



## PLC Integration of ODT3CL\_2220

**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**

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# 1 Legal information

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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\_IOL\_ ODT3CL\_2220" 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_ ODT3CL_2220	Sensor data

See structure description of ST\_Leuze\_IOL\_ ODT3CL\_2220 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\_ODT3CL\_2220". 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\_ODT3CL\_2220" 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\_ODT3CL\_2220" 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\_ODT3CL\_2220 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.

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_ODT3CL_2220	OUTPUT	ST_Leuze_PD_ODT3CL_2220	Reference to the instance of the data structure ST_Leuze_PD_ODT3CL_2220. The structure includes the disaggregated values of the process data.

See structure description of ST\_Leuze\_PD\_ODT3CL\_2220 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\_ ODT3CL\_2220

Parameter name	Data type	Description
stDeviceData.stSelection.stCommands.bCmdDeviceReset	BOOL	[WRITE_ONLY] Device Reset
stDeviceData.stSelection.stCommands.bCmdApplicationReset	BOOL	[WRITE_ONLY] Application Reset
stDeviceData.stSelection.stCommands.bCmdRestoreFactorySettings	BOOL	[WRITE_ONLY] Restore Factory Settings
stDeviceData.stSelection.stCommands.bCmdBackToBox	BOOL	[WRITE_ONLY] Back-to-box
stDeviceData.stSelection.stCommands.bCmdTeachSp1	BOOL	[WRITE_ONLY] Teach SP1
stDeviceData.stSelection.stCommands.bCmdTeachSp2	BOOL	[WRITE_ONLY] Teach SP2
stDeviceData.stSelection.stCommands.bCmdActivationTakesPriorityOverPdout	BOOL	[WRITE_ONLY] Activation (Takes Priority over PDout)
stDeviceData.stSelection.stCommands.bCmdDeactivationTakesPriorityOverPdout	BOOL	[WRITE_ONLY] Deactivation (Takes Priority over PDout)
stDeviceData.stSelection.stCommands.bCmdResetPriorityPdoutWorking	BOOL	[WRITE_ONLY] Reset Priority (PDout working)
stDeviceData.stSelection.stCommands.bCmdStartStopObjecttest	BOOL	[WRITE_ONLY] Start/Stop Objecttest
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.bSystemCommand	BOOL	[WRITE_ONLY] Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.
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] Possibility to mark a device with function-specific information.

Parameter name	Data type	Description
stDeviceData.stSelection.bLocationTag	BOOL	[READ_WRITE] Possibility to mark a device with location-specific information.
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.bTeachSelect	BOOL	[READ_WRITE] Selects the switching signal channel for which a teach procedure will be applied.
stDeviceData.stSelection.stTeachResult.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stSelection.stSsc1Param.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stSsc1Param.bSp1	BOOL	[READ_WRITE] Defines the setpoint 1 value for the switching signal channel.
stDeviceData.stSelection.stSsc1Param.bSp2	BOOL	[READ_WRITE] Defines the setpoint 2 value for the switching signal channel.
stDeviceData.stSelection.stSsc1Config.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stSsc1Config.bLogic	BOOL	[READ_WRITE] Defines the logical representation of the switching signal SSC in the process data.
stDeviceData.stSelection.stSsc1Config.bMode	BOOL	[READ_WRITE] Defines the evaluation mode for the switching signal SSC.
stDeviceData.stSelection.stSsc1Config.bHysteresis	BOOL	[READ_WRITE] Defines the hysteresis at the switchpoint. A higher hysteresis may help to increase stability in critical applications.
stDeviceData.stSelection.stSsc2Param.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stSsc2Param.bSp1	BOOL	[READ_WRITE] Defines the setpoint 1 value for the switching signal channel.
stDeviceData.stSelection.stSsc2Param.bSp2	BOOL	[READ_WRITE] Defines the setpoint 2 value for the switching signal channel.
stDeviceData.stSelection.stSsc2Config.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stSsc2Config.bLogic	BOOL	[READ_WRITE] Defines the logical representation of the switching signal SSC in the process data.

Parameter name	Data type	Description
stDeviceData.stSelection.stSsc2Config.bMode	BOOL	[READ_WRITE] Defines the evaluation mode for the switching signal SSC.
stDeviceData.stSelection.stSsc2Config.bHysteresis	BOOL	[READ_WRITE] Defines the hysteresis at the switchpoint. A higher hysteresis may help to increase stability in critical applications.
stDeviceData.stSelection.bSsc2TeachingOffset	BOOL	[READ_WRITE] Adds an distinct distance in mm on the TeachPoint to assure an active SSC.2. This only has an Effect for SP1 in Single Point Mode.
stDeviceData.stSelection.bSsc1TeachingOffset	BOOL	[READ_WRITE] Adds an distinct distance in mm on the TeachPoint to assure an active SSC.1. This only has an Effect for SP1 in Single Point Mode.
stDeviceData.stSelection.bAnalysisDepthSsc2	BOOL	[READ_WRITE] Number of Scans considered for the Switching Output SSC.2 to toggle.
stDeviceData.stSelection.bTimerUnitSsc2	BOOL	[READ_WRITE] Enable or Disable Timer Unit for SSC.2.
stDeviceData.stSelection.bFunctionOfTimerUnitSsc2	BOOL	[READ_WRITE] Function of Timer Unit SSC.2
stDeviceData.stSelection.bTimeSsc2	BOOL	[READ_WRITE] Timebase of Timer Unit SSC.2.
stDeviceData.stSelection.bNumberOfObjectsSsc2	BOOL	[READ_WRITE] Internal Object Counter SSC.2.
stDeviceData.stSelection.bAnalysisDepthSsc1	BOOL	[READ_WRITE] Number of Scans considered for the Switching Output SSC.1 to toggle.
stDeviceData.stSelection.bTimerUnitSsc1	BOOL	[READ_WRITE] Enable or Disable Timer Unit for SSC.1.
stDeviceData.stSelection.bFunctionOfTimerUnitSsc1	BOOL	[READ_WRITE] Function of Timer Unit SSC.1
stDeviceData.stSelection.bTimeSsc1	BOOL	[READ_WRITE] Timebase of Timer Unit SSC.1.
stDeviceData.stSelection.bNumberOfObjectsSsc1	BOOL	[READ_WRITE] Internal Object Counter SSC.1.
stDeviceData.stSelection.bTemperature	BOOL	[READ_ONLY] Temperature inside the Device.
stDeviceData.stSelection.bButtonFunctionLevel1	BOOL	[READ_WRITE] Selection of function being executed after Button pressed for 2 to 6 seconds.
stDeviceData.stSelection.bButtonFunctionLevel2	BOOL	[READ_WRITE] Selection of function being executed after Button pressed for 7 to 11 seconds.

Parameter name	Data type	Description
stDeviceData.stSelection.bButtonFunctionLevel3	BOOL	[READ_WRITE] Selection of function being executed after Button pressed for 12 to 16 seconds.
stDeviceData.stSelection.bPin4Function	BOOL	[READ_WRITE] Modification of Pin 4 Function.
stDeviceData.stSelection.bPin2Function	BOOL	[READ_WRITE] Modification of Pin 2 Function.
stDeviceData.stSelection.stMdcDescriptor.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stSelection.stMdcDescriptor.bLowerValue	BOOL	[READ_ONLY] Shows the lower value of measurement range.
stDeviceData.stSelection.stMdcDescriptor.bUpperValue	BOOL	[READ_ONLY] Shows the upper value of measurement range.
stDeviceData.stSelection.stMdcDescriptor.bUnitCode	BOOL	[READ_ONLY] Shows the unique code for the physical unit.
stDeviceData.stSelection.stMdcDescriptor.bScale	BOOL	[READ_ONLY] Shows the multiplier for measurement value - $10^{\text{exp}(\text{scale})}$ .
stDeviceData.stData.stCommands.nCmdDeviceReset	UINT	[WRITE_ONLY] Device Reset
stDeviceData.stData.stCommands.nCmdApplicationReset	UINT	[WRITE_ONLY] Application Reset
stDeviceData.stData.stCommands.nCmdRestoreFactorySettings	UINT	[WRITE_ONLY] Restore Factory Settings
stDeviceData.stData.stCommands.nCmdBackToBox	UINT	[WRITE_ONLY] Back-to-box
stDeviceData.stData.stCommands.nCmdTeachSp1	UINT	[WRITE_ONLY] Teach SP1
stDeviceData.stData.stCommands.nCmdTeachSp2	UINT	[WRITE_ONLY] Teach SP2
stDeviceData.stData.stCommands.nCmdActivationTakesPriorityOverPdout	UINT	[WRITE_ONLY] Activation (Takes Priority over PDout)
stDeviceData.stData.stCommands.nCmdDeactivationTakesPriorityOverPdout	UINT	[WRITE_ONLY] Deactivation (Takes Priority over PDout)
stDeviceData.stData.stCommands.nCmdResetPriorityPdoutWorking	UINT	[WRITE_ONLY] Reset Priority (PDout working)
stDeviceData.stData.stCommands.nCmdStartStopObjecttest	UINT	[WRITE_ONLY] Start/Stop Objecttest
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.



Parameter name	Data type	Description
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).
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.

Parameter name	Data type	Description
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.
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.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.
stDeviceData.stData.stDeviceAccessLocks.bLocalParameterization	BOOL	[READ_WRITE] This lock prevents the device settings from being changed via local operating elements on the device.

Parameter name	Data type	Description
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] Possibility to mark a device with function-specific information.
stDeviceData.stData.sLocationTag	STRING	[READ_WRITE] Possibility to mark a device with location-specific information.
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.stDetailedDeviceStatus.sltem_2	STRING	[READ_ONLY] List of all currently pending events in the device.
stDeviceData.stData.nTeachSelect	UINT	[READ_WRITE] Selects the switching signal channel for which a teach procedure will be applied.
stDeviceData.stData.stTeachResult.nState	UINT	[READ_ONLY] Indicates the current state of the teach procedure.

Parameter name	Data type	Description
stDeviceData.stData.stTeachResult.bFlagSp1Tp1	BOOL	[READ_ONLY] Indicates the current teach result for the teach point.
stDeviceData.stData.stTeachResult.bFlagSp1Tp2	BOOL	[READ_ONLY] Indicates the current teach result for the teach point.
stDeviceData.stData.stTeachResult.bFlagSp2Tp1	BOOL	[READ_ONLY] Indicates the current teach result for the teach point.
stDeviceData.stData.stTeachResult.bFlagSp2Tp2	BOOL	[READ_ONLY] Indicates the current teach result for the teach point.
stDeviceData.stData.stSsc1Param.nSp1	INT	[READ_WRITE] Defines the setpoint 1 value for the switching signal channel.
stDeviceData.stData.stSsc1Param.nSp2	INT	[READ_WRITE] Defines the setpoint 2 value for the switching signal channel.
stDeviceData.stData.stSsc1Config.nLogic	UINT	[READ_WRITE] Defines the logical representation of the switching signal SSC in the process data.
stDeviceData.stData.stSsc1Config.nMode	UINT	[READ_WRITE] Defines the evaluation mode for the switching signal SSC.
stDeviceData.stData.stSsc1Config.nHysteresis	INT	[READ_WRITE] Defines the hysteresis at the switchpoint. A higher hysteresis may help to increase stability in critical applications.
stDeviceData.stData.stSsc2Param.nSp1	INT	[READ_WRITE] Defines the setpoint 1 value for the switching signal channel.
stDeviceData.stData.stSsc2Param.nSp2	INT	[READ_WRITE] Defines the setpoint 2 value for the switching signal channel.
stDeviceData.stData.stSsc2Config.nLogic	UINT	[READ_WRITE] Defines the logical representation of the switching signal SSC in the process data.
stDeviceData.stData.stSsc2Config.nMode	UINT	[READ_WRITE] Defines the evaluation mode for the switching signal SSC.
stDeviceData.stData.stSsc2Config.nHysteresis	INT	[READ_WRITE] Defines the hysteresis at the switchpoint. A higher hysteresis may help to increase stability in critical applications.
stDeviceData.stData.nSsc2TeachingOffset	INT	[READ_WRITE] Adds an distinct distance in mm on the TeachPoint to assure an active SSC.2. This only has an Effect for SP1 in Single Point Mode.

Parameter name	Data type	Description
stDeviceData.stData.nSsc1TeachingOffset	INT	[READ_WRITE] Adds an distinct distance in mm on the TeachPoint to assure an active SSC.1. This only has an Effect for SP1 in Single Point Mode.
stDeviceData.stData.nAnalysisDepthSsc2	INT	[READ_WRITE] Number of Scans considered for the Switching Output SSC.2 to toggle.
stDeviceData.stData.nTimerUnitSsc2	UINT	[READ_WRITE] Enable or Disable Timer Unit for SSC.2.
stDeviceData.stData.nFunctionOfTimerUnitSsc2	UINT	[READ_WRITE] Function of Timer Unit SSC.2
stDeviceData.stData.nTimeSsc2	UINT	[READ_WRITE] Timebase of Timer Unit SSC.2.
stDeviceData.stData.nNumberOfObjectsSsc2	UINT	[READ_WRITE] Internal Object Counter SSC.2.
stDeviceData.stData.nAnalysisDepthSsc1	INT	[READ_WRITE] Number of Scans considered for the Switching Output SSC.1 to toggle.
stDeviceData.stData.nTimerUnitSsc1	UINT	[READ_WRITE] Enable or Disable Timer Unit for SSC.1.
stDeviceData.stData.nFunctionOfTimerUnitSsc1	UINT	[READ_WRITE] Function of Timer Unit SSC.1
stDeviceData.stData.nTimeSsc1	UINT	[READ_WRITE] Timebase of Timer Unit SSC.1.
stDeviceData.stData.nNumberOfObjectsSsc1	UINT	[READ_WRITE] Internal Object Counter SSC.1.
stDeviceData.stData.nTemperature	INT	[READ_ONLY] Temperature inside the Device.
stDeviceData.stData.nButtonFunctionLevel1	INT	[READ_WRITE] Selection of function being executed after Button pressed for 2 to 6 seconds.
stDeviceData.stData.nButtonFunctionLevel2	INT	[READ_WRITE] Selection of function being executed after Button pressed for 7 to 11 seconds.
stDeviceData.stData.nButtonFunctionLevel3	INT	[READ_WRITE] Selection of function being executed after Button pressed for 12 to 16 seconds.
stDeviceData.stData.nPin4Function	UINT	[READ_WRITE] Modification of Pin 4 Function.
stDeviceData.stData.nPin2Function	UINT	[READ_WRITE] Modification of Pin 2 Function.
stDeviceData.stData.stMdcDescriptor.nLowerValue	INT	[READ_ONLY] Shows the lower value of measurement range.
stDeviceData.stData.stMdcDescriptor.nUpperValue	INT	[READ_ONLY] Shows the upper value of measurement range.

Parameter name	Data type	Description
stDeviceData.stData.stMdcDescriptor.nUnitCode	UINT	[READ_ONLY] Shows the unique code for the physical unit.
stDeviceData.stData.stMdcDescriptor.nScale	INT	[READ_ONLY] Shows the multiplier for measurement value - $10^{\text{exp}(\text{scale})}$ .

Tab. 7.2: ST\_Leuze\_PD\_ODT3CL\_2220

Parameter name	Data type	Description
ST_Leuze_PD_ODT3CL_2220.nMdcMeasurementValue	INT	
ST_Leuze_PD_ODT3CL_2220.nMdcScale	INT	
ST_Leuze_PD_ODT3CL_2220.bSsc1SwitchingSignal	BOOL	
ST_Leuze_PD_ODT3CL_2220.bSsc2SwitchingSignal	BOOL	
ST_Leuze_PD_ODT3CL_2220.bMeasure	BOOL	
ST_Leuze_PD_ODT3CL_2220.bSignal	BOOL	
ST_Leuze_PD_ODT3CL_2220.bWarning	BOOL	
ST_Leuze_PD_ODT3CL_2220.nQuality	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.
Device Reset			UIntegerT	128	W	Device Reset
Application Reset			UIntegerT	129	W	Application Reset
Restore Factory Settings			UIntegerT	130	W	Restore Factory Settings
Back-to-box			UIntegerT	131	W	Back-to-box
Teach SP1			UIntegerT	65	W	Teach SP1
Teach SP2			UIntegerT	66	W	Teach SP2
Activation (Takes Priority over PDout)			UIntegerT	176	W	Activation (Takes Priority over PDout)
Deactivation (Takes Priority over PDout)			UIntegerT	177	W	Deactivation (Takes Priority over PDout)
Reset Priority (PDout working)			UIntegerT	178	W	Reset Priority (PDout working)
Start/Stop Objecttest			UIntegerT	180	W	Start/Stop Objecttest
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.
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).

Parameter	Index	Subindex	Data type	Default	AR	Description
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
System Command	2	0	UIntegerT		W	Command interface for applications. A positive acknowledge indicates the complete and correct finalization of the requested function.  128: Device Reset 129: Application Reset 130: Restore Factory Settings 131: Back-to-box (0 ... 63): Reserved (132 ... 159): Reserved 65: Teach SP1 66: Teach SP2 176: Activation (Takes Priority over PDout) 177: Deactivation (Takes Priority over PDout) 178: Reset Priority (PDout working) 180: Start/Stop Objecttest



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	ODT3CL1-2 M.3/L6	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	Scanner with Distance Data	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	Possibility to mark a device with function-specific information.
Location Tag	26	0	StringT	***	RW	Possibility to mark a device with location-specific information.
Device Status	36	0	UIntegerT	0	R	Indicator for the current device condition and diagnosis state.

Parameter	Index	Subindex	Data type	Default	AR	Description
Detailed Device Status	37	0	ArrayT		R	List of all currently pending events in the device.
	37	0	OctetStringT		R	
Teach Select	58	0	UIntegerT	1	RW	Selects the switching signal channel for which a teach procedure will be applied. 0: Default Channel (SSC.1) 1: SSC.1 2: SSC.2 255: All SSC
Teach Result	59	0	RecordT		R	Shows the complete result information of the teach procedure including current state and result flags.
State	59	1	UIntegerT	0	R	Indicates the current state of the teach procedure. 0: Idle 1: Success 4: Wait for command 5: Busy 7: Error
Flag SP1 TP1	59	2	BooleanT	false	R	Indicates the current teach result for the teach point. False: Initial or not ok True: Ok
Flag SP1 TP2	59	3	BooleanT	false	R	Indicates the current teach result for the teach point. False: Initial or not ok True: Ok
Flag SP2 TP1	59	4	BooleanT	false	R	Indicates the current teach result for the teach point. False: Initial or not ok True: Ok
Flag SP2 TP2	59	5	BooleanT	false	R	Indicates the current teach result for the teach point. False: Initial or not ok True: Ok
SSC.1 Param	60	0	RecordT		RW	Defines the setpoint values for switching signal channel 1.
SP1	60	1	IntegerT	1000	RW	Defines the setpoint 1 value for the switching signal channel. (50 ... 2500)
SP2	60	2	IntegerT	500	RW	Defines the setpoint 2 value for the switching signal channel. (50 ... 2500)
SSC.1 Config	61	0	RecordT		RW	Defines the configuration parameter for switching signal channel 1.
Logic	61	1	UIntegerT	0	RW	Defines the logical representation of the switching signal SSC in the process data. 0: High active 1: Low active

Parameter	Index	Subindex	Data type	Default	AR	Description
Mode	61	2	UIntegerT	1	RW	Defines the evaluation mode for the switching signal SSC. 0: Deactivated 1: Single point 2: Window 3: Two point
Hysteresis	61	3	IntegerT	0	RW	Defines the hysteresis at the switchpoint. A higher hysteresis may help to increase stability in critical applications. 0: Auto
SSC.2 Param	62	0	RecordT		RW	Defines the setpoint values for switching signal channel 2.
SP1	62	1	IntegerT	1000	RW	Defines the setpoint 1 value for the switching signal channel. (50 ... 2500)
SP2	62	2	IntegerT	500	RW	Defines the setpoint 2 value for the switching signal channel. (50 ... 2500)
SSC.2 Config	63	0	RecordT		RW	Defines the configuration parameter for switching signal channel 2.
Logic	63	1	UIntegerT	0	RW	Defines the logical representation of the switching signal SSC in the process data. 0: High active 1: Low active
Mode	63	2	UIntegerT	1	RW	Defines the evaluation mode for the switching signal SSC. 0: Deactivated 1: Single point 2: Window 3: Two point
Hysteresis	63	3	IntegerT	0	RW	Defines the hysteresis at the switchpoint. A higher hysteresis may help to increase stability in critical applications. 0: Auto
SSC.2 Teaching Offset	82	0	IntegerT	20	RW	Adds an distinct distance in mm on the TeachPoint to assure an active SSC.2. This only has an Effect for SP1 in Single Point Mode. (-200 ... 200)
SSC.1 Teaching Offset	92	0	IntegerT	20	RW	Adds an distinct distance in mm on the TeachPoint to assure an active SSC.1. This only has an Effect for SP1 in Single Point Mode. (-200 ... 200)
Analysis Depth SSC.2	180	0	IntegerT	2	RW	Number of Scans considered for the Switching Output SSC.2 to toggle. (1 ... 100)

Parameter	Index	Subindex	Data type	Default	AR	Description
Timer Unit SSC.2	182	0	UIntegerT	0	RW	Enable or Disable Timer Unit for SSC.2. 0: Off 255: On
Function of Timer Unit SSC.2	183	0	UIntegerT	0	RW	Function of Timer Unit SSC.2 0: On Delay 1: Off Delay 2: Pulse Stretching 3: Pulse Suppression
Time SSC.2	184	0	UIntegerT	200	RW	Timebase of Timer Unit SSC.2. (1 ... 50000)
Number of Objects SSC.2	185	0	UIntegerT		RW	Internal Object Counter SSC.2.
Analysis Depth SSC.1	190	0	IntegerT	2	RW	Number of Scans considered for the Switching Output SSC.1 to toggle. (1 ... 100)
Timer Unit SSC.1	192	0	UIntegerT	0	RW	Enable or Disable Timer Unit for SSC.1. 0: Off 255: On
Function of Timer Unit SSC.1	193	0	UIntegerT	0	RW	Function of Timer Unit SSC.1 0: On Delay 1: Off Delay 2: Pulse Stretching 3: Pulse Suppression
Time SSC.1	194	0	UIntegerT	200	RW	Timebase of Timer Unit SSC.1. (1 ... 50000)
Number of Objects SSC.1	195	0	UIntegerT		RW	Internal Object Counter SSC.1.
Temperature	220	0	IntegerT		R	Temperature inside the Device.
Button Function Level 1	241	0	IntegerT	2	RW	Selection of function being executed after Button pressed for 2 to 6 seconds.  0: No Button Function 2: Teach SP1 of SSC.1 with defined Offset 3: Teach SP1 of SSC.2 with defined Offset 19: Set SSC.1 Logic to Non-Inverted 20: Set SSC.1 Logic to Inverted 21: Toggle SSC.1 Logic 22: Enable SSC.1 Time Module 23: Disable SSC.1 Time Module 24: On/Off Toggle SSC.1 Time Module 31: Set SSC.2 Logic to Non-Inverted 32: Set SSC.2 Logic to Inverted 33: Toggle SSC.2 Logic 34: Enable SSC.2 Time Module 35: Disable SSC.2 Time Module 36: On/Off Toggle SSC.2 Time Module 43: Set SSC.1 and SSC.2 Logic to Non-Inverted 44: Set SSC.1 and SSC.2 Logic to inverted 45: Toggle SSC.1 and SSC.2 Logic

Parameter	Index	Subindex	Data type	Default	AR	Description
Button Function Level 2	242	0	IntegerT	3	RW	<p>Selection of function being executed after Button pressed for 7 to 11 seconds.</p> <p>0: No Button Function  2: Teach SP1 of SSC.1 with defined Offset  3: Teach SP1 of SSC.2 with defined Offset  19: Set SSC.1 Logic to Non-Inverted  20: Set SSC.1 Logic to Inverted  21: Toggle SSC.1 Logic  22: Enable SSC.1 Time Module  23: Disable SSC.1 Time Module  24: On/Off Toggle SSC.1 Time Module  31: Set SSC.2 Logic to Non-Inverted  32: Set SSC.2 Logic to Inverted  33: Toggle SSC.2 Logic  34: Enable SSC.2 Time Module  35: Disable SSC.2 Time Module  36: On/Off Toggle SSC.2 Time Module  43: Set SSC.1 and SSC.2 Logic to Non-Inverted  44: Set SSC.1 and SSC.2 Logic to inverted  45: Toggle SSC.1 and SSC.2 Logic</p>
Button Function Level 3	243	0	IntegerT	45	RW	<p>Selection of function being executed after Button pressed for 12 to 16 seconds.</p> <p>0: No Button Function  2: Teach SP1 of SSC.1 with defined Offset  3: Teach SP1 of SSC.2 with defined Offset  19: Set SSC.1 Logic to Non-Inverted  20: Set SSC.1 Logic to Inverted  21: Toggle SSC.1 Logic  22: Enable SSC.1 Time Module  23: Disable SSC.1 Time Module  24: On/Off Toggle SSC.1 Time Module  31: Set SSC.2 Logic to Non-Inverted  32: Set SSC.2 Logic to Inverted  33: Toggle SSC.2 Logic  34: Enable SSC.2 Time Module  35: Disable SSC.2 Time Module  36: On/Off Toggle SSC.2 Time Module  43: Set SSC.1 and SSC.2 Logic to Non-Inverted  44: Set SSC.1 and SSC.2 Logic to inverted  45: Toggle SSC.1 and SSC.2 Logic</p>
Pin 4 Function	251	0	UIntegerT	1	RW	<p>Modification of Pin 4 Function.</p> <p>0: No Pin Function  1: Pin is SSC.1  2: Pin is not SSC.1  3: Pin is SSC.2  4: Pin is not SSC.2  7: Pin is Warning  8: Pin is not Warning</p>

Parameter	Index	Subindex	Data type	Default	AR	Description
Pin 2 Function	252	0	UIntegerT	3	RW	Modification of Pin 2 Function.  0: No Pin Function 1: Pin is SSC.1 2: Pin is not SSC.1 3: Pin is SSC.2 4: Pin is not SSC.2 7: Pin is Warning 8: Pin is not Warning
MDC Descriptor	16512	0	RecordT		R	Descriptor for the characteristic of the measurement data channel (process data MV).
Lower Value	16512	1	IntegerT	50	R	Shows the lower value of measurement range.
Upper Value	16512	2	IntegerT	2500	R	Shows the upper value of measurement range.
Unit Code	16512	3	UIntegerT	1010	R	Shows the unique code for the physical unit.
Scale	16512	4	IntegerT	-3	R	Shows the multiplier for measurement value - 10exp(scale).

# 9 Technical specifications

## 9.1 General data

Tab. 9.1: Sensor and IODD version

IODD version	V1.0
IODD release date	2024-01-31
Device family	Scanner with Distance Data
Device ID	2220
Device name	ODT3CL1-2M.3/L6
Device variants	ODT3CL1-2M.3/L6-M8 (50150018), ODT3CL1-2M.3/L6-200-M8 (50150019), ODT3CL1-2M.3/L6-200-M12 (50150020), ODT3CL1-2M.3/L6 (50150021)