Technical Information

IO-Link MLG2_Pro PLC Integration

IO-Link service data function block + process data parser function for Beckhoff (TwinCAT V2.x) PLC controls in combination with a EtherCAT IO-Link Master

IO-Link

SICK
Sensor Intelligence.

Table of content

1. About this document

Please read this chapter carefully before working with this documentation and the SICK 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 SICK IO-Link devices.

Device family: Automation light grids
Device ID: 8388712

-MLG-2 Pro (1XXXXXX)

The function block "FB_SICK_MLG2_Pro_EC" interprets the call-up of the acyclic service data.
The function "F_SICK_PDInParser_MLG2_Pro" interprets the process data telegram sent from the IO-Link device.

The functionality of these PLC blocks depends on the IODD IO-Link parameters (ISDUs). This means that the blocks also could be used for other SICK devices with identical ISDUs.

2. Service data function block

The function block "FB_SICK_MLG2_Pro_EC" simplifies the use of SICK IO-Link devices on Beckhoff (TwinCAT V2.x) PLC controls in combination with a EtherCAT IO-Link Master.

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

2.1. Function block specifications

Block name:	FB_SICK_MLG2_Pro_EC
Version:	1.3.0.5
Used blocks:	SIOL_C_EC
	R_TRIG
	TON
	LEN
	ADSREADEX
	ADSWRITE
Used libraries:	STANDARD.lib
	TCBase.lib
	TcSystem.lib
Used structures:	ST_SICK_MLG2_Pro
Call up:	Cyclic
Programming language:	Structured text (ST)
Based on the IODD:	IO-Link Device Description/SICK-MLG-2Pro-20140408.xml (V1.01)

"FB_SICK_MLG2_Pro_EC"

NetID	STRING (80)		
PortNumber	BYTE		
Enable	BOOL		
RD_WR	BOOL		
SysCommand	BOOL		
VendorName	BOOL		
ProductName	BOOL		
ProductID	BOOL		
SerialNumber	BOOL		
HWVersion	BOOL		
FWVersion	BOOL		
AppliName	BOOL		
DeviceSpecificTag	BOOL		
DeviceMode	BOOL		
PerformanceOptions	BOOL		
ProcessDataUserDef	BOOL		
TransparentMode	BOOL		
AlignmentHelpEnable	BOOL		
MutingTeachEnable	BOOL		
BeamBlankingMask	BOOL		
BeamNumeration	BOOL		
StandbyEnable	BOOL		
KeyLock	BOOL		
DeviceProperties	BOOL		
TeachResult	BOOL		
Systemstatus	BOOL		
AlignmentHelp	BOOL		
ProcessDataSelect	BOOL		
Temperature	BOOL		
Q1Config	BOOL		
Q2Config	BOOL		
Q3Config	BOOL		
Q4Config	BOOL		
BlankAllCurBlockBeam	BOOL		
BlankAllCurMadeBeam	BOOL		
FindMe	BOOL		
SICKProfileVersion	BOOL	BOOL	Done
TeachQuality	BOOL	BOOL	Busy
ProcessQuality	BOOL	BOOL	Error
Values	POINTER TO ST_SICK_MLG2_Pro	DWORD	Error_Code

2.2. Method of function

The function block uses the data structure "ST_SICK_MLG2_Pro". The data structure contains the values of all IO-Link variables. Before you can use it, the structure must be instantiated in the PLC program. 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. Some parameters can be handled by reading or writing. The input variable must be RD_WR = FALSE to call up a reading parameter. The value to be written is in the data structure and transferred as soon as the parameter is RD_WD =

TRUE. You start each transfer by calling up the function block "FB_SICK_MLG2_Pro_EC" 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 or 10 sec. are 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.

2.3. Behavior when error occurs

An error bit (ERROR) is set and an error code (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
NetID	INPUT	STRING (80)	Includes AoeNetId of the IO-Link Master (see chapter 5). Example: NetID = "5.4.148.177.2.4"
PortNumber	INPUT	BYTE	Number of the port where the IO-Link device is connected to the IO-Link Master 0: Master 1..255: Port number
Enable	INPUT	BOOL	Positive trigger: Start data transfer
RD_WR	INPUT	BOOL	Read or write access to the selected input parameter FALSE: Read parameter TRUE: Write Parameter
SysCommand	INPUT	BOOL	Selection of the IO-Link parameter "Standard Command" =====IO-Link parameter information: ===== IO-Link Index: 2 Access: Write only Parameter values of the data structure (decimal): 130: Restore Factory Settings 128: Device Reset 160: Teach
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

Parameter name	Declaration	Data type	Description
ProductID	INPUT	BOOL	Selection of the IO-Link parameter "Product ID" =====IO-Link parameter information: ===== IO-Link Index: 19 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
DeviceSpecificTag	INPUT	BOOL	Selection of the IO-Link parameter "Device Specific Tag" =====IO-Link parameter information: ===== IO-Link Index: 64 Access: Read/Write
DeviceMode	INPUT	BOOL	Selection of the IO-Link parameter "Device Mode" =====IO-Link parameter information: ===== IO-Link Index: 65 Access: Read/Write Parameter values of the data structure (decimal): 0: Standard Mode 2: Sun Light Resistant Mode 1: Transparent Mode

Parameter name	Declaration	Data type	Description
PerformanceOptions	INPUT	BOOL	Selection of the IO-Link parameter "Performance Options" =====IO-Link parameter information: ===== IO-Link Index: 66 Access: Read/Write Parameter values of the data structure (decimal): 0: Standard Resolution 1: High Resolution 2: High Functional Reserve 3: Cross Beam Mode 4: Cross Beam Mode with High Functional Reserve 5: High Speed Scan 6: High Speed with High Resolution 7: High Speed with High Functional Reserve
ProcessDataUserDef	INPUT	BOOL	Selection of the IO-Link parameter "Process Data User Definition" =====IO-Link parameter information: ===== IO-Link Index: 67 Access: Read/Write
TransparentMode	INPUT	BOOL	Selection of the IO-Link parameter "Transparent Mode" =====IO-Link parameter information: ===== IO-Link Index: 68 Access: Read/Write Parameter values of the data structure (decimal): 0: Signal Attenuation 30% 1: Signal Attenuation 15% 2: Signal Attenuation 10%
AlignmentHelpEnable	INPUT	BOOL	Selection of the IO-Link parameter "Alignment Help Enable" =====IO-Link parameter information: ===== IO-Link Index: 69 Access: Read/Write Parameter values of the data structure (decimal): 0: Alignment Help Inactive 1: Alignment Help Active
MutingTeachEnable	INPUT	BOOL	Selection of the IO-Link parameter "Muting Teach Enable" =====IO-Link parameter information: ===== IO-Link Index: 70 Access: Read/Write Parameter values of the data structure (decimal): 0: Blanking Teach Inactive 1: Blanking Teach Active
BeamBlankingMask	INPUT	BOOL	Selection of the IO-Link parameter "Beam Blanking Mask" =====IO-Link parameter information: ===== IO-Link Index: 72 Access: Read/Write

Parameter name	Declaration	Data type	Description
BeamNumeration	INPUT	BOOL	Selection of the IO-Link parameter "Beam Numeration" =====IO-Link parameter information: ===== IO-Link Index: 74 Access: Read/Write Parameter values of the data structure (decimal): 0: Beam no. 1 is at Connector side 1: Beam no. 1 is at Head side
StandbyEnable	INPUT	BOOL	Selection of the IO-Link parameter "Standby Enable" =====IO-Link parameter information: ===== IO-Link Index: 75 Access: Read/Write Parameter values of the data structure (decimal): 0: Green Mode Inactive 1: Green Mode Active
KeyLock	INPUT	BOOL	Selection of the IO-Link parameter "Key Lock" =====IO-Link parameter information: ===== IO-Link Index: 81 Access: Read/Write Parameter values of the data structure (decimal): 0: Unlock 1: Lock
DeviceProperties	INPUT	BOOL	Selection of the IO-Link parameter "Device Properties" =====IO-Link parameter information: ===== IO-Link Index: 83 Access: Read only
TeachResult	INPUT	BOOL	Selection of the IO-Link parameter "Teach Result" =====IO-Link parameter information: ===== IO-Link Index: 98 Access: Read only
Systemstatus	INPUT	BOOL	Selection of the IO-Link parameter "Systemstatus" =====IO-Link parameter information: ===== IO-Link Index: 100 Access: Read only
AlignmentHelp	INPUT	BOOL	Selection of the IO-Link parameter "Alignment Help" =====IO-Link parameter information: ===== IO-Link Index: 101 Access: Read only

Parameter name	Declaration	Data type	Description
ProcessDataSelect	INPUT	BOOL	Selection of the IO-Link parameter "Process Data Select" =====IO-Link parameter information: ===== IO-Link Index: 120 Access: Read/Write Parameter values of the data structure (decimal): 0: Systemstatus, Q-Status and Run-Length Code 1: Systemstatus, Q-Status and Beam Status 2: User defined process data
Temperature	INPUT	BOOL	Selection of the IO-Link parameter "Temperature" =====IO-Link parameter information: ===== IO-Link Index: 153 Access: Read only
Q1Config	INPUT	BOOL	Selection of the IO-Link parameter "Output 1 (Q1) Configuration" =====IO-Link parameter information: ===== IO-Link Index: 183 Access: Read/Write
Q2Config	INPUT	BOOL	Selection of the IO-Link parameter "Output 2 (Q2) Configuration" =====IO-Link parameter information: ===== IO-Link Index: 184 Access: Read/Write
Q3Config	INPUT	BOOL	Selection of the IO-Link parameter "Output 3 (Q3) Configuration" =====IO-Link parameter information: ===== IO-Link Index: 185 Access: Read/Write
Q4Config	INPUT	BOOL	Selection of the IO-Link parameter "Output 4 (Q4) Configuration" =====IO-Link parameter information: ===== IO-Link Index: 186 Access: Read/Write
BlankAllCurBlockBeam	INPUT	BOOL	Selection of the IO-Link parameter "Blank all Currently Blocked Beams" =====IO-Link parameter information: ===== IO-Link Index: 188 Access: Write only Parameter values of the data structure (decimal): 1: Blank all Currently Blocked Beams
BlankAllCurMadeBeam	INPUT	BOOL	Selection of the IO-Link parameter "Blank all Currently Made Beams" =====IO-Link parameter information: ===== IO-Link Index: 189 Access: Write only Parameter values of the data structure (decimal): 1: Blank all Currently Made Beams

Parameter name	Declaration	Data type	Description
FindMe	INPUT	BOOL	Selection of the IO-Link parameter "Find Me" =====IO-Link parameter information: ===== IO-Link Index: 204 Access: Read/Write Parameter values of the data structure (decimal): 0: Stop FindMe 1: LEDs blink with 1 Hz
SICKProfileVersion	INPUT	BOOL	Selection of the IO-Link parameter "SICK Profile Version" =====IO-Link parameter information: ===== IO-Link Index: 205 Access: Read only
TeachQuality	INPUT	BOOL	Selection of the IO-Link parameter "Teach Quality" =====IO-Link parameter information: ===== IO-Link Index: 224 Access: Read only
ProcessQuality	INPUT	BOOL	Selection of the IO-Link parameter "Process Quality" =====IO-Link parameter information: ===== IO-Link Index: 225 Access: Read only
Values	INPUT	POINTER TO ST_SICK _MLG2_Pro	Pointer to the instance of the data structure ST_SICK_MLG2_Pro. Example: VAR stIOLData: ST_SICK_MLG2_Pro; END_VAR Values:= ADR(stIOLData);
Done	OUTPUT	BOOL	Indicates whether data is valid.
Busy	OUTPUT	BOOL	Request in process. FALSE: Request is terminated TRUE: Request is being process
Error	OUTPUT	BOOL	Error flag. FALSE: No error TRUE: Error detected
Error_Code	OUTPUT	DWORD	Error code

2.5. Error description

2.5.1. Error code (ERROR_CODE)

The parameter ERROR_CODE contains detailed information of the occurred error:

WORD 1	WORD 0
Block error	ADS communication error

Device errors are errors send from the connected device. Communication errors are errors generated by the used standard function blocks "ADSWRITE" and "ADSREADEX". Further information is given in

the documentation of these function blocks.

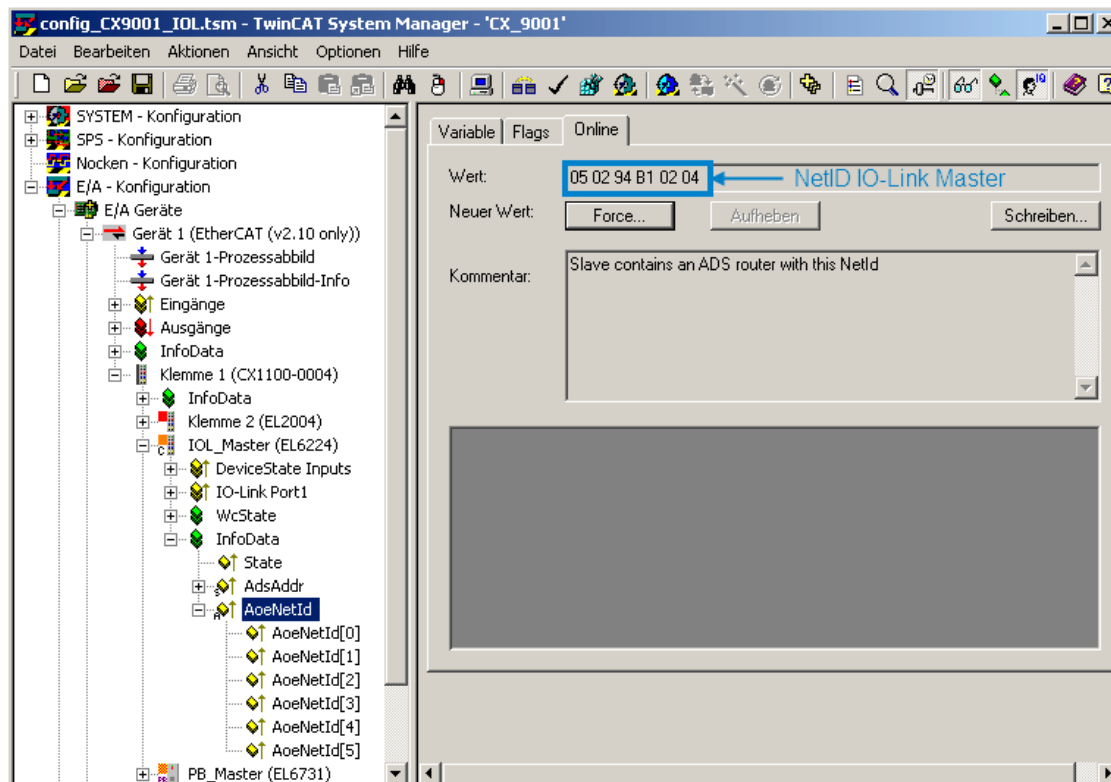| Error code (WORD 0)	Error code
0x0001 ... 0x001B	Global error codes (see Beckhoff ADS return codes)
0x0500 ... 0x050A	Router error codes (see Beckhoff ADS return codes)
0x0700 ... 0x0755	Generals ADS error codes (see Beckhoff ADS return codes)
0x1000 ... 0x1010	RTime error codes (see Beckhoff ADS return codes)
0x274C ... 0x2751	Socket error codes (see Beckhoff ADS return codes)

For further information see ADS Return Codes (Beckhoff).

Error code (WORD 1)	Error code
0x0000	FB error: No error
0x0001	FB error: Only one parameter can be selected at the same time
0x0002	FB error: The function block was initiated with out any choice of parameter
0x0003	FB error: Chosen parameter cannot be read
0x0004	FB error: Chosen parameter cannot be written
0x0005	FB error: The value to transmit is bigger then allowed for this data type
0x0006	FB error: The value to transmit is smaller then allowed for this data type
0x5200	Device error: Checksum error
0x5600	Device error: Buffer overflow
0x5700	Master error: ISDU illegal service
0x5800	Device error: Byte length does not fit to the chosen parameter
0x8000	Device error: The requested service has been refused by the device application
0x8011	Device error: Read write access to a not existing Index
0x8012	Device error: Read write access to a not existing sub index
0x8020	Device error: Parameter is not accessible for a read or write service due to the current state in the device
0x8021	Device error: Parameter is not accessible for a read or write service due to an ongoing local operation at the device
0x8022	Device error: Parameter is not accessible for a read or write service due to an remote triggered state of the device application
0x8023	Device error: Write service tries to access a read-only parameter
0x8030	Device error: Write service to a parameter outside its permitted range of values
0x8031	Device error: Write service to a parameter above its specified value range
0x8032	Device error: Write service to a parameter below its specified value range
0x8033	Device error: Write service to a parameter above its specified length
0x8034	Device error: Write service to a parameter below its predefined length
0x8035	Device error: Write service with a command value not supported by the device application
0x8036	Device error: Write service with a command value calling a device function not available due to the current state
0x8040	Device error: The value via single parameter transfer collide with other actual parameter settings
0x8041	Device error: Inconsistent parameter set
0x8082	Device error: The read or write service is refused due to a temporarily unavailable application

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_SICK_MLG2_Pro_EC" is a part of the SICK_IO_LINK library. The library can be included by using the library administrator of TwinCAT PLC Control.

The function block requires the Aoe NetId of the IO-Link master device. The following figure shows where the NetId can be found in the System Manager.
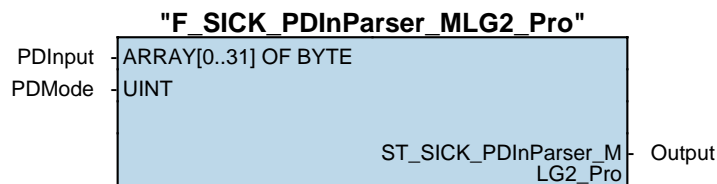
3. Process data parser function

The function F_SICK_PDInParser_MLG2_Pro simplifies the interpretation of composed IO-Link process data.

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

3.1. Function block specifications

Block name:	F_SICK_PDInParser_MLG2_Pro
Version:	1.3.0.5
Used structures:	ST_SICK_PDInParser_MLG2_Pro
Programming language:	Structured text (ST)
Based on the IODD:	IO-Link Device Description/SICK-MLG-2Pro-20140408.xml (V1.01)

"F_SICK_PDInParser_MLG2_Pro"

PDInput - ARRAY[0..31] OF BYTE
PDMode - UINT

ST_SICK_PDInParser_MLG2_Pro - Output

3.2. Parameter

Parameter name	Declaration	Data type	Description
PDInput	INPUT	ARRAY[0..31] OF BYTE	Raw process data of the IO-Link device. Please make sure that the byte order is not swapped.
PDMode	INPUT	UINT	This device has the possibility to switch the content of the process data during operation. Please set the current process data mode of the connected device. According to the setting, the function decrypts the process data and stored it into the respective output structure.

The following formats are available:
[0]: Systemstatus (High-Byte) and Q-Status (Low-Byte) + RLC1 + RLC2 + RLC3 + RLC4 + RLC5 + RLC6 + RLC7 + RLC8 + RLC9 + RLC10 + RLC11 + RLC12 + RLC13 + RLC14 + RLC15
[1]: Systemstatus (High-Byte) and Q-Status (Low-Byte) + Beam 1...16 + Beam 17..32 + Beam 33...48 + Beam 49...64 + Beam 65...80 + Beam 81...96 + Beam 97...112 + Beam 113...128 + Beam 129...144 + Beam 145...160 + Beam 167...176 + Beam 167...176 + Beam 193...208 + Beam 209...224 + Beam 225...240
[2]: Output Function 1 + Output Function 2 + Output Function 3 + Output Function 4 + Output Function 5 + Output Function 6 + Output Function 7 + Output Function 8 + Output Function 9 + Output Function 10 + Output Function 11 + Output Function 12 + Output Function 13 + Output Function 14 + Output Function 15 + Output Function 16 |

Parameter name	Declaration	Data type	Description
Output	OUTPUT	ST_SICK _PDInPar ser_MLG 2_Pro	Reference to the instance of the data structure ST_SICK_PDInParser_MLG2_Pro. The structure includes the disaggregated values of the process data.

3.3. Including into the PLC project

The function "F_SICK_PDInParser_MLG2_Pro" is a part of the SICK IO-Link library SICK_IO_LINK . The library can be included by using the library administrator of TwinCAT PLC Control. The function needs the process data of the IO-Link device as an input value. The process data is obtained by linking a PLC variable via AT-declaration with the process value of the IO-Link device in the TwinCAT System Manager. Please make sure that the byte order is not swapped (see picture). The output value of the function is a data structure which includes the disaggregated values of the process data.