

IO-Link P8S PLC Integration

IO-Link service data function block + process data parser
function for Siemens S7-300/S7-400 (Step7 V5.X) PLC
systems in combination with a PROFIBUS / PROFINET
IO-Link Master

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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

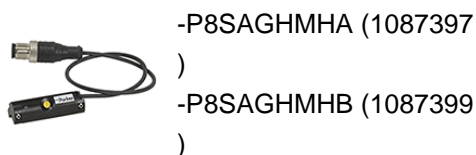
These instructions are addressed to programming engineers and the operators of machines and systems which are operated by one or several IO-Link devices. They also address people, who connect the IO-Link device via an IO-Link-Master-Gateway to a PLC-Control for data exchange.

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

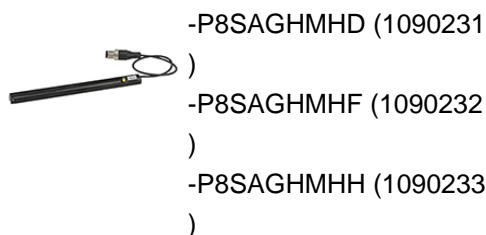


-P8SAGHMHA (1087397

)

-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 S7-300/S7-400 (Step7 V5.X) 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.

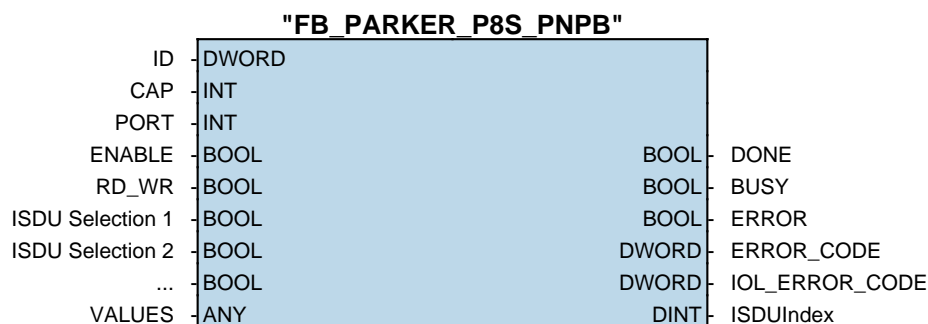
2.1. Block specifications

Block name:	FB_PARKER_P8S_PNPB (FB21)
Version:	1.6
Used blocks:	FB10 (FB_IOL_Call_PNDP) SFB4 (TON) SFB52 (RDREC) SFB53 (WRREC) F_IOL_Internal2 (FC2) F_IOL_Internal7 (FC7) F_IOL_Internal11 (FC11) F_IOL_Internal16 (FC16) F_IOL_Internal14 (FC14) F_IOL_Internal17 (FC17) F_IOL_Internal5 (FC5) F_IOL_Internal8 (FC8)
Used structures:	ST_PARKER_P8S (UDT21)
Call up:	Cyclic
Programming language:	Instruction list (IL)
IODD:	Parker-Magnetic-Cylinder-Sensors-20171013-IODD1.1.xml (V1.3)



Please note!

In general, all block numbers are changeable. Please note that all block references need to be updated in the project (Step7: Extras --> Rewire...).



2.2. Method of function

The function block uses the data structure (UDT21) "ST_PARKER_P8S". The UDT block contains the values of all IO-Link variables. Before you can use it, the UDT must be instantiated to 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.

A desired parameter can be selected via the input variables. Depending on the device definition, IO-Link parameters are read or writable. The input variable must be "RD_WR" = FALSE to read parameter. The value that should be written can be defined in the data structure, as soon as the input parameter "RD_WR" = TRUE. You start each transfer by calling up the function block "FB_PARKER_P8S_PNPB" with a positive trigger at the ENABLE input. As long as there is no valid answer the output BUSY is TRUE. In the case, the timeout period of 10 sec. 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 ENABLE 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 (ERROR_CODE/IOL_ERROR_CODE) 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	DWORD	Logical address of the IO-Link master (see HW-configuration). Some IO-Link master manufacturers use the diagnostic address of the master to connect it to the PLC. Please follow the instructions of the respective IO-Link master.
CAP	INPUT	INT	Client access point of the IO-Link function (IO-Link Master specific). Siemens ET200: 227 Weidmüller: 227 Other manufacturers: 255
PORT	INPUT	INT	Number of the port where the IO-Link device is connected to. 0: Master 1..255: Port number
ENABLE	INPUT	BOOL	Positive trigger: Start data transfer

Parameter name	Declaration	Data type	Description
RD_WR	INPUT	BOOL	Read or write the selected IO-Link parameter. FALSE: Read parameter TRUE: Write Parameter
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
VALUES	INPUT	ANY	Pointer to the data structure to be used. The UDT structure must be instantiated in a data block. Example: P#DB10.DBX0.0 BYTE 30
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
ERROR_CODE	OUTPUT	DWORD	Error code
IOL_ERROR_CODE	OUTPUT	DWORD	IO-Link error code
ISDUIndex	OUTPUT	DINT	If an error occurs, this output shows the corresponding ISDU index

2.5. Error description

2.5.1. Error code (ERROR_CODE)

The parameter ERROR_CODE contains error information of the Siemens blocks SFB52/53 (communication errors). For interpretation of this parameter, please refer to the help on SFB52 / SFB53 in the Step7 help system. Furthermore the parameter shows the following errors:

Error code	Error code
0x00000000	FB error: No error
0x10010000	Reserved
0x10020000	Reserved
0x10030000	Reserved

Error code	Error code
0x10040000	FB error: Time out error occurred while communicating with the IO-Link device
0x10050000	Reserved
0x10060000	FB error: The function block was initiated with out any choice of parameter
0x10070000	FB error: Selected parameter(s) not readable. There was at least one parameter selected with a write-only access (see "ISDUIndex").
0x10080000	FB error: Selected parameter(s) not writable. There was at least one parameter selected with read-only access (see "ISDUIndex").
0x10090000	FB error: Internal block error
0x100A0000	FB error: At least one selected parameter, the input value is greater then the data type allows (see "ISDUIndex").
0x100B0000	FB error: At least one selected parameter, the input value is lower than the data type allows (see "ISDUIndex").

2.5.2. IO-Link error code (IOL_ERROR_CODE)

Device specific error codes will directly mapped to the IOL_ERROR_CODE (Bytes 0, 1). The error encoding of their IO-Link devices, see documentation.

Error codes from the IO-Link master are mapped into IOL_ERROR_CODE (Byte 2, 3).

Error code	Error code
0x00000000	Master error: No error
0x70000000	Master error: Send and response data inconsistent
0x70010000	Master error: Decoding error
0x70020000	Master error: Port occupied by a different request, or non existing
0x80000000	Master error: Request could not be executed within the timeout period
0x80010000	Master error: IO-Link index > 32767
0x80020000	Master error: Port address beyond defined maximum
0x80030000	Master error: Port function is not supported
0x80040000	Master error: Reserved / Master specific
0x80050000	Master error: Invalid length of the data that should be written (>232 / <1)
0x80060000	Master error: Reserved / Master specific
0x80070000	Master error: IO-Link subindex > 255
0x80080000	Master error: Wrong pointer format at RECORD_IOL_DATA input (DB required / Byte-length <> 232)
0x80090000	Master error: Reserved / Master specific
...	
0x80510000	
0x80520000	Master error: Error during acyclic data access (SFB 52 error)
0x80530000	Master error: Error during acyclic data access (SFB 53 error)
0x00001000	Master communication error
0x00001100	ISDU time out / Device event error
0x00005200	Device checksum error
0x00005600	Device buffer overflow
0x00005700	Master ISDU illegal service
0x00005800	Device error: Byte length does not fit to the chosen parameter
0x00008000	The requested service has been refused by the device application
0x00008011	Read write access to a not existing Index
0x00008012	Read write access to a not existing sub index
0x00008020	Parameter is not accessible for a read or write service due to the current state in the device
0x00008021	Parameter is not accessible for a read or write service due to an ongoing local operation at the device
0x00008022	Parameter is not accessible for a read or write service due to an remote triggered state of the device application
0x00008023	Write service tries to access a read-only parameter
0x00008030	Write service to a parameter outside its permitted range of values
0x00008031	Write service to a parameter above its specified value range
0x00008032	Write service to a parameter below its specified value range
0x00008033	Write service to a parameter above its specified length
0x00008034	Write service to a parameter below its predefined length
0x00008035	Write service with a command value not supported by the device application

Error code	Error code
0x00008036	Write service with a command value calling a device function not available due to the current state
0x00008040	The value via single parameter transfer collide with other actual parameter settings
0x00008041	Inconsistent parameter set (at least an ISDU cannot be written)
0x00008082	The read or write service is refused due to a temporarily unavailable application
0x00008100	Unspecified
0x00008101	Device specific (see device description)
...	
0x000081FF	

For additional information see the product description or the IO-Link specification (www.IO-Link.com).

2.6. Including into the PLC project

The function block "FB_PARKER_P8S_PNPB" (FB 21) is a part of the Simatic Step7 library . Please open the library project and copy all relevant blocks into your PLC project.



Attention!

If several devices connect to the IO-Link Master, you can only communicate with one device over the acyclic communication. Due this restriction, the communication blocks must to be blocked against each other.

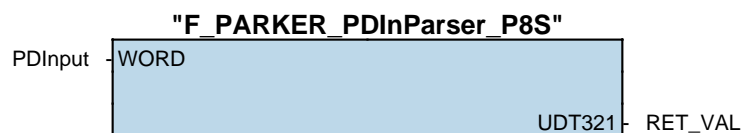
3. Process data parser function

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 (FC321)
 Version: 1.6
 Used structures: ST_PARKER_PDInParser_P8S (UDT321)
 Programming language: Instruction list (IL)
 IODD: Parker-Magnetic-Cylinder-Sensors-20171013-IODD1.1.xml (V1.3)



3.2. Parameter

Parameter name	Declaration	Data type	Description
PDInput	INPUT	WORD	Raw process data of the IO-Link device. Please make sure that the byte order is not swapped.
RET_VAL	OUTPUT	UDT321	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" (FC 321) is a part of the Simatic Step7 library . It needs the process data of the IO-Link device as an input value. 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 type of the UDT structure ST_PARKER_PDInParser_P8S (UDT 321) . The instantiated structure must be connected with the function. The output value of the function is a data structure which includes the disaggregated values of the process data.