



## PLC Integration of HT5xC\_6002

**IO-Link service data function block + process data parser function for Beckhoff (TwinCAT 3.x) PLC systems in combination with a EtherCAT IO-Link Master**

© 2023

Leuze electronic GmbH & Co. KG

In der Braike 1

D-73277 Owen / Germany

Phone: +49 7021 573-0

Fax: +49 7021 573-199

<http://www.leuze.com>

[info@leuze.com](mailto:info@leuze.com)

# Table of Contents

- 1 Legal information.....4**
  - 1.1 Disclaimer..... 4
- 2 About this document.....5**
  - 2.1 Purpose of use.....5
  - 2.2 Target group..... 5
- 3 General use of function block..... 6**
  - 3.1 Short description..... 6
  - 3.2 Calling and designation..... 6
  - 3.3 Configuration..... 6
  - 3.4 Method of function..... 7
  - 3.5 Behavior when error occurs.....7
- 4 Integration into the PLC project.....8**
- 5 Process data parser function..... 9**
  - 5.1 Calling and designation..... 9
  - 5.2 Configuration..... 9
- 6 Error description.....10**
- 7 Data structures..... 11**
- 8 Parameter descriptions..... 23**
- 9 Technical specifications..... 29**
  - 9.1 General data..... 29

# 1 Legal information


## 1.1 Disclaimer

With the installation, copying or other use of this software product, you agree to the following conditions of use. If you do not agree with the conditions, do not install this software product. If you received the software product by means of download, terminate the download and delete all files that have already been downloaded.

This software product is protected by European and U.S. copyright law and international treaty provisions. You are in no way authorized to rent, lease, lend or sell the software or parts thereof to third parties.

Before you link the library, please close all unnecessary programs to avoid loss of data.

We highly recommend installing the software on a computer which is not already used in the production process or is needed for storing important data. It cannot be completely excluded that existing files will be changed or overwritten. Leuze electronic GmbH & Co. KG is not liable for damages and data loss that result from this installation or the failure to observe this warning notice.

	NOTICE
	<p><b>Observe the operating instructions!</b></p> <ul style="list-style-type: none"><li>👉 Observe all safety notices provided in the operating instructions for these devices. Leuze electronic GmbH &amp; Co. KG is not liable for personal injury and property damage that result from failure to comply with these safety notices.</li><li>👉 Download the operating instructions for these devices at <a href="http://www.leuze.com">www.leuze.com</a>.</li></ul>

## **2 About this document**

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

### **2.1 Purpose of use**

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

These instructions are intended to provide support during the commissioning of a Leuze IO-Link sensor using standard software from Siemens. The described module is part of this standard software.

### **2.2 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.

## 3 General use of function block

### 3.1 Short description

The function block "FB\_Leuze\_IOL\_ HT5xC\_6002" simplifies the usage of Leuze IO-Link devices on Beckhoff (TwinCAT 3.x) PLC controls. This FB supports IO-Link Masters which can be connected via EtherCAT 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.

### 3.2 Calling and designation



Fig. 3.1: Example of module call

### 3.3 Configuration

Tab. 3.1: Parameter IN

Parameter	Data type	Description
bExecute	Bool	Positive trigger: Start data transfer
bRW	Bool	Read or write the selected IO-Link parameter. FALSE: Read parameter TRUE: Write Parameter
nPort	T_AmsPort	Port number of the ADS device.
sNetId	T_AmsNetID	String containing the AMS network identifier of the target device to which the ADS command is directed. Beckhoff EL6224/EP6224: AoeNetId of the IO-Link Master
nIdxGroup	UDInt	Index group number.
tTimeOut	Time	Time, after a Timeout-Error is triggered.

Tab. 3.2: Parameter INOUT

Parameter	Data type	Description
stDeviceData	ST_Leuze_IOL_ HT5xC_6002	Sensor data

See structure description of ST\_Leuze\_IOL\_ HT5xC\_6002 in chapter 7.

Tab. 3.3: Parameter OUT

Parameter	Data type	Description
bDone	Bool	Indicates whether data is valid.

Parameter	Data type	Description
bBusy	Bool	Request in process. FALSE: Request is terminated TRUE: Request is being processed
bError	Bool	Error flag FALSE: No error TRUE: Error detected
stErrorCode	ST_Leuze_IOL_Error	Status of the function block

See structure description of ST\_Leuze\_IOL\_Error in chapter 6.

### 3.4 Method of function

The function block uses the data structure "ST\_Leuze\_IOL\_HT5xC\_6002". 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 "bRW" = FALSE to read parameter. The value that should be written can be defined in the data structure, as soon as the input parameter "bRW" = TRUE. You start each transfer by calling up the "FB\_Leuze\_IOL\_HT5xC\_6002" with a positive trigger at the "bExecute" input. As long as there is no valid answer the output "bBusy" 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 "bDone" = TRUE output shows that the transmission was successful. The outputs retain there states as long as there is no new positive trigger at the "bExecute" 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.

### 3.5 Behavior when error occurs


An error bit (bError) is set and an error code (ST\_Leuze\_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.

## 4 Integration into the PLC project

The function block "FB\_Leuze\_IOL\_ HT5xC\_6002" is a part of the TwinCAT V3.x library. The library can be installed by using the Library Repository. Afterwards the library can be added to your project (References --> Add library...).

### Integration step by step:

- Download the library
- Open the Library repository in Library Manager tab in Beckhoff TwinCAT
- Click Install... and select downloaded library
- Open Add library in Library Manager tab
- Find installed library under Leuze electronic GmbH + Co. KG

NOTICE	
	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.

## 5 Process data parser function

The function `F_Leuze_PD_HT5xC_6002` simplifies the interpretation of composed IO-Link process data. This data is provided as a data structure on the PLC side. Some sensors support different process data output. User must select mode of PD according to the sensors settings.

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

### 5.1 Calling and designation

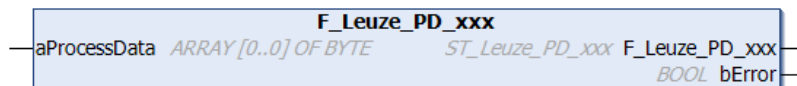


Fig. 5.1: Example of process data parsing function call

### 5.2 Configuration

Tab. 5.1: Parameters

Parameter name	Declaration	Data type	Description
aProcessData	INPUT	ARRAY OF BYTE	Raw process data of the IO-Link device.
nPDMMode	INPUT	INT	Mode of the PD. User must select mode of PD according to the sensors settings. The PD Mode parameter only appears for some sensors.
bError	OUTPUT	BOOL	Error flag FALSE: No error TRUE: Error detected
F_Leuze_PD_HT5xC_6002	OUTPUT	ST_Leuze_PD_HT5xC_6002	Reference to the instance of the data structure ST_Leuze_PD_HT5xC_6002. The structure includes the disaggregated values of the process data.

See structure description of `ST_Leuze_PD_HT5xC_6002` in chapter 7.

## 6 Error description

The parameter "ErrorCode" can be interpreted using the PLC data type ST\_Leuze\_IOL\_Error. This data type contains the following error information:

Tab. 6.1: ST\_Leuze\_IOL\_Error description

Parameter name	Data type	Description
ErrorStatus.nBlockError	WORD	Error number representing FB where error occurred
ErrorStatus.nAdsReadError	UDINT	ADS read error code
ErrorStatus.nAdsWriteError	UDINT	ADS write error code
ErrorStatus.nIndex	INT	IO-Link index to which the error code refers
ErrorStatus.nSubIndex	INT	IO-Link sub-index to which the error code refers

Tab. 6.2: Error description for nBlockError

Error code (nBlockError)	Error description
0x0000	No error
0x8001	Time out error occurred
0x8002	No parameter selected
0x8003	Error in FB_Leuze_IOL_AdsReadWrite block

For additional information see the Beckhoff ADS Return Codes (<https://infosys.beckhoff.com>).

## 7 Data structures

Tab. 7.1: ST\_Leuze\_IOL\_HT5xC\_6002

Parameter name	Data type	Description
stDeviceData.stSelection.stCommands.bCmdRestoreFactorySettings	BOOL	[WRITE_ONLY] Restore Factory Settings
stDeviceData.stSelection.stCommands.bCmdBackToBox	BOOL	[WRITE_ONLY] Back To Box
stDeviceData.stSelection.stCommands.bCmdReserved_3	BOOL	[WRITE_ONLY] reserved; Suffix "_3" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_4	BOOL	[WRITE_ONLY] reserved; Suffix "_4" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_5	BOOL	[WRITE_ONLY] reserved; Suffix "_5" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_6	BOOL	[WRITE_ONLY] reserved; Suffix "_6" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_7	BOOL	[WRITE_ONLY] reserved; Suffix "_7" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_8	BOOL	[WRITE_ONLY] reserved; Suffix "_8" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_9	BOOL	[WRITE_ONLY] reserved; Suffix "_9" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_10	BOOL	[WRITE_ONLY] reserved; Suffix "_10" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_11	BOOL	[WRITE_ONLY] reserved; Suffix "_11" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_12	BOOL	[WRITE_ONLY] reserved; Suffix "_12" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
stDeviceData.stSelection.stCommands.bCmdReserved_13	BOOL	[WRITE_ONLY] reserved; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_14	BOOL	[WRITE_ONLY] reserved; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_15	BOOL	[WRITE_ONLY] reserved; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_16	BOOL	[WRITE_ONLY] reserved; Suffix "_16" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdReserved_17	BOOL	[WRITE_ONLY] reserved; Suffix "_17" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stCommands.bCmdClearObjectcount	BOOL	[WRITE_ONLY] Clear ObjectCount
stDeviceData.stSelection.stDirectParametersPage1.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stDirectParametersPage1.bReserved_1	BOOL	[READ_ONLY] ; Suffix "_1" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stDirectParametersPage1.bMasterCycleTime	BOOL	[READ_ONLY] Communication: Current communication cycle duration used by the master. This value defines the process data cycle.
stDeviceData.stSelection.stDirectParametersPage1.bMinCycleTime	BOOL	[READ_ONLY] Communication: Minimum communication cycle duration supported by the device. This value defines the lowest possible process data cycle.
stDeviceData.stSelection.stDirectParametersPage1.bMSequenceCapability	BOOL	[READ_ONLY] Communication: Information on the structure and the supported features of the communication messages.
stDeviceData.stSelection.stDirectParametersPage1.bIoLinkRevisionId	BOOL	[READ_ONLY] Communication: Identifier for the currently used communication protocol revision.

Parameter name	Data type	Description
stDeviceData.stSelection.stDirectParametersPage1. bProcessDataInputLength	BOOL	[READ_ONLY] Communication: Information on width and features of the process input data (Process Data from Device to Master).
stDeviceData.stSelection.stDirectParametersPage1. bProcessDataOutputLength	BOOL	[READ_ONLY] Communication: Information on width of the process output data (Process Data from Master to Device).
stDeviceData.stSelection.stDirectParametersPage1.bVendorId1	BOOL	[READ_ONLY] Identification: Highest octet of the Vendor ID. Combined with the parameter Vendor ID 2, this parameter defines the 16-bit value of the unique Vendor ID as assigned by the IO-Link Community.
stDeviceData.stSelection.stDirectParametersPage1.bVendorId2	BOOL	[READ_ONLY] Identification: Lowest octet of the Vendor ID. Combined with the parameter Vendor ID 1, this parameter defines the 16-bit value of the unique Vendor ID as assigned by the IO-Link Community.
stDeviceData.stSelection.stDirectParametersPage1.bDeviceId1	BOOL	[READ_ONLY] Identification: Highest octet of the Device ID. Combined with the parameters Device ID 2 and 3, this parameter defines the 24-bit value of the vendor-specific Device ID.
stDeviceData.stSelection.stDirectParametersPage1.bDeviceId2	BOOL	[READ_ONLY] Identification: Middle octet of the Device ID. Combined with the parameters Device ID 1 and 3, this parameter defines the 24-bit value of the vendor-specific Device ID.
stDeviceData.stSelection.stDirectParametersPage1.bDeviceId3	BOOL	[READ_ONLY] Identification: Lowest octet of the Device ID. Combined with the parameters Device ID 1 and 2, this parameter defines the 24-bit value of the vendor-specific Device ID.
stDeviceData.stSelection.stDirectParametersPage1. bReserved_13	BOOL	[READ_ONLY] ; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
stDeviceData.stSelection.stDirectParametersPage1. bReserved_14	BOOL	[READ_ONLY] ; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stDirectParametersPage1. bReserved_15	BOOL	[READ_ONLY] ; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stSelection.stDirectParametersPage1. bSystemCommand	BOOL	[WRITE_ONLY] Application: Command interface for devices without ISDU support. Validity and execution of commands are not confirmed.
stDeviceData.stSelection.stDirectParametersPage2.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter1	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter2	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter3	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter4	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter5	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter6	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter7	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter8	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter9	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter10	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter11	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter12	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter13	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter14	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter15	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParametersPage2. bDeviceSpecificParameter16	BOOL	[READ_WRITE]
stDeviceData.stSelection.bSystemCommand	BOOL	[WRITE_ONLY] Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.

Parameter name	Data type	Description
stDeviceData.stSelection.stDeviceAccessLocks.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.bVendorName	BOOL	[READ_ONLY] The vendor name that is assigned to a Vendor ID.
stDeviceData.stSelection.bVendorText	BOOL	[READ_ONLY] Additional information about the vendor.
stDeviceData.stSelection.bProductName	BOOL	[READ_ONLY] Complete product name.
stDeviceData.stSelection.bProductId	BOOL	[READ_ONLY] Vendor-specific product or type identification (e.g., item number or model number).
stDeviceData.stSelection.bProductText	BOOL	[READ_ONLY] Additional product information for the device.
stDeviceData.stSelection.bSerialNumber	BOOL	[READ_ONLY] Unique, vendor-specific identifier of the individual device.
stDeviceData.stSelection.bHardwareRevision	BOOL	[READ_ONLY] Unique, vendor-specific identifier of the hardware revision of the individual device.
stDeviceData.stSelection.bFirmwareRevision	BOOL	[READ_ONLY] Unique, vendor-specific identifier of the firmware revision of the individual device.
stDeviceData.stSelection.bApplicationSpecificTag	BOOL	[READ_WRITE] Possibility to mark a device with user- or application-specific information.
stDeviceData.stSelection.bFunctionTag	BOOL	[READ_WRITE]
stDeviceData.stSelection.bLocationTag	BOOL	[READ_WRITE]
stDeviceData.stSelection.bDeviceStatus	BOOL	[READ_ONLY] Indicator for the current device condition and diagnosis state.
stDeviceData.stSelection.stDetailedDeviceStatus.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stSelection.stConfig.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.bObjectCount	BOOL	[READ_ONLY]
stDeviceData.stSelection.bOperationHours	BOOL	[READ_ONLY]
stDeviceData.stSelection.stSetpoints.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stData.stCommands.nCmdRestoreFactorySettings	UINT	[WRITE_ONLY] Restore Factory Settings
stDeviceData.stData.stCommands.nCmdBackToBox	UINT	[WRITE_ONLY] Back To Box

Parameter name	Data type	Description
stDeviceData.stData.stCommands.nCmdReserved_3	UINT	[WRITE_ONLY] reserved; Suffix "_3" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_4	UINT	[WRITE_ONLY] reserved; Suffix "_4" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_5	UINT	[WRITE_ONLY] reserved; Suffix "_5" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_6	UINT	[WRITE_ONLY] reserved; Suffix "_6" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_7	UINT	[WRITE_ONLY] reserved; Suffix "_7" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_8	UINT	[WRITE_ONLY] reserved; Suffix "_8" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_9	UINT	[WRITE_ONLY] reserved; Suffix "_9" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_10	UINT	[WRITE_ONLY] reserved; Suffix "_10" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_11	UINT	[WRITE_ONLY] reserved; Suffix "_11" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_12	UINT	[WRITE_ONLY] reserved; Suffix "_12" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_13	UINT	[WRITE_ONLY] reserved; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_14	UINT	[WRITE_ONLY] reserved; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
stDeviceData.stData.stCommands.nCmdReserved_15	UINT	[WRITE_ONLY] reserved; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_16	UINT	[WRITE_ONLY] reserved; Suffix "_16" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdReserved_17	UINT	[WRITE_ONLY] reserved; Suffix "_17" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stCommands.nCmdClearObjectcount	UINT	[WRITE_ONLY] Clear ObjectCount
stDeviceData.stData.stDirectParametersPage1.nReserved_1	UINT	[READ_ONLY] ; Suffix "_1" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stDirectParametersPage1.nMasterCycleTime	UINT	[READ_ONLY] Communication: Current communication cycle duration used by the master. This value defines the process data cycle.
stDeviceData.stData.stDirectParametersPage1.nMinCycleTime	UINT	[READ_ONLY] Communication: Minimum communication cycle duration supported by the device. This value defines the lowest possible process data cycle.
stDeviceData.stData.stDirectParametersPage1.nMSequenceCapability	UINT	[READ_ONLY] Communication: Information on the structure and the supported features of the communication messages.
stDeviceData.stData.stDirectParametersPage1.nIoLinkRevisionId	UINT	[READ_ONLY] Communication: Identifier for the currently used communication protocol revision.
stDeviceData.stData.stDirectParametersPage1.nProcessDataInputLength	UINT	[READ_ONLY] Communication: Information on width and features of the process input data (Process Data from Device to Master).
stDeviceData.stData.stDirectParametersPage1.nProcessDataOutputLength	UINT	[READ_ONLY] Communication: Information on width of the process output data (Process Data from Master to Device).

Parameter name	Data type	Description
stDeviceData.stData.stDirectParametersPage1.nVendorId1	UINT	[READ_ONLY] Identification: Highest octet of the Vendor ID. Combined with the parameter Vendor ID 2, this parameter defines the 16-bit value of the unique Vendor ID as assigned by the IO-Link Community.
stDeviceData.stData.stDirectParametersPage1.nVendorId2	UINT	[READ_ONLY] Identification: Lowest octet of the Vendor ID. Combined with the parameter Vendor ID 1, this parameter defines the 16-bit value of the unique Vendor ID as assigned by the IO-Link Community.
stDeviceData.stData.stDirectParametersPage1.nDeviceId1	UINT	[READ_ONLY] Identification: Highest octet of the Device ID. Combined with the parameters Device ID 2 and 3, this parameter defines the 24-bit value of the vendor-specific Device ID.
stDeviceData.stData.stDirectParametersPage1.nDeviceId2	UINT	[READ_ONLY] Identification: Middle octet of the Device ID. Combined with the parameters Device ID 1 and 3, this parameter defines the 24-bit value of the vendor-specific Device ID.
stDeviceData.stData.stDirectParametersPage1.nDeviceId3	UINT	[READ_ONLY] Identification: Lowest octet of the Device ID. Combined with the parameters Device ID 1 and 2, this parameter defines the 24-bit value of the vendor-specific Device ID.
stDeviceData.stData.stDirectParametersPage1.nReserved_13	UINT	[READ_ONLY] ; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stDirectParametersPage1.nReserved_14	UINT	[READ_ONLY] ; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stDirectParametersPage1.nReserved_15	UINT	[READ_ONLY] ; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
stDeviceData.stData.stDirectParametersPage1. nSystemCommand	UINT	[WRITE_ONLY] Application: Command interface for devices without ISDU support. Validity and execution of commands are not confirmed.
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter1	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter2	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter3	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter4	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter5	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter6	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter7	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter8	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter9	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter10	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter11	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter12	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter13	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter14	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter15	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParametersPage2. nDeviceSpecificParameter16	UINT	[READ_WRITE]
stDeviceData.stData.nSystemCommand	UINT	[WRITE_ONLY] Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.
stDeviceData.stData.stDeviceAccessLocks. bParameterWriteAccess	BOOL	[READ_WRITE] This lock prevents the write access to all read/write parameters of the device except for the parameter 'Device Access Locks'.
stDeviceData.stData.stDeviceAccessLocks.bDataStorage	BOOL	[READ_WRITE] This lock prevents the write access to the device parameters via the data storage mechanism.

Parameter name	Data type	Description
stDeviceData.stData.stDeviceAccessLocks.bLocalParameterization	BOOL	[READ_WRITE] This lock prevents the device settings from being changed via local operating elements on the device.
stDeviceData.stData.stDeviceAccessLocks.bLocalUserInterface	BOOL	[READ_WRITE] This lock prevents the access to the device settings and display via a local user interface. The user interface is disabled.
stDeviceData.stData.sVendorName	STRING	[READ_ONLY] The vendor name that is assigned to a Vendor ID.
stDeviceData.stData.sVendorText	STRING	[READ_ONLY] Additional information about the vendor.
stDeviceData.stData.sProductName	STRING	[READ_ONLY] Complete product name.
stDeviceData.stData.sProductId	STRING	[READ_ONLY] Vendor-specific product or type identification (e.g., item number or model number).
stDeviceData.stData.sProductText	STRING	[READ_ONLY] Additional product information for the device.
stDeviceData.stData.sSerialNumber	STRING	[READ_ONLY] Unique, vendor-specific identifier of the individual device.
stDeviceData.stData.sHardwareRevision	STRING	[READ_ONLY] Unique, vendor-specific identifier of the hardware revision of the individual device.
stDeviceData.stData.sFirmwareRevision	STRING	[READ_ONLY] Unique, vendor-specific identifier of the firmware revision of the individual device.
stDeviceData.stData.sApplicationSpecificTag	STRING	[READ_WRITE] Possibility to mark a device with user- or application-specific information.
stDeviceData.stData.sFunctionTag	STRING	[READ_WRITE]
stDeviceData.stData.sLocationTag	STRING	[READ_WRITE]
stDeviceData.stData.nDeviceStatus	UINT	[READ_ONLY] Indicator for the current device condition and diagnosis state.
stDeviceData.stData.stDetailedDeviceStatus.sltem_1	STRING	[READ_ONLY] List of all currently pending events in the device.
stDeviceData.stData.stConfig.nPdInputConfiguration	UINT	[READ_WRITE] Configuration of process data content
stDeviceData.stData.stConfig.bReserved_2	BOOL	[READ_WRITE] reserved; Suffix "_2" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
stDeviceData.stData.stConfig.bPdOutputConfiguration	BOOL	[READ_WRITE] Configuration of CSC (sensor control)
stDeviceData.stData.stConfig.nOut2Function	UINT	[READ_WRITE]
stDeviceData.stData.stConfig.nReserved_5	UINT	[READ_WRITE] reserved; Suffix "_5" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.nDelayFunction	UINT	[READ_WRITE] Operating function of the internal delay unit
stDeviceData.stData.stConfig.nDelayTimeBase	UINT	[READ_WRITE] Time base of the internal delay unit: 1ms, 10ms, 100ms, 1000ms
stDeviceData.stData.stConfig.nDelayMultiplier	UINT	[READ_WRITE] Multiplier of the internal delay unit: 1-15 * delay time base
stDeviceData.stData.stConfig.bReserved_9	BOOL	[READ_WRITE] reserved; Suffix "_9" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.bReserved_10	BOOL	[READ_WRITE] reserved; Suffix "_10" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.bReserved_11	BOOL	[READ_WRITE] reserved; Suffix "_11" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.bReserved_12	BOOL	[READ_WRITE] reserved; Suffix "_12" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.bReserved_13	BOOL	[READ_WRITE] reserved; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.bSscLogic	BOOL	[READ_WRITE] SSC logic: adjusting the switching behavior of the switching signal channel
stDeviceData.stData.stConfig.bReserved_15	BOOL	[READ_WRITE] reserved; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
stDeviceData.stData.stConfig.bDelayUnit	BOOL	[READ_WRITE] Enable/disable internal delay unit (based on object)
stDeviceData.stData.nObjectCount	UINT	[READ_ONLY]
stDeviceData.stData.nOperationHours	UINT	[READ_ONLY]

Parameter name	Data type	Description
stDeviceData.stData.stSetpoints.nSp1	UINT	[READ_ONLY] Defines the setpoint 1 value for the switching signal channel.
stDeviceData.stData.stSetpoints.nSp2	UINT	[READ_ONLY] Defines the setpoint 2 value for the switching signal channel.

Tab. 7.2: ST\_Leuze\_PD\_HT5xC\_6002

Parameter name	Data type	Description
ST_Leuze_PD_HT5xC_6002.stMode_0.bSscSwitchingSignal	BOOL	
ST_Leuze_PD_HT5xC_6002.stMode_0.bWarning	BOOL	
ST_Leuze_PD_HT5xC_6002.stMode_0.bStatus	BOOL	
ST_Leuze_PD_HT5xC_6002.stMode_1.bSscSwitchingSignal	BOOL	
ST_Leuze_PD_HT5xC_6002.stMode_1.nMeasurementValue	UINT	

## 8 Parameter descriptions

Tab. 8.1: IODD parameter descriptions

(AR - Access Rights, R - Read only, W - Write only, RW - Read and Write, NS - Not specified)

Parameter	Index	Subindex	Data type	Default	AR	Description
Commands			RecordT		W	Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.
Restore Factory Settings			UIntegerT	130	W	Restore Factory Settings
Back To Box			UIntegerT	192	W	Back To Box
reserved			UIntegerT	161	W	reserved
reserved			UIntegerT	162	W	reserved
reserved			UIntegerT	163	W	reserved
reserved			UIntegerT	164	W	reserved
reserved			UIntegerT	165	W	reserved
reserved			UIntegerT	166	W	reserved
reserved			UIntegerT	167	W	reserved
reserved			UIntegerT	168	W	reserved
reserved			UIntegerT	169	W	reserved
reserved			UIntegerT	170	W	reserved
reserved			UIntegerT	171	W	reserved
reserved			UIntegerT	172	W	reserved
reserved			UIntegerT	173	W	reserved
reserved			UIntegerT	174	W	reserved
reserved			UIntegerT	175	W	reserved
Clear ObjectCount			UIntegerT	176	W	Clear ObjectCount
Direct Parameters - Page 1	0	0	RecordT		RW	Comprises the required parameters defining the communication characteristics and identifiers for device validation.
Reserved	0	1	UIntegerT		R	
Master Cycle Time	0	2	UIntegerT		R	Communication: Current communication cycle duration used by the master. This value defines the process data cycle.

Parameter	Index	Subindex	Data type	Default	AR	Description
Min Cycle Time	0	3	UIntegerT		R	Communication: Minimum communication cycle duration supported by the device. This value defines the lowest possible process data cycle.
M-Sequence Capability	0	4	UIntegerT		R	Communication: Information on the structure and the supported features of the communication messages.
IO-Link Revision ID	0	5	UIntegerT	17	R	Communication: Identifier for the currently used communication protocol revision.
Process Data Input Length	0	6	UIntegerT		R	Communication: Information on width and features of the process input data (Process Data from Device to Master).
Process Data Output Length	0	7	UIntegerT		R	Communication: Information on width of the process output data (Process Data from Master to Device).
Vendor ID 1	0	8	UIntegerT		R	Identification: Highest octet of the Vendor ID. Combined with the parameter Vendor ID 2, this parameter defines the 16-bit value of the unique Vendor ID as assigned by the IO-Link Community.
Vendor ID 2	0	9	UIntegerT		R	Identification: Lowest octet of the Vendor ID. Combined with the parameter Vendor ID 1, this parameter defines the 16-bit value of the unique Vendor ID as assigned by the IO-Link Community.
Device ID 1	0	10	UIntegerT		R	Identification: Highest octet of the Device ID. Combined with the parameters Device ID 2 and 3, this parameter defines the 24-bit value of the vendor-specific Device ID.
Device ID 2	0	11	UIntegerT		R	Identification: Middle octet of the Device ID. Combined with the parameters Device ID 1 and 3, this parameter defines the 24-bit value of the vendor-specific Device ID.
Device ID 3	0	12	UIntegerT		R	Identification: Lowest octet of the Device ID. Combined with the parameters Device ID 1 and 2, this parameter defines the 24-bit value of the vendor-specific Device ID.
Reserved	0	13	UIntegerT		R	
Reserved	0	14	UIntegerT		R	
Reserved	0	15	UIntegerT		R	
System Command	0	16	UIntegerT		W	Application: Command interface for devices without ISDU support. Validity and execution of commands are not confirmed.  (0 ... 63): Reserved 128: Device Reset 129: Application Reset 130: Restore Factory Settings 131: Back-to-box (132 ... 159): Reserved
Direct Parameters - Page 2	1	0	RecordT		RW	A set of parameters for devices without ISDU support.

Parameter	Index	Subindex	Data type	Default	AR	Description
Device-specific Parameter 1	1	1	UIntegerT		RW	
Device-specific Parameter 2	1	2	UIntegerT		RW	
Device-specific Parameter 3	1	3	UIntegerT		RW	
Device-specific Parameter 4	1	4	UIntegerT		RW	
Device-specific Parameter 5	1	5	UIntegerT		RW	
Device-specific Parameter 6	1	6	UIntegerT		RW	
Device-specific Parameter 7	1	7	UIntegerT		RW	
Device-specific Parameter 8	1	8	UIntegerT		RW	
Device-specific Parameter 9	1	9	UIntegerT		RW	
Device-specific Parameter 10	1	10	UIntegerT		RW	
Device-specific Parameter 11	1	11	UIntegerT		RW	
Device-specific Parameter 12	1	12	UIntegerT		RW	
Device-specific Parameter 13	1	13	UIntegerT		RW	
Device-specific Parameter 14	1	14	UIntegerT		RW	
Device-specific Parameter 15	1	15	UIntegerT		RW	
Device-specific Parameter 16	1	16	UIntegerT		RW	
System Command	2	0	UIntegerT		W	<p>Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.</p> <p>130: Restore Factory Settings  (0 ... 63): Reserved  (132 ... 159): Reserved  192: Back To Box  161: reserved  162: reserved  163: reserved  164: reserved  165: reserved  166: reserved  167: reserved  168: reserved  169: reserved  170: reserved  171: reserved  172: reserved  173: reserved  174: reserved  175: reserved  176: Clear ObjectCount</p>

Parameter	Index	Subindex	Data type	Default	AR	Description
Device Access Locks	12	0	RecordT		RW	The access to the device parameters can be restricted by setting appropriate flags within this parameter.
Parameter Write Access	12	1	BooleanT		RW	This lock prevents the write access to all read/write parameters of the device except for the parameter 'Device Access Locks'.  True: Locked False: Unlocked
Data Storage	12	2	BooleanT		RW	This lock prevents the write access to the device parameters via the data storage mechanism.  True: Locked False: Unlocked
Local Parameterization	12	3	BooleanT		RW	This lock prevents the device settings from being changed via local operating elements on the device.  True: Locked False: Unlocked
Local User Interface	12	4	BooleanT		RW	This lock prevents the access to the device settings and display via a local user interface. The user interface is disabled.  True: Locked False: Unlocked
Vendor Name	16	0	StringT	Leuze electronic GmbH + Co. KG	R	The vendor name that is assigned to a Vendor ID.
Vendor Text	17	0	StringT	The Sensor People	R	Additional information about the vendor.
Product Name	18	0	StringT	HT5xC.V/LG	R	Complete product name.
Product ID	19	0	StringT		R	Vendor-specific product or type identification (e.g., item number or model number).
Product Text	20	0	StringT	Diffuse Sensor with BGS	R	Additional product information for the device.
Serial Number	21	0	StringT		R	Unique, vendor-specific identifier of the individual device.
Hardware Revision	22	0	StringT		R	Unique, vendor-specific identifier of the hardware revision of the individual device.
Firmware Revision	23	0	StringT		R	Unique, vendor-specific identifier of the firmware revision of the individual device.
Application-specific Tag	24	0	StringT	***	RW	Possibility to mark a device with user- or application-specific information.
Function Tag	25	0	StringT	***	RW	
Location Tag	26	0	StringT	***	RW	
Device Status	36	0	UIntegerT		R	Indicator for the current device condition and diagnosis state.
Detailed Device Status	37	0	ArrayT		R	List of all currently pending events in the device.

Parameter	Index	Subindex	Data type	Default	AR	Description
	37	0	OctetStringT		R	
Config	64	0	RecordT		RW	
PD input configuration	64	1	UIntegerT	0	RW	Configuration of process data content 0: Default 1: Measurement value
reserved	64	2	BooleanT	0	RW	reserved False: reserved (0)
PD output configuration	64	3	BooleanT	0	RW	Configuration of CSC (sensor control) False: CSC is deactivation True: CSC is activation
Out2 function	64	4	UIntegerT	0	RW	0: Inverted switching output 1: Switching output
reserved	64	5	UIntegerT	0	RW	reserved 0: reserved (0)
Delay function	64	6	UIntegerT	1	RW	Operating function of the internal delay unit 0: On delay 1: Off delay 2: Pulse stretching 3: Pulse suppression
Delay time base	64	7	UIntegerT	1	RW	Time base of the internal delay unit: 1ms, 10ms, 100ms, 1000ms 0: 1ms 1: 10ms 2: 100ms 3: 1000ms
Delay multiplier	64	8	UIntegerT	1	RW	Multiplier of the internal delay unit: 1-15 * delay time base
reserved	64	9	BooleanT	0	RW	reserved False: reserved (0)
reserved	64	10	BooleanT	0	RW	reserved False: reserved (0)
reserved	64	11	BooleanT	0	RW	reserved False: reserved (0)
reserved	64	12	BooleanT	0	RW	reserved False: reserved (0)
reserved	64	13	BooleanT	0	RW	reserved False: reserved (0)
SSC logic	64	14	BooleanT	1	RW	SSC logic: adjusting the switching behavior of the switching signal channel False: Out is no object True: Out is object
reserved	64	15	BooleanT	0	RW	reserved False: reserved (0)

Parameter	Index	Subindex	Data type	Default	AR	Description
Delay unit	64	16	BooleanT	0	RW	Enable/disable internal delay unit (based on object) False: Disabled True: Enabled
Object count	70	0	UIntegerT		R	
Operation hours	71	0	UIntegerT		R	
Setpoints	73	0	RecordT		R	Setpoints for the switching signal channel.
SP1	73	1	UIntegerT		R	Defines the setpoint 1 value for the switching signal channel.
SP2	73	2	UIntegerT		R	Defines the setpoint 2 value for the switching signal channel.

# 9 Technical specifications

## 9.1 General data

Tab. 9.1: Sensor and IODD version

IODD version	V1.0
IODD release date	2023-03-31
Device family	HT5xC
Device ID	6002
Device name	HT5xC.V/LG
Device variants	HT53C.V/LG-M8 (50148173), HT55C.V/LG-200-M12 (50148214)