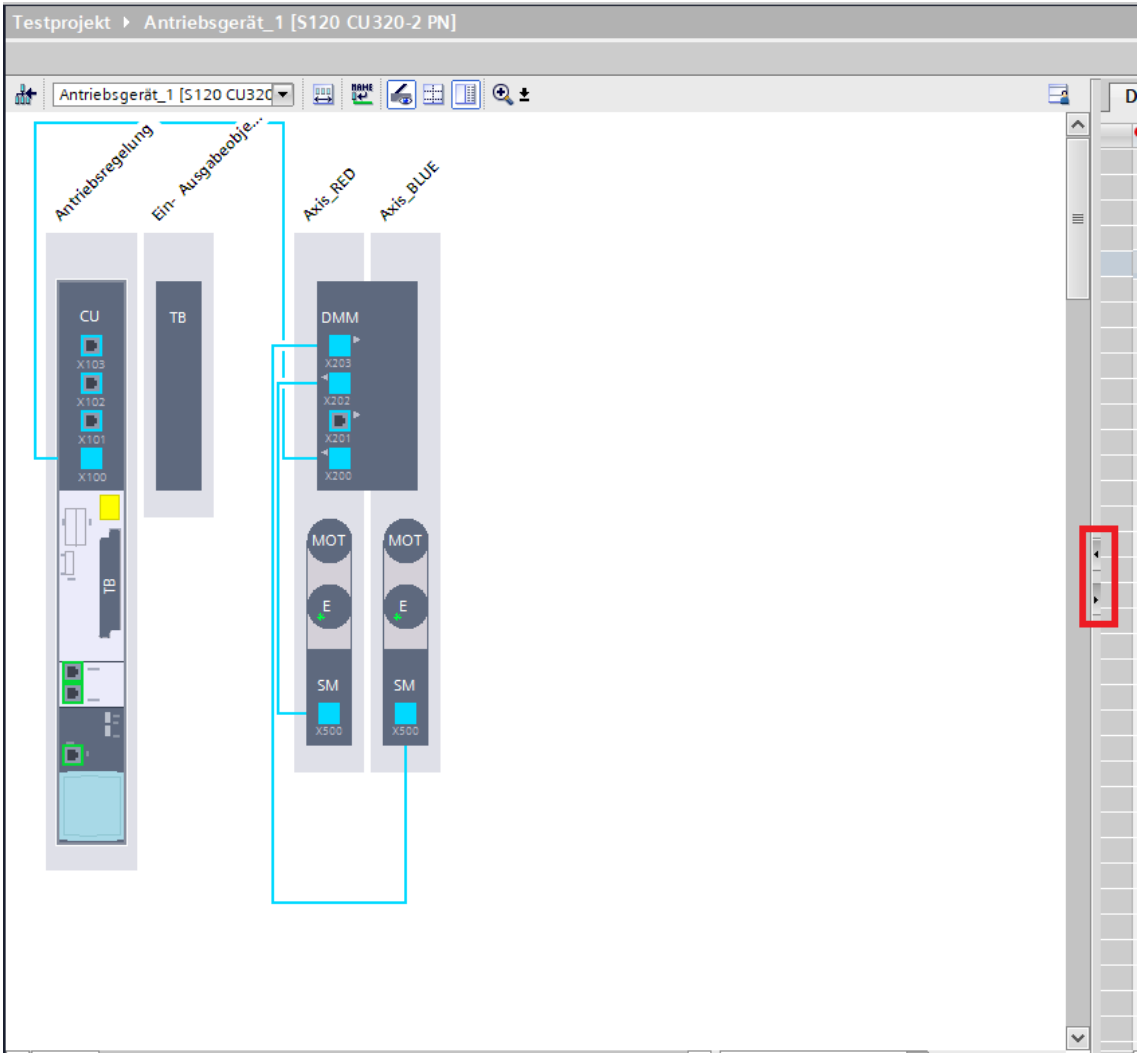
Object	Drive object	-No.	Telegram type		Input data Length	Output data Length
1	RedAxis	2	Free telegram configuration with BICO		28	20
2	BlueAxis	3	Free telegram configuration with BICO		0	0
3	TB30_04	4	Free telegram configuration with BICO		0	0
4	Control_Unit	1	Free telegram configuration with BICO		0	0
DOs that are not assigned to a slot. (No cyclic data exchange)						

4.1.2 TIA-Portal

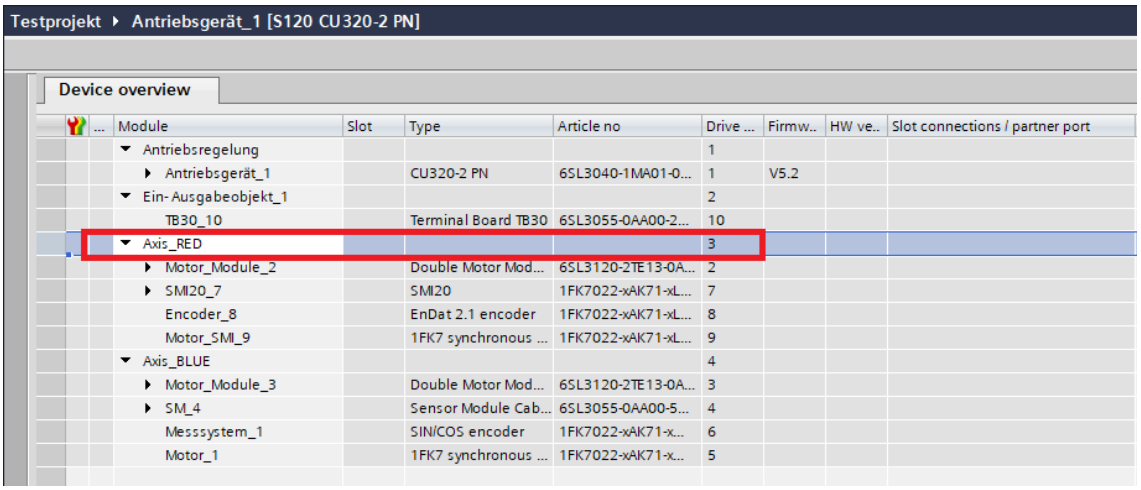
1. Open your existing project with TIA-Portal
2. Navigate to the Device Configuration of your drive device



3. Use the Arrow pointing left to maximize the table



4. You will the Axis Number in the same line as the Name of the Axis

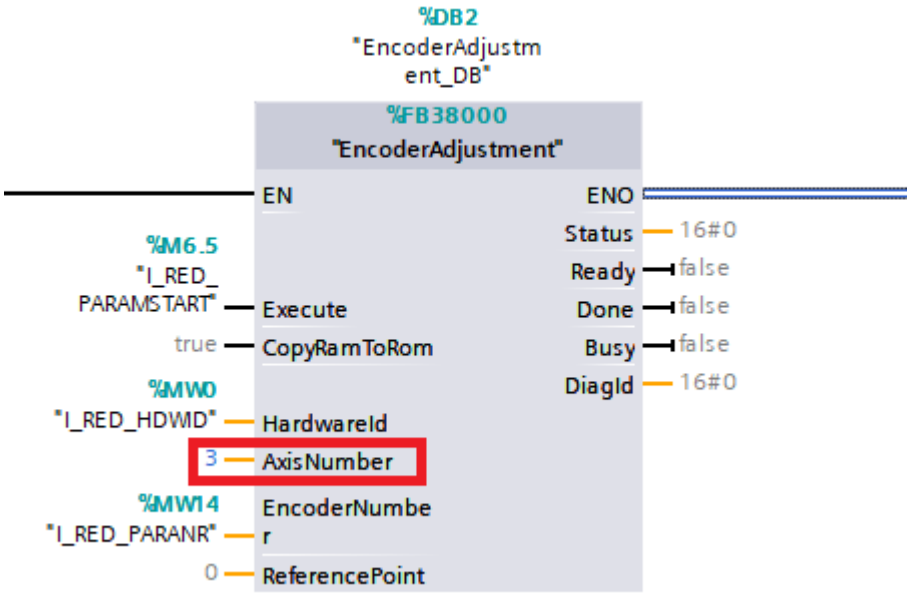


4.1.3 V-Assistant

If you are using the V- Assistant to configure your Axis, the Axis Number will always be 2.

4.1.4 Set Axis Number for the Block

To set the Axis Number write it to the Input “AxisNumber”



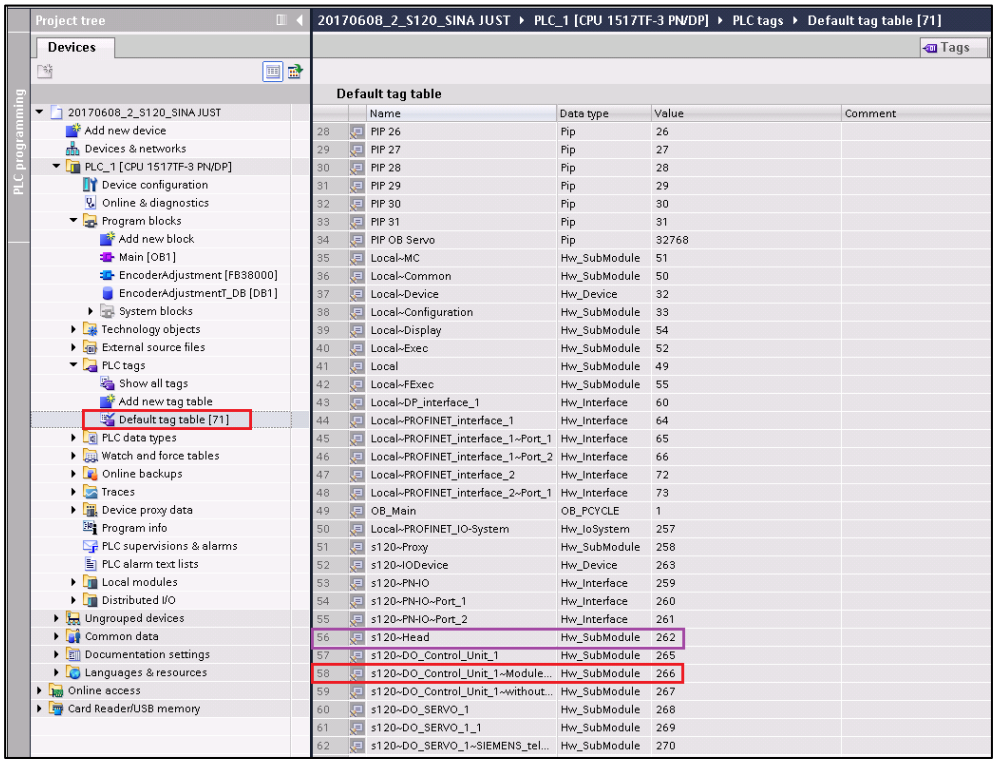
4.2 Example for determining the hardware identification number

The hardware identifier of type “HW_SUBMODULE” refers to an addressable component of the IO device, e. g. the SINAMICS S120 CU. These hardware identifiers are created by TIA Portal when a new SINAMICS drive is added in the project.

In the picture below, the relevant system constant has the value 266 (0x10A) or the symbolic name *s120~DO_Control_Unit_1~Module_Access_Point (red color)*.

It is also possible to communicate via the control unit head which has the value 262 and the hardware identifier *S120~Head (purple color)* configured in TIA Portal.

Fig. 4-1



When calling the function blocks of the LAcycCom library the system constant has to be interconnected via tag name or the decimal value to the input *hardwareId*.

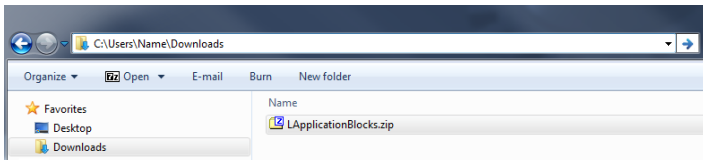
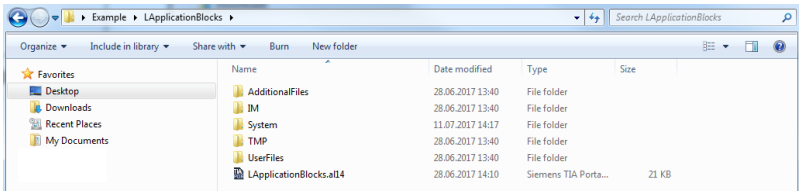
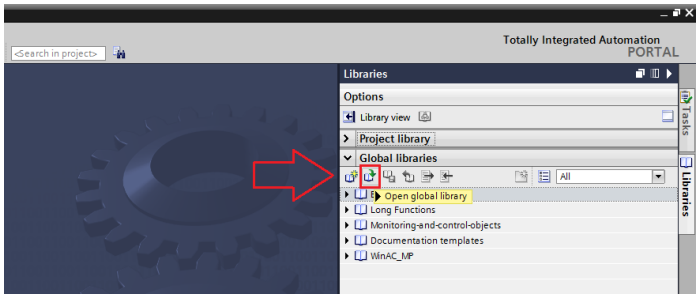
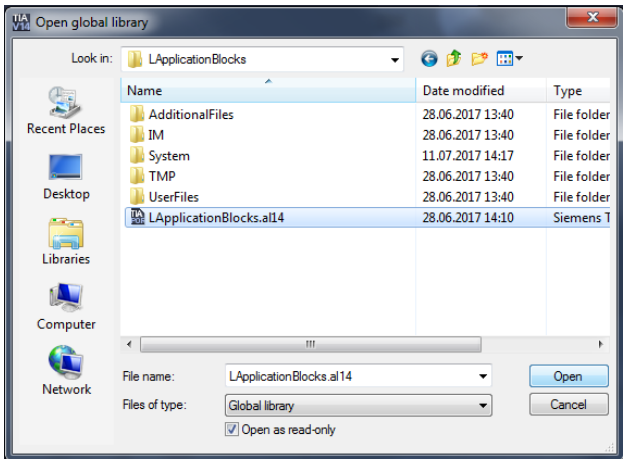
The symbolic name of the system constant depends on the selected device name and the project language. The value of the constant in the above picture may deviate to the value in the user project.

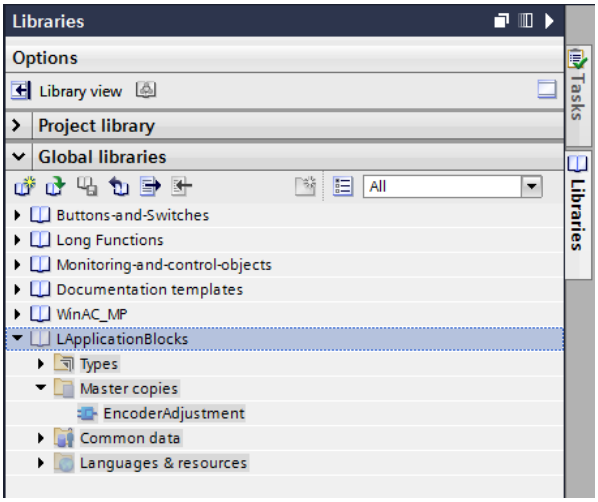
Note

When using a SINAMICS S120-CU320 (< FW V4.x) it is mandatory to use hardware identifier of the telegram address. This is labeled as “Parameter Access Point”. The hardware identifier of the head control unit does not work properly.

4.3 Adding the block library to TIA Portal V14

Table 4-1

No.	Action	Remark
1	Download the library from the SIEMENS Industry Online Support web portal.	https://support.industry.siemens.com/cs/ww/en/view/109748317 
2	Unzip the library to an arbitrary directory.	
3	Open TIA Portal V14 and in the menu “Libraries” click on “Open global library”.	
4	Search for the “LApplicationBlocks” library in the directory and open it.	

No.	Action	Remark
5	The library is ready to be used. Pull the block from the library.	

5 FAQ

5.1 The Encoder Adjustment is not working, although I checked all fault codes?

Drive Devices are capped for 20 acyclic accesses at once. The Buffer-Management “LAcycCom” can be found at

https://support.industry.siemens.com/cs/ww/de/view/109479553

5.2 The Encoder Adjustment is not working anymore, although it worked before?

Please check if the Axis is turned off. The Encoder Adjustment will only work if the Axis is turned off. Turn the Axis off and then please try again.

6 Appendix

6.1 Service and support

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

6.2 Links and literature

Table 6-1

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/109760317
\3\	DriveLib-Bausteine der SINA-Serie https://support.industry.siemens.com/cs/ww/en/view/109475044
\4\	SINAMICS S120 http://support.automation.siemens.com/WW/view/en/59737625
\5\	List Manual SINAMICS S120 http://support.automation.siemens.com/WW/view/en/68041075
\6\	LAcycCom https://support.industry.siemens.com/cs/ww/en/view/109479553

6.3 Change documentation

Table 6-2

Version	Date	Modifications
V1.0	08/2018	First version
V1.1	08/2020	Bug Fix: RamToRom now also works with position control to a 2nd or 3rd motor encoder Therefore line 594 of version 1.0 was adjusted to: #tempInt := 0; So p971 of the Control Unit is always accessed and RamToRom is executed correctly
V1.2	10/2020	The Operation “RamToRom” is actively checked. Output “Done” will only be set to High Level after “RamToRom” is finished