

IO-Link P8S PLC Integration

IO-Link service data function block + process data parser function for Siemens S7-1200/S7-1500 (TIA-Portal V12+SP1 / V13) PLC systems in combination with a PROFIBUS / PROFINET IO-Link Master

Table of content

| | |
|--|-----------|
| 1. About this document | 3 |
| 1.1. Function of this document | 3 |
| 1.2. Target group | 3 |
| 1.3. Scope | 3 |
| 2. Service data function block | 4 |
| 2.1. Block specifications | 4 |
| 2.2. Method of function | 5 |
| 2.3. Behavior when error occurs | 5 |
| 2.4. Parameter | 5 |
| 2.5. Error description | 7 |
| 2.5.1. Error code (ErrorCode) | 7 |
| 2.6. Including into the PLC project | 9 |
| 3. Process data parser function | 10 |
| 3.1. Block specifications | 10 |
| 3.2. Parameter | 10 |
| 3.3. Including into the PLC project | 10 |

1. About this document

Please read this chapter carefully before working with this documentation and the PARKER IO-Link device.

1.1. Function of this document

These instructions have been designed for the technical personnel for the use of the IO-Link PLC blocks.

These instructions do not provide instructions for operating the machine, the system or the vehicle on which IO-Link devices are, or will be, integrated. Information on this is to be found in the appropriate operating instructions of the machine, the system or the vehicle.

1.2. Target group

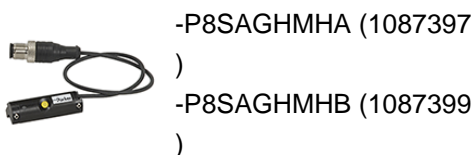
These instructions are addressed to programming engineers and the operators of machines and systems which are operated by one or several IO-Link devices. They also address people, who connect the IO-Link device via an IO-Link-Master-Gateway to a PLC-Control for data exchange.

1.3. Scope

These function blocks are device type-specific and only suitable for the following PARKER IO-Link devices.

Device family: Magnetic cylinder sensors

Device ID: 409856

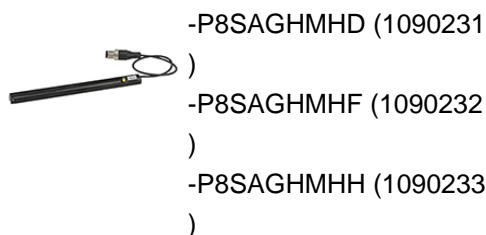


-P8SAGHMHA (1087397

)

-P8SAGHMH B (1087399

)



-P8SAGHMHD (1090231

)

-P8SAGMHF (1090232

)

-P8SAGMH H (1090233

)

The function block "FB_PARKER_P8S_PNPB" interprets the call-up of the acyclic service data.

The function "F_PARKER_PDInParser_P8S" interprets the process data telegram sent from the IO-Link device.

The functionality of these PLC blocks depends on the IO-Link parameter set described by the IODD. This means, that these blocks also may be used for other PARKER devices (e.g. new device variants) with identical IO-Link parameter sets.

2. Service data function block

The function block "FB_PARKER_P8S_PNPB" simplifies the usage of PARKER IO-Link devices on Siemens S7-1200/S7-1500 (TIA-Portal V12+SP1 / V13) PLC controls. This FB supports IO-Link Masters which can be connected via PROFIBUS / PROFINET to the PLC system.

The function block is device type-specific and thus only suitable for the appropriate PARKER IO-Link devices. The FB interprets the call-up of the acyclic service data between the PLC and the IO-Link device.

The IO-Link function block can only be used in combination with the listed helper functions / libraries.

2.1. Block specifications

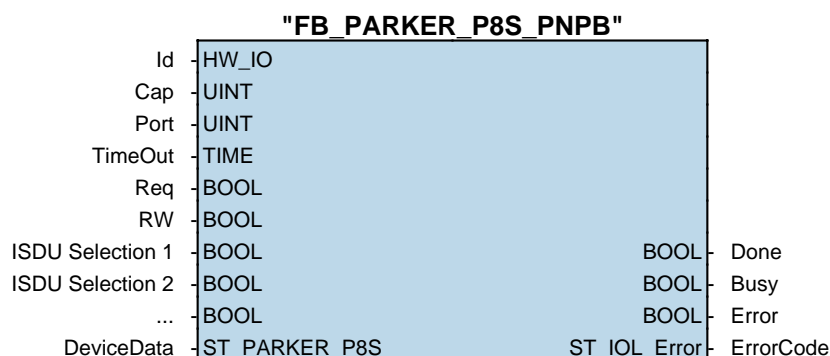
| | |
|-----------------------|--|
| Block name: | FB_PARKER_P8S_PNPB |
| Version: | 1.6 |
| Used blocks: | FB_IOL_Call_PNDP F_IOL_Internal2 F_IOL_Internal7 F_IOL_Internal11 F_IOL_Internal16 F_IOL_Internal14 F_IOL_Internal17 F_IOL_Internal5 F_IOL_Internal8 |
| Used structures: | ST_PARKER_P8S ST_IOL_Error |
| Call up: | Cyclic |
| Programming language: | Structured text (ST) |
| IODD: | Parker-Magnetic-Cylinder-Sensors-20171013-IODD1.1.xml (V1.3) |



Please note!

The library is compatible with the following TIA-Portal versions:

- TIA-Portal V12 + SP1
- TIA-Portal V13 (the library is automatically upgraded when opened)



2.2. Method of function

The function block uses the data structure "ST_PARKER_P8S". The PLC data structure contains the values of all IO-Link variables. Before you can use it, the structure must be instantiated by a data block. Each IO-Link FB parameter has a data point representing it in this data structure. This data point will be actualized every time a read request was executed successfully.

The desired parameters can be selected via the input variables. Depending on the device definition, IO-Link parameters are read or writable. The input variable must be "RW" = FALSE to read parameter. The value that should be written can be defined in the data structure, as soon as the input parameter "RW" = TRUE. You start each transfer by calling up the "FB_PARKER_P8S_PNPB" with a positive trigger at the "Req" input. As long as there is no valid answer the output "Busy" is TRUE. In the case that the chosen timeout period has elapsed a timeout error will be generated and the thread will be terminated. The "Done" =TRUE output shows that the transmission was successful. The outputs retain there states as long as there is no new positive trigger at the "Req" input again.

The function block allows you to read or write multiple IO-Link parameters sequentially (multi-selection). Please note that it may happen, that a single parameter can not be written. The function block aborts at this point and it is possible, that the IO-Link device contains an inconsistent set of parameters.

2.3. Behavior when error occurs

An error bit (Error) is set and an error code ST_IOL_Error) generated, if there is a spurious input value or an incorrect input connection of the FB. In this case, no further processing is carried out, until the input has been corrected.

2.4. Parameter

| Parameter name | Declaration | Data type | Description |
|----------------|-------------|-----------|---|
| Id | INPUT | HW_IO | Hardware IO-Address of the IO-Link master (see HW-Configuration). |
| Cap | INPUT | UINT | Client access point of the IO-Link function (IO-Link Master specific). Siemens ET200: 227 Weidmüller: 227 Other manufacturers: 255 |
| Port | INPUT | UINT | Number of the port where the IO-Link device is connected to. 0: Master 1..255: Port number |
| TimeOut | INPUT | TIME | Time, after a Timeout-Error is triggered. |
| Req | INPUT | BOOL | Positive trigger: Start data transfer |
| RW | INPUT | BOOL | Read or write the selected IO-Link parameter. FALSE: Read parameter TRUE: Write Parameter |

| Parameter name | Declaration | Data type | Description |
|----------------|-------------|-----------|---|
| VendorName | INPUT | BOOL | Selection of the IO-Link parameter "Vendor Name" ===== IO-Link parameter information ===== IO-Link Index: 16 Access: Read only |
| ProductName | INPUT | BOOL | Selection of the IO-Link parameter "Product Name" ===== IO-Link parameter information ===== IO-Link Index: 18 Access: Read only |
| VendorText | INPUT | BOOL | Selection of the IO-Link parameter "Vendor Text" ===== IO-Link parameter information ===== IO-Link Index: 17 Access: Read only |
| ProductID | INPUT | BOOL | Selection of the IO-Link parameter "Product ID" ===== IO-Link parameter information ===== IO-Link Index: 19 Access: Read only |
| ProductText | INPUT | BOOL | Selection of the IO-Link parameter "Product Text" ===== IO-Link parameter information ===== IO-Link Index: 20 Access: Read only |
| SerialNumber | INPUT | BOOL | Selection of the IO-Link parameter "Serial Number" ===== IO-Link parameter information ===== IO-Link Index: 21 Access: Read only |
| HWVersion | INPUT | BOOL | Selection of the IO-Link parameter "Hardware Version" ===== IO-Link parameter information ===== IO-Link Index: 22 Access: Read only |
| FWVersion | INPUT | BOOL | Selection of the IO-Link parameter "Firmware Version" ===== IO-Link parameter information ===== IO-Link Index: 23 Access: Read only |
| AppliName | INPUT | BOOL | Selection of the IO-Link parameter "Application Specific Tag" ===== IO-Link parameter information ===== IO-Link Index: 24 Access: Read/Write |

| Parameter name | Declaration | Data type | Description |
|----------------|-------------|---------------|--|
| SysCommand | INPUT | BOOL | Selection of the IO-Link parameter "Standard Command" ===== IO-Link parameter information ===== IO-Link Index: 2 Access: Write only Valid parameter values of the data structure (dec.): 160: Teach measuring range start 161: Teach measuring range end 162: Reset measuring range 163: Key Lock 164: Key Unlock |
| KeyLock | INPUT | BOOL | Selection of the IO-Link parameter "Key Lock" ===== IO-Link parameter information ===== IO-Link Index: 81 Access: Read/Write Valid parameter values of the data structure (dec.): 0: inactive 1: active |
| DeviceData | IN_OUT | ST_PARKER_P8S | Reference to the PLC data type of the device. This data type contains all the parameter values of the IO-Link device. |
| Done | OUTPUT | BOOL | Indicates whether data is valid. |
| Busy | OUTPUT | BOOL | Request in process. FALSE: Request is terminated TRUE: Request is being processed |
| Error | OUTPUT | BOOL | Error flag FALSE: No error TRUE: Error detected |
| ErrorCode | OUTPUT | ST_IOL_Error | Error codes |

2.5. Error description

2.5.1. Error code (ErrorCode)

The parameter "ErrorCode" can be interpreted using the PLC data type ST_IOL_Error. This data type contains the following error information:

| Parameter name | Data type | Description |
|---------------------|-----------|---|
| nCommunicationError | DWORD | Communication errors (see TIA-Portal help system about RDREC/WRREC) |
| nBlockError | DWORD | PARKER Function block errors |
| nIOLMError | WORD | IO-Link Master error (see IO-Link specification) |
| nIOLError | WORD | IO-Link error. Contains the IOL Error_Code the IOL Add_Error_Code (see IO-Link specification) and the device specific error codes |
| iISDUIndex | UINT | IO-Link Index (ISDU) to which the error code refers. |

| Error code (nBlockError) | Error code |
|--------------------------|--|
| 0x0000 | No error |
| 0x0001 | Reserved |
| 0x0002 | No parameter selected |
| 0x0003 | Selected parameter(s) not readable. There was at least one parameter selected with a write-only access (see ErrorCode.iISDUIndex). |
| 0x0004 | Selected parameter(s) not writable. There was at least one parameter selected with read-only access (see ErrorCode.iISDUIndex). |
| 0x0005 | At least one selected parameter, the input value is greater then the data type allows (see ErrorCode.iISDUIndex). |
| 0x0006 | At least one selected parameter, the input value is lower than the data type allows (see ErrorCode.iISDUIndex). |
| 0x0007 | Reserved |
| 0x0008 | Reserved |
| 0x0009 | Time out error occurred |

| Error code (nIOLMError) | Error code |
|-------------------------|---|
| 0x0000 | No error |
| 0x0001 ... 0x06FF | Reserved / Master specific |
| 0x7000 | Unexpected Write request instead of read request / Invalid response PDU |
| 0x7001 | Decode error |
| 0x7002 | Port occupied by another task |
| 0x7003 ... 0x7FFF | Reserved / Master specific |
| 0x8000 | Timeout when IOL-Devices or IOL-Master port are busy |
| 0x8001 | IO-Link index > 32767 |
| 0x8002 | Port address beyond defined maximum |
| 0x8003 | Port function not supported |
| 0x8004 | Reserved / Master specific |
| 0x8005 | Invalid length of the data that should be written (>232 / <1) |
| 0x8006 | Reserved / Master specific |
| 0x8007 | IO-Link subindex > 255 |
| 0x8008 ... 0x8051 | Reserved / Master specific |
| 0x8052 | Error during acyclic data access (FB RDREC error) |
| 0x8053 | Error during acyclic data access (FB WRREC error) |
| 0x8054 ... 0x8FFFF | Reserved / Master specific |

For additional information see the technical specification "IO-Link Integration Part 1" (www.profibus.com).

| Error code (nIOLError) | Error code |
|------------------------|--|
| 0x0000 | No error |
| 0x1000 | Master communication error |
| 0x1100 | ISDU time out / Device event error |
| 0x5200 | Device checksum error |
| 0x5600 | Device checksum error |
| 0x5700 | Master ISDU illegal service |
| 0x5800 | Device error: Byte length does not fit to the chosen parameter |
| 0x8000 | The requested service has been refused by the device application |
| 0x8011 | Read write access to a not existing Index |

| Error code (nIOLError) | Error code |
|------------------------|--|
| 0x8012 | Read write access to a not existing sub index |
| 0x8020 | Parameter is not accessible for a read or write service due to the current state in the device |
| 0x8021 | Parameter is not accessible for a read or write service due to an ongoing local operation at the device |
| 0x8022 | Parameter is not accessible for a read or write service due to an remote triggered state of the device application |
| 0x8023 | Write service tries to access a read-only parameter |
| 0x8030 | Write service to a parameter outside its permitted range of values |
| 0x8031 | Write service to a parameter above its specified value range |
| 0x8032 | Write service to a parameter below its specified value range |
| 0x8033 | Write service to a parameter above its specified length |
| 0x8034 | Write service to a parameter below its predefined length |
| 0x8035 | Write service with a command value not supported by the device application |
| 0x8036 | Write service with a command value calling a device function not available due to the current state |
| 0x8040 | The value via single parameter transfer collide with other actual parameter settings |
| 0x8041 | Inconsistent parameter set (at least an ISDU cannot be written) |
| 0x8082 | The read or write service is refused due to a temporarily unavailable application |
| 0x8100 | Unspecified |
| 0x8101 ... 0x81FF | Device specific (see device description) |

For additional information see the specification "IO-Link Communication" (www.IO-Link.com).

2.6. Including into the PLC project

The function block "FB_PARKER_P8S_PNPB" is a part of the TIA-Portal library . To get all relevant blocks into your PLC project, please open the library as a "global" library. Afterwards, the library elements can be copied into the currently opened project.

Integration step by step:

- Downloading the library
- Open the library in the "global" library tab
- Including the blocks of the PARKER library into your project (code-blocks and data types)
- Compiling the PLC project



Attention!

If several devices connect to the IO-Link Master, you can only exchange acyclic data (service data) with one device at the same time. Due this restriction, the service data communication blocks must to be blocked against each other.

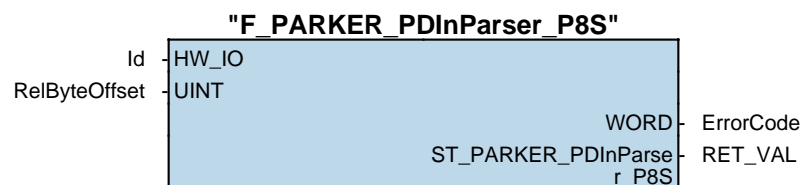
3. Process data parser function

The function F_PARKER_PDInParser_P8S simplifies the interpretation of composed IO-Link process data. This data is provided as a data structure on the PLC side.

The function is device type-specific and thus only suitable for the appropriated PARKER IO-Link devices.

3.1. Block specifications

Block name: F_PARKER_PDInParser_P8S
 Version: 1.6
 Used structures: ST_PARKER_PDInParser_P8S
 Programming language: Structured text (ST)
 IODD: Parker-Magnetic-Cylinder-Sensors-20171013-IODD1.1.xml (V1.3)



3.2. Parameter

| Parameter name | Declaration | Data type | Description |
|----------------|-------------|--------------------------|---|
| Id | INPUT | HW_IO | Hardware IO-Address of the IO-Link master (see HW-Configuration). For masters that do not use the Siemens PCT-Tool please use the HW IO-Address of the configured Master port. |
| RelByteOffset | INPUT | UINT | Relative start address of the IO-Link device on the IO-Link master port (see PCT-Tool -> Addresses -> Inputs Start). If the process data is mapped into a specified logical IO-Address, the relative byte offset = 0. |
| ErrorCode | OUTPUT | WORD | Error code details see in the Siemens help system ("DPRD_DAT"). |
| RET_VAL | OUTPUT | ST_PARKER_PDInParser_P8S | Reference to the instance of the data structure ST_PARKER_PDInParser_P8S. The structure includes the disaggregated values of the process data. |

3.3. Including into the PLC project

The function "F_PARKER_PDInParser_P8S" is a part of the TIA-Portal library . It needs the Hardware IO-Address of the Master Port and the relative byte offset (see PCT-Tool) as input values. Please note that the byte order is not swapped or packed with other values. Before using the FC, a data block must be created that contains a variable from the PLC data type (ST_PARKER_PDInParser_P8S) . This variable must be connected with the function. It includes the disaggregated values of the process data.

