

PLC Integration of LV463_513

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

© 2021

Leuze electronic GmbH & Co. KG

In der Braike 1

D-73277 Owen / Germany

Phone: +49 7021 573-0

Fax: +49 7021 573-199

<http://www.leuze.com>

info@leuze.com

Table of Contents

| | | |
|----------|--|-----------|
| 1 | Legal information..... | 4 |
| 1.1 | Disclaimer..... | 4 |
| 2 | About this document..... | 5 |
| 2.1 | Purpose of use..... | 5 |
| 2.2 | Target group..... | 5 |
| 3 | General use of function block..... | 6 |
| 3.1 | Short description..... | 6 |
| 3.2 | Calling and designation..... | 6 |
| 3.3 | Configuration..... | 6 |
| 3.4 | Method of function..... | 7 |
| 3.5 | Behavior when error occurs..... | 7 |
| 4 | Integration into the PLC project..... | 8 |
| 5 | Process data parser function..... | 9 |
| 5.1 | Calling and designation..... | 9 |
| 5.2 | Configuration..... | 9 |
| 6 | Error description..... | 10 |
| 7 | Data structures..... | 11 |
| 8 | Parameter descriptions..... | 20 |
| 9 | Technical specifications..... | 27 |
| 9.1 | General data..... | 27 |

1 Legal information

1.1 Disclaimer

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

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

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

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

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

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_ LV463_513" 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_ LV463_513 | Sensor data |

See structure description of ST_Leuze_IOL_ LV463_513 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_LV463_513". 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_LV463_513" 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_ LV463_513" 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_LV463_513 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

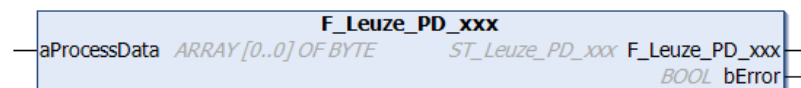


Fig. 5.1: Example of process data parsing function call

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_LV463_513 | OUTPUT | ST_Leuze_PD_LV463_513 | Reference to the instance of the data structure ST_Leuze_PD_LV463_513. The structure includes the disaggregated values of the process data. |

See structure description of ST_Leuze_PD_LV463_513 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_LV463_513

| 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.bSp1SingleValueTeach | BOOL | [WRITE_ONLY] SP1 Single Value Teach |
| stDeviceData.stSelection.stCommands.bSp1TwoValueTeachTp1 | BOOL | [WRITE_ONLY] SP1 Two Value Teach TP1 |
| stDeviceData.stSelection.stCommands.bSp1TwoValueTeachTp2 | BOOL | [WRITE_ONLY] SP1 Two Value Teach TP2 |
| stDeviceData.stSelection.stCommands.bSp1DynamicTeachStart | BOOL | [WRITE_ONLY] SP1 Dynamic Teach Start |
| stDeviceData.stSelection.stCommands.bSp1DynamicTeachStop | BOOL | [WRITE_ONLY] SP1 Dynamic Teach Stop |
| stDeviceData.stSelection.stCommands.bS1ExitTeach | BOOL | [WRITE_ONLY] S1 Exit Teach |
| stDeviceData.stSelection.stCommands.bDisableEmitter | BOOL | [WRITE_ONLY] Disable Emitter |
| stDeviceData.stSelection.stCommands.bEnableEmitter | BOOL | [WRITE_ONLY] Enable Emitter |
| stDeviceData.stSelection.stCommands.bStopSensorSearch | BOOL | [WRITE_ONLY] Stop Sensor Search |
| stDeviceData.stSelection.stCommands.bStartSensorSearch | BOOL | [WRITE_ONLY] Start Sensor Search |
| stDeviceData.stSelection.stCommands.bBaselineNull | BOOL | [WRITE_ONLY] Baseline Null |
| stDeviceData.stSelection.stCommands.bBaselineDisable | BOOL | [WRITE_ONLY] Baseline Disable |
| 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 |
| 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] |

| Parameter name | Data type | Description |
|---|-----------|--|
| 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] |
| 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 |

| Parameter name | Data type | Description |
|--|-----------|--|
| 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.bFirmwareVersion | BOOL | [READ_ONLY] |
| stDeviceData.stSelection.bApplicationSpecificTag | BOOL | [READ_WRITE] |
| stDeviceData.stSelection.bDeviceStatus | BOOL | [READ_ONLY] |
| stDeviceData.stSelection.stDetailedDeviceStatus.bAll | BOOL | [READ_ONLY] all parameters of complex data type |
| stDeviceData.stSelection.stTeachInChannel.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stTeachStatus.bAll | BOOL | [READ_ONLY] all parameters of complex data type |
| stDeviceData.stSelection.stBdc1Setpoints.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stBdc1Configuration.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stBdc1Configuration.bBdcLogic | BOOL | [READ_WRITE] LO/DO Selection |
| stDeviceData.stSelection.stBdc1Configuration.bBdcMode | BOOL | [READ_WRITE] Defines how the binary switching information is created depending on Setpoint parameters (SP1, SP2) and the current measurement value |
| stDeviceData.stSelection.stBdc1Configuration.bHysteresis | BOOL | [READ_WRITE] User selectable hysteresis. Selectable as a multiple of the minimum possible hysteresis level |
| stDeviceData.stSelection.stConfiguration.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stConfiguration.bResponseSpeed | BOOL | [READ_WRITE] The smallest sensing event the sensor is guaranteed to register |
| stDeviceData.stSelection.stConfiguration.bGainMode | BOOL | [READ_WRITE] In Auto Gain, the LV463 optimizes the gain during a TEACH/SET method for the presented condition(s) |

| Parameter name | Data type | Description |
|---|-----------|--|
| stDeviceData.stSelection.stConfiguration.bGainLevel | BOOL | [READ_WRITE] Current gain setting. In auto-gain this will be changed to reflect the optimal gain found during the TEACH/SET method |
| stDeviceData.stSelection.stConfiguration.bProcessDataFilterUpdateTime | BOOL | [READ_WRITE] Amount of time to collect averaged sample for process data (defaults to 2.6 ms - min cycle time) |
| stDeviceData.stSelection.stConfiguration.bDisplayOrientation | BOOL | [READ_WRITE] The display orientation can be reversed to accomodate any mounting orientation |
| stDeviceData.stSelection.stBdc1VendorSpecificConfiguration.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stStatistics.bAll | BOOL | [READ_ONLY] all parameters of complex data type |
| stDeviceData.stSelection.stAllTimeRunTime.bAll | BOOL | [READ_ONLY] all parameters of complex data type |
| stDeviceData.stSelection.stResetableRunTime.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stBdc1Status.bAll | BOOL | [READ_ONLY] all parameters of complex data type |
| stDeviceData.stSelection.stBdc1Status.bLowerThreshold | BOOL | [READ_ONLY] |
| stDeviceData.stSelection.stBdc1Status.bUpperThreshold | BOOL | [READ_ONLY] |
| stDeviceData.stSelection.stBdc1Status.bOutputStateQ1 | BOOL | [READ_ONLY] |
| stDeviceData.stSelection.stBdc1Status.bAlarmState | BOOL | [READ_ONLY] If any alarm is present, the sensors threshold(s) cannot be optimized. If a threshold warning is present the sensor's output will still continue to function. If a threshold error is present, the sensor's output will stop functioning |
| stDeviceData.stSelection.stQ1ObjectCounterDarkToLight.bAll | BOOL | [READ_WRITE] all parameters of complex data type |
| stDeviceData.stSelection.stQ1ObjectCounterLightToDark.bAll | BOOL | [READ_WRITE] 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.nSp1SingleValueTeach | UINT | [WRITE_ONLY] SP1 Single Value Teach |

| Parameter name | Data type | Description |
|---|-----------|--------------------------------------|
| stDeviceData.stData.stCommands.nSp1TwoValueTeachTp1 | UINT | [WRITE_ONLY] SP1 Two Value Teach TP1 |
| stDeviceData.stData.stCommands.nSp1TwoValueTeachTp2 | UINT | [WRITE_ONLY] SP1 Two Value Teach TP2 |
| stDeviceData.stData.stCommands.nSp1DynamicTeachStart | UINT | [WRITE_ONLY] SP1 Dynamic Teach Start |
| stDeviceData.stData.stCommands.nSp1DynamicTeachStop | UINT | [WRITE_ONLY] SP1 Dynamic Teach Stop |
| stDeviceData.stData.stCommands.nS1ExitTeach | UINT | [WRITE_ONLY] S1 Exit Teach |
| stDeviceData.stData.stCommands.nDisableEmitter | UINT | [WRITE_ONLY] Disable Emitter |
| stDeviceData.stData.stCommands.nEnableEmitter | UINT | [WRITE_ONLY] Enable Emitter |
| stDeviceData.stData.stCommands.nStopSensorSearch | UINT | [WRITE_ONLY] Stop Sensor Search |
| stDeviceData.stData.stCommands.nStartSensorSearch | UINT | [WRITE_ONLY] Start Sensor Search |
| stDeviceData.stData.stCommands.nBaselineNull | UINT | [WRITE_ONLY] Baseline Null |
| stDeviceData.stData.stCommands.nBaselineDisable | UINT | [WRITE_ONLY] Baseline Disable |
| 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.nIoLinkId | 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] |
| 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] |

| Parameter name | Data type | Description |
|--|-----------|--------------|
| 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.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.sFirmwareVersion | STRING | [READ_ONLY] |

| Parameter name | Data type | Description |
|--|-----------|--|
| stDeviceData.stData.sApplicationSpecificTag | 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.stDetailedDeviceStatus.sltem_3 | STRING | [READ_ONLY] |
| stDeviceData.stData.stDetailedDeviceStatus.sltem_4 | STRING | [READ_ONLY] |
| stDeviceData.stData.stDetailedDeviceStatus.sltem_5 | STRING | [READ_ONLY] |
| stDeviceData.stData.stDetailedDeviceStatus.sltem_6 | STRING | [READ_ONLY] |
| stDeviceData.stData.stTeachInChannel.nTeachInChannel | UINT | [READ_WRITE] Teach-in Channel |
| stDeviceData.stData.stTeachStatus.nTeachState | UINT | [READ_ONLY] Provides feedback on the status and the results of the teach-in activities |
| stDeviceData.stData.stTeachStatus.bSp1Tp1Flag | BOOL | [READ_ONLY] |
| stDeviceData.stData.stTeachStatus.bSp1Tp2Flag | BOOL | [READ_ONLY] |
| stDeviceData.stData.stTeachStatus.bSp2Tp1Flag | BOOL | [READ_ONLY] |
| stDeviceData.stData.stTeachStatus.bSp2Tp2Flag | BOOL | [READ_ONLY] |
| stDeviceData.stData.stBdc1Setpoints.nUpperThreshold | INT | [READ_WRITE] Switch point |
| stDeviceData.stData.stBdc1Setpoints.nSp2 | INT | [READ_WRITE] Unused |
| stDeviceData.stData.stBdc1Configuration.nBdcLogic | UINT | [READ_WRITE] LO/DO Selection |
| stDeviceData.stData.stBdc1Configuration.nBdcMode | UINT | [READ_WRITE] Defines how the binary switching information is created depending on Setpoint parameters (SP1, SP2) and the current measurement value |
| stDeviceData.stData.stBdc1Configuration.nHysteresis | UINT | [READ_WRITE] User selectable hysteresis. Selectable as a multiple of the minimum possible hysteresis level |
| stDeviceData.stData.stConfiguration.nResponseSpeed | UINT | [READ_WRITE] The smallest sensing event the sensor is guaranteed to register |
| stDeviceData.stData.stConfiguration.nGainMode | UINT | [READ_WRITE] In Auto Gain, the LV463 optimizes the gain during a TEACH/SET method for the presented condition(s) |

| Parameter name | Data type | Description |
|---|-----------|---|
| stDeviceData.stData.stConfiguration.nGainLevel | UINT | [READ_WRITE] Current gain setting. In auto-gain this will be changed to reflect the optimal gain found during the TEACH/SET method |
| stDeviceData.stData.stConfiguration.nProcessDataFilterUpdateTime | UINT | [READ_WRITE] Amount of time to collect averaged sample for process data (defaults to 2.6 ms - min cycle time) |
| stDeviceData.stData.stConfiguration.nDisplayOrientation | UINT | [READ_WRITE] The display orientation can be reversed to accomodate any mounting orientation |
| stDeviceData.stData.stBdc1VendorSpecificConfiguration.nDelayMode | UINT | [READ_WRITE] Select the type of delay to be used. Controls the meaning of the On and Off Delay values |
| stDeviceData.stData.stBdc1VendorSpecificConfiguration.nTimerOnDelayOff1Shot | UINT | [READ_WRITE] Off delay or on/off oneshot time. If configured in 1-shot mode, this parameter will have a minimum value of 1 ms. |
| stDeviceData.stData.stBdc1VendorSpecificConfiguration.nTimerOffDelayOn1Shot | UINT | [READ_WRITE] On delay time or additional delay time. In off-on delay mode, this parameter will be the ON Delay. In on-onshot mode, this parameter will be the on delay. In off-oneshot mode this parameter will be the off delay. |
| stDeviceData.stData.stBdc1VendorSpecificConfiguration.nTeachSelection | UINT | [READ_WRITE] The teach method to be used for a TEACH/SET performed from the front panel |
| stDeviceData.stData.stBdc1VendorSpecificConfiguration.nAutoThreshold | UINT | [READ_WRITE] The Auto Thresholds algorithm continuously tracks slow changes in the taught condition(s) and optimizes the threshold(s) to provide for reliable sensing |
| stDeviceData.stData.stStatistics.nNumberOfSamples | UINT | [READ_ONLY] Number of samples present in Sum and Sum-Squared - Only the first 32767 samples after the last read (approximately 3 seconds) are entered into the Sum, SumSquared, and Number of Samples |
| stDeviceData.stData.stStatistics.nSum | INT | [READ_ONLY] Sum of Signals in Counts - Compute the Mean Signal as: $\text{Mean} = \text{Sum} / \text{Number of Samples}$ |
| stDeviceData.stData.stStatistics.nMin_68 | INT | [READ_ONLY] Minimal signal measured since last read |

| Parameter name | Data type | Description |
|--|-----------|--|
| stDeviceData.stData.stStatistics.nMax_68 | INT | [READ_ONLY] Maximum signal measured since last read - All samples since the last read are entered into the Min/Max Signals |
| stDeviceData.stData.stStatistics.nBdc1LightDarkDarkTransitionCount | UINT | [READ_ONLY] Number of times sensor's BDC1 sensing state transitioned from the light to the dark state (will not incorporate on/off delays) - All samples since the last read are entered into the Transition Counts |
| stDeviceData.stData.stStatistics.nBdc1DarkLightLightTransitionCount | UINT | [READ_ONLY] Number of times sensor's BDC1 sensing state transitioned from the dark to the light state (will not incorporate on/off delays) |
| stDeviceData.stData.stAllTimeRunTime.nAllTimeRunTime | UINT | [READ_ONLY] A run time counter that can tracks the total time the sensor has been running since manufacture |
| stDeviceData.stData.stResetableRunTime.nResetableRunTime | UINT | [READ_WRITE] A run time counter that can be written by the user |
| stDeviceData.stData.stBdc1Status.nLowerThreshold | UINT | [READ_ONLY] |
| stDeviceData.stData.stBdc1Status.nUpperThreshold | UINT | [READ_ONLY] |
| stDeviceData.stData.stBdc1Status.nOutputStateQ1 | UINT | [READ_ONLY] |
| stDeviceData.stData.stBdc1Status.nAlarmState | UINT | [READ_ONLY] If any alarm is present, the sensors threshold(s) cannot be optimized. If a threshold warning is present the sensor's output will still continue to function. If a threshold error is present, the sensor's output will stop functioning |
| stDeviceData.stData.stQ1ObjectCounterDarkToLight.nObjectCounterDarkToLight | INT | [READ_WRITE] |
| stDeviceData.stData.stQ1ObjectCounterLightToDark.nObjectCounterLightToDark | INT | [READ_WRITE] |

Tab. 7.2: ST_Leuze_PD_LV463_513

| Parameter name | Data type | Description |
|--|-----------|-------------|
| ST_Leuze_PD_LV463_513.bBdc1OutputStateQ1 | BOOL | |
| ST_Leuze_PD_LV463_513.nProcessData | UINT | |

8 Parameter descriptions

Tab. 8.1: IODD parameter descriptions

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

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|----------------------------|-------|----------|-----------|---------|----|--------------------------|
| Commands | | | RecordT | | W | |
| Device Reset | | | UIntegerT | 128 | W | Device Reset |
| Application Reset | | | UIntegerT | 129 | W | Application Reset |
| Restore Factory Settings | | | UIntegerT | 130 | W | Restore Factory Settings |
| SP1 Single Value Teach | | | UIntegerT | 65 | W | SP1 Single Value Teach |
| SP1 Two Value Teach TP1 | | | UIntegerT | 67 | W | SP1 Two Value Teach TP1 |
| SP1 Two Value Teach TP2 | | | UIntegerT | 68 | W | SP1 Two Value Teach TP2 |
| SP1 Dynamic Teach Start | | | UIntegerT | 71 | W | SP1 Dynamic Teach Start |
| SP1 Dynamic Teach Stop | | | UIntegerT | 72 | W | SP1 Dynamic Teach Stop |
| S1 Exit Teach | | | UIntegerT | 79 | W | S1 Exit Teach |
| Disable Emitter | | | UIntegerT | 160 | W | Disable Emitter |
| Enable Emitter | | | UIntegerT | 161 | W | Enable Emitter |
| Stop Sensor Search | | | UIntegerT | 176 | W | Stop Sensor Search |
| Start Sensor Search | | | UIntegerT | 177 | W | Start Sensor Search |
| Baseline Null | | | UIntegerT | 178 | W | Baseline Null |
| Baseline Disable | | | UIntegerT | 179 | W | Baseline Disable |
| 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 | |
| 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 | |

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|------------------------------|-------|----------|-----------|---------|----|---|
| 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 | |
| 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 | |

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|-------------------------------|-------|----------|--------------|---------|----|--|
| Standard Command | 2 | 0 | UIntegerT | | W | (0 ... 63): Reserved 128: Device Reset 129: Application Reset 130: Restore Factory Settings (131 ... 159): Reserved 65: SP1 Single Value Teach 67: SP1 Two Value Teach TP1 68: SP1 Two Value Teach TP2 71: SP1 Dynamic Teach Start 72: SP1 Dynamic Teach Stop 79: S1 Exit Teach 160: Disable Emitter 161: Enable Emitter 176: Stop Sensor Search 177: Start Sensor Search 178: Baseline Null 179: Baseline Disable |
| 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 | |
| Vendor Name | 16 | 0 | StringT | | R | |
| Vendor Text | 17 | 0 | StringT | | R | |
| Product Name | 18 | 0 | StringT | | R | |
| Product ID | 19 | 0 | StringT | | R | |
| Product Text | 20 | 0 | StringT | | R | |
| Serial Number | 21 | 0 | StringT | | R | |
| Firmware Version | 23 | 0 | StringT | | R | |
| Application Specific Tag | 24 | 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 | |
| Teach-in Channel | 58 | 0 | RecordT | | RW | The parameter 'Teach-in Channel' allows addressing the particular BDC or a set of BDCs for which the teach-in commands apply. |

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|--------------------|-------|----------|-----------|---------|----|--|
| Teach-in Channel | 58 | 1 | UIntegerT | 0 | RW | Teach-in Channel 0: Default 1: BDC1 |
| Teach Status | 59 | 0 | RecordT | | R | Provides feedback on the status and the results of the teach-in activities (See IOL Smart Sensor Profile 12.4) |
| Teach State | 59 | 1 | UIntegerT | | R | Provides feedback on the status and the results of the teach-in activities 0: Idle 1: SP1 Success 2: SP2 Success 3: SP12 Success 4: Wait for Command 5: Busy 7: Error |
| SP1 TP1 Flag | 59 | 2 | BooleanT | | R | |
| SP1 TP2 Flag | 59 | 3 | BooleanT | | R | |
| SP2 TP1 Flag | 59 | 4 | BooleanT | | R | |
| SP2 TP2 Flag | 59 | 6 | BooleanT | | R | |
| BDC1 Setpoints | 60 | 0 | RecordT | | RW | The reference value used for sensor switching (See IOL Smart Sensor Profile 9.2.5) |
| upper threshold | 60 | 1 | IntegerT | 5000 | RW | Switch point |
| SP2 | 60 | 2 | IntegerT | 0 | RW | Unused |
| BDC1 Configuration | 61 | 0 | RecordT | | RW | Parameter coding of the Setpoint and Switchpoint parameter. (See IOL Smart Sensor Profile 9.2.6) |
| BDC Logic | 61 | 1 | UIntegerT | 128 | RW | LO/DO Selection 0: Light Operate 1: Dark Operate 128: Switch Select |
| BDC Mode | 61 | 2 | UIntegerT | 1 | RW | Defines how the binary switching information is created depending on Setpoint parameters (SP1, SP2) and the current measurement value 1: Single Point |
| Hysteresis | 61 | 3 | UIntegerT | 0 | RW | User selectable hysteresis. Selectable as a multiple of the minimum possible hysteresis level 0: small 1: medium 2: large |
| Configuration | 64 | 0 | RecordT | | RW | Vender specific user configuration options |

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|------------------------------------|-------|----------|-----------|---------|----|---|
| Response Speed | 64 | 1 | UIntegerT | 4 | RW | The smallest sensing event the sensor is guaranteed to register 0: 500 µS 1: 1000 µS 2: 2 ms 3: 8 ms 4: 24 ms |
| Gain Mode | 64 | 2 | UIntegerT | 1 | RW | In Auto Gain, the LV463 optimizes the gain during a TEACH/SET method for the presented condition(s) 0: Fixed Gain 1: Auto Gain |
| Gain Level | 64 | 3 | UIntegerT | 5 | RW | Current gain setting. In auto-gain this will be changed to reflect the optimal gain found during the TEACH/SET method 0: Gain 1 1: Gain 2 2: Gain 3 3: Gain 4 4: Gain 5 5: Gain 6 6: Gain 7 |
| Process Data Filter Update Time | 64 | 4 | UIntegerT | 0 | RW | Amount of time to collect averaged sample for process data (defaults to 2.6 ms - min cycle time) |
| Display Orientation | 64 | 5 | UIntegerT | 0 | RW | The display orientation can be reversed to accomodate any mounting orientation 0: Normal 1: Flipped |
| BDC1 Vendor Specific Configuration | 65 | 0 | RecordT | | RW | Vendor specific user selectable BDC settings |
| Delay Mode | 65 | 1 | UIntegerT | 0 | RW | Select the type of delay to be used. Controls the meaning of the On and Off Delay values 0: Disabled 1: Off-On Delay 2: Off Oneshot 3: On Oneshot |
| Timer ON Delay / OFF 1-Shot | 65 | 2 | UIntegerT | 0 | RW | Off delay or on/off oneshot time. If configured in 1-shot mode, this parameter will have a minimum value of 1 ms. (0 ... 9999) |
| Timer OFF Delay / ON 1-Shot | 65 | 3 | UIntegerT | 0 | RW | On delay time or additonal delay time. In off-on delay mode, this parameter will be the ON Delay. In on-onshot mode, this parameter will be the on delay. In off-oneshot mode this parameter will be the off delay. (0 ... 9999) |

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|--|-------|----------|-----------|---------|----|---|
| TEACH Selection | 65 | 4 | UIntegerT | 0 | RW | The teach method to be used for a TEACH/SET performed from the front panel 0: Single Point Set 1: Two-Point Teach 2: Dynamic Teach |
| Auto Threshold | 65 | 5 | UIntegerT | 0 | RW | The Auto Thresholds algorithm continuously tracks slow changes in the taught condition(s) and optimizes the threshold(s) to provide for reliable sensing 0: Disabled 1: Enabled |
| Statistics | 68 | 0 | RecordT | | R | - All statistics are reset on every read - Example statistics procedure: - Read the statistics to reset the statistics - Read the statistics again, or periodically |
| Number of Samples | 68 | 1 | UIntegerT | | R | Number of samples present in Sum and Sum-Squared - Only the first 32767 samples after the last read (approximately 3 seconds) are entered into the Sum, SumSquared, and Number of Samples |
| Sum | 68 | 2 | IntegerT | | R | Sum of Signals in Counts - Compute the Mean Signal as: $\text{Mean} = \text{Sum} / \text{Number of Samples}$ |
| Min | 68 | 4 | IntegerT | | R | Minimal signal measured since last read |
| Max | 68 | 5 | IntegerT | | R | Maximum signal measured since last read - All samples since the last read are entered into the Min/Max Signals |
| BDC1 Light-dark;Dark Transition Count | 68 | 6 | UIntegerT | | R | Number of times sensor's BDC1 sensing state transitioned from the light to the dark state (will not incorporate on/off delays) - All samples since the last read are entered into the Transition Counts |
| BDC1 Dark-light;Light Transition Count | 68 | 7 | UIntegerT | | R | Number of times sensor's BDC1 sensing state transitioned from the dark to the light state (will not incorporate on/off delays) |
| All-time Run Time | 69 | 0 | RecordT | | R | A run time counter that can tracks the total time the sensor has been running since manufacture |
| All-time Run Time | 69 | 1 | UIntegerT | | R | A run time counter that can tracks the total time the sensor has been running since manufacture |
| Resetable Run Time | 70 | 0 | RecordT | | RW | A run time counter that can be written by the user |
| Resetable Run Time | 70 | 1 | UIntegerT | | RW | A run time counter that can be written by the user |
| BDC1 Status | 71 | 0 | RecordT | | R | Status related to the BDC output channel. |
| Lower Threshold | 71 | 1 | UIntegerT | | R | |
| Upper Threshold | 71 | 2 | UIntegerT | | R | |
| Output State (Q1) | 71 | 3 | UIntegerT | | R | 0: Inactive 1: Active |

| Parameter | Index | Subindex | Data type | Default | AR | Description |
|-----------------------------------|-------|----------|-----------|---------|----|--|
| Alarm State | 71 | 4 | UIntegerT | | R | <p>If any alarm is present, the sensors threshold(s) cannot be optimized. If a threshold warning is present the sensor's output will still continue to function. If a threshold error is present, the sensor's output will stop functioning</p> <p>0: No alarm present 1: Threshold Warning 2: Threshold Error</p> |
| Q1 Object Counter - Dark to Light | 207 | 0 | RecordT | | RW | Number of dark to light sensing transitions seen by the sensor (reset on power ON). |
| Object Counter - Dark to Light | 207 | 1 | IntegerT | | RW | |
| Q1 Object Counter - Light to Dark | 208 | 0 | RecordT | | RW | Number of light to dark sensing transitions seen by the sensor (reset on power ON). |
| Object Counter - Light to Dark | 208 | 1 | IntegerT | | RW | |

9 Technical specifications

9.1 General data

Tab. 9.1: Sensor and IODD version

| | |
|-------------------|--|
| IODD version | V1.0.0 |
| IODD release date | 2016-11-9 |
| Device family | LV463 |
| Device ID | 513 |
| Device name | LV463.XR |
| Device variants | LV463.XR7/L4 (50134008), LV463.XR7/L4-M8 (50134007), LV463.XR7/L4-150-M12 (50134009) |