



## PLC Integration ODS9\_2160

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

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# 1 Legal information


## 1.1 Disclaimer

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## **2 About this document**

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

### **2.1 Purpose of use**

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

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

### **2.2 Target group**

These instructions are addressed to programming engineers and the operators of machines and systems, which are operated by one or several IO-Link devices. They also address people, who connect the IO-Link device via an IO-Link-Master-Gateway to a PLC-Control for data exchange.

## 3 General use of function block

### 3.1 Short description

The function block "FB\_Leuze\_ODS9\_2160" simplifies the usage of Leuze IO-Link devices on Siemens S7-1200/S7-1500 (TIA-Portal V15.1 or higher) PLC controls. This FB supports IO-Link Masters which can be connected via PROFIBUS / PROFINET to the PLC system.

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

The IO-Link function block can only be used in combination with the listed helper functions / libraries.

### 3.2 Calling and designation

The module can be called as a single-instance.



Fig. 3.1: Example of module call with single instance

### 3.3 Configuration

Tab. 3.1: Parameter IN

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

Tab. 3.2: Parameter INOUT

Parameter	Data type	Description
DeviceData	Leuze_type_ODS9_2160	Sensor data

See structure description of Leuze\_type\_ODS9\_2160 in chapter 7.

Tab. 3.3: Parameter OUT

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

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

## 3.4 Method of function

The function block uses the data structure "FB\_Leuze\_ODS9\_2160". The PLC data structure contains the values of all IO-Link variables. Before you can use it, the structure must be instantiated by a data block. Each IO-Link FB parameter has a data point representing it in this data structure. This data point will be actualized every time a read request was executed successfully.

The desired parameters can be selected via the input variables. Depending on the device definition, IO-Link parameters are read or writable. The input variable must be "RW" = FALSE to read parameter. The value that should be written can be defined in the data structure, as soon as the input parameter "RW" = TRUE. You start each transfer by calling up the "FB\_Leuze\_ODS9\_2160" with a positive trigger at the "Execute" input. As long as there is no valid answer the output "Busy" is TRUE. In the case that the chosen timeout period has elapsed a timeout error will be generated and the thread will be terminated. The "Done" = TRUE output shows that the transmission was successful. The outputs retain there states as long as there is no new positive trigger at the "Execute" input again.

The function block allows you to read or write multiple IO-Link parameters sequentially (multiselection). Please note that it may happen, that a single parameter can not be written. The function block aborts at this point and it is possible, that the IO-Link device contains an inconsistent set of parameters.

## 3.5 Behavior when error occurs

An error bit (Error) is set and an error code (Leuze\_type\_lolError) generated, if there is a spurious input value or an incorrect input connection of the FB. In this case, no further processing is carried out, until the input has been corrected.

## 4 Integration into the PLC project

The function block "FB\_Leuze\_ ODS9\_2160" is a part of the TIA-Portal library. To get all relevant blocks into your PLC project, please open the library as a "global" library. Afterwards, the library elements can be copied into the currently opened project.

### Integration step by step:

- Downloading the library
- Open the library in the "global" library tab
- Including the blocks of the Leuze library into your project (code-blocks and data type)
- Compiling the PLC project

NOTICE	
	If several devices connect to the IO-Link Master, you can only exchange acyclic data (service data) with one device at the same time. Due this restriction, the service data communication blocks must to be blocked against each other.



## 5 Process data parser function

The function FC\_Leuze\_PD\_ODS9\_2160 simplifies the interpretation of composed IO-Link process data. This data is provided as a data structure on the PLC side. Some sensors supports different process data output. User must select mode of PD according to the sensors settings. Each sensor connected to Leuze IO-Link master has its own hardware ID. See Fig. 5.2.

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

### 5.1 Calling and designation



Fig. 5.1: Example of process data parsing function call

### 5.2 Configuration

Tab. 5.1: Parameters

Parameter name	Declaration	Data type	Description
HwID	INPUT	HW_IO	Hardware IO-Address of the IO-Link master (see HW-Configuration). For masters that do not use the Siemens PCT-Tool please use the HW IOAddress of the configured Master port.
RelByteOffset	INPUT	UINT	Relative start address of the IO-Link device on the IO-Link master port (see PCT-Tool -> Addresses -> Inputs Start). If the process date is mapped into a specified logical IO-Address, the relative byte offset = 0.
PDMode	INPUT	INT	Mode of the PD. User must select mode of PD according to the sensors settings.
ErrorCode	OUTPUT	WORD	Error code details see in the Siemens help system ("DPRD_DAT").
RET_VAL	OUTPUT	Leuze_type_PD_ODS9_2160	Reference to the instance of the data structure Leuze_type_PD_ODS9_2160. The structure includes the disaggregated values of the process data.

See structure description of Leuze\_type\_PD\_ODS9\_2160 in chapter 7.



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

## 6 Error description

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

Tab. 6.1: Leuze\_type\_IolError description

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

Tab. 6.2: Error description for status

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

Tab. 6.3: Error description for ioLError

Error code (ioLError)	Error description
0x0000	No error
0x0001 ... 0x06FF	Reserved / Master specific
0x7000	Unexpected Write request instead of read request / Invalid response PDU
0x7001	Decode error
0x7002	Port occupied by another task
0x7003 ... 0x7FFF	Reserved / Master specific
0x8000	Timeout when IOL-Devices or IOL-Master port are busy
0x8001	IO-Link index > 32767
0x8002	Port address beyond defined maximum
0x8003	Port function not supported
0x8004	Reserved / Master specific
0x8005	Invalid length of the data that should be written (>232 / <1)
0x8006	Reserved / Master specific
0x8007	IO-Link subindex > 255
0x8008 ... 0x8051	Reserved / Master specific
0x8052	Error during acyclic data access (FB RDREC error)
0x8053	Error during acyclic data access (FB WRREC error)
0x8054 ... 0x8FFFF	Reserved / Master specific

For additional information see the technical specification "IO-Link Integration Part 1" ([www.profibus.com](http://www.profibus.com)).

Tab. 6.4: Error description for ioLError

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

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

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

## 7 Data structures

Tab. 7.1: Leuze\_type\_ ODS9\_2160

Parameter name	Data type	Description
DeviceData.Selection.Commands.DeviceReset	Bool	[WRITE_ONLY] Device Reset
DeviceData.Selection.Commands.ApplicationReset	Bool	[WRITE_ONLY] Application Reset
DeviceData.Selection.Commands.RestoreFactorySettings	Bool	[WRITE_ONLY] Restore Factory Settings
DeviceData.Selection.Commands.TeachSp1TeachOfDistantSetpoint	Bool	[WRITE_ONLY] Teach SP1 (Teach of distant setpoint)
DeviceData.Selection.Commands.TeachSp2TeachOfNearSetpoint	Bool	[WRITE_ONLY] Teach SP2 (Teach of near setpoint)
DeviceData.Selection.Commands.CustomTeachWindowTeachOfBothSetpoints	Bool	[WRITE_ONLY] Custom Teach: Window (Teach of both setpoints)
DeviceData.Selection.Commands.CustomTeachSp1aTeachOfAlternativeDistantSetpoint	Bool	[WRITE_ONLY] Custom Teach SP1a (Teach of alternative distant setpoint)
DeviceData.Selection.Commands.ClearDsUploadFlag	Bool	[WRITE_ONLY] Clear DS Upload Flag
DeviceData.Selection.Commands.SetDsUploadFlag	Bool	[WRITE_ONLY] Set DS Upload Flag
DeviceData.Selection.Commands.ActivationWithPriorityOverridingPdoutsTransducerDisableSignalOnlyInputFunctionsHaveAHigherPriority	Bool	[WRITE_ONLY] Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
DeviceData.Selection.Commands.DeactivationWithPriorityOverridingPdoutsTransducerDisableSignalOnlyInputFunctionsHaveAHigherPriority	Bool	[WRITE_ONLY] Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
DeviceData.Selection.Commands.ResetPriorityToUsePdoutsTransducerDisableSignalAgainOnlyInputFunctionsHaveAHigherPriority	Bool	[WRITE_ONLY] Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority
DeviceData.Selection.Commands.TeachDistanceOfMinimumAnalogOutput	Bool	[WRITE_ONLY] Teach distance of minimum analog output
DeviceData.Selection.Commands.TeachDistanceOfMaximumAnalogOutput	Bool	[WRITE_ONLY] Teach distance of maximum analog output
DeviceData.Selection.Commands.TeachOffsetInOrderToAchieveThePresetValue	Bool	[WRITE_ONLY] Teach offset in order to achieve the preset value
DeviceData.Selection.DirectParameters1.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.DirectParameters1.All	Bool	[READ_WRITE] all parameters of complex data type

Parameter name	Data type	Description
DeviceData.Selection.DirectParameters1.Reserved_1	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.MasterCycleTime	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.MinCycleTime	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.MSequenceCapability	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.IoLinkVersionId	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.ProcessDataInputLength	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.ProcessDataOutputLength	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.VendorId1	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.VendorId2	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.DeviceId1	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.DeviceId2	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.DeviceId3	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.Reserved_13	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.Reserved_14	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters1.Reserved_15	Bool	[READ_ONLY]
DeviceData.Selection.DirectParameters2.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter1	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter2	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter3	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter4	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter5	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter6	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter7	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter8	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter9	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter10	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter11	Bool	[READ_WRITE]

Parameter name	Data type	Description
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter12	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter13	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter14	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter15	Bool	[READ_WRITE]
DeviceData.Selection.DirectParameters2.DeviceSpecificParameter16	Bool	[READ_WRITE]
DeviceData.Selection.StandardCommand	Bool	[WRITE_ONLY]
DeviceData.Selection.DeviceAccessLocks.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.ProfileCharacteristic.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Selection.VendorName	Bool	[READ_ONLY]
DeviceData.Selection.VendorText	Bool	[READ_ONLY]
DeviceData.Selection.ProductName	Bool	[READ_ONLY]
DeviceData.Selection.ProductId	Bool	[READ_ONLY]
DeviceData.Selection.ProductText	Bool	[READ_ONLY]
DeviceData.Selection.SerialNumber	Bool	[READ_ONLY]
DeviceData.Selection.HardwareVersion	Bool	[READ_ONLY]
DeviceData.Selection.FirmwareVersion	Bool	[READ_ONLY]
DeviceData.Selection.ApplicationSpecificTag	Bool	[READ_WRITE]
DeviceData.Selection.FunctionTag	Bool	[READ_WRITE]
DeviceData.Selection.LocationTag	Bool	[READ_WRITE]
DeviceData.Selection.DeviceStatus	Bool	[READ_ONLY]
DeviceData.Selection.DetailedDeviceStatus.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Selection.TiSelect	Bool	[READ_WRITE] select teach channel, 0=SSC1, 1=SSC1, 2=SSC2, 255=all SSCs
DeviceData.Selection.TiResult.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Selection.Ssc1Param.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.Ssc1Config.All	Bool	[READ_WRITE] all parameters of complex data type



Parameter name	Data type	Description
DeviceData.Selection.Ssc2Param.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.Ssc2Config.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.Ssc1_Sp1a	Bool	[READ_WRITE] SSC1_SP1a
DeviceData.Selection.Ssc2_Sp1a	Bool	[READ_WRITE] SSC2_SP1a
DeviceData.Selection.Ssc1_Reserve	Bool	[READ_WRITE] SSC1_Reserve
DeviceData.Selection.Ssc2_Reserve	Bool	[READ_WRITE] SSC2_Reserve
DeviceData.Selection.SystemStateInformationBits.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Selection.DataStorageUploadFlag	Bool	[READ_ONLY] Shows the preference of local changes as opposed to the configuration data, stored in master DS
DeviceData.Selection.IntegrationTimeLevel	Bool	[READ_ONLY] Readout of the adjusted integration time level, depending on the target's diffuse reflectance. Small value = short integration time.
DeviceData.Selection.SysstateToStatusBitsAssignment.All	Bool	[READ_WRITE] all parameters of complex data type
DeviceData.Selection.TeachCount	Bool	[READ_WRITE] Number of measurement values, used for Teach averaging
DeviceData.Selection.SwitchingOutputProperty	Bool	[READ_WRITE] General behaviour of all the Switching Outputs in case of no measurement value is available
DeviceData.Selection.Ssc1_WindowWidth	Bool	[READ_WRITE] SSC1_WindowWidth
DeviceData.Selection.Ssc1_EvalDepth	Bool	[READ_WRITE] SSC1_EvalDepth
DeviceData.Selection.Ssc2_WindowWidth	Bool	[READ_WRITE] SSC2_WindowWidth
DeviceData.Selection.Ssc2_EvalDepth	Bool	[READ_WRITE] SSC2_EvalDepth
DeviceData.Selection.AnalogOutputProperty	Bool	[READ_WRITE] Output behaviour in case of missing measurement value
DeviceData.Selection.PositionOfMaximumAnalogOutput	Bool	[READ_WRITE] Distance giving maximum Analog Output
DeviceData.Selection.PositionOfMinimumAnalogOutput	Bool	[READ_WRITE] Distance giving minimum Analog Output
DeviceData.Selection.AnalogOutputRangeSettings	Bool	[READ_WRITE] Selection of Analog Output current or voltage Range

Parameter name	Data type	Description
DeviceData.Selection.MeasurementMode	Bool	[READ_WRITE] Application specific processing of raw measurement data
DeviceData.Selection.MenuLanguage	Bool	[READ_WRITE] Local device Menu Language settings
DeviceData.Selection.DisplayMode	Bool	[READ_WRITE] Display behaviour. Auto: Maximum intensity when pushing a button; dimmed to lower intensity during stand-By.
DeviceData.Selection.MenuPasswordLock	Bool	[READ_WRITE] password-lock of the local device menu
DeviceData.Selection.DistanceOffset	Bool	[READ_WRITE] Signed distance Offset Value. May be internally modified by preset calculation.
DeviceData.Selection.Gradient	Bool	[READ_WRITE] Simple gradient with values 'rising' (+1) or 'falling' (-1). Can be used for fill level detection
DeviceData.Selection.RamTeachOption	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.
DeviceData.Selection.MenuExitBehaviour	Bool	[READ_WRITE] Handling of local changed parameters relating to the IO-Link Master's Data Storage.
DeviceData.Selection.DeactivationProperty	Bool	[READ_WRITE] Behaviour of measurement output in deactivation state
DeviceData.Selection.IntegrationTimeLevelLowerLimit	Bool	[READ_WRITE] set a lower limit to prevent a value that is too high.
DeviceData.Selection.IntegrationTimeLevelUpperLimit	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.
DeviceData.Selection.PresetValue	Bool	[READ_WRITE] This requested measurement value will be displayed after a Preset-to-Offset calculation
DeviceData.Selection.FilterSelection	Bool	[READ_WRITE] Application specific selection of different filtering methods
DeviceData.Selection.AverageCount	Bool	[READ_WRITE] Buffer size of 'Averaging' measurement filter

Parameter name	Data type	Description
DeviceData.Selection.SpikeSuppressionCount	Bool	[READ_WRITE] Buffer size of 'Spike Suppression' measurement mode
DeviceData.Selection.SpikeSuppressionDepth	Bool	[READ_WRITE] Filter depth of 'Spike Suppression' measurement mode
DeviceData.Selection.LightSuppressionRepetitionLimit	Bool	[READ_WRITE] Reduction of repetition cycles in 'Light Suppression' measurement mode in order to limit the measurement duration.
DeviceData.Selection.Resolution	Bool	[READ_ONLY] Distance = Measured Value * Resolution
DeviceData.Selection.MinimumOfOperatingRangeSspDetectionRange	Bool	[READ_ONLY] Minimum of the allowed output range, with Offset=0 and Gradient=rising.
DeviceData.Selection.MaximumOfOperatingRangeSspDetectionRange	Bool	[READ_ONLY] Maximum of the allowed output range, with Offset=0 and Gradient=rising.
DeviceData.Selection.MinimumOfMeasuringRangeSspMeasurementRange	Bool	[READ_ONLY] Minimum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Lower Limit.
DeviceData.Selection.MaximumOfMeasuringRangeSspMeasurementRange	Bool	[READ_ONLY] Maximum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Upper Limit.
DeviceData.Selection.Temperature	Bool	[READ_ONLY] Device temperature in 1/10 °C steps, accuracy: +/-5 °C
DeviceData.Selection.MdcDescr.All	Bool	[READ_ONLY] all parameters of complex data type
DeviceData.Data.Commands.DeviceReset	UInt	[WRITE_ONLY] Device Reset
DeviceData.Data.Commands.ApplicationReset	UInt	[WRITE_ONLY] Application Reset
DeviceData.Data.Commands.RestoreFactorySettings	UInt	[WRITE_ONLY] Restore Factory Settings
DeviceData.Data.Commands.TeachSp1TeachOfDistantSetpoint	UInt	[WRITE_ONLY] Teach SP1 (Teach of distant setpoint)
DeviceData.Data.Commands.TeachSp2TeachOfNearSetpoint	UInt	[WRITE_ONLY] Teach SP2 (Teach of near setpoint)
DeviceData.Data.Commands.CustomTeachWindowTeachOfBothSetpoints	UInt	[WRITE_ONLY] Custom Teach: Window (Teach of both setpoints)
DeviceData.Data.Commands.CustomTeachSp1aTeachOfAlternativeDistantSetpoint	UInt	[WRITE_ONLY] Custom Teach SP1a (Teach of alternative distant setpoint)

Parameter name	Data type	Description
DeviceData.Data.Commands.ClearDsUploadFlag	UInt	[WRITE_ONLY] Clear DS Upload Flag
DeviceData.Data.Commands.SetDsUploadFlag	UInt	[WRITE_ONLY] Set DS Upload Flag
DeviceData.Data.Commands.ActivationWithPriorityOverridingPdoutsTransducerDisableSignalOnlyInputFunctionsHaveAHigherPriority	UInt	[WRITE_ONLY] Activation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
DeviceData.Data.Commands.DeactivationWithPriorityOverridingPdoutsTransducerDisableSignalOnlyInputFunctionsHaveAHigherPriority	UInt	[WRITE_ONLY] Deactivation with priority, overriding PDout's transducer disable signal. Only Input functions have a higher priority
DeviceData.Data.Commands.ResetPriorityToUsePdoutsTransducerDisableSignalAgainOnlyInputFunctionsHaveAHigherPriority	UInt	[WRITE_ONLY] Reset priority to use PDout's transducer disable signal again. Only Input functions have a higher priority
DeviceData.Data.Commands.TeachDistanceOfMinimumAnalogOutput	UInt	[WRITE_ONLY] Teach distance of minimum analog output
DeviceData.Data.Commands.TeachDistanceOfMaximumAnalogOutput	UInt	[WRITE_ONLY] Teach distance of maximum analog output
DeviceData.Data.Commands.TeachOffsetInOrderToAchieveThePresetValue	UInt	[WRITE_ONLY] Teach offset in order to achieve the preset value
DeviceData.Data.DirectParameters1.Reserved_1	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.MasterCycleTime	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.MinCycleTime	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.MSequenceCapability	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.IoLinkId	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.ProcessDataInputLength	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.ProcessDataOutputLength	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.VendorId1	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.VendorId2	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.DeviceId1	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.DeviceId2	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.DeviceId3	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.Reserved_13	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters1.Reserved_14	UInt	[READ_ONLY]

Parameter name	Data type	Description
DeviceData.Data.DirectParameters1.Reserved_15	UInt	[READ_ONLY]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter1	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter2	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter3	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter4	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter5	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter6	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter7	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter8	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter9	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter10	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter11	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter12	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter13	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter14	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter15	UInt	[READ_WRITE]
DeviceData.Data.DirectParameters2.DeviceSpecificParameter16	UInt	[READ_WRITE]
DeviceData.Data.StandardCommand	UInt	[WRITE_ONLY]
DeviceData.Data.DeviceAccessLocks.ParameterWriteAccessLock	Bool	[READ_WRITE]
DeviceData.Data.DeviceAccessLocks.DataStorageLock	Bool	[READ_WRITE]
DeviceData.Data.DeviceAccessLocks.LocalParameterizationLock	Bool	[READ_WRITE]
DeviceData.Data.DeviceAccessLocks.LocalUserInterfaceLock	Bool	[READ_WRITE]
DeviceData.Data.ProfileCharacteristic.DeviceProfile1	UInt	[READ_ONLY] 0x0001: Generic Profiled Sensor
DeviceData.Data.ProfileCharacteristic.DeviceProfile2	UInt	[READ_ONLY] 0x000C: DMS Digital Measuring Sensor 16bit, Transducer Disable
DeviceData.Data.ProfileCharacteristic.ApplicationProfile	UInt	[READ_ONLY] 0x4000: Identification and Diagnosis
DeviceData.Data.ProfileCharacteristic.FunctionClass1	UInt	[READ_ONLY] 0x8001: Switching Signal Channel

Parameter name	Data type	Description
DeviceData.Data.ProfileCharacteristic.FunctionClass2	UInt	[READ_ONLY] 0x8004: Teach-in
DeviceData.Data.VendorName	String	[READ_ONLY]
DeviceData.Data.VendorText	String	[READ_ONLY]
DeviceData.Data.ProductName	String	[READ_ONLY]
DeviceData.Data.ProductId	String	[READ_ONLY]
DeviceData.Data.ProductText	String	[READ_ONLY]
DeviceData.Data.SerialNumber	String	[READ_ONLY]
DeviceData.Data.HardwareVersion	String	[READ_ONLY]
DeviceData.Data.FirmwareVersion	String	[READ_ONLY]
DeviceData.Data.ApplicationSpecificTag	String	[READ_WRITE]
DeviceData.Data.FunctionTag	String	[READ_WRITE]
DeviceData.Data.LocationTag	String	[READ_WRITE]
DeviceData.Data.DeviceStatus	UInt	[READ_ONLY]
DeviceData.Data.DetailedDeviceStatus.Item_1	String	[READ_ONLY]
DeviceData.Data.DetailedDeviceStatus.Item_2	String	[READ_ONLY]
DeviceData.Data.TiSelect	UInt	[READ_WRITE] select teach channel, 0=SSC1, 1=SSC1, 2=SSC2, 255=all SSCs
DeviceData.Data.TiResult.TiResultState	UInt	[READ_ONLY]
DeviceData.Data.TiResult.TiResultFlagSp1Tp1	Bool	[READ_ONLY]
DeviceData.Data.TiResult.TiResultFlagSp1Tp2	Bool	[READ_ONLY]
DeviceData.Data.TiResult.TiResultFlagSp2Tp1	Bool	[READ_ONLY]
DeviceData.Data.TiResult.TiResultFlagSp2Tp2	Bool	[READ_ONLY]
DeviceData.Data.Ssc1Param.Sp1	Int	[READ_WRITE] Value of distant setpoint
DeviceData.Data.Ssc1Param.Sp2	Int	[READ_WRITE] Value of near setpoint
DeviceData.Data.Ssc1Config.Logic	UInt	[READ_WRITE] Output level of switching output when object is detected
DeviceData.Data.Ssc1Config.Mode	UInt	[READ_WRITE] Configuration of the switching edge positions from one or both setpoints, using hysteresis and others.

Parameter name	Data type	Description
DeviceData.Data.Ssc1Config.Hyst	UInt	[READ_WRITE] distance range between the two opposite switching edges related to the same setpoint
DeviceData.Data.Ssc2Param.Sp1	Int	[READ_WRITE] Value of distant setpoint
DeviceData.Data.Ssc2Param.Sp2	Int	[READ_WRITE] Value of near setpoint
DeviceData.Data.Ssc2Config.Logic	UInt	[READ_WRITE] Output level of switching output when object is detected
DeviceData.Data.Ssc2Config.Mode	UInt	[READ_WRITE] Configuration of the switching edge positions from one or both setpoints, using hysteresis and others.
DeviceData.Data.Ssc2Config.Hyst	UInt	[READ_WRITE] distance range between the two opposite switching edges related to the same setpoint
DeviceData.Data.Ssc1_Sp1a	Int	[READ_WRITE] SSC1_SP1a
DeviceData.Data.Ssc2_Sp1a	Int	[READ_WRITE] SSC2_SP1a
DeviceData.Data.Ssc1_Reserve	UInt	[READ_WRITE] SSC1_Reserve
DeviceData.Data.Ssc2_Reserve	UInt	[READ_WRITE] SSC2_Reserve
DeviceData.Data.SystemStateInformationBits.Zero	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Measure	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Signal	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Warning	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Value	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.CalibratedRange	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.LimitedAccuracy	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Deactivated	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.TriggerToggle	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Ssc1State	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Ssc2State	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Ssc3State	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.AnalogInRange	Bool	[READ_ONLY]

Parameter name	Data type	Description
DeviceData.Data.SystemStateInformationBits.AnalogOutMin	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.AnalogOutMax	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.LaserError	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Option1	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Option2	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_19	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_20	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_21	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_22	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_23	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_24	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_25	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_26	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_27	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.Reserved_28	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.TeachBusy	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.TeachSuccess	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.TeachError	Bool	[READ_ONLY]
DeviceData.Data.SystemStateInformationBits.TeachReserved	Bool	[READ_ONLY]
DeviceData.Data.DataStorageUploadFlag	UInt	[READ_ONLY] Shows the preference of local changes as opposed to the configuration data, stored in master DS
DeviceData.Data.IntegrationTimeLevel	UInt	[READ_ONLY] Readout of the adjusted integration time level, depending on the target's diffuse reflectance. Small value = short integration time.
DeviceData.Data.SysstateToStatusBitsAssignment.Item_1	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.SysstateToStatusBitsAssignment.Item_2	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits



Parameter name	Data type	Description
DeviceData.Data.SysstateToStatusBitsAssignment.Item_3	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.SysstateToStatusBitsAssignment.Item_4	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.SysstateToStatusBitsAssignment.Item_5	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.SysstateToStatusBitsAssignment.Item_6	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.SysstateToStatusBitsAssignment.Item_7	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.SysstateToStatusBitsAssignment.Item_8	UInt	[READ_WRITE] 8 element array with SysState Bit numbers assigned to the 8 PDin Status Bits
DeviceData.Data.TeachCount	UInt	[READ_WRITE] Number of measurement values, used for Teach averaging
DeviceData.Data.SwitchingOutputProperty	UInt	[READ_WRITE] General behaviour of all the Switching Outputs in case of no measurement value is available
DeviceData.Data.Ssc1_WindowWidth	UInt	[READ_WRITE] SSC1_WindowWidth
DeviceData.Data.Ssc1_EvalDepth	UInt	[READ_WRITE] SSC1_EvalDepth
DeviceData.Data.Ssc2_WindowWidth	UInt	[READ_WRITE] SSC2_WindowWidth
DeviceData.Data.Ssc2_EvalDepth	UInt	[READ_WRITE] SSC2_EvalDepth
DeviceData.Data.AnalogOutputProperty	UInt	[READ_WRITE] Output behaviour in case of missing measurement value
DeviceData.Data.PositionOfMaximumAnalogOutput	Int	[READ_WRITE] Distance giving maximum Analog Output
DeviceData.Data.PositionOfMinimumAnalogOutput	Int	[READ_WRITE] Distance giving minimum Analog Output
DeviceData.Data.AnalogOutputRangeSettings	UInt	[READ_WRITE] Selection of Analog Output current or voltage Range
DeviceData.Data.MeasurementMode	UInt	[READ_WRITE] Application specific processing of raw measurement data
DeviceData.Data.MenuLanguage	UInt	[READ_WRITE] Local device Menu Language settings

Parameter name	Data type	Description
DeviceData.Data.DisplayMode	UInt	[READ_WRITE] Display behaviour. Auto: Maximum intensity when pushing a button; dimmed to lower intensity during stand-By.
DeviceData.Data.MenuPasswordLock	UInt	[READ_WRITE] password-lock of the local device menu
DeviceData.Data.DistanceOffset	Int	[READ_WRITE] Signed distance Offset Value. May be internally modified by preset calculation.
DeviceData.Data.Gradient	Int	[READ_WRITE] Simple gradient with values 'rising' (+1) or 'falling' (-1). Can be used for fill level detection
DeviceData.Data.RamTeachOption	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.
DeviceData.Data.MenuExitBehaviour	UInt	[READ_WRITE] Handling of local changed parameters relating to the IO-Link Master's Data Storage.
DeviceData.Data.DeactivationProperty	UInt	[READ_WRITE] Behaviour of measurement output in deactivation state
DeviceData.Data.IntegrationTimeLevelLowerLimit	UInt	[READ_WRITE] set a lower limit to prevent a value that is too high.
DeviceData.Data.IntegrationTimeLevelUpperLimit	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.
DeviceData.Data.PresetValue	Int	[READ_WRITE] This requested measurement value will be displayed after a Preset-to-Offset calculation
DeviceData.Data.FilterSelection	UInt	[READ_WRITE] Application specific selection of different filtering methods
DeviceData.Data.AverageCount	UInt	[READ_WRITE] Buffer size of 'Averaging' measurement filter
DeviceData.Data.SpikeSuppressionCount	UInt	[READ_WRITE] Buffer size of 'Spike Suppression' measurement mode
DeviceData.Data.SpikeSuppressionDepth	UInt	[READ_WRITE] Filter depth of 'Spike Suppression' measurement mode

Parameter name	Data type	Description
DeviceData.Data.LightSuppressionRepetitionLimit	UInt	[READ_WRITE] Reduction of repetition cycles in 'Light Suppression' measurement mode in order to limit the measurement duration.
DeviceData.Data.Resolution	UInt	[READ_ONLY] Distance = Measured Value * Resolution
DeviceData.Data. MinimumOfOperatingRangeSspDetectionRange	Int	[READ_ONLY] Minimum of the allowed output range, with Offset=0 and Gradient=rising.
DeviceData.Data. MaximumOfOperatingRangeSspDetectionRange	Int	[READ_ONLY] Maximum of the allowed output range, with Offset=0 and Gradient=rising.
DeviceData.Data. MinimumOfMeasuringRangeSspMeasurementRange	Int	[READ_ONLY] Minimum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Lower Limit.
DeviceData.Data. MaximumOfMeasuringRangeSspMeasurementRange	Int	[READ_ONLY] Maximum of the range with guaranteed accuracy (Offset=0 and Gradient=rising). Equals MDC Descr parameter Upper Limit.
DeviceData.Data.Temperature	UInt	[READ_ONLY] Device temperature in 1/10 °C steps, accuracy: +/-5 °C
DeviceData.Data.MdcDescr.MdcDescrLowerLimit	Int	[READ_ONLY]
DeviceData.Data.MdcDescr.MdcDescrUpperLimit	Int	[READ_ONLY]
DeviceData.Data.MdcDescr.MdcDescrUnit	Int	[READ_ONLY]
DeviceData.Data.MdcDescr.MdcDescrScale	Int	[READ_ONLY]

Tab. 7.2: Leuze\_type\_PD\_ODS9\_2160

Parameter name	Data type	Description
FC_Leuze_PD_ODS9_2160.DistanceValue	Int	
FC_Leuze_PD_ODS9_2160.DistanceScale	Int	
FC_Leuze_PD_ODS9_2160.StatusBit0Ssc1OutputState	Bool	
FC_Leuze_PD_ODS9_2160.StatusBit1Ssc2OutputState	Bool	
FC_Leuze_PD_ODS9_2160.StatusBit2Reserved	Bool	
FC_Leuze_PD_ODS9_2160.StatusBit3MeasureState	Bool	
FC_Leuze_PD_ODS9_2160.StatusBit4SignalAvailable	Bool	

Parameter name	Data type	Description
FC_Leuze_PD_ODS9_2160.StatusBit5WarningLowSignal	Bool	
FC_Leuze_PD_ODS9_2160.StatusBit6Reserved	Bool	
FC_Leuze_PD_ODS9_2160.StatusBit7ToggleBit	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	3500	RW	Value of distant setpoint (-6500 ... 6500)
SP2	60	2	IntegerT	500	RW	Value of near setpoint (-6500 ... 6500)
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	100	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	3500	RW	Value of distant setpoint (-6500 ... 6500)
SP2	62	2	IntegerT	500	RW	Value of near setpoint (-6500 ... 6500)
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	100	RW	distance range between the two opposite switching edges related to the same setpoint (0 ... 32000)
SSC1_SP1a	64	0	IntegerT	-6500	RW	SSC1_SP1a (-6500 ... 6500)
SSC2_SP1a	65	0	IntegerT	-6500	RW	SSC2_SP1a (-6500 ... 6500)
SSC1_Reserve	67	0	UIntegerT		RW	SSC1_Reserve (0 ... 6000)
SSC2_Reserve	68	0	UIntegerT		RW	SSC2_Reserve (0 ... 6000)
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
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 ... 6000)
SSC1_EvalDepth	89	0	UIntegerT	2	RW	SSC1_EvalDepth (1 ... 100)
SSC2_WindowWidth	97	0	UIntegerT		RW	SSC2_WindowWidth (0 ... 6000)
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	6500	RW	Distance giving maximum Analog Output (-6500 ... 6500)
Position of minimum Analog Output	112	0	IntegerT	500	RW	Distance giving minimum Analog Output (-6500 ... 6500)
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
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

Parameter	Index	Subindex	Data type	Default	AR	Description
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. (-6500 ... 6500)
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 prevent 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 (-6500 ... 6500)
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)

Parameter	Index	Subindex	Data type	Default	AR	Description
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)
Resolution	213	0	UIntegerT	1	R	Distance = Measured Value * Resolution  0: Resolution 1 mm 1: Resolution 0.1 mm 2: Resolution 0.01 mm
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	7000	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	6500	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	2160
Device name	ODS9L2.8/LA6-650-M12
Device variants	ODS9L2.8/LA6-650-M12 (50136953)