



## PLC Integration HT5xC\_6004

**IO - Link service data function block + process data parser function for Siemens S7-1200 / S7 - 1500 (TIA - Portal V15.1 or higher) PLC systems in combination with a PROFIBUS / PROFINET IO - Link Master**

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# 1 Legal information


## 1.1 Disclaimer

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## **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\_HT5xC\_6004" simplifies the usage of Leuze IO-Link devices on Siemens S7-1200/S7-1500 (TIA-Portal V15.1 or higher) 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 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

The module can be called as a single-instance.



Fig. 3.1: Example of module call with single instance

### 3.3 Configuration

Tab. 3.1: Parameter IN

Parameter	Data type	Description
Execute	Bool	Positive trigger: Start data transfer
RW	Bool	Read or write the selected IO-Link parameter. FALSE: Read parameter TRUE: Write Parameter
Port	Int	Number of the master port the IO-Link device is connected, starting with 1.
HwID	HW_IO	Hardware IO-Address of the IO-Link master
Cap	DInt	Client access point of the IO-Link function (IO-LinkMaster specific). Siemens: 227 Weidmüller: 227 Other manufacturers: 255
TimeOut	Time	Time, after a Timeout-Error is triggered.

Tab. 3.2: Parameter INOUT

Parameter	Data type	Description
DeviceData	Leuze_type_HT5xC_6004	Sensor data

See structure description of Leuze\_type\_HT5xC\_6004 in chapter 7.

Tab. 3.3: Parameter OUT

Parameter	Data type	Description
Done	Bool	Indicates whether data is valid.
Busy	Bool	Request in process. FALSE: Request is terminated TRUE: Request is being processed
Error	Bool	Error flag FALSE: No error TRUE: Error detected
ErrorCode	Leuze_type_lolError	Status of the function block
Diagnostics	LIOLink_typeDiagnostics	Detailed diagnostic information of the FB. See description of Siemens Library for IO-Link (LIOLink).

See structure description of Leuze\_type\_lolError in chapter 6.

## 3.4 Method of function

The function block uses the data structure "FB\_Leuze\_HT5xC\_6004". The PLC data structure contains the values of all IO-Link variables. Before you can use it, the structure must be instantiated by a data block. Each IO-Link FB parameter has a data point representing it in this data structure. This data point will be actualized every time a read request was executed successfully.

The desired parameters can be selected via the input variables. Depending on the device definition, IO-Link parameters are read or writable. The input variable must be "RW" = FALSE to read parameter. The value that should be written can be defined in the data structure, as soon as the input parameter "RW" = TRUE. You start each transfer by calling up the "FB\_Leuze\_HT5xC\_6004" with a positive trigger at the "Execute" input. As long as there is no valid answer the output "Busy" is TRUE. In the case that the chosen timeout period has elapsed a timeout error will be generated and the thread will be terminated. The "Done" = TRUE output shows that the transmission was successful. The outputs retain there states as long as there is no new positive trigger at the "Execute" input again.

The function block allows you to read or write multiple IO-Link parameters sequentially (multiselection). 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 (Error) is set and an error code (Leuze\_type\_lolError) 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\_HT5xC\_6004" 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 type)
- Compiling the PLC project

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 FC\_Leuze\_PD\_HT5xC\_6004 simplifies the interpretation of composed IO-Link process data. This data is provided as a data structure on the PLC side. Some sensors supports different process data output. User must select mode of PD according to the sensors settings. Each sensor connected to Leuze IO-Link master has its own hardware ID. See Fig. 5.2.

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
HwID	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 IOAddress 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 date is mapped into a specified logical IO-Address, the relative byte offset = 0.
PDMode	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.
Error	OUTPUT	BOOL	Error flag FALSE: No error TRUE: Error detected
ErrorCode	OUTPUT	WORD	Error code details see in the Siemens help system ("DPRD_DAT").
RET_VAL	OUTPUT	Leuze_type_PD_HT5xC_6004	Reference to the instance of the data structure Leuze_type_PD_HT5xC_6004. The structure includes the disaggregated values of the process data.

See structure description of Leuze\_type\_PD\_HT5xC\_6004 in chapter 7.



Fig. 5.2: Hardware ID for sensors connected to Leuze MD798 IO-Link master

## 6 Error description

The parameter "ErrorCode" can be interpreted using the PLC data type Leuze\_type\_IolError. This data type contains the following error information:

Tab. 6.1: Leuze\_type\_IolError description

Parameter name	Data type	Description
ErrorCode.status	Word	16#0000–16#7FFF: Status of the FB, 16#8000–16#FFFF: Error codes
ErrorCode.iolMError	Word	IO-Link Master error (see IO-Link specification)
ErrorCode.iolError	Word	IO-Link error. Contains the IOL_Error_Code the IOL_Add_Error_Code (see IO-Link specification) and the device specific error codes
ErrorCode.isduIndex	Int	IO-Link Index (ISDU) to which the error code refers

Tab. 6.2: Error description for status

Error code (status)	Error description
0x0000	Operation completed, no warning and no further details
0x7000	No operation in progress (initial value)
0x7001	First call after input of a new command (rising edge on "execute")
0x7002	Subsequent cal
0x8001	Time out error occurred
0x8002	No parameter selected
0x8201	Unsupported port
0x8202	Unsupported index
0x8203	Unsupported subindex
0x8205	The length at the "writeLen" parameter does not match the data record that will be written
0x8401	The IO-Link master has reported an error code, see "diagnostics"
0x8402	Received data record does not match operation
0x8403	Operation could not be completed in the specified time
0x8600	Internal state machine has reached an undefined state
0x8601	System function WRREC reports an error, see "diagnostics"
0x8602	System function RDREC reports an error, see "diagnostics"

Tab. 6.3: Error description for ioLError

Error code (ioLError)	Error description
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](http://www.profibus.com)).

Tab. 6.4: Error description for ioLError

Error code (ioLError)	Error description
0x0000	No error
0x1000	Master communication error
0x1100	ISDU time out / Device event error
0x5200	Device checksum error
0x5600	Device checksum error

Error code (ioLError)	Error description
0x5700	Master ISDU illegal service
0x5800	Device error: Byte length does not fit to the chosen parameter
0x8000	The requested service has been refused by the device application
0x8011	Read write access to a not existing Index
0x8012	Read write access to a not existing sub index
0x8020	Parameter is not accessible for a read or write service due to the current state in the device
0x8021	Parameter is not accessible for a read or write service due to an ongoing local operation at the device
0x8022	Parameter is not accessible for a read or write service due to an remote triggered state of the device application
0x8023	Write service tries to access a read-only parameter
0x8030	Write service to a parameter outside its permitted range of values
0x8031	Write service to a parameter above its specified value range
0x8032	Write service to a parameter below its specified value range
0x8033	Write service to a parameter above its specified length
0x8034	Write service to a parameter below its predefined length
0x8035	Write service with a command value not supported by the device application
0x8036	Write service with a command value calling a device function not available due to the current state
0x8040	The value via single parameter transfer collide with other actual parameter settings
0x8041	Inconsistent parameter set (at least an ISDU cannot be written)
0x8082	The read or write service is refused due to a temporarily unavailable application
0x8100	Unspecified
0x8101 ... 0x81FF	Device specific (see device description)

For additional information see the specification "IO-Link Communication" ([www.IO-Link.com](http://www.IO-Link.com)).

## 7 Data structures

Tab. 7.1: Leuze\_type\_HT5xC\_6004

Parameter name	Data type	Description
DeviceData.Selection.Commands.CmdRestoreFactorySettings	Bool	[WRITE_ONLY] Restore Factory Settings
DeviceData.Selection.Commands.CmdBackToBox	Bool	[WRITE_ONLY] Back To Box
DeviceData.Selection.Commands.CmdReserved_3	Bool	[WRITE_ONLY] reserved; Suffix "_3" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_4	Bool	[WRITE_ONLY] reserved; Suffix "_4" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_5	Bool	[WRITE_ONLY] reserved; Suffix "_5" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_6	Bool	[WRITE_ONLY] reserved; Suffix "_6" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_7	Bool	[WRITE_ONLY] reserved; Suffix "_7" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_8	Bool	[WRITE_ONLY] reserved; Suffix "_8" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_9	Bool	[WRITE_ONLY] reserved; Suffix "_9" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_10	Bool	[WRITE_ONLY] reserved; Suffix "_10" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_11	Bool	[WRITE_ONLY] reserved; Suffix "_11" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_12	Bool	[WRITE_ONLY] reserved; Suffix "_12" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
DeviceData.Selection.Commands.CmdReserved_13	Bool	[WRITE_ONLY] reserved; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_14	Bool	[WRITE_ONLY] reserved; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_15	Bool	[WRITE_ONLY] reserved; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_16	Bool	[WRITE_ONLY] reserved; Suffix "_16" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdReserved_17	Bool	[WRITE_ONLY] reserved; Suffix "_17" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.Commands.CmdClearObjectcount	Bool	[WRITE_ONLY] Clear ObjectCount
DeviceData.Selection.DirectParametersPage1.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.DirectParametersPage1.Reserved_1	Bool	[READ_ONLY] ; Suffix "_1" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.DirectParametersPage1.MasterCycleTime	Bool	[READ_ONLY] Communication: Current communication cycle duration used by the master. This value defines the process data cycle.
DeviceData.Selection.DirectParametersPage1.MinCycleTime	Bool	[READ_ONLY] Communication: Minimum communication cycle duration supported by the device. This value defines the lowest possible process data cycle.
DeviceData.Selection.DirectParametersPage1.MSequenceCapability	Bool	[READ_ONLY] Communication: Information on the structure and the supported features of the communication messages.
DeviceData.Selection.DirectParametersPage1.IoLinkRevisionId	Bool	[READ_ONLY] Communication: Identifier for the currently used communication protocol revision.

Parameter name	Data type	Description
DeviceData.Selection.DirectParametersPage1.ProcessDataInputLength	Bool	[READ_ONLY] Communication: Information on width and features of the process input data (Process Data from Device to Master).
DeviceData.Selection.DirectParametersPage1.ProcessDataOutputLength	Bool	[READ_ONLY] Communication: Information on width of the process output data (Process Data from Master to Device).
DeviceData.Selection.DirectParametersPage1.VendorId1	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.
DeviceData.Selection.DirectParametersPage1.VendorId2	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.
DeviceData.Selection.DirectParametersPage1.DeviceId1	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.
DeviceData.Selection.DirectParametersPage1.DeviceId2	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.
DeviceData.Selection.DirectParametersPage1.DeviceId3	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.
DeviceData.Selection.DirectParametersPage1.Reserved_13	Bool	[READ_ONLY] ; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.



Parameter name	Data type	Description
DeviceData.Selection.DirectParametersPage1.Reserved_14	Bool	[READ_ONLY] ; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.DirectParametersPage1.Reserved_15	Bool	[READ_ONLY] ; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Selection.DirectParametersPage1.SystemCommand	Bool	[WRITE_ONLY] Application: Command interface for devices without ISDU support. Validity and execution of commands are not confirmed.
DeviceData.Selection.DirectParametersPage2.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter1	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter2	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter3	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter4	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter5	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter6	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter7	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter8	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter9	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter10	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter11	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter12	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter13	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter14	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter15	Bool	[READ_WRITE]
DeviceData.Selection.DirectParametersPage2.DeviceSpecificParameter16	Bool	[READ_WRITE]
DeviceData.Selection.SystemCommand	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
DeviceData.Selection.DeviceAccessLocks.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.VendorName	Bool	[READ_ONLY] The vendor name that is assigned to a Vendor ID.
DeviceData.Selection.VendorText	Bool	[READ_ONLY] Additional information about the vendor.
DeviceData.Selection.ProductName	Bool	[READ_ONLY] Complete product name.
DeviceData.Selection.ProductId	Bool	[READ_ONLY] Vendor-specific product or type identification (e.g., item number or model number).
DeviceData.Selection.ProductText	Bool	[READ_ONLY] Additional product information for the device.
DeviceData.Selection.SerialNumber	Bool	[READ_ONLY] Unique, vendor-specific identifier of the individual device.
DeviceData.Selection.HardwareRevision	Bool	[READ_ONLY] Unique, vendor-specific identifier of the hardware revision of the individual device.
DeviceData.Selection.FirmwareRevision	Bool	[READ_ONLY] Unique, vendor-specific identifier of the firmware revision of the individual device.
DeviceData.Selection.ApplicationSpecificTag	Bool	[READ_WRITE] Possibility to mark a device with user- or application-specific information.
DeviceData.Selection.FunctionTag	Bool	[READ_WRITE]
DeviceData.Selection.LocationTag	Bool	[READ_WRITE]
DeviceData.Selection.DeviceStatus	Bool	[READ_ONLY] Indicator for the current device condition and diagnosis state.
DeviceData.Selection.DetailedDeviceStatus.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Selection.Config.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.ObjectCount	Bool	[READ_ONLY]
DeviceData.Selection.OperationHours	Bool	[READ_ONLY]
DeviceData.Selection.Setpoints.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Data.Commands.CmdRestoreFactorySettings	UInt	[WRITE_ONLY] Restore Factory Settings
DeviceData.Data.Commands.CmdBackToBox	UInt	[WRITE_ONLY] Back To Box

Parameter name	Data type	Description
DeviceData.Data.Commands.CmdReserved_3	UInt	[WRITE_ONLY] reserved; Suffix "_3" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_4	UInt	[WRITE_ONLY] reserved; Suffix "_4" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_5	UInt	[WRITE_ONLY] reserved; Suffix "_5" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_6	UInt	[WRITE_ONLY] reserved; Suffix "_6" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_7	UInt	[WRITE_ONLY] reserved; Suffix "_7" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_8	UInt	[WRITE_ONLY] reserved; Suffix "_8" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_9	UInt	[WRITE_ONLY] reserved; Suffix "_9" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_10	UInt	[WRITE_ONLY] reserved; Suffix "_10" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_11	UInt	[WRITE_ONLY] reserved; Suffix "_11" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_12	UInt	[WRITE_ONLY] reserved; Suffix "_12" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_13	UInt	[WRITE_ONLY] reserved; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_14	UInt	[WRITE_ONLY] reserved; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
DeviceData.Data.Commands.CmdReserved_15	UInt	[WRITE_ONLY] reserved; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_16	UInt	[WRITE_ONLY] reserved; Suffix "_16" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdReserved_17	UInt	[WRITE_ONLY] reserved; Suffix "_17" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Commands.CmdClearObjectcount	UInt	[WRITE_ONLY] Clear ObjectCount
DeviceData.Data.DirectParametersPage1.Reserved_1	UInt	[READ_ONLY] ; Suffix "_1" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.DirectParametersPage1.MasterCycleTime	UInt	[READ_ONLY] Communication: Current communication cycle duration used by the master. This value defines the process data cycle.
DeviceData.Data.DirectParametersPage1.MinCycleTime	UInt	[READ_ONLY] Communication: Minimum communication cycle duration supported by the device. This value defines the lowest possible process data cycle.
DeviceData.Data.DirectParametersPage1.MSequenceCapability	UInt	[READ_ONLY] Communication: Information on the structure and the supported features of the communication messages.
DeviceData.Data.DirectParametersPage1.IoLinkRevisionId	UInt	[READ_ONLY] Communication: Identifier for the currently used communication protocol revision.
DeviceData.Data.DirectParametersPage1.ProcessDataInputLength	UInt	[READ_ONLY] Communication: Information on width and features of the process input data (Process Data from Device to Master).
DeviceData.Data.DirectParametersPage1.ProcessDataOutputLength	UInt	[READ_ONLY] Communication: Information on width of the process output data (Process Data from Master to Device).

Parameter name	Data type	Description
DeviceData.Data.DirectParametersPage1.VendorId1	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.
DeviceData.Data.DirectParametersPage1.VendorId2	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.
DeviceData.Data.DirectParametersPage1.DeviceId1	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.
DeviceData.Data.DirectParametersPage1.DeviceId2	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.
DeviceData.Data.DirectParametersPage1.DeviceId3	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.
DeviceData.Data.DirectParametersPage1.Reserved_13	UInt	[READ_ONLY] ; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.DirectParametersPage1.Reserved_14	UInt	[READ_ONLY] ; Suffix "_14" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.DirectParametersPage1.Reserved_15	UInt	[READ_ONLY] ; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
DeviceData.Data.DirectParametersPage1.SystemCommand	UInt	[WRITE_ONLY] Application: Command interface for devices without ISDU support. Validity and execution of commands are not confirmed.
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter1	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter2	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter3	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter4	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter5	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter6	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter7	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter8	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter9	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter10	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter11	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter12	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter13	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter14	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter15	UInt	[READ_WRITE]
DeviceData.Data.DirectParametersPage2.DeviceSpecificParameter16	UInt	[READ_WRITE]
DeviceData.Data.SystemCommand	UInt	[WRITE_ONLY] Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.
DeviceData.Data.DeviceAccessLocks.ParameterWriteAccess	Bool	[READ_WRITE] This lock prevents the write access to all read/write parameters of the device except for the parameter 'Device Access Locks'.
DeviceData.Data.DeviceAccessLocks.DataStorage	Bool	[READ_WRITE] This lock prevents the write access to the device parameters via the data storage mechanism.

Parameter name	Data type	Description
DeviceData.Data.DeviceAccessLocks.LocalParameterization	Bool	[READ_WRITE] This lock prevents the device settings from being changed via local operating elements on the device.
DeviceData.Data.DeviceAccessLocks.LocalUserInterface	Bool	[READ_WRITE] This lock prevents the access to the device settings and display via a local user interface. The user interface is disabled.
DeviceData.Data.VendorName	String	[READ_ONLY] The vendor name that is assigned to a Vendor ID.
DeviceData.Data.VendorText	String	[READ_ONLY] Additional information about the vendor.
DeviceData.Data.ProductName	String	[READ_ONLY] Complete product name.
DeviceData.Data.ProductId	String	[READ_ONLY] Vendor-specific product or type identification (e.g., item number or model number).
DeviceData.Data.ProductText	String	[READ_ONLY] Additional product information for the device.
DeviceData.Data.SerialNumber	String	[READ_ONLY] Unique, vendor-specific identifier of the individual device.
DeviceData.Data.HardwareRevision	String	[READ_ONLY] Unique, vendor-specific identifier of the hardware revision of the individual device.
DeviceData.Data.FirmwareRevision	String	[READ_ONLY] Unique, vendor-specific identifier of the firmware revision of the individual device.
DeviceData.Data.ApplicationSpecificTag	String	[READ_WRITE] Possibility to mark a device with user- or application-specific information.
DeviceData.Data.FunctionTag	String	[READ_WRITE]
DeviceData.Data.LocationTag	String	[READ_WRITE]
DeviceData.Data.DeviceStatus	UInt	[READ_ONLY] Indicator for the current device condition and diagnosis state.
DeviceData.Data.DetailedDeviceStatus.Item_1	String	[READ_ONLY] List of all currently pending events in the device.
DeviceData.Data.Config.PdInputConfiguration	UInt	[READ_WRITE] Configuration of process data content
DeviceData.Data.Config.Reserved_2	Bool	[READ_WRITE] reserved; Suffix "_2" (parameter index or subindex) added because of duplicate parameter names.

Parameter name	Data type	Description
DeviceData.Data.Config.PdOutputConfiguration	Bool	[READ_WRITE] Configuration of CSC (sensor control)
DeviceData.Data.Config.Out2Function	UInt	[READ_WRITE]
DeviceData.Data.Config.Reserved_5	UInt	[READ_WRITE] reserved; Suffix "_5" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.DelayFunction	UInt	[READ_WRITE] Operating function of the internal delay unit
DeviceData.Data.Config.DelayTimeBase	UInt	[READ_WRITE] Time base of the internal delay unit: 1ms, 10ms, 100ms, 1000ms
DeviceData.Data.Config.DelayMultiplier	UInt	[READ_WRITE] Multiplier of the internal delay unit: 1-15 * delay time base
DeviceData.Data.Config.Reserved_9	Bool	[READ_WRITE] reserved; Suffix "_9" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.Reserved_10	Bool	[READ_WRITE] reserved; Suffix "_10" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.Reserved_11	Bool	[READ_WRITE] reserved; Suffix "_11" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.Reserved_12	Bool	[READ_WRITE] reserved; Suffix "_12" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.Reserved_13	Bool	[READ_WRITE] reserved; Suffix "_13" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.SscLogic	Bool	[READ_WRITE] SSC logic: adjusting the switching behavior of the switching signal channel
DeviceData.Data.Config.Reserved_15	Bool	[READ_WRITE] reserved; Suffix "_15" (parameter index or subindex) added because of duplicate parameter names.
DeviceData.Data.Config.DelayUnit	Bool	[READ_WRITE] Enable/disable internal delay unit (based on object)
DeviceData.Data.ObjectCount	UInt	[READ_ONLY]
DeviceData.Data.OperationHours	UInt	[READ_ONLY]



Parameter name	Data type	Description
DeviceData.Data.Setpoints.Sp1	UInt	[READ_ONLY] Defines the setpoint 1 value for the switching signal channel.
DeviceData.Data.Setpoints.Sp2	UInt	[READ_ONLY] Defines the setpoint 2 value for the switching signal channel.

Tab. 7.2: Leuze\_type\_PD\_HT5xC\_6004

Parameter name	Data type	Description
FC_Leuze_PD_HT5xC_6004.Mode_0.SscSwitchingSignal	Bool	
FC_Leuze_PD_HT5xC_6004.Mode_0.Warning	Bool	
FC_Leuze_PD_HT5xC_6004.Mode_0.Status	Bool	
FC_Leuze_PD_HT5xC_6004.Mode_1.SscSwitchingSignal	Bool	
FC_Leuze_PD_HT5xC_6004.Mode_1.MeasurementValue	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.XL/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	6004
Device name	HT5xC.XL/LG
Device variants	HT53C.XL/LG-M8 (50148172), HT55C.XL/LG-M8 (50148207), HT55C.XL/LG-200-M12 (50148208)