|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Application Note sample program Simple Motion PN for 1200/1500** | | | | | | | |
| Theme | | | | | | | |
| **Application Note** | | | | | | | |
| Document type | | | |  | | |  |
| **Sigma-7** | | | | | | | |
| Product |  |  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Version | Author | Changes |
| 10/22/2020 | Initial | Küster Chris | - |
|  |  |  |  |
|  |  |  |  |
| Limitations and Applications | | | |
| Sigma-7 200V - PROFINET, Sigma-7 400V - PROFINET, Servopack Firmware 002A or higher, SigmaWin + V2.7 or higher | | | |
| SIEMENS PLC 12xx firmware V4.0 or higher, SIEMENS PLC 15xx FW V2.5 or higher, TIA Portal V15.0 or higher | | | |
| Applied files | | | |
| "Demo\_TIA\_1x00\_V0000.zip" | | | |

Contents

[1 General 4](#_Toc54615357)

[1.1 Purpose of this document 4](#_Toc54615358)

[1.2 Precondition 4](#_Toc54615359)

[1.2.1 TIA Portal 4](#_Toc54615360)

[1.2.1.1 PLC 4](#_Toc54615361)

[1.2.1.2 Sigma-7 5](#_Toc54615362)

[1.2.2 SigmaWin+ 6](#_Toc54615363)

[1.2.2.1 Telegramm 6](#_Toc54615364)

[1.2.2.2 Optional settings 7](#_Toc54615365)

[2 Hardware configuration 8](#_Toc54615366)

[3 Software 9](#_Toc54615367)

[3.1 Hierarchy 9](#_Toc54615368)

[3.2 Data storage 9](#_Toc54615369)

[3.3 FB1 – CallAxis 11](#_Toc54615370)

[3.4 FB2 - multi-point positioning 12](#_Toc54615371)

[3.4.1 Layout 12](#_Toc54615372)

[3.4.2 Inputs 13](#_Toc54615373)

[3.4.3 OUTPUT 13](#_Toc54615374)

[3.4.4 Usage 14](#_Toc54615375)

[3.5 FBX – 2-Speed-Velocity-Block 15](#_Toc54615376)

[3.5.1 Layout 15](#_Toc54615377)

[3.5.2 Inputs 16](#_Toc54615378)

[3.5.3 Outputs 16](#_Toc54615379)

[3.5.4 Usage 17](#_Toc54615380)

[3.5.4.1 Fast and slow velocity 17](#_Toc54615381)

[3.5.4.2 Homing 17](#_Toc54615382)

[3.6 Variables 18](#_Toc54615383)

List of figures

[Figure 1: Changing the IP address](#_Toc54615384)

[Figure 2: Activate the clock memory byte s](#_Toc54615385)

[Figure 3: Assigning a device name](#_Toc54615386)

[Figure 4: USB-Type Mini and Type A](#_Toc54615387)

[Figure 5: Connection to the Servopack](#_Toc54615388)

[Figure 6: Supported telegrams in the SIGMA-7](#_Toc54615389)

[Figure 7: Selected telegram 100](#_Toc54615390)

[Figure 8: Position, speed and acceleration numerator and denominator](#_Toc54615391)

[Figure 9: PROFINET communication is running](#_Toc54615392)

[Figure 10: Hardware identification](#_Toc54615393)

[Figure 11: Program hierarchy](#_Toc54615394)

[Figure 12: Inputs and outputs from FB1](#_Toc54615395)

[Figure 13: FB1 with all connected inputs and outputs](#_Toc54615396)

[Figure 14: Layout of FB2 - multi-point positioning](#_Toc54615397)

[Figure 15: Layout FB2 – 2-Geschwindigkeiten-Block](#_Toc54615398)

# General

## Purpose of this document

This document explains the use of the sample project for the new Simple Motion library for the Siemens PLC 1200 and 1500.

If errors occur on the drive or controller, please refer to the associated documentation. This also applies to any errors in the Simple Motion block library. You can find both user manuals on the website <https://www.yaskawa.de/services/dokumenten-download-center>.

## Precondition

This chapter describes the requirements for the individual PLC types and the Sigma-7.

### TIA Portal

#### PLC

###### IP-Address

Regardless of the type of PLC used for the project, the first step is to adapt and change the IP address according to your network

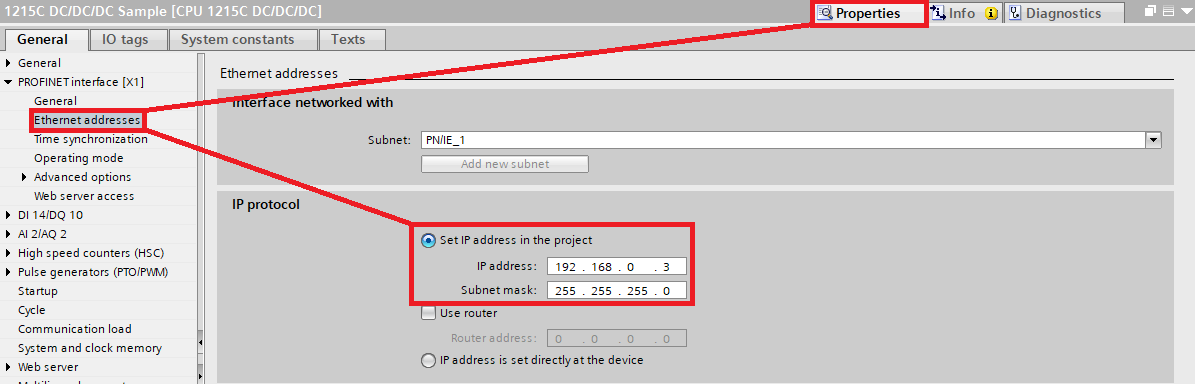


Figure 1: Changing the IP address

###### Time and timer

A time bit is used in these sample projects. This setting must therefore be made in the hardware configuration. These bits automatically change their status in a predefined period (see Figure 2)

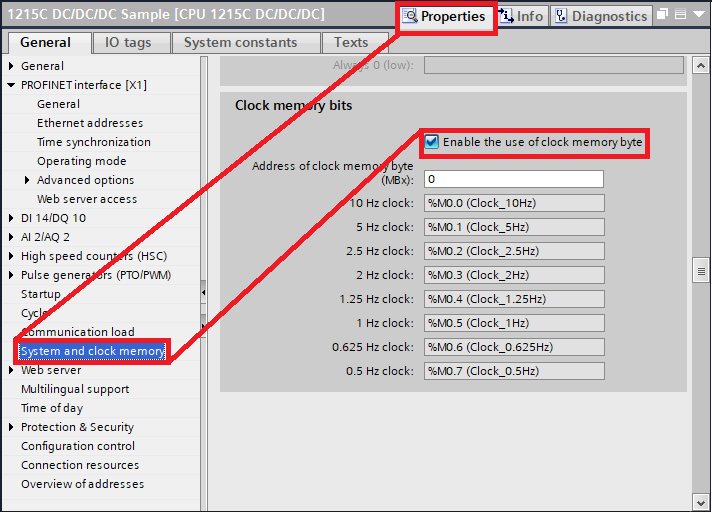


Figure 2: Activate the clock memory byte s

#### Sigma-7

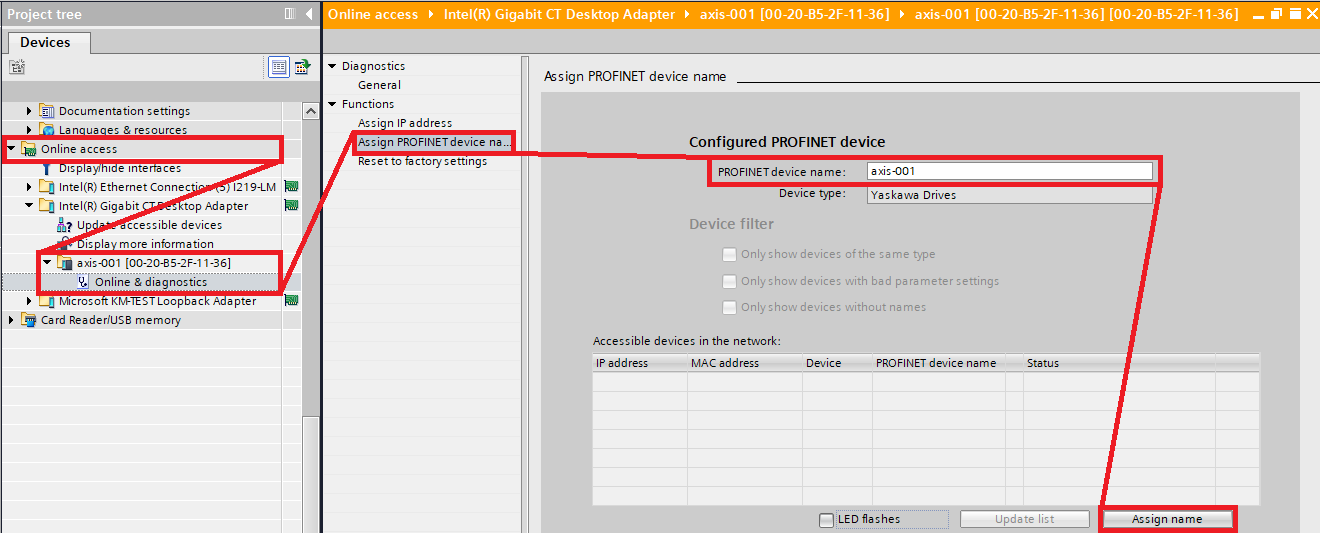
In order to establish a correct connection between the PLC and the Sigma-7 drive via PROFINET, the names of the individual bus participants must be identical to the names in the hardware configuration. The names currently assigned can be shown online in the list of accessible devices and if necessary, changed as described in Figure 3.

Figure 3: Assigning a device name

### SigmaWin+

With the YASKAWA tool SigmaWin+, some conditions must be set in the Sigma-7 drive. The connection between the tool and the Sigma-7 is established with an USB type Mini-B cable (drive side) and USB type A (computer side). It is recommended to use the Yaskawa connection cable here. This has the designation JZSP-CVS06-02-E.

Ein Bild, das Kabel, Verbinder, Adapter enthält.

Automatisch generierte Beschreibung

Figure 4: USB-Type Mini and Type A

Open the tool, select the USB connection method and search for servo packs. Your device will then be listed on the next screen. Select this and establish a connection.

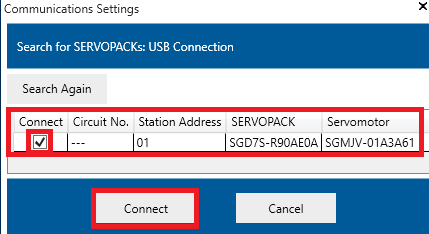
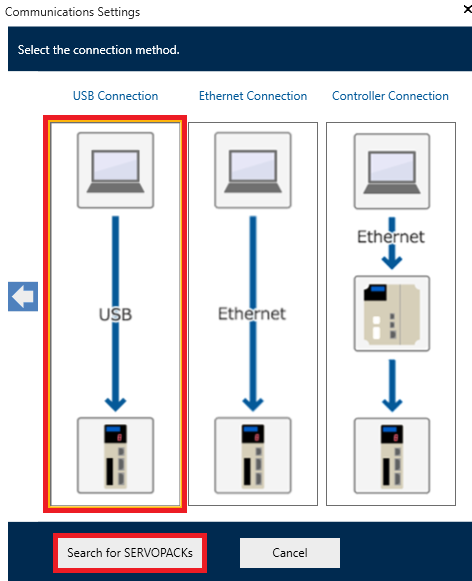


Figure 5: Connection to the Servopack

#### Telegramm

As specified in the hardware configuration, the SIGMA-7 drive communicates with the PLC via telegram 100. The telegram type must be set in the SIGMA-7 via the parameter **PnC90(922).** With the Sigma-5 this setting is made on the option card with the rotary switch S11. The following additional telegrams are also supported by the SIGMA-7:

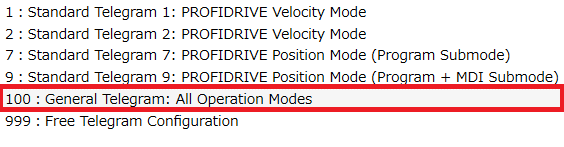


Figure 6: Supported telegrams in the SIGMA-7



Figure 7: Selected telegram 100

#### Optional settings

Acyclic communication is possible in telegram 100 and is also described in the manual. This function is not programmed in the example program. This means that the gear ratios and gear settings must be set manually using SigmaWin + in the parameters shown below.

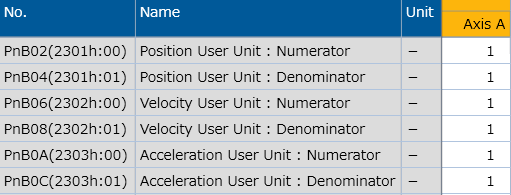


Figure 8: Position, speed and acceleration numerator and denominator

# Hardware configuration

In this sample project, the hardware configuration has already been completed. Please make sure that the configuration matches your existing hardware.

The individual configurations are identical except the respective PLC:

* 1215C DC/DC/DC (6ES7 215-1AG40-0XB0)
* 1516TF-3 PN/DP (6ES7 516-3UN00-0AB0)

Please adapt your hardware configuration according to your project and recompile it. If no further errors occur, you can upload it directly into your CPU and test online whether a PROFINET connection was established.

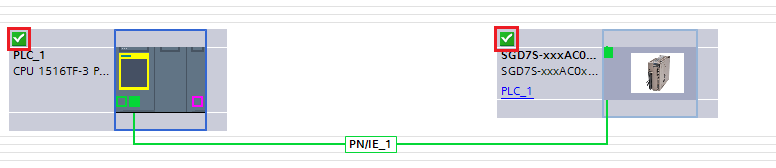


Figure 9: PROFINET communication is running

If an error occurs, please check the following points:

* Name of the configured devices
  + Must be the same offline and online
* Telegram of the PROFINET devices
  + Please check the Sigma-7 telegram in SigmaWin + and in the hardware configuration
  + Refer to chapter Telegramm

**Annotation**: Once you are using your own program, please make sure that you are using the correct addressing.

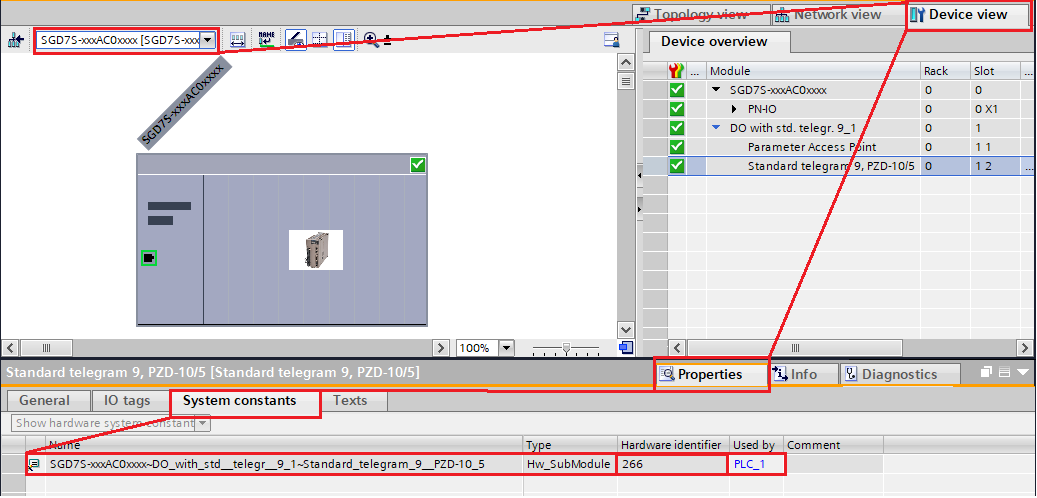


Figure 10: Hardware identification

# Software

## Hierarchy

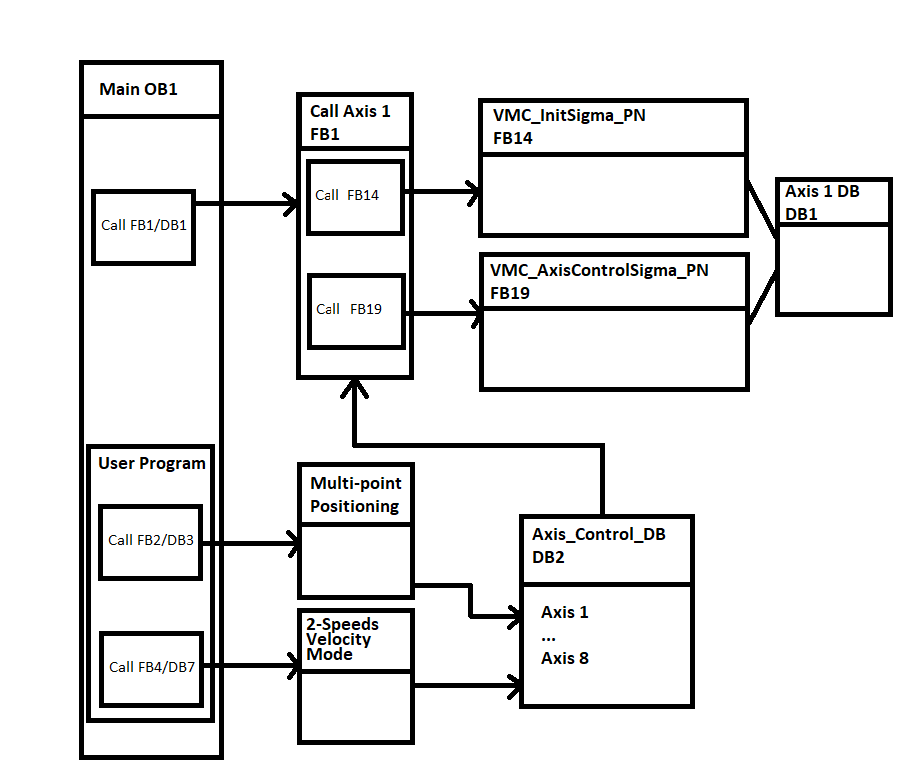


Figure 11: Program hierarchy

The main structure of the program consists of OB 1, in which all other blocks of the program are called. On the one hand the blocks for communication in FB1 (FB14 and FB19) and on the other hand the user program FB2 (multi-point positioning) and FB4 (2-speed velocity) programmed as an example. The data required to control the drive from the user program are written directly to DB2 (Axis\_Control\_DB), which is connected to the axis communication FB (FB19) and controls the axis via this.

## Data storage

The DB2 is structured as an array of 8 axes. Each axis is then divided into the following 6 sections:

1. Control\_In

These are the control registers of the user program.

1. Control\_Out

These are the status data of the user program.

1. Init\_In

The initial values of the axis are controlled via this.

1. Init\_Out

The initial values of the axis are mapped on this.

1. Config\_Reference

The configuration values of the axis are saved here and called by the program.

1. Axis\_Reference

The current status of the axis is saved here and called by the program.

## FB1 – CallAxis

In this block, the blocks VMC\_InitSigma\_PN and VMC\_ControlAxisSigma\_PN required for communication are called and controlled. The variables are transferred via DB2, which is described in more detail in Chapter 3.2.

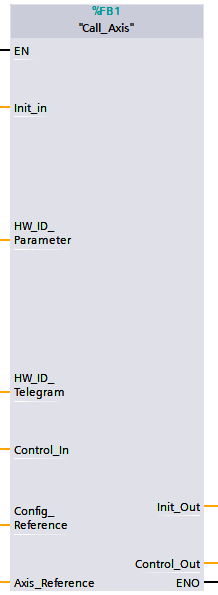


Figure 12: Inputs and outputs from FB1

The inputs "HW\_ID\_Parameter" and "HW\_ID\_Telegram" are used by the hardware addresses of the PROFINET drive. All other inputs and outputs are connected to DB2, which is controlled by the sample program.

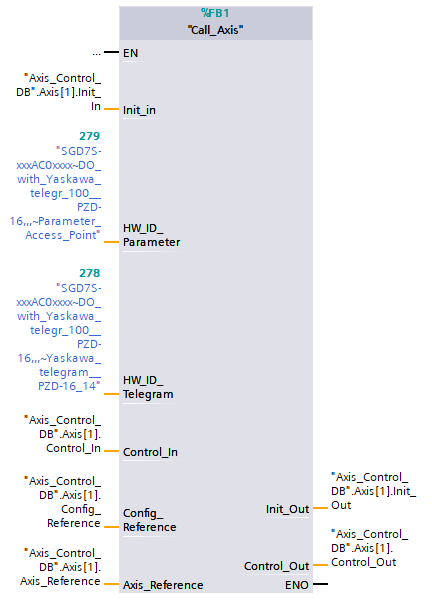


Figure 13: FB1 with all connected inputs and outputs

## FB2 - multi-point positioning

This function block allows the drive to move to 3 predefined positions and repeats the process until the "Stop" input is activated. Homing with this block is also possible. The block was programmed entirely in the SCL language.

### Layout

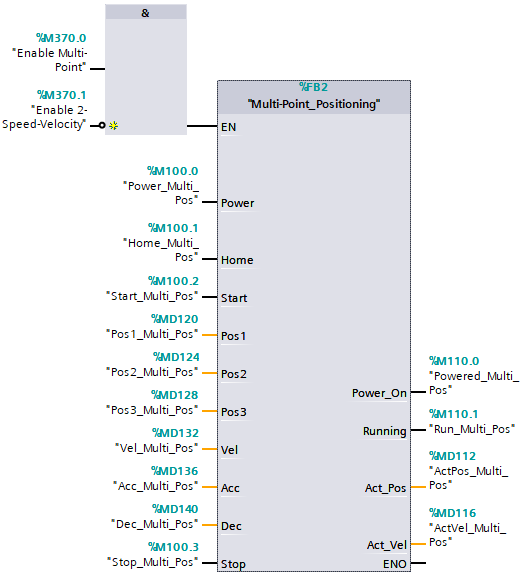


Figure 14: Layout of FB2 - multi-point positioning

### Inputs

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Default** | **Comment** |
| **Input** | | | |
| Power | BOOL | FALSE | 1 = switches the drive ON |
| Home | Bool | FALSE | Starts the homing procedure |
| Start | Bool | 0.0 | Starts the positioning run |
| Pos1 | Real | 0.0 | Target position 1 |
| Pos2 | Real | 0.0 | Target position 2 |
| Pos3 | Real | 0.0 | Target position 3 |
| Vel | Real | 0.0 | Velocity of motion while driving |
| Acc | Real | 0.0 | User value acceleration If 0 then automatically set to 100. |
| Dec | Real | 0.0 | User value negative acceleration (braking). If 0 then automatically set to 100. |
| Stop | Bool | FALSE | Stops the drive |

### OUTPUT

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Default** | **Comment** |
| **Output** | | | |
| Power\_On | Bool | FALSE | 1 = servo is switched ON |
| Running | Bool | FALSE | 1 = positioning run has started |
| Act\_Pos | DWord | 16 # 0 | Shows the current position |
| Act\_Vel | DWord | 16 # 0 | Displays the current velocity |

### Usage

The following step chain describes how the FB works and in which order which bits have to be switched.

**Annotation:** For your own safety, please ensure that the drive is free and can turn.

1. Activate bit MB370.0 ("Enable\_Multi-Point") in OB1
2. Deactivation bit MB370.1 ("Enable\_2\_Speed-Velocity") in OB1
   1. Enables the function block
3. Enter user values:
   1. "Pos1\_Multi\_Pos"
   2. "Pos2\_Multi\_Pos"
   3. "Pos3\_Multi\_Pos"
   4. "Vel\_Multi\_Pos"
   5. "Acc\_Multi\_Pos"
   6. "Dec\_Multi\_Pos"
4. Activate the "Power" input with bit M100.0 ("Power\_Multi\_Pos")
5. Activation of the homing bit: "Home" (if required)
   1. Starts the homing procedure of the controller
   2. Homing is complete when the "ActPos\_Multi\_Pos" output shows 0
6. Disabling the "Home" input
7. Activate "Start" with bit MB100.2 ("Start\_Multi\_Pos")
   1. The drive starts and moves to the first position
   2. Once there, it moves straight to the second position
   3. Once there, it moves straight to the third position
8. The "ActPos\_Multi\_Pos" output shows the current position
9. To stop the movement, activate the "Stop" input with the Stop\_Multi\_Pos bit (MB 100.3)

## FBX – 2-Speed-Velocity-Block

In this function block, 2 velocities are specified, which are activated when the respective bit is set. The input with the lower velocity has priority here. Further information on the inputs and outputs can be found below.

### Layout

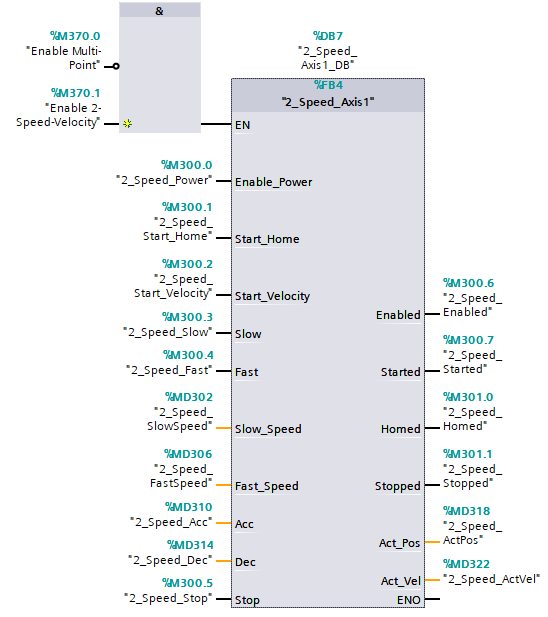


Figure 15: Layout FB2 – 2-Geschwindigkeiten-Block

### Inputs

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Default** | **Comment** |
| **Input** | | | | |
| Enable\_Power | Bool | FALSE | Switches the drive ON |
| Start\_Home | Bool | FALSE | Enable the homing function |
| Start\_Velocity | Bool | FALSE | Starts the servo drive |
| Slow | Bool | FALSE | Activates the slow velocity |
| Fast | Bool | FALSE | Activates the fast velocity |
| Slow\_Speed | Real | 0.0 | Slow velocity user value |
| Fast\_Speed | Real | 0.0 | Fast velocity user value |
| Acc | Real | 0.0 | User value acceleration. |
| Dec | Real | 0.0 | User value negative acceleration (braking). |
| Stop | Bool | FALSE | Starts the positioning run |

### Outputs

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Default** | **Comment** |
| **Output** | | | |
| Enabled | Bool | FALSE | 1 = drive is switched ON |
| Started | Bool | FALSE | 1 = drive has started |
| Homed | Bool | FALSE | 1 = drive has homed Current position = 0.0 |
| Stopped | Bool | FALSE | 1 = drive stands still |
| Act\_Pos | Real | 0.0 | Shows the current position |
| Act\_Vel | Real | 0.0 | Shows the current velocity |

### Usage

The following step chain describes how the FB works and in which order which bits have to be switched.

**Annotation:** For your own safety, please ensure that the drive is free and can turn

#### Fast and slow velocity

1. Activation of bit MB370.1 ("Enable 2-Speed-Velocity") in OB1
2. Deactivation of bit MB370.0 ("Enable\_Multi-Point") in OB1
   1. Enables the function block
3. Activation of input "Enable\_Power"
4. Enter user values:
   1. "Slow\_Speed"
   2. "Fast\_Speed"
   3. "Acc"
   4. "Dec"
5. Activate the "Slow" or "Fast" input
   1. "Slow" activates the slow velocity
   2. "Fast" activates the fast velocity
   3. If both inputs are activated, the slow velocity has priority!
6. Activation of the "Start\_Velocity" input
   1. Starts the drive with set velocity (see point 5)
7. While driving, the velocity to be driven can now be activated/deactivated with the inputs "Slow" and "Fast"

#### Homing

1. Activation of bit MB370.1 ("Enable 2-Speed-Velocity") in OB1
2. Deactivation of bit MB370.0 ("Enable\_Multi-Point") in OB1
   1. Enables the function block
3. Activation of input "Enable\_Power"
4. Activation of the "Start\_Home" input
   1. Homing is complete when the "Act\_Pos" output shows 0
   2. The "Homed" output has the status TRUE

## Variables

All variables used in this example program are listed and commented on below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Data type** | **Address** | **Comment** |
| **General** | | | |
| System\_Byte | Byte | %MB0 |  |
| FirstScan | Bool | %M0.0 | Changes the status during the first scan after switching on the CPU |
| DiagStatusUpdate | Bool | %M0.1 | Changes the status during a diagnostic status update |
| AlwaysTRUE | Bool | %M0.2 | Is always "TRUE" |
| AlwaysFALSE | Bool | %M0.3 | Is always "FALSE" |
| Clock\_Byte | Byte | %MB1 |  |
| Clock\_10Hz | Bool | %M1.0 | Changes the status at 10Hz intervals |
| Clock\_5Hz | Bool | %M1.1 | Changes the status at 5Hz intervals |
| Clock\_2.5Hz | Bool | %M1.2 | Changes the status at 2.5Hz intervals |
| Clock\_2Hz | Bool | %M1.3 | Changes the status at 2Hz intervals |
| Clock\_1.25Hz | Bool | %M1.4 | Changes the status at 1.25Hz intervals |
| Clock\_1Hz | Bool | %M1.5 | Changes the status at 1Hz intervals |
| Clock\_0.625Hz | Bool | %M1.6 | Changes the status at 0.625Hz intervals |
| Clock\_0.5Hz | Bool | %M1.7 | Changes the status at 0.5Hz intervals |
| **Enable** | | | |
| Enable Multi-Point | Bool | %M370.0 | Activates the multi-point positioning and blocks the 2 speed velocity function |
| Enable 2-Speed-Velocity | Bool | %M370.1 | Activates the 2 speed velocity function and blocks multi-point positioning |
| **Multi-point positioning** | | | |
| Power\_Multi\_Pos | %M100.0 | Bool | Switches the drive ON |
| Home\_Multi\_Pos | %M100.1 | Bool | Starts the homing function |
| Start\_Multi\_Pos | %M100.2 | Bool | Starts the positioning run |
| Stop\_Multi\_Pos | %M100.3 | Bool | Stops the positioning run |
| Powered\_Multi\_Pos | %M110.0 | Bool | Saves the current status of the "Power\_On" output |
| Run\_Multi\_Pos | %M110.1 | Bool | The drive is in the active positioning run |
| ActPos\_Multi\_Pos | %MD112 | Real | Shows the current position |
| ActVel\_Multi\_Pos | %MD116 | Real | Displays the current velocity |
| Pos1\_Multi\_Pos | %MD120 | Real | Target position 1 |
| Pos2\_Multi\_Pos | %MD124 | Real | Target position 2 |
| Pos3\_Multi\_Pos | %MD128 | Real | Target position 3 |
| Vel\_Multi\_Pos | %MD132 | Real | Velocity while movenment  Can be adjusted and changed while movement |
| Acc\_Multi\_Pos | %MD136 | Real | Acceleration while movement  Can be adjusted and changed while movement |
| Dec\_Multi\_Pos | %MD140 | Real | Negative acceleration while movement  Can be adjusted and changed while movement |
| **Name** | **Data type** | **Address** | **Comment** |
| **2-Speed-Velocity** | | | |
| 2\_Speed\_Vel\_Power | %M300.0 | Bool | Switches the drive ON |
| 2\_Speed\_Vel\_Start\_Home | %M300.1 | Bool | Starts the homing function of the drive |
| 2\_Speed\_Vel\_Start | %M300.2 | Bool | Starts the servo drive |
| 2\_Speed\_Vel\_Slow | %M300.3 | Bool | Activates the slow velocity |
| 2\_Speed\_Vel\_Fast | %M300.4 | Bool | Activates the fast velocity |
| 2\_Speed\_Vel\_SlowSpeed | %MD302 | Real | Low velocity  Can be adjusted and changed while movement |
| 2\_Speed\_Vel\_FastSpeed | %MD306 | Real | Fast velocity  Can be adjusted and changed while movement |
| 2\_Speed\_Vel\_Acc | %MD310 | Real | Acceleration while movement  Can be adjusted and changed while movement |
| 2\_Speed\_Vel\_Dec | %MD314 | Real | Negative acceleration while movement  Can be adjusted and changed while movement |
| 2\_Speed\_Vel\_Stop | %M300.5 | Bool | Stops the drive |
| 2\_Speed\_Vel\_Enabled | %M300.6 | Bool | Drive is switched ON |
| 2\_Speed\_Vel\_Started | %M300.7 | Bool | Drive has started |
| 2\_Speed\_Vel\_Homed | %M301.0 | Bool | Drive is homed |
| 2\_Speed\_Vel\_Stopped | %M301.1 | Bool | Drive is stopped |
| 2\_Speed\_Vel\_ActPos | %MD318 | Real | Shows the current position |
| 2\_Speed\_Vel\_ActVel | %MD322 | Real | Shows the current velocity |