

# AG03/1 IO-Link

**Siemens S7-1500® Interface Module**

**for TIA Portal® V14 SP1 in SCL**

Software Description



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## **1 General Information**

### **1.1 Trademarks**

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### **1.3 Limitations**

The library and its function were tested with a Siemens S7-1500 1511-1PN. The module was programmed using Siemens TIA Portal® V14 SP1 Update 9.

### **1.4 Requirements**

- Basic knowledge of handling and programming Siemens systems.
- Familiarity with IO-Link.

### **1.5 Versions Overview**

This manual is related to the following library.

- SIKO\_AG03\_IOL\_1200\_1500\_TIA\_V14\_SP1\_Upd9\_1.02.zal14

## 1.6 List of Abbreviations

| Abbreviation | Definition                    |
|--------------|-------------------------------|
| FB           | Function block                |
| CW           | Control word                  |
| IOL          | IO-Link                       |
| ISDU         | Indexed service data unit     |
| PLC          | Programmable logic controller |
| SW           | Status word                   |
| UDT          | User data type                |

## 1.7 Document History

| Version | Date       | Description  |
|---------|------------|--|
| 1.0     | 15.10.2020 | Document created   |
| 1.1     | 30.03.2021 | from FW-V1.02 upwards<br>Chapter 1.5 updated<br>Chapter 2.2 bs13_CalibrationRequest added<br>Chapter 3.2 description bcExecute changed |
| 1.2     | 23.07.2021 | Data type from nGenMapCh1+2 changed from Byte to SInt  |

## 2 Description of PLC data types

### 2.1 General

The library contains operating mode dependent data types that can be used for creation of PLC tags. By using PLC data types symbolic access to inputs and outputs is possible.

The library contains following data types:

| Name                | Description                       |
|---------------------|-----------------------------------|
| DT_AG03_IOL_POS_PDI | Process data input position mode  |
| DT_AG03_IOL_POS_PDO | Process data output position mode |

### 2.2 DT\_AG03\_IOL\_POS\_PDI UDT

| Name                    | Type | Description                              |
|-------------------------|------|--|
| bs08_OperationEnabled   | Bool | True if operation is enabled             |
| bs09_SwitchLock         | Bool | True if switch-lock is active            |
| bs10_TravelJobAck       | Bool | True if travel job is acknowledged       |
| bs11_BatteryState       | Bool | True if battery state is critical or low |
| bs12_TorqueDeactState   | Bool | True if torque deactivation is active    |
| bs13_CalibrationRequest | Bool | True if calibration is required          |

| Name                     | Type | Description  |
|--------------------------|------|--|
| bs14_GuardingBit         | Bool | Communication guarding                             |
| bs15_CalibrationExecuted | Bool | True if calibration command is executed            |
| bs00_Supply              | Bool | Output stage voltage status                        |
| bs01_ReadyToTravel       | Bool | True if ready to travel                            |
| bs02_UpperLimit          | Bool | True if upper limit is violated                    |
| bs03_LowerLimit          | Bool | True if lower limit is violated                    |
| bs04_ActuatorTravels     | Bool | True if actuator travels                           |
| bs05_TarWinReached       | Bool | True if target window is reached                   |
| bs06_ActiveTravelJob     | Bool | True if travel job is active                       |
| bs07_GeneralError        | Bool | True if error is active                            |
| nGenMapCh2               | SInt | Content selectable via generic mapping parameter 2 |
| nGenMapCh1               | SInt | Content selectable via generic mapping parameter 1 |
| nActualValue             | DInt | Actual position                                    |

### 2.3 DT\_AG03\_IOL\_POS\_PDO UDT

| Name                    | Type | Description                               |
|-------------------------|------|---|
| bc08_InchingMode2Neg    | Bool | Inching in negative direction             |
| bc09_Reserved           | Bool | Reserved                                  |
| bc10_MoveRelative       | Bool | Select absolute or relative positioning   |
| bc11_Reserved           | Bool | Reserved                                  |
| bc12_Reserved           | Bool | Reserved                                  |
| bc13_Reserved           | Bool | Reserved                                  |
| bc14_GuardingBit        | Bool | Communication guarding                    |
| bc15_CalibrationExecute | Bool | If true calibration becomes executed      |
| bc00_CoastStop          | Bool | Coast stop command                        |
| bc01_QuickStop          | Bool | Quick stop command                        |
| bc02_NormalStop         | Bool | Normal stop command                       |
| bc03_IntermediateStop   | Bool | Interrupt active travel job               |
| bc04_StartTravelJob     | Bool | Rising edge starts travel job             |
| bc05_ErrorAck           | Bool | If true, the actual error is acknowledged |
| bc06_InchingMode1       | Bool | Inching with positioning steps            |
| bc07_InchingMode2Pos    | Bool | Inching in positive direction             |
| nGenMapPrm2             | Byte | Set content of mapping channel 2          |
| nGenMapPrm1             | Byte | Set content of mapping channel 1          |
| nTargetValue            | DInt | Target position                           |

### 3 Description of SIKO\_IOL\_PRM Function Block

#### 3.1 General

This function block supports read and write of parameters (IO-Link ISDU). The IO-Link block IO\_LINK\_DEVICE from the Siemens IO-Link library is used. Furthermore the IO\_LINK\_DEVICE function block uses the system function blocks SFB 52 (RDREC) and SFB 53 (WRREC). A read or write command takes several PLC cycles. The function block can read or write an individual parameter acyclically. For this purpose, an index and a subindex must be passed to the function block. The input value is transformed to a DINT (nReceiveValue) and the output value nWriteValue is converted from a DINT to the native format of the parameter.

The following parameters are interpreted as strings by the function block. The parameters sReadString and sWriteString are automatically used for write and read accesses.

| Index | Name                   |
|-------|------------------------|
| 16    | VendorName             |
| 17    | VendorText             |
| 18    | ProductName            |
| 19    | ProductID              |
| 20    | ProductText            |
| 21    | SerialNumber           |
| 22    | HardwareRevision       |
| 23    | FirmwareRevision       |
| 24    | ApplicationSpecificTag |
| 25    | FunctionTag            |
| 26    | LocationTag            |
| 95    | DisplayData            |
| 180   | ProductionDate         |

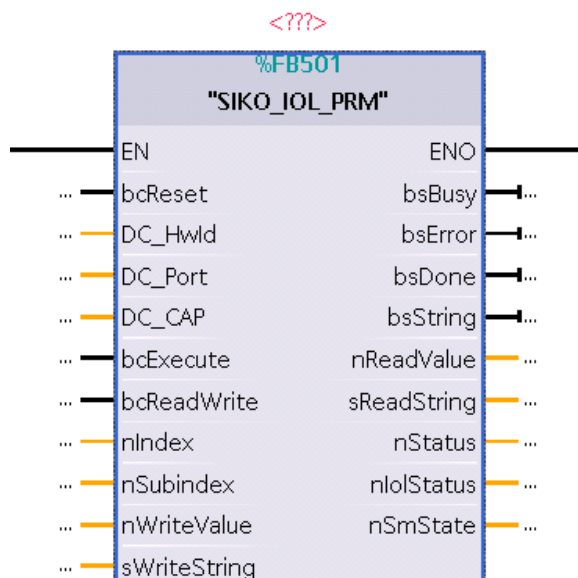


Fig. 1: Function block SIKO\_IOL\_PRM

### 3.2 Input Parameter

| Name         | Type       | Description   |
|--------------|------------|---|
| bcReset      | Bool       | Reset function block  |
| DC_HwId      | HW_IO      | Hardware identification of the IOL master module (HW_IO) from HW configuration            |
| DC_Port      | Int        | Port/channel number on which the IO-Link device is operated. (ET200 = 0 .. 4, 0 = Master) |
| DC_CAP       | DInt       | Client Access Point (CAP), with ET200 always 227 dec                                      |
| bcExecute    | Bool       | Rising edge executes command<br>0 = Reset function block (same as bcReset = 1)            |
| bcReadWrite  | Bool       | Command type 0 = read / 1 = write   |
| nIndex       | Int        | IO-Link index   |
| nSubindex    | Int        | IO-Link subindex  |
| nWriteValue  | DInt       | Value to write  |
| sWriteString | String[32] | String to write   |

### 3.3 Output Parameter

| Name        | Type       | Description  |
|-------------|------------|--|
| bsBusy      | Bool       | Function block status - busy   |
| bsError     | Bool       | Function block status - error  |
| bsDone      | Bool       | Function block status - done   |
| bsString    | Bool       | Function block status - response is a string   |
| nReadValue  | DInt       | Read value   |
| sReadString | String[32] | Read string  |
| nStatus     | DWORD      | DP/ PNIO - error status<br>ERROR flag = 1 - detailed communication error status  |
| nIoIStatus  | DWORD      | IO-Link error status<br>ERROR flag = 1 - detailed IO-Link error status   |
| nSmState    | Int        | Status of the function block internal state machine:<br>0 = SM_IDLE<br>1 = SM_START_READ_REQUEST<br>2 = SM_CHECK_READ_RESPONSE<br>3 = SM_FINISH_READ_CMD<br>4 = SM_START_WRITE_REQUEST<br>5 = SM_CHECK_WRITE_RESPONSE<br>6 = SM_FINISH_WRITE_CMD |

### 3.4 Errors

If a communication error occurs, the output "bsError" will be set. Additionally, an error code will be generated and displayed at the outputs "nStatus" or "nIoIStatus".

### 3.4.1 System Function Block Error Codes

The status of the used SFB 52 (RDREC) or SFB 53 (WRREC) is passed on to the "nStatus" output parameter. The description of the status can, in this case, be found in the online help of the respective SFBs.

### 3.4.2 IO-Link Specific Error Codes

If there is an IO-Link error, this is displayed at output parameter "nIoIStatus" (in this case, the "nStatus" parameter has the value 16#0000 0000). Device error codes are directly mapped into the "nIoIStatus". For detailed description see the manual of the AG03 IO-Link.

IO-Link master error codes are also mapped into the nIoIStatus.

|                             |         |                   |         |
|-----------------------------|---------|-------------------|---------|
| nIoIStatus = DW#16#00000000 |         |                   |         |
| IOL-M Error Code            |         | Device Error Code |         |
| W#16#0000                   |         | W#16#0000         |         |
| B#16#00                     | B#16#00 | B#16#00           | B#16#00 |

| IOL-Master Error Code | Meaning               | Explanation   |
|-----------------------|-----------------------|---|
| 16#0000               | No error              | No error pending  |
| 16#0001               | No call               | Function ready for new job                                    |
| 16#0002               | IO_LINK_CALL write    | Function in send state (SEND_REQUEST)                         |
| 16#0003               | IO_LINK_CALL read     | Function in polling state (WAIT_ON_RESPONSE)                  |
| 16#0004 .. 06FF       | -                     | Reserved  |
| 16#7000               | IO_LINK_CALL conflict | Send and response data inconsistent                           |
| 16#7001               | Wrong IO_LINK_CALL    | Decoding error  |
| 16#7002               | Port blocked          | Port occupied by another job or not existing                  |
| 16#7003 .. 7FFF       | -                     | Reserved  |
| 16#8000               | Timeout               | Timeout. Job could not be performed within the timeout period |
| 16#8001               | Wrong port address    | Port address smaller than 0 or larger than 63                 |
| 16#8002               | Wrong index           | Index smaller than 0 or larger than 32767                     |
| 16#8003               | Wrong subindex        | Subindex smaller than 0 or larger than 255                    |
| 16#8004               | No device             | No device connected (however port still in IO-Link mode)      |
| 16#8005               | Wrong LEN             | Invalid length when writing, less than 1 or over 232          |
| 16#8006               | Wrong LEN             | Invalid length when reading, less than 0 or over 232          |
| 16#8007               | DI/DO mode            | Port in DI or DO mode   |
| 16#8008               | No SPDU               | Device in IO-Link mode does not support SPDU                  |
| 16#8009               | -                     | An upload is not possible, since the function is disabled     |
| 16#8010 .. 8051       | -                     | Reserved  |



| <b>IOL-Master Error Code</b> | <b>Meaning</b>         | <b>Explanation</b>   |
|------------------------------|------------------------|--|
| 16#8053                      | RDREC Fault            | Error occurred when calling RDREC, see STATUS                                      |
| 16#8054                      | WRREC Fault            | Error occurred when calling WRREC, see STATUS                                      |
| 16#8054                      | Unexpected acknowledge | Internal error in IO-Link technology (unexpected status during an IO-Link request) |
| 16#8055                      | Port function failed   | Only relevant for port functions   |
| 16#8056 .. FFFF              | -                      | Reserved   |

### 3.5 Limitations

All parameters are treated as signed integers by the function block during input and output. In the Devices, however, there are also parameters in unsigned representation. As long as these parameters do not exceed the positive value range of a signed integer, the value in the variable nReadValue is displayed correctly.

These value ranges are:

| <b>Type</b> | <b>Range MIN</b> | <b>Range MAX</b> |
|-------------|------------------|------------------|
| int8_t      | -128             | 127              |
| int16_t     | -32768           | 32767            |
| int32_t     | -2147483648      | 2147483647       |

The reading and writing of parameters of the data type Record is not supported. If more than 4 characters are returned when reading a numeric parameter, the outputs bsError = 1, bsString = 1 and sReadString = "ERROR: DATA\_SIZE\_TOO\_LARGE" are set.



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