



## PLC Integration of ODS9\_2164

**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\_ ODS9\_2164" 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_ ODS9_2164	Sensor data

See structure description of ST\_Leuze\_IOL\_ ODS9\_2164 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\_ODS9\_2164". 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\_ODS9\_2164" 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\_ ODS9\_2164" 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\_ODS9\_2164 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.
nPDMODE	INPUT	INT	Mode of the PD. User must select mode of PD according to the sensors settings.
bError	OUTPUT	BOOL	Error flag FALSE: No error TRUE: Error detected
F_Leuze_PD_ODS9_2164	OUTPUT	ST_Leuze_PD_ ODS9_2164	Reference to the instance of the data structure ST_Leuze_PD_ ODS9_2164. The structure includes the disaggregated values of the process data.

See structure description of ST\_Leuze\_PD\_ ODS9\_2164 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\_ODS9\_2164

Parameter name	Data type	Description
stDeviceData.stSelection.stCommands.bDeviceReset	BOOL	[WRITE_ONLY] Device Reset
stDeviceData.stSelection.stCommands.bApplicationReset	BOOL	[WRITE_ONLY] Application Reset
stDeviceData.stSelection.stCommands.bRestoreFactorySettings	BOOL	[WRITE_ONLY] Restore Factory Settings
stDeviceData.stSelection.stCommands.bTeachSp1TeachOfDistantSetpoint	BOOL	[WRITE_ONLY] Teach SP1 (Teach of distant setpoint)
stDeviceData.stSelection.stCommands.bTeachSp2TeachOfNearSetpoint	BOOL	[WRITE_ONLY] Teach SP2 (Teach of near setpoint)
stDeviceData.stSelection.stCommands.bCustomTeachWindowTeachOfBothSetpoints	BOOL	[WRITE_ONLY] Custom Teach: Window (Teach of both setpoints)
stDeviceData.stSelection.stCommands.bCustomTeachSp1aTeachOfAlternativeDistantSetpoint	BOOL	[WRITE_ONLY] Custom Teach SP1a (Teach of alternative distant setpoint)
stDeviceData.stSelection.stCommands.bClearDsUploadFlag	BOOL	[WRITE_ONLY] Clear DS Upload Flag
stDeviceData.stSelection.stCommands.bSetDsUploadFlag	BOOL	[WRITE_ONLY] Set DS Upload Flag
stDeviceData.stSelection.stCommands.bActivationWithPriorityOverridingPdoutsTransducerDisableSignalOnlyInputFunctionsHaveAHigherPriority	BOOL	[WRITE_ONLY] Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
stDeviceData.stSelection.stCommands.bDeactivationWithPriorityOverridingPdoutsTransducerDisableSignalOnlyInputFunctionsHaveAHigherPriority	BOOL	[WRITE_ONLY] Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
stDeviceData.stSelection.stCommands.bResetPriorityToUsePdoutsTransducerDisableSignalAgainOnlyInputFunctionsHaveAHigherPriority	BOOL	[WRITE_ONLY] Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority
stDeviceData.stSelection.stCommands.bTeachDistanceOfMinimumAnalogOutput	BOOL	[WRITE_ONLY] Teach distance of minimum analog output
stDeviceData.stSelection.stCommands.bTeachDistanceOfMaximumAnalogOutput	BOOL	[WRITE_ONLY] Teach distance of maximum analog output
stDeviceData.stSelection.stCommands.bTeachOffsetInOrderToAchieveThePresetValue	BOOL	[WRITE_ONLY] Teach offset in order to achieve the preset value
stDeviceData.stSelection.stDirectParameters1.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stDirectParameters1.bAll	BOOL	[READ_WRITE] all parameters of complex data type

Parameter name	Data type	Description
stDeviceData.stSelection.stDirectParameters1.bReserved_1	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bMasterCycleTime	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bMinCycleTime	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bMSequenceCapability	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bIoLinkVersionId	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bProcessDataInputLength	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bProcessDataOutputLength	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bVendorId1	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bVendorId2	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bDeviceId1	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bDeviceId2	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bDeviceId3	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bReserved_13	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bReserved_14	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters1.bReserved_15	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDirectParameters2.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter1	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter2	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter3	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter4	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter5	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter6	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter7	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter8	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter9	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter10	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter11	BOOL	[READ_WRITE]

Parameter name	Data type	Description
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter12	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter13	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter14	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter15	BOOL	[READ_WRITE]
stDeviceData.stSelection.stDirectParameters2.bDeviceSpecificParameter16	BOOL	[READ_WRITE]
stDeviceData.stSelection.bStandardCommand	BOOL	[WRITE_ONLY]
stDeviceData.stSelection.stDeviceAccessLocks.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stProfileCharacteristic.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stSelection.bVendorName	BOOL	[READ_ONLY]
stDeviceData.stSelection.bVendorText	BOOL	[READ_ONLY]
stDeviceData.stSelection.bProductName	BOOL	[READ_ONLY]
stDeviceData.stSelection.bProductId	BOOL	[READ_ONLY]
stDeviceData.stSelection.bProductText	BOOL	[READ_ONLY]
stDeviceData.stSelection.bSerialNumber	BOOL	[READ_ONLY]
stDeviceData.stSelection.bHardwareVersion	BOOL	[READ_ONLY]
stDeviceData.stSelection.bFirmwareVersion	BOOL	[READ_ONLY]
stDeviceData.stSelection.bApplicationSpecificTag	BOOL	[READ_WRITE]
stDeviceData.stSelection.bFunctionTag	BOOL	[READ_WRITE]
stDeviceData.stSelection.bLocationTag	BOOL	[READ_WRITE]
stDeviceData.stSelection.bDeviceStatus	BOOL	[READ_ONLY]
stDeviceData.stSelection.stDetailedDeviceStatus.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stSelection.bTiSelect	BOOL	[READ_WRITE] select teach channel, 0=SSC1, 1=SSC1, 2=SSC2, 255=all SSCs
stDeviceData.stSelection.stTiResult.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.stSsc1Config.bAll	BOOL	[READ_WRITE] all parameters of complex data type

Parameter name	Data type	Description
stDeviceData.stSelection.stSsc2Param.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.stSsc2Config.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.bSsc1_Sp1a	BOOL	[READ_WRITE] SSC1_SP1a
stDeviceData.stSelection.bSsc2_Sp1a	BOOL	[READ_WRITE] SSC2_SP1a
stDeviceData.stSelection.bSsc1_Reserve	BOOL	[READ_WRITE] SSC1_Reserve
stDeviceData.stSelection.bSsc2_Reserve	BOOL	[READ_WRITE] SSC2_Reserve
stDeviceData.stSelection.stSystemStateInformationBits.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stSelection.bDataStorageUploadFlag	BOOL	[READ_ONLY] Shows the preference of local changes as opposed to the configuration data, stored in master DS
stDeviceData.stSelection.bIntegrationTimeLevel	BOOL	[READ_ONLY] Readout of the adjusted integration time level, depending on the target's diffuse reflectance. Small value = short integration time.
stDeviceData.stSelection.stSysstateToStatusBitsAssignment.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.bInputMode	BOOL	[READ_WRITE] Input Handling functionality
stDeviceData.stSelection.bTeachCount	BOOL	[READ_WRITE] Number of measurement values, used for Teach averaging
stDeviceData.stSelection.bSwitchingOutputProperty	BOOL	[READ_WRITE] General behaviour of all the Switching Outputs in case of no measurement value is available
stDeviceData.stSelection.bSsc1_WindowWidth	BOOL	[READ_WRITE] SSC1_WindowWidth
stDeviceData.stSelection.bSsc1_EvalDepth	BOOL	[READ_WRITE] SSC1_EvalDepth
stDeviceData.stSelection.bSsc2_WindowWidth	BOOL	[READ_WRITE] SSC2_WindowWidth
stDeviceData.stSelection.bSsc2_EvalDepth	BOOL	[READ_WRITE] SSC2_EvalDepth
stDeviceData.stSelection.bAnalogOutputProperty	BOOL	[READ_WRITE] Output behaviour in case of missing measurement value
stDeviceData.stSelection.bPositionOfMaximumAnalogOutput	BOOL	[READ_WRITE] Distance giving maximum Analog Output
stDeviceData.stSelection.bPositionOfMinimumAnalogOutput	BOOL	[READ_WRITE] Distance giving minimum Analog Output

Parameter name	Data type	Description
stDeviceData.stSelection.bAnalogOutputRangeSettings	BOOL	[READ_WRITE] Selection of Analog Output current or voltage Range
stDeviceData.stSelection.bMeasurementMode	BOOL	[READ_WRITE] Application specific processing of raw measurement data
stDeviceData.stSelection.bMenuLanguage	BOOL	[READ_WRITE] Local device Menu Language settings
stDeviceData.stSelection.bDisplayMode	BOOL	[READ_WRITE] Display behaviour. Auto: Maximum intensity when pushing a button; dimmed to lower intensity during stand-By.
stDeviceData.stSelection.bMenuPasswordLock	BOOL	[READ_WRITE] password-lock of the local device menu
stDeviceData.stSelection.bDistanceOffset	BOOL	[READ_WRITE] Signed distance Offset Value. May be internally modified by preset calculation.
stDeviceData.stSelection.bGradient	BOOL	[READ_WRITE] Simple gradient with values 'rising' (+1) or 'falling' (-1). Can be used for fill level detection
stDeviceData.stSelection.bRamTeachOption	BOOL	[READ_WRITE] If option is set to 'on', the teach results are only stored into the volatile RAM storage. Used for continually re-teaching applications.
stDeviceData.stSelection.bMenuExitBehaviour	BOOL	[READ_WRITE] Handling of local changed parameters relating to the IO-Link Master's Data Storage.
stDeviceData.stSelection.bDeactivationProperty	BOOL	[READ_WRITE] Behaviour of measurement output in deactivation state
stDeviceData.stSelection.bIntegrationTimeLevelLowerLimit	BOOL	[READ_WRITE] set a lower limit to prevent a value that is too high.
stDeviceData.stSelection.bIntegrationTimeLevelUpperLimit	BOOL	[READ_WRITE] set an upper limit to prevent long measurement loops. For faster detection of an appearing bright target in front of a dark distant background.
stDeviceData.stSelection.bPresetValue	BOOL	[READ_WRITE] This requested measurement value will be displayed after a Preset-to-Offset calculation
stDeviceData.stSelection.bFilterSelection	BOOL	[READ_WRITE] Application specific selection of different filtering methods

Parameter name	Data type	Description
stDeviceData.stSelection.bAverageCount	BOOL	[READ_WRITE] Buffer size of 'Averaging' measurement filter
stDeviceData.stSelection.bSpikeSuppressionCount	BOOL	[READ_WRITE] Buffer size of 'Spike Suppression' measurement mode
stDeviceData.stSelection.bSpikeSuppressionDepth	BOOL	[READ_WRITE] Filter depth of 'Spike Suppression' measurement mode
stDeviceData.stSelection.bLightSuppressionRepetitionLimit	BOOL	[READ_WRITE] Reduction of repetition cycles in 'Light Suppression' measurement mode in order to limit the measurement duration.
stDeviceData.stSelection.stWireFunctionArray.bAll	BOOL	[READ_WRITE] all parameters of complex data type
stDeviceData.stSelection.bResolution	BOOL	[READ_ONLY] Distance = Measured Value * Resolution
stDeviceData.stSelection.bMinimumOfOperatingRangeSspDetectionRange	BOOL	[READ_ONLY] Minimum of the allowed output range, with Offset=0 and Gradient=rising.
stDeviceData.stSelection.bMaximumOfOperatingRangeSspDetectionRange	BOOL	[READ_ONLY] Maximum of the allowed output range, with Offset=0 and Gradient=rising.
stDeviceData.stSelection.bMinimumOfMeasuringRangeSspMeasurementRange	BOOL	[READ_ONLY] Minimum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Lower Limit.
stDeviceData.stSelection.bMaximumOfMeasuringRangeSspMeasurementRange	BOOL	[READ_ONLY] Maximum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Upper Limit.
stDeviceData.stSelection.bTemperature	BOOL	[READ_ONLY] Device temperature in 1/10 °C steps, accuracy: +/-5 °C
stDeviceData.stSelection.stMdcDescr.bAll	BOOL	[READ_ONLY] all parameters of complex data type
stDeviceData.stData.stCommands.nDeviceReset	UINT	[WRITE_ONLY] Device Reset
stDeviceData.stData.stCommands.nApplicationReset	UINT	[WRITE_ONLY] Application Reset
stDeviceData.stData.stCommands.nRestoreFactorySettings	UINT	[WRITE_ONLY] Restore Factory Settings
stDeviceData.stData.stCommands.nTeachSp1TeachOfDistantSetpoint	UINT	[WRITE_ONLY] Teach SP1 (Teach of distant setpoint)
stDeviceData.stData.stCommands.nTeachSp2TeachOfNearSetpoint	UINT	[WRITE_ONLY] Teach SP2 (Teach of near setpoint)



Parameter name	Data type	Description
stDeviceData.stData.stCommands. nCustomTeachWindowTeachOfBothSetpoints	UINT	[WRITE_ONLY] Custom Teach: Window (Teach of both setpoints)
stDeviceData.stData.stCommands. nCustomTeachSp1aTeachOfAlternativeDistantSetpoint	UINT	[WRITE_ONLY] Custom Teach SP1a (Teach of alternative distant setpoint)
stDeviceData.stData.stCommands.nClearDsUploadFlag	UINT	[WRITE_ONLY] Clear DS Upload Flag
stDeviceData.stData.stCommands.nSetDsUploadFlag	UINT	[WRITE_ONLY] Set DS Upload Flag
stDeviceData.stData.stCommands. nActivationWithPriorityOverridingPdoutsTransducerDisableSignal OnlyInputFunctionsHaveAHigherPriority	UINT	[WRITE_ONLY] Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
stDeviceData.stData.stCommands. nDeactivationWithPriorityOverridingPdoutsTransducerDisableSig nalOnlyInputFunctionsHaveAHigherPriority	UINT	[WRITE_ONLY] Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
stDeviceData.stData.stCommands. nResetPriorityToUsePdoutsTransducerDisableSignalAgainOnlyIn putFunctionsHaveAHigherPriority	UINT	[WRITE_ONLY] Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority
stDeviceData.stData.stCommands. nTeachDistanceOfMinimumAnalogOutput	UINT	[WRITE_ONLY] Teach distance of minimum analog output
stDeviceData.stData.stCommands. nTeachDistanceOfMaximumAnalogOutput	UINT	[WRITE_ONLY] Teach distance of maximum analog output
stDeviceData.stData.stCommands. nTeachOffsetInOrderToAchieveThePresetValue	UINT	[WRITE_ONLY] Teach offset in order to achieve the preset value
stDeviceData.stData.stDirectParameters1.nReserved_1	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nMasterCycleTime	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nMinCycleTime	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nMSequenceCapability	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nIoLinkVersionId	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1. nProcessDataInputLength	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1. nProcessDataOutputLength	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nVendorId1	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nVendorId2	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nDeviceId1	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nDeviceId2	UINT	[READ_ONLY]

Parameter name	Data type	Description
stDeviceData.stData.stDirectParameters1.nDeviceId3	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nReserved_13	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nReserved_14	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters1.nReserved_15	UINT	[READ_ONLY]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter1	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter2	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter3	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter4	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter5	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter6	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter7	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter8	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter9	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter10	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter11	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter12	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter13	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter14	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter15	UINT	[READ_WRITE]
stDeviceData.stData.stDirectParameters2.nDeviceSpecificParameter16	UINT	[READ_WRITE]
stDeviceData.stData.nStandardCommand	UINT	[WRITE_ONLY]
stDeviceData.stData.stDeviceAccessLocks.bParameterWriteAccessLock	BOOL	[READ_WRITE]
stDeviceData.stData.stDeviceAccessLocks.bDataStorageLock	BOOL	[READ_WRITE]
stDeviceData.stData.stDeviceAccessLocks.bLocalParameterizationLock	BOOL	[READ_WRITE]
stDeviceData.stData.stDeviceAccessLocks.bLocalUserInterfaceLock	BOOL	[READ_WRITE]
stDeviceData.stData.stProfileCharacteristic.nDeviceProfile1	UINT	[READ_ONLY] 0x0001: Generic Profiled Sensor

Parameter name	Data type	Description
stDeviceData.stData.stProfileCharacteristic.nDeviceProfile2	UINT	[READ_ONLY] 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable
stDeviceData.stData.stProfileCharacteristic.nApplicationProfile	UINT	[READ_ONLY] 0x4000: Identification and Diagnosis
stDeviceData.stData.stProfileCharacteristic.nFunctionClass1	UINT	[READ_ONLY] 0x8001: Switching Signal Channel
stDeviceData.stData.stProfileCharacteristic.nFunctionClass2	UINT	[READ_ONLY] 0x8004: Teach-in
stDeviceData.stData.sVendorName	STRING	[READ_ONLY]
stDeviceData.stData.sVendorText	STRING	[READ_ONLY]
stDeviceData.stData.sProductName	STRING	[READ_ONLY]
stDeviceData.stData.sProductId	STRING	[READ_ONLY]
stDeviceData.stData.sProductText	STRING	[READ_ONLY]
stDeviceData.stData.sSerialNumber	STRING	[READ_ONLY]
stDeviceData.stData.sHardwareVersion	STRING	[READ_ONLY]
stDeviceData.stData.sFirmwareVersion	STRING	[READ_ONLY]
stDeviceData.stData.sApplicationSpecificTag	STRING	[READ_WRITE]
stDeviceData.stData.sFunctionTag	STRING	[READ_WRITE]
stDeviceData.stData.sLocationTag	STRING	[READ_WRITE]
stDeviceData.stData.nDeviceStatus	UINT	[READ_ONLY]
stDeviceData.stData.stDetailedDeviceStatus.sltem_1	STRING	[READ_ONLY]
stDeviceData.stData.stDetailedDeviceStatus.sltem_2	STRING	[READ_ONLY]
stDeviceData.stData.nTiSelect	UINT	[READ_WRITE] select teach channel, 0=SSC1, 1=SSC1, 2=SSC2, 255=all SSCs
stDeviceData.stData.stTiResult.nTiResultState	UINT	[READ_ONLY]
stDeviceData.stData.stTiResult.bTiResultFlagSp1Tp1	BOOL	[READ_ONLY]
stDeviceData.stData.stTiResult.bTiResultFlagSp1Tp2	BOOL	[READ_ONLY]
stDeviceData.stData.stTiResult.bTiResultFlagSp2Tp1	BOOL	[READ_ONLY]
stDeviceData.stData.stTiResult.bTiResultFlagSp2Tp2	BOOL	[READ_ONLY]
stDeviceData.stData.stSsc1Param.nSp1	INT	[READ_WRITE] Value of distant setpoint

Parameter name	Data type	Description
stDeviceData.stData.stSsc1Param.nSp2	INT	[READ_WRITE] Value of near setpoint
stDeviceData.stData.stSsc1Config.nLogic	UINT	[READ_WRITE] Output level of switching output when object is detected
stDeviceData.stData.stSsc1Config.nMode	UINT	[READ_WRITE] Configuration of the switching edge positions from one or both setpoints, using hysteresis and others.
stDeviceData.stData.stSsc1Config.nHyst	UINT	[READ_WRITE] distance range between the two opposite switching edges related to the same setpoint
stDeviceData.stData.stSsc2Param.nSp1	INT	[READ_WRITE] Value of distant setpoint
stDeviceData.stData.stSsc2Param.nSp2	INT	[READ_WRITE] Value of near setpoint
stDeviceData.stData.stSsc2Config.nLogic	UINT	[READ_WRITE] Output level of switching output when object is detected
stDeviceData.stData.stSsc2Config.nMode	UINT	[READ_WRITE] Configuration of the switching edge positions from one or both setpoints, using hysteresis and others.
stDeviceData.stData.stSsc2Config.nHyst	UINT	[READ_WRITE] distance range between the two opposite switching edges related to the same setpoint
stDeviceData.stData.nSsc1_Sp1a	INT	[READ_WRITE] SSC1_SP1a
stDeviceData.stData.nSsc2_Sp1a	INT	[READ_WRITE] SSC2_SP1a
stDeviceData.stData.nSsc1_Reserve	UINT	[READ_WRITE] SSC1_Reserve
stDeviceData.stData.nSsc2_Reserve	UINT	[READ_WRITE] SSC2_Reserve
stDeviceData.stData.stSystemStateInformationBits.bZero	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bMeasure	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bSignal	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bWarning	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bValue	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bCalibratedRange	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bLimitedAccuracy	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bDeactivated	BOOL	[READ_ONLY]

Parameter name	Data type	Description
stDeviceData.stData.stSystemStateInformationBits. bTriggerToggle	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bSsc1State	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bSsc2State	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bSsc3State	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits. bAnalogInRange	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits. bAnalogOutMin	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits. bAnalogOutMax	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bLaserError	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bOption1	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bOption2	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_19	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_20	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_21	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_22	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_23	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_24	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_25	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_26	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_27	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bReserved_28	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bTeachBusy	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits. bTeachSuccess	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits.bTeachError	BOOL	[READ_ONLY]
stDeviceData.stData.stSystemStateInformationBits. bTeachReserved	BOOL	[READ_ONLY]
stDeviceData.stData.nDataStorageUploadFlag	UINT	[READ_ONLY] Shows the preference of local changes as opposed to the configuration data, stored in master DS

Parameter name	Data type	Description
stDeviceData.stData.nIntegrationTimeLevel	UINT	[READ_ONLY] Readout of the adjusted integration time level, depending on the target's diffuse reflectance. Small value = short integration time.
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_1	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_2	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_3	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_4	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_5	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_6	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_7	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.stSysstateToStatusBitsAssignment.nItem_8	UINT	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
stDeviceData.stData.nInputMode	UINT	[READ_WRITE] Input Handling functionality
stDeviceData.stData.nTeachCount	UINT	[READ_WRITE] Number of measurement values, used for Teach averaging
stDeviceData.stData.nSwitchingOutputProperty	UINT	[READ_WRITE] General behaviour of all the Switching Outputs in case of no measurement value is available
stDeviceData.stData.nSsc1_WindowWidth	UINT	[READ_WRITE] SSC1_WindowWidth
stDeviceData.stData.nSsc1_EvalDepth	UINT	[READ_WRITE] SSC1_EvalDepth
stDeviceData.stData.nSsc2_WindowWidth	UINT	[READ_WRITE] SSC2_WindowWidth
stDeviceData.stData.nSsc2_EvalDepth	UINT	[READ_WRITE] SSC2_EvalDepth
stDeviceData.stData.nAnalogOutputProperty	UINT	[READ_WRITE] Output behaviour in case of missing measurement value

Parameter name	Data type	Description
stDeviceData.stData.nPositionOfMaximumAnalogOutput	INT	[READ_WRITE] Distance giving maximum Analog Output
stDeviceData.stData.nPositionOfMinimumAnalogOutput	INT	[READ_WRITE] Distance giving minimum Analog Output
stDeviceData.stData.nAnalogOutputRangeSettings	UINT	[READ_WRITE] Selection of Analog Output current or voltage Range
stDeviceData.stData.nMeasurementMode	UINT	[READ_WRITE] Application specific processing of raw measurement data
stDeviceData.stData.nMenuLanguage	UINT	[READ_WRITE] Local device Menu Language settings
stDeviceData.stData.nDisplayMode	UINT	[READ_WRITE] Display behaviour. Auto: Maximum intensity when pushing a button; dimmed to lower intensity during stand-By.
stDeviceData.stData.nMenuPasswordLock	UINT	[READ_WRITE] password-lock of the local device menu
stDeviceData.stData.nDistanceOffset	INT	[READ_WRITE] Signed distance Offset Value. May be internally modified by preset calculation.
stDeviceData.stData.nGradient	INT	[READ_WRITE] Simple gradient with values 'rising' (+1) or 'falling' (-1). Can be used for fill level detection
stDeviceData.stData.nRamTeachOption	UINT	[READ_WRITE] If option is set to 'on', the teach results are only stored into the volatile RAM storage. Used for continually re-teaching applications.
stDeviceData.stData.nMenuExitBehaviour	UINT	[READ_WRITE] Handling of local changed parameters relating to the IO-Link Master's Data Storage.
stDeviceData.stData.nDeactivationProperty	UINT	[READ_WRITE] Behaviour of measurement output in deactivation state
stDeviceData.stData.nIntegrationTimeLevelLowerLimit	UINT	[READ_WRITE] set a lower limit to prevent a value that is too high.
stDeviceData.stData.nIntegrationTimeLevelUpperLimit	UINT	[READ_WRITE] set an upper limit to prevent long measurement loops. For faster detection of an appearing bright target in front of a dark distant background.
stDeviceData.stData.nPresetValue	INT	[READ_WRITE] This requested measurement value will be displayed after a Preset-to-Offset calculation

Parameter name	Data type	Description
stDeviceData.stData.nFilterSelection	UINT	[READ_WRITE] Application specific selection of different filtering methods
stDeviceData.stData.nAverageCount	UINT	[READ_WRITE] Buffer size of 'Averaging' measurement filter
stDeviceData.stData.nSpikeSuppressionCount	UINT	[READ_WRITE] Buffer size of 'Spike Suppression' measurement mode
stDeviceData.stData.nSpikeSuppressionDepth	UINT	[READ_WRITE] Filter depth of 'Spike Suppression' measurement mode
stDeviceData.stData.nLightSuppressionRepetitionLimit	UINT	[READ_WRITE] Reduction of repetition cycles in 'Light Suppression' measurement mode in order to limit the measurement duration.
stDeviceData.stData.stWireFunctionArray.nItem_1	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_2	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_3	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_4	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_5	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_6	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)



Parameter name	Data type	Description
stDeviceData.stData.stWireFunctionArray.nItem_7	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widthes of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_8	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widthes of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_9	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widthes of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_10	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widthes of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_11	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widthes of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.stWireFunctionArray.nItem_12	UINT	[READ_WRITE] Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widthes of 20-80 ms, 120-180ms, ..., 1120-1180ms)
stDeviceData.stData.nResolution	UINT	[READ_ONLY] Distance = Measured Value * Resolution
stDeviceData.stData. nMinimumOfOperatingRangeSspDetectionRange	INT	[READ_ONLY] Minimum of the allowed output range, with Offset=0 and Gradient=rising.
stDeviceData.stData. nMaximumOfOperatingRangeSspDetectionRange	INT	[READ_ONLY] Maximum of the allowed output range, with Offset=0 and Gradient=rising.
stDeviceData.stData. nMinimumOfMeasuringRangeSspMeasurementRange	INT	[READ_ONLY] Minumum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Lower Limit.

Parameter name	Data type	Description
stDeviceData.stData. nMaximumOfMeasuringRangeSspMeasurementRange	INT	[READ_ONLY] Maximum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Upper Limit.
stDeviceData.stData.nTemperature	UINT	[READ_ONLY] Device temperature in 1/10 °C steps, accuracy: +/-5 °C
stDeviceData.stData.stMdcDescr.nMdcDescrLowerLimit	INT	[READ_ONLY]
stDeviceData.stData.stMdcDescr.nMdcDescrUpperLimit	INT	[READ_ONLY]
stDeviceData.stData.stMdcDescr.nMdcDescrUnit	INT	[READ_ONLY]
stDeviceData.stData.stMdcDescr.nMdcDescrScale	INT	[READ_ONLY]

Tab. 7.2: ST\_Leuze\_PD\_ODS9\_2164

Parameter name	Data type	Description
ST_Leuze_PD_ODS9_2164.nDistanceValue	INT	
ST_Leuze_PD_ODS9_2164.nDistanceScale	INT	
ST_Leuze_PD_ODS9_2164.bStatusBit0Ssc1OutputState	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit1Ssc2OutputState	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit2Reserved	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit3MeasureState	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit4SignalAvailable	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit5WarningLowSignal	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit6Reserved	BOOL	
ST_Leuze_PD_ODS9_2164.bStatusBit7ToggleBit	BOOL	

## 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	
Device Reset			UIntegerT	128	W	Device Reset
Application Reset			UIntegerT	129	W	Application Reset
Restore Factory Settings			UIntegerT	130	W	Restore Factory Settings
Teach SP1 (Teach of distant setpoint)			UIntegerT	65	W	Teach SP1 (Teach of distant setpoint)
Teach SP2 (Teach of near setpoint)			UIntegerT	66	W	Teach SP2 (Teach of near setpoint)
Custom Teach: Window (Teach of both setpoints)			UIntegerT	75	W	Custom Teach: Window (Teach of both setpoints)
Custom Teach SP1a (Teach of alternative distant setpoint)			UIntegerT	76	W	Custom Teach SP1a (Teach of alternative distant setpoint)
Clear DS Upload Flag			UIntegerT	160	W	Clear DS Upload Flag
Set DS Upload Flag			UIntegerT	161	W	Set DS Upload Flag
Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority			UIntegerT	176	W	Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority			UIntegerT	177	W	Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority			UIntegerT	178	W	Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority
Teach distance of minimum analog output			UIntegerT	195	W	Teach distance of minimum analog output
Teach distance of maximum analog output			UIntegerT	196	W	Teach distance of maximum analog output
Teach offset in order to achieve the preset value			UIntegerT	212	W	Teach offset in order to achieve the preset value
Direct Parameters 1	0	0	RecordT		RW	
Reserved	0	1	UIntegerT		R	
Master Cycle Time	0	2	UIntegerT		R	
Min Cycle Time	0	3	UIntegerT		R	

Parameter	Index	Subindex	Data type	Default	AR	Description
M-Sequence Capability	0	4	UIntegerT		R	
IO-Link Version ID	0	5	UIntegerT	17	R	
Process Data Input Length	0	6	UIntegerT		R	
Process Data Output Length	0	7	UIntegerT		R	
Vendor ID 1	0	8	UIntegerT		R	
Vendor ID 2	0	9	UIntegerT		R	
Device ID 1	0	10	UIntegerT		R	
Device ID 2	0	11	UIntegerT		R	
Device ID 3	0	12	UIntegerT		R	
Reserved	0	13	UIntegerT		R	
Reserved	0	14	UIntegerT		R	
Reserved	0	15	UIntegerT		R	
Standard Command	0	16	UIntegerT		W	(0 ... 63): Reserved 128: Device Reset 129: Application Reset 130: Restore Factory Settings (131 ... 159): Reserved
Direct Parameters 2	1	0	RecordT		RW	
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	

Parameter	Index	Subindex	Data type	Default	AR	Description
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	
Standard Command	2	0	UIntegerT		W	(0 ... 63): Reserved 128: Device Reset 129: Application Reset 130: Restore Factory Settings (131 ... 159): Reserved 65: Teach SP1 (Teach of distant setpoint) 66: Teach SP2 (Teach of near setpoint) 75: Custom Teach: Window (Teach of both setpoints) 76: Custom Teach SP1a (Teach of alternative distant setpoint) 160: Clear DS Upload Flag 161: Set DS Upload Flag 176: Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority 177: Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority 178: Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority 195: Teach distance of minimum analog output 196: Teach distance of maximum analog output 212: Teach offset in order to achieve the preset value
Device Access Locks	12	0	RecordT		RW	
Parameter (write) Access Lock	12	1	BooleanT		RW	
Data Storage Lock	12	2	BooleanT		RW	
Local Parameterization Lock	12	3	BooleanT		RW	
Local User Interface Lock	12	4	BooleanT		RW	
Profile Characteristic	13	0	RecordT		R	Collection of Profile Identifiers
Device Profile 1	13	1	UIntegerT	1	R	0x0001: Generic Profiled Sensor  1: 0x0001: Generic Profiled Sensor 12: 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable 16384: 0x4000: Identification and Diagnosis 32769: 0x8001: Switching Signal Channel 32772: 0x8004: Teach-in

Parameter	Index	Subindex	Data type	Default	AR	Description
Device Profile 2	13	2	UIntegerT	12	R	0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable  1: 0x0001: Generic Profiled Sensor 12: 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable 16384: 0x4000: Identification and Diagnosis 32769: 0x8001: Switching Signal Channel 32772: 0x8004: Teach-in
Application Profile	13	3	UIntegerT	16384	R	0x4000: Identification and Diagnosis  1: 0x0001: Generic Profiled Sensor 12: 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable 16384: 0x4000: Identification and Diagnosis 32769: 0x8001: Switching Signal Channel 32772: 0x8004: Teach-in
Function Class 1	13	4	UIntegerT	32769	R	0x8001: Switching Signal Channel  1: 0x0001: Generic Profiled Sensor 12: 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable 16384: 0x4000: Identification and Diagnosis 32769: 0x8001: Switching Signal Channel 32772: 0x8004: Teach-in
Function Class 2	13	5	UIntegerT	32772	R	0x8004: Teach-in  1: 0x0001: Generic Profiled Sensor 12: 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable 16384: 0x4000: Identification and Diagnosis 32769: 0x8001: Switching Signal Channel 32772: 0x8004: Teach-in
Vendor Name	16	0	StringT	Leuze electronic GmbH + Co. KG	R	
Vendor Text	17	0	StringT	Leuze electronic - the sensor people	R	
Product Name	18	0	StringT		R	
Product ID	19	0	StringT		R	
Product Text	20	0	StringT	Optical distance sensor	R	
Serial Number	21	0	StringT		R	
Hardware Version	22	0	StringT		R	
Firmware Version	23	0	StringT		R	

Parameter	Index	Subindex	Data type	Default	AR	Description
Application Specific Tag	24	0	StringT	***	RW	
Function Tag	25	0	StringT	***	RW	
Location Tag	26	0	StringT	***	RW	
Device Status	36	0	UIntegerT		R	0: Device is OK 1: Maintenance required 2: Out of specification 3: Functional check 4: Failure (5 ... 255): Reserved
Detailed Device Status	37	0	ArrayT		R	
	37	0	OctetStringT		R	
TI - Select	58	0	UIntegerT		RW	select teach channel, 0=SSC1, 1=SSC1, 2=SSC2, 255=all SSCs  0: Select Default SSC (Q1, SSC1) for teach 1: Select Q1 equal SSC1 for teach 2: Select Q2 equal SSC2 for teach 255: Select all SSCs for teach
TI Result	59	0	RecordT		R	Teach-In Result
TI Result - State	59	1	UIntegerT		R	0: Idle. No Teach since power-on 1: Teach of SP1 succeeded 2: Teach of SP2 succeeded 3: Teach of SP1 and SP2 succeeded 5: Busy. Teach is running 7: Teach Error 12: Other Teach succeeded (Analog or Offset)
TI Result - Flag SP1 TP1	59	2	BooleanT		R	False: No teach of SP1 TP1 since power-on or teach error True: Teach of SP1 TP1 was successful
TI Result - Flag SP1 TP2	59	3	BooleanT		R	False: No teach of SP1 TP2 since power-on or teach error True: Teach of SP1 TP2 was successful
TI Result - Flag SP2 TP1	59	4	BooleanT		R	False: No teach of SP2 TP1 since power-on or teach error True: Teach of SP2 TP1 was successful
TI Result - Flag SP2 TP2	59	5	BooleanT		R	False: No teach of SP2 TP2 since power-on or teach error True: Teach of SP1 TP2 was successful
SSC1 Param	60	0	RecordT		RW	Switching Signal Channel 1 Parameters
SP1	60	1	IntegerT	2500	RW	Value of distant setpoint (-4500 ... 4500)
SP2	60	2	IntegerT	500	RW	Value of near setpoint (-4500 ... 4500)
SSC1 Config	61	0	RecordT		RW	Switching Signal Channel 1 Configuration
Logic	61	1	UIntegerT	0	RW	Output level of switching output when object is detected  0: high active 1: low active

Parameter	Index	Subindex	Data type	Default	AR	Description
Mode	61	2	UIntegerT	1	RW	Configuration of the switching edge positions from one or both setpoints, using hysteresis and others. 0: deactivated 1: single point mode (object) 2: window mode 128: single point mode (background)
Hyst	61	3	UIntegerT	50	RW	distance range between the two opposite switching edges related to the same setpoint (0 ... 32000)
SSC2 Param	62	0	RecordT		RW	Switching Signal Channel 2 Parameters
SP1	62	1	IntegerT	2500	RW	Value of distant setpoint (-4500 ... 4500)
SP2	62	2	IntegerT	500	RW	Value of near setpoint (-4500 ... 4500)
SSC2 Config	63	0	RecordT		RW	Switching Signal Channel 2 Configuration
Logic	63	1	UIntegerT	0	RW	Output level of switching output when object is detected 0: high active 1: low active
Mode	63	2	UIntegerT	1	RW	Configuration of the switching edge positions from one or both setpoints, using hysteresis and others. 0: deactivated 1: single point mode (object) 2: window mode 128: single point mode (background)
Hyst	63	3	UIntegerT	50	RW	distance range between the two opposite switching edges related to the same setpoint (0 ... 32000)
SSC1_SP1a	64	0	IntegerT	-4500	RW	SSC1_SP1a (-4500 ... 4500)
SSC2_SP1a	65	0	IntegerT	-4500	RW	SSC2_SP1a (-4500 ... 4500)
SSC1_Reserve	67	0	UIntegerT		RW	SSC1_Reserve (0 ... 4000)
SSC2_Reserve	68	0	UIntegerT		RW	SSC2_Reserve (0 ... 4000)
System State Information Bits	72	0	RecordT		R	Status information, measurement-, processing- and output states.
Zero	72	1	BooleanT		R	False: cleared bit
Measure	72	2	BooleanT		R	False: no measurement (Startup, Teach or deactivated) True: measurement is running



Parameter	Index	Subindex	Data type	Default	AR	Description
Signal	72	3	BooleanT		R	False: signal too less: no measurement value available True: signal and measurement value available
Warning	72	4	BooleanT		R	False: No Warning True: Warning: weak Signal
Value	72	5	BooleanT		R	False: Substitutional value sent to measurement output True: Regular value sent to measurement output
Calibrated Range	72	6	BooleanT		R	False: Outside calibrated range True: Inside calibrated range
Limited Accuracy	72	7	BooleanT		R	False: Outside limited accuracy range True: Inside limited accuracy range
deactivated	72	8	BooleanT		R	False: Activated True: deactivated
Trigger Toggle	72	9	BooleanT		R	False: Trigger Toggle Clear True: Trigger Toggle Set
SSC1 State	72	10	BooleanT		R	False: SSC 1 inactive True: SSC 1 active
SSC2 State	72	11	BooleanT		R	False: SSC 2 inactive True: SSC 2 active
SSC3 State	72	12	BooleanT		R	False: SSC 3 inactive True: SSC 3 active
Analog In Range	72	13	BooleanT		R	False: Analog Output outside configured range True: Analog Output inside configured range
Analog Out Min	72	14	BooleanT		R	False: Analog Output not lower than configured minimum True: Analog Output lower than configured minimum
Analog Out Max	72	15	BooleanT		R	False: Analog Output not above configured maximum True: Analog Output higher than configured maximum
Laser Error	72	16	BooleanT		R	False: No laser error True: Laser error detected
Option 1	72	17	BooleanT		R	False: Option bit 1 clear True: Option bit 1 set
Option 2	72	18	BooleanT		R	False: Option bit 2 clear True: Option bit 2 set
reserved	72	19	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	20	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	21	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	22	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	23	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	24	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	25	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	26	BooleanT		R	False: reserved bit clear True: reserved bit set

Parameter	Index	Subindex	Data type	Default	AR	Description
reserved	72	27	BooleanT		R	False: reserved bit clear True: reserved bit set
reserved	72	28	BooleanT		R	False: reserved bit clear True: reserved bit set
Teach Busy	72	29	BooleanT		R	False: - True: Teach busy (running)
Teach Success	72	30	BooleanT		R	False: - True: Last Teach succeeded
Teach Error	72	31	BooleanT		R	False: - True: Last Teach failed
Teach Reserved	72	32	BooleanT		R	False: - True: Reserved bit set
Data Storage Upload Flag	73	0	UIntegerT		R	Shows the preference of local changes as opposed to the configuration data, stored in master DS  0: Clear: No upload request for local sensor data 128: Set: Upload request for local sensor data is set
Integration Time Level	74	0	UIntegerT		R	Readout of the adjusted integration time level, depending on the target's diffuse reflectance. Small value = short integration time.
SysState to Status Bits Assignment	79	0	ArrayT		RW	8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
	79	0	UIntegerT		RW	0: Zero 1: Measure 2: Signal 3: Warning 4: Value 5: Calibrated Range 6: Limited Accuracy 7: deactivated 8: Trigger Toggle 9: SSC1 State 10: SSC2 State 11: SSC3 State 12: Analog In Range 13: Analog Out Min 14: Analog Out Max 15: Laser Error 16: Option 1 17: Option 2 18: reserved 19: reserved 20: reserved 21: reserved 22: reserved 23: reserved 24: reserved 25: reserved 26: reserved 27: reserved 28: Teach Busy 29: Teach Success 30: Teach Error 31: Teach Reserved

Parameter	Index	Subindex	Data type	Default	AR	Description
Input Mode	80	0	UIntegerT	1	RW	Input Handling functionality 0: No function 1: Teach 2: Deactivation 3: Activation 4: Trigger on rising edge 5: Trigger on falling edge
Teach Count	81	0	UIntegerT	50	RW	Number of measurement values, used for Teach averaging (2 ... 1000)
Switching Output Property	82	0	UIntegerT		RW	General behaviour of all the Switching Outputs in case of no measurement value is available 0: Switching Off 1: Switching On 2: Unchanged
SSC1_WindowWidth	88	0	UIntegerT		RW	SSC1_WindowWidth (0 ... 4000)
SSC1_EvalDepth	89	0	UIntegerT	2	RW	SSC1_EvalDepth (1 ... 100)
SSC2_WindowWidth	97	0	UIntegerT		RW	SSC2_WindowWidth (0 ... 4000)
SSC2_EvalDepth	98	0	UIntegerT	2	RW	SSC2_EvalDepth (1 ... 100)
Analog Output Property	110	0	UIntegerT		RW	Output behaviour in case of missing measurement value 0: Minimum Analog Output Value 1: Maximum Analog Output Value 2: Unchanged Analog Output Value
Position of maximum Analog Output	111	0	IntegerT	4500	RW	Distance giving maximum Analog Output (-4500 ... 4500)
Position of minimum Analog Output	112	0	IntegerT	500	RW	Distance giving minimum Analog Output (-4500 ... 4500)
Analog Output Range Settings	113	0	UIntegerT		RW	Selection of Analog Output current or voltage Range 0: 4-20mA Current Output 1: 1-10V Voltage Output 2: 0-10V Voltage Output
Measurement Mode	114	0	UIntegerT		RW	Application specific processing of raw measurement data 0: Standard 1: Precision 2: Light Suppression
Menu Language	115	0	UIntegerT		RW	Local device Menu Language settings 0: English 1: German

Parameter	Index	Subindex	Data type	Default	AR	Description
Display Mode	116	0	UIntegerT	1	RW	Display behaviour. Auto: Maximum intensity when pushing a button; dimmed to lower intensity during stand-By. 0: On 1: Auto 2: Auto Off 3: Off
Menu Password Lock	117	0	UIntegerT		RW	password-lock of the local device menu 0: Disabled 255: Enabled
Distance Offset	118	0	IntegerT		RW	Signed distance Offset Value. May be internally modified by preset calculation. (-4500 ... 4500)
Gradient	119	0	IntegerT	1	RW	Simple gradient with values 'rising' (+1) or 'falling' (-1). Can be used for fill level detection 1: rising -1: falling
RAM Teach Option	120	0	UIntegerT		RW	If option is set to 'on', the teach results are only stored into the volatile RAM storage. Used for continually re-teaching applications. 0: Inactive 255: Activated
Menu Exit Behaviour	121	0	UIntegerT		RW	Handling of local changed parameters relating to the IO-Link Master's Data Storage. 0: Report changes to DS (set DSUpload Flag and generate an event) 1: Only local changes (clear DSUpload flag)
Deactivation Property	122	0	UIntegerT		RW	Behaviour of measurement output in deactivation state 0: Show 'No Measurement Data' (Smart Sensor Profile standard behaviour) 1: Freeze current value
Integration Time Level, Lower Limit	123	0	UIntegerT		RW	set a lower limit to preven a value that is too high. (0 ... 48)
Integration Time Level, Upper Limit	124	0	UIntegerT	48	RW	set an upper limit to prevent long measurement loops. For faster detection of an appearing bright target in front of a dark distant background. (0 ... 48)
Preset Value	126	0	IntegerT		RW	This requested measurement value will be displayed after a Preset-to-Offset calculation (-4500 ... 4500)

Parameter	Index	Subindex	Data type	Default	AR	Description
Filter Selection	129	0	UIntegerT		RW	Application specific selection of different filtering methods 0: Off 1: Averaging 2: Spike Suppression
Average Count	130	0	UIntegerT	10	RW	Buffer size of 'Averaging' measurement filter (2 ... 99)
Spike Suppression Count	133	0	UIntegerT	10	RW	Buffer size of 'Spike Suppression' measurement mode (5 ... 99)
Spike Suppression Depth	134	0	UIntegerT		RW	Filter depth of 'Spike Suppression' measurement mode 0: Raw: averaging a huge amount of the values around the sorted center 1: Medium: averaging half of the values around the sorted center 2: Fine: averaging a little amount of the values around the sorted center
Light Suppression Repetition Limit	135	0	UIntegerT	32	RW	Reduction of repetition cycles in 'Light Suppression' measurement mode in order to limit the measurement duration. (2 ... 32)
Wire Function Array	140	0	ArrayT		RW	Input Function=Teach. Functions Being Called With all Selection Widthes on Input Wire (low pulse widths of 20-80 ms, 120-180ms, ..., 1120-1180ms)

Parameter	Index	Subindex	Data type	Default	AR	Description
	140	0	UIntegerT		RW	0: No function, no error 1: No function, error 2: SSP Teach-in of SP1, SSC selection by TI Select 3: SSP Teach-in of SP2, SSC selection by TI Select 4: Custom Teach-in of Window, SSC selection by TI Select 5: Custom Teach-in of SP1a, SSC selection by TI Select 6: Teach-In of Position for Analog Minimum Value 7: Teach-in of Position for Analog Maximum Value 8: Teach-in for Preset Position by modifying Offset 9: Activation, overriding Transducer Disable signal priority (IO-Link PDout) 10: Deactivation, overriding Transducer Disable signal priority (IO-Link PDout) 11: Restore Priority to Transducer Disable signal (IO-Link PDout) after Act-/Deactivation function 12: Teach-in of SSC1 SP1 (distant setpoint) 13: Teach-in of SSC1 SP2 (near setpoint) 14: Object targeting Teach-In of SSC1 SP1 (includes setting to Object Mode) 15: Window center targeting Teach-In of SSC1 SP1-SP2 Window or use WindowWidth (includes setting to Window mode) 16: Background-targeting Teach-In of SSC1 SP1 (includes setting to Background Mode) 17: Teach-in of SSC1 SP1a (alternative distant setpoint) 18: Invert SSC1 Logic 19: Set SSC1 Logic to 'High Active' 20: Set SSC1 Logic to 'Low Active' 21: Teach-in of SSC2 SP1 (distant setpoint) 22: Teach-in of SSC2 SP2 (near setpoint) 23: Object targeting Teach-In of SSC2 SP1 (includes setting to Object Mode) 24: Window center targeting Teach-In of SSC2 SP1-SP2 Window or use WindowWidth (includes setting to Window mode) 25: Background-targeting Teach-In of SSC2 SP1 (includes setting to Background Mode) 26: Teach-in of SSC2 SP1a (alternative distant setpoint) 27: Invert SSC2 Logic 28: Set SSC2 Logic to 'High Active' 29: Set SSC2 Logic to 'Low Active'
Resolution	213	0	UIntegerT	1	R	Distance = Measured Value * Resolution 0: Resolution 1 mm 1: Resolution 0.1 mm 2: Resolution 0.01 mm

Parameter	Index	Subindex	Data type	Default	AR	Description
Minimum of Operating Range (SSP: Detection Range)	214	0	IntegerT	450	R	Minimum of the allowed output range, with Offset=0 and Gradient=rising.
Maximum of Operating Range (SSP: Detection Range)	215	0	IntegerT	5000	R	Maximum of the allowed output range, with Offset=0 and Gradient=rising.
Minimum of Measuring Range (SSP: Measurement Range)	216	0	IntegerT	500	R	Minimum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Lower Limit.
Maximum of Measuring Range (SSP: Measurement Range)	217	0	IntegerT	4500	R	Maximum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Upper Limit.
Temperature	220	0	UIntegerT		R	Device temperature in 1/10 °C steps, accuracy: +/-5 °C
MDC Descr	16512	0	RecordT		R	Measuring Data Channel
MDC Descr - Lower Limit	16512	1	IntegerT		R	
MDC Descr - Upper Limit	16512	2	IntegerT		R	
MDC Descr - Unit	16512	3	IntegerT		R	
MDC Descr - Scale	16512	4	IntegerT		R	

## 9 Technical specifications

### 9.1 General data

Tab. 9.1: Sensor and IODD version

IODD version	V1.0
IODD release date	2018-3-28
Device family	Optical distance sensor
Device ID	2164
Device name	ODS9L2.8/LAK-450-M12
Device variants	ODS9L2.8/LAK-450-M12 (50137818)