

IO-Link LV463 PLC Integration

IO-Link service data function block + process data parser function for Siemens S7-1200/S7-1500 (TIA Portal V12 + SP1) PLC controls 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 Leuze 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 Leuze IO-Link devices.

Device family: LV463

Device ID: 512



- LV463.7/L4 (50122460)
- LV463.7/L4-M8 (50122456)
- LV463.7/L4-150-M8 (50122659)
- LV463.7/L4-150-M12 (50122457)

The function block "FB_Leuze_LV463_PNPB" interprets the call-up of the acyclic service data.

The function "F_Leuze_PDInParser_LV463" 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 Leuze devices (e.g. new device variants) with identical IO-Link parameter sets.

2. Service data function block

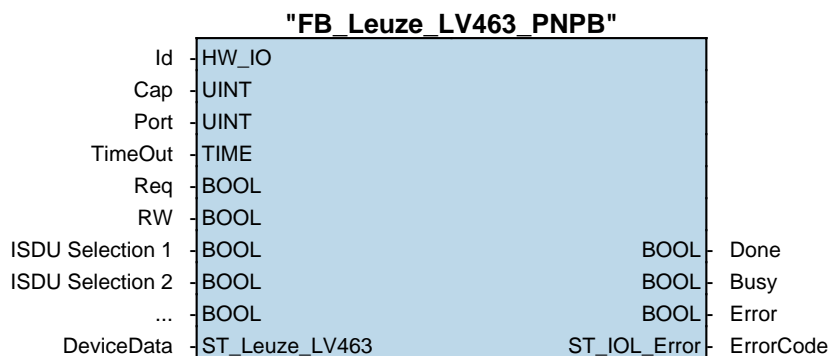
The function block "FB_Leuze_LV463_PNPB" simplifies the usage of Leuze IO-Link devices on Siemens S7-1200/S7-1500 (TIA Portal V12 + SP1) PLC controls. The FB supports IO-Link Masters which can be connected via PROFIBUS / PROFINET to the PLC system.

The function block is device type-specific and thus only suitable for the appropriate Leuze 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_Leuze_LV463_PNPB
Version:	1.1
Used blocks:	FB_IOL_Call_PNDP F_IOL_Internal11 F_IOL_Internal12 F_IOL_Internal14 F_IOL_Internal16 F_IOL_Internal17 F_IOL_Internal2 F_IOL_Internal3 F_IOL_Internal5 F_IOL_Internal6 F_IOL_Internal7 F_IOL_Internal8
Used structures:	ST_Leuze_LV463 ST_IOL_Error
Call up:	Cyclic
Programming language:	Structured text (ST)
Based on the IODD:	Leuze_electronic-LV463_512-20140331-IODD1.1xml (V1.3)



2.2. Method of function

The function block uses the data structure "ST_Leuze_LV463". 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.

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 "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_Leuze_LV463_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 their states as long as there is no new positive trigger at the "Req" input again.

2.3. Behavior when error occurs

An error bit (Error) is set and an error code (ErrorCode) 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 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
DirectPar1	INPUT	BOOL	Selection of the IO-Link parameter "Direct Parameters 1" =====IO-Link parameter information: ===== IO-Link Index: 0 Access: Read/Write

Parameter name	Declaration	Data type	Description
SysCommand	INPUT	BOOL	<p>Selection of the IO-Link parameter "Standard Command"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 2 Access: Write only</p> <p>Parameter values of the data structure (decimal): 130: Restore Factory Settings 65: SP1 Single Value Teach 67: SP1 Two Value Teach TP1 68: SP1 Two Value Teach TP2 71: SP1 Dynamic Teach Start 72: SP1 Dynamic Teach Stop 79: S1 Exit Teach 176: Stop Sensor Search 177: Start Sensor Search 178: Baseline Null 179: Baseline Disable</p>
DeviceAccessLocks	INPUT	BOOL	<p>Selection of the IO-Link parameter "Device Access Locks"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 12 Access: Read/Write</p>
VendorName	INPUT	BOOL	<p>Selection of the IO-Link parameter "Vendor Name"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 16 Access: Read only</p>
VendorText	INPUT	BOOL	<p>Selection of the IO-Link parameter "Vendor Text"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 17 Access: Read only</p>
ProductName	INPUT	BOOL	<p>Selection of the IO-Link parameter "Product Name"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 18 Access: Read only</p>
ProductID	INPUT	BOOL	<p>Selection of the IO-Link parameter "Product ID"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 19 Access: Read only</p>
ProductText	INPUT	BOOL	<p>Selection of the IO-Link parameter "Product Text"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 20 Access: Read only</p>
SerialNumber	INPUT	BOOL	<p>Selection of the IO-Link parameter "Serial Number"</p> <p>=====IO-Link parameter information: ===== IO-Link Index: 21 Access: Read only</p>

Parameter name	Declaration	Data type	Description
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
DeviceStatus	INPUT	BOOL	Selection of the IO-Link parameter "Device Status" =====IO-Link parameter information: ===== IO-Link Index: 36 Access: Read only Parameter values of the data structure (decimal): 0: Device is OK 1: Maintenance required 2: Out of specification 3: Functional check 4: Failure 5-255: Reserved
DetailedDeviceStatus	INPUT	BOOL	Selection of the IO-Link parameter "Detailed Device Status" =====IO-Link parameter information: ===== IO-Link Index: 37 Access: Read only
S1ExitTeach	INPUT	BOOL	Selection of the IO-Link parameter "S1 Exit Teach" =====IO-Link parameter information: ===== IO-Link Index: 13 Access: Read only
TeachStatus	INPUT	BOOL	Selection of the IO-Link parameter "Teach Status" =====IO-Link parameter information: ===== IO-Link Index: 59 Access: Read only
BDC1Setpoints	INPUT	BOOL	Selection of the IO-Link parameter "BDC1 Setpoints" =====IO-Link parameter information: ===== IO-Link Index: 60 Access: Read/Write
BDC1Configuration	INPUT	BOOL	Selection of the IO-Link parameter "BDC1 Configuration" =====IO-Link parameter information: ===== IO-Link Index: 61 Access: Read/Write
Configuration	INPUT	BOOL	Selection of the IO-Link parameter "Configuration" =====IO-Link parameter information: ===== IO-Link Index: 64 Access: Read/Write

Parameter name	Declaration	Data type	Description
MicroStatus	INPUT	BOOL	Selection of the IO-Link parameter "Micro Status" =====IO-Link parameter information: ===== IO-Link Index: 65 Access: Read only
TeachableLimits	INPUT	BOOL	Selection of the IO-Link parameter "Teachable Limits" =====IO-Link parameter information: ===== IO-Link Index: 68 Access: Read only
ObjCount_DTL	INPUT	BOOL	Selection of the IO-Link parameter "Object Counter - Dark to Light" =====IO-Link parameter information: ===== IO-Link Index: 207 Access: Read/Write
ObjCount_LTD	INPUT	BOOL	Selection of the IO-Link parameter "Object Counter - Light to Dark" =====IO-Link parameter information: ===== IO-Link Index: 208 Access: Read/Write
DeviceData	IN_OUT	ST_Leuze_LV463	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	Leuze 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

Error code (nBlockError)	Error code
0x0000	No error

Error code (nBlockError)	Error code
0x0001	Only one parameter can be selected at the same time
0x0002	The function block was initiated without any choice of parameter
0x0003	Chosen parameter cannot be read
0x0004	Chosen parameter cannot be written
0x0005	The value to transmit is bigger then allowed for this data type
0x0006	The value to transmit is less then allowed for this data type
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
0x8000	The requested service has been refused by the device application
0x8011	Read write access to a not existing Index
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

Error code (nIOLError)	Error code
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
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_Leuze_LV463_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 Leuze 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.

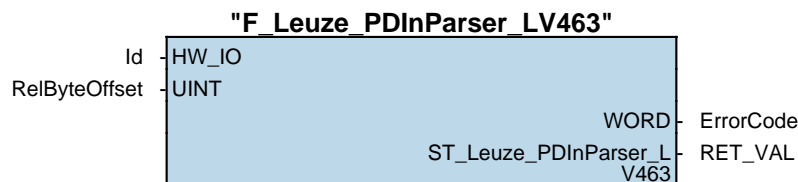
3. Process data parser function

The function F_Leuze_PDInParser_LV463 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 Leuze IO-Link devices.

3.1. Block specifications

Block name: F_Leuze_PDInParser_LV463
 Version: 1.1
 Used structures: ST_Leuze_PDInParser_LV463
 Programming language: Structured text (ST)
 Based on the IODD: Leuze_electronic-LV463_512-20140331-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_Leuze_PDInParser_LV463	Reference to the instance of the data structure ST_Leuze_PDInParser_LV463. The structure includes the disaggregated values of the process data.

3.3. Including into the PLC project

The function "F_Leuze_PDInParser_LV463" 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_Leuze_PDInParser_LV463) . This variable must be connected with the function. It includes the disaggregated values of the process data.