

 **IO-Link**
PLUG. SET. PLAY.



E-BOX XL IO-LINK

IO-Link Interface Description

Version 1.2, 04/2026

Table of contents

1	Product variants	4
2	Description	8
2.1	Device structure	8
2.2	Mounting	8
2.3	Pin assignment	9
2.4	Electrical connection	10
3	Communication	11
4	Parameter overview	12
5	System commands	15
6	Process data overview	16
6.1	Process data in (PDin)	17
6.1.1	Byte 0-5: Mounting positions	17
6.1.2	Byte 6: I/Os	17
6.1.3	Byte 7: Validity & Device Status Index	17
6.2	Process data out (PDout)	18
6.2.1	Byte 0-5: Mounting positions	18
6.2.2	Byte 6: I/Os	18
6.2.3	Byte 7: Reserved	18

6.2.4	Reaction on invalid process data	19
7	Operation	20
7.1	Device Identification Parameters.....	20
7.2	Contacts of mounting positions	20
7.3	Illumination	22
7.4	Buzzer	26
7.5	I/Os.....	28
7.6	Firmware Update	29
7.6.1	Updating scenario.....	29
7.6.2	Manual disabling of the update capability / interface	30
7.7	Diagnosis.....	30
7.7.1	Status LED	30
7.7.2	Events.....	31
7.7.3	Error Types.....	32
7.7.4	Diagnosis Parameters.....	33
8	Support	34
9	Disclaimer	35

1 Product variants

Device ID for all variants: 0x030010 (hex.) 196624 (dec.)

Article Number + Product ID	Product Name + Description	Product URI	Picture
1.24.300.001/0000	E-BOX XL IO-LINK 3.00MP0001 3x Pushbutton each 1 NO tactile feedback & RGB LED	https://ecatalog.rafi-group.com/1243000010000	
1.24.310.001/0000	E-BOX XL IO-LINK 3.10MP0002 3x Pushbutton each 1 NO tactile feedback & RGB LED, Input/Output M12 socket	https://ecatalog.rafi-group.com/1243100010000	
1.24.303.001/0000	E-BOX XL IO-LINK 3.03MP0003 2x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop	https://ecatalog.rafi-group.com/1243030010000	
1.24.313.001/0000	E-BOX XL IO-LINK 3.13MP0004 2x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop, Input/Output M12 socket	https://ecatalog.rafi-group.com/1243130010000	
1.24.400.001/0000	E-BOX XL IO-LINK 4.00MP0001 4x Pushbutton each 1 NO tactile feedback & RGB LED	https://ecatalog.rafi-group.com/1244000010000	

Article Number + Product ID	Product Name + Description	Product URI	Picture
1.24.410.001/0000	E-BOX XL IO-LINK 4.10MP0002 4x Pushbutton each 1 NO tactile feedback & RGB LED, Input/Output M12 socket	https://ecatalog.rafi-group.com/1244100010000	
1.24.403.001/0000	E-BOX XL IO-LINK 4.03MP0003 3x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop	https://ecatalog.rafi-group.com/1244030010000	
1.24.413.001/0000	E-BOX XL IO-LINK 4.13MP0004 3x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop, Input/Output M12 socket	https://ecatalog.rafi-group.com/1244130010000	
1.24.413.002/0000	E-BOX XL IO-LINK 4.13MP0005 1x Selector switch 2x 60°, 1x pushbutton 1 NO tactile feedback, 1x buzzer, 1x e-stop, Input/Output M12 socket	https://ecatalog.rafi-group.com/1244130020000	
1.24.500.001/0000	E-BOX XL IO-LINK 5.00MP0001 5x Pushbutton each 1 NO tactile feedback & RGB LED	https://ecatalog.rafi-group.com/1245000010000	
1.24.510.001/0000	E-BOX XL IO-LINK 5.10MP0002 5x Pushbutton each 1 NO tactile feedback & RGB LED, Input/Output M12 socket	https://ecatalog.rafi-group.com/1245100010000	
1.24.503.001/0000	E-BOX XL IO-LINK 5.03MP0003 4x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop	https://ecatalog.rafi-group.com/1245030010000	

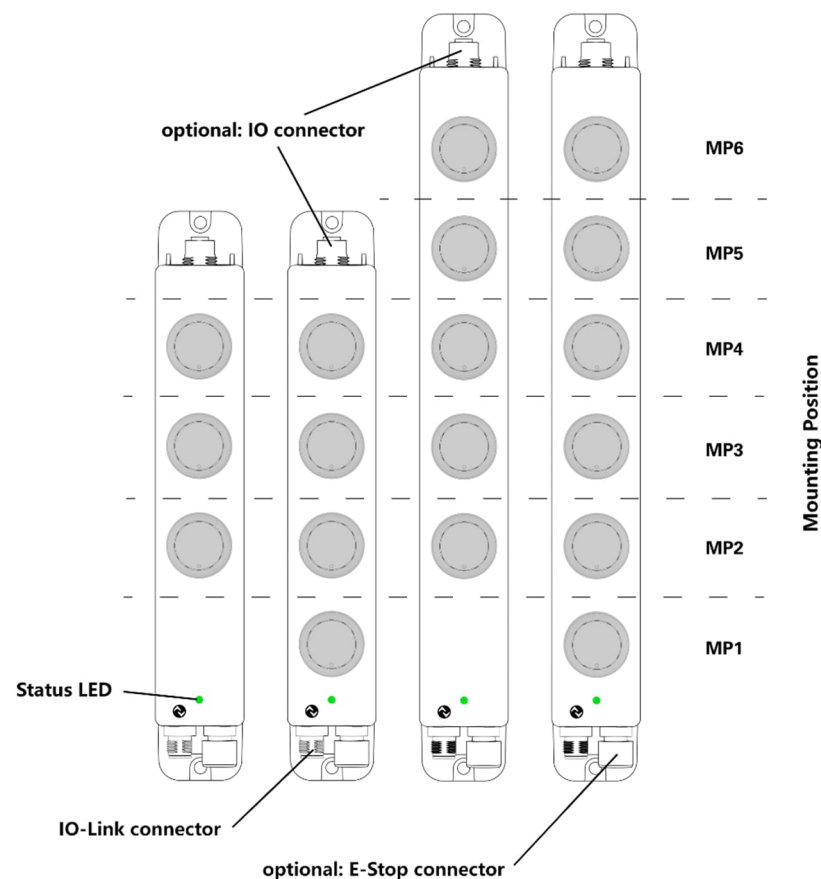
Article Number + Product ID	Product Name + Description	Product URI	Picture
1.24.513.001/0000	E-BOX XL IO-LINK 5.13MP0004 4x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop, Input/Output M12 socket	https://ecatalog.rafi-group.com/1245130010000	
1.24.600.001/0000	E-BOX XL IO-LINK 6.00MP0001 6x Pushbutton each 1 NO tactile feedback & RGB LED	https://ecatalog.rafi-group.com/1246000010000	
1.24.610.001/0000	E-BOX XL IO-LINK 6.10MP0002 6x Pushbutton each 1 NO tactile feedback & RGB LED, Input/Output M12 socket	https://ecatalog.rafi-group.com/1246100010000	
1.24.603.001/0000	E-BOX XL IO-LINK 6.03MP0003 5x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop	https://ecatalog.rafi-group.com/1246030010000	
1.24.613.001/0000	E-BOX XL IO-LINK 6.13MP0004 5x Pushbutton each 1 NO tactile feedback & RGB LED, 1x e-stop, Input/Output M12 socket	https://ecatalog.rafi-group.com/1246130010000	
1.24.613.002/0000	E-BOX XL IO-LINK 6.13MP0005 1x Buzzer, 3x pushbutton each 1 NO tactile feedback, 1x selector switch 2x 60°, 1x e-stop, Input/Output M12 socket	https://ecatalog.rafi-group.com/1246130020000	



You will find more technical data or drawings in our [eCatalog](#) for the specified products. Downloads such as the IODD or IO-Link manufacturer's declaration of conformity and more are also available there.

2 Description

2.1 Device structure



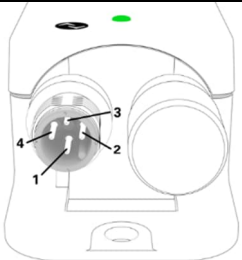
Mounting positions (MP) can be pushbuttons, mushroom pushbuttons, emergency stops, selector switches, keylock switches, signal indicators and buzzers.

2.2 Mounting

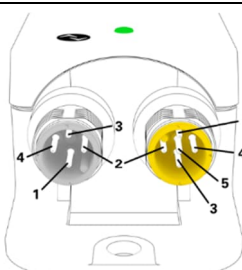
Use a flat mounting surface for installation. Fix the device to the mounting surface with two mounting screws with a diameter of max. 5.3 mm and a head diameter of max. 9.5 mm. A tightening torque of 2 Nm is recommended for the mounting screws.

2.3 Pin assignment

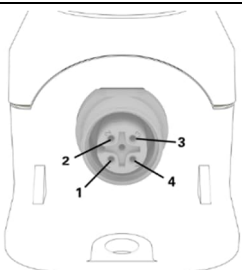
M12 male, 4-pin, A-coded for IO-Link communication + Power supply

	Pin 1	24 V (L+)
	Pin 2	n.c.
	Pin 3	0 V (L-)
	Pin 4	C/Q (IO-Link data line)

M12 male, 5-pin, A-coded for the NC contacts of the emergency stop

	Pin 1	Normally-closed contact 1
	Pin 2	Normally-closed contact 2
	Pin 3	n.c.
	Pin 4	Normally-closed contact 1
	Pin 5	Normally-closed contact 2

M12 female, 4-pin, A-coded for digital I/O functionality

	Pin 1	I/O 1
	Pin 2	I/O 2
	Pin 3	I/O 3
	Pin 4	I/O 4

2.4 Electrical connection

A qualified electrician must connect the device. Observe the national and international regulations for the installation of electrical equipment.

The device is only suitable for operation on SELV/PELV voltages and must be supplied with power exclusively via an IO-Link master. If you are using an E-BOX XL IO-LINK variant with I/Os, please check chapter 7.5.

The IP rating depends on the individual degree of protection of the device, the connecting elements used and the corresponding protective covers.

For UL applications:

For connecting the device use UL certificated cables of category CYJV or PVVA.

3 Communication

Vendor ID	1343 (dec.), 0x053F (hex.)
Vendor Name	RAFI GmbH and Co. KG
Vendor Text	www.rafi-group.com
Vendor URL	www.rafi-group.com/io-link
Device ID	196624 (dec.), 0x030010 (hex.)
IO-Link Revision	1.1.4
Bit rate	COM2 / 38.4 kBaud
Minimum cycle time	6.2 ms
Data length of Process Data	PDin 8 bytes / PDout 8 bytes
SIO mode supported	No
Block parameterization	Yes
Data storage	Yes
IO-Link Application Profiles	Common Profile: Identification & Diagnosis Firmware-Update Profile
IO-Link Function Classes	Common Profile: Device Identification, Process Data Variable, Device Diagnosis, Extended Identification, Locator, Product URI
Connection type	M12 – 4 pin (IO-Link communication + Power supply)

4 Parameter overview

Name	Index (dec.)	Sub-index (dec.)	Data type	Access right	Data Storage	Default value
Direct Parameter Page 1	0	0	RecordT	R	No	
Direct Parameter Page 2	1	0	RecordT	R/W	No	
System Command	2	0	UIntegerT (8 Bit)	W	No	
Data Storage Index	3	0	RecordT	R/W	No	
Device-Access-Locks	12	0	RecordT (16 Bit)	R/W	No	
Profile-Characteristic	13	0	ArrayT of UIntegerT16	R	No	
PDinput-Descriptor	14	0	ArrayT of OctetStringT3	R	No	
PDoutput-Descriptor	15	0	ArrayT of OctetStringT3	R	No	
Vendor Name	16	0	StringT (20 Byte)	R	No	RAFI GmbH and Co. KG
Vendor Text	17	0	StringT (18 Byte)	R	No	www.rafi-group.com
Product Name	18	0	StringT (27 Byte)	R	No	See product variants
Product ID	19	0	StringT (18 Byte)	R	No	See product variants
Product Text	20	0	StringT (64 Byte)	R	No	
Serial Number	21	0	StringT (16 Byte)	R	No	
Hardware Revision	22	0	StringT (64 Byte)	R	No	
Firmware Revision	23	0	StringT (64 Byte)	R	No	
Application Specific Tag	24	0	StringT (32 Byte)	R/W	Yes	***
Function Tag	25	0	StringT (32 Byte)	R/W	Yes	***
Location Tag	26	0	StringT (32 Byte)	R/W	Yes	***
Product URI	27	0	StringT (100 Byte)	R	No	See product variants
Error Count	32	0	UIntegerT (16 Bit)	R	No	
Device Status	36	0	UIntegerT (8 Bit)	R	No	
Detailed-Device-Status	37	0	ArrayT of OctetStringT3	R	No	
ProcessDataInput	40	0	RecordT (8 Byte)	R	No	
ProcessDataOutput	41	0	RecordT (8 Byte)	R	No	
Night Mode Configuration	100	0	UIntegerT (8 Bit)	R/W	Yes	0 (Activation with Process Data)
Night Mode Mounting Position 1	101	0	UIntegerT (8 Bit)	R/W	Yes	2 (Brightness of 50%)
Night Mode Mounting Position 2	102	0	UIntegerT (8 Bit)	R/W	Yes	2 (Brightness of 50%)
Night Mode Mounting Position 3	103	0	UIntegerT (8 Bit)	R/W	Yes	2 (Brightness of 50%)
Night Mode Mounting Position 4	104	0	UIntegerT (8 Bit)	R/W	Yes	2 (Brightness of 50%)
Night Mode Mounting Position 5	105	0	UIntegerT (8 Bit)	R/W	Yes	2 (Brightness of 50%)
Night Mode Mounting Position 6	106	0	UIntegerT (8 Bit)	R/W	Yes	2 (Brightness of 50%)
Blink Mode Configuration	120	0	UIntegerT (8 Bit)	R/W	Yes	0 (Activation with Process Data)

Name	Index (dec.)	Sub-index (dec.)	Data type	Access right	Data Storage	Default value
Blink Mode Mounting Position 1	121	0	UIntegerT (8 Bit)	R/W	Yes	0 (Constant light)
Blink Mode Mounting Position 2	122	0	UIntegerT (8 Bit)	R/W	Yes	0 (Constant light)
Blink Mode Mounting Position 3	123	0	UIntegerT (8 Bit)	R/W	Yes	0 (Constant light)
Blink Mode Mounting Position 4	124	0	UIntegerT (8 Bit)	R/W	Yes	0 (Constant light)
Blink Mode Mounting Position 5	125	0	UIntegerT (8 Bit)	R/W	Yes	0 (Constant light)
Blink Mode Mounting Position 6	126	0	UIntegerT (8 Bit)	R/W	Yes	0 (Constant light)
Operating Cycles Mounting Position 1	130	0	UIntegerT (32 Bit)	R	No	
Operating Cycles Mounting Position 2	131	0	UIntegerT (32 Bit)	R	No	
Operating Cycles Mounting Position 3	132	0	UIntegerT (32 Bit)	R	No	
Operating Cycles Mounting Position 4	133	0	UIntegerT (32 Bit)	R	No	
Operating Cycles Mounting Position 5	134	0	UIntegerT (32 Bit)	R	No	
Operating Cycles Mounting Position 6	135	0	UIntegerT (32 Bit)	R	No	
Variable Color 1						Orange
R-Value Color 1	140	0	UIntegerT (8 Bit)	R/W	Yes	255
G-Value Color 1	141	0	UIntegerT (8 Bit)	R/W	Yes	140
B-Value Color 1	142	0	UIntegerT (8 Bit)	R/W	Yes	0
Variable Color 2						Cyan
R-Value Color 2	143	0	UIntegerT (8 Bit)	R/W	Yes	54
G-Value Color 2	144	0	UIntegerT (8 Bit)	R/W	Yes	204
B-Value Color 2	145	0	UIntegerT (8 Bit)	R/W	Yes	204

Name	Index (dec.)	Sub-index (dec.)	Data type	Access right	Data Storage	Default value
Variable Color 3						Magenta
R-Value Color 3	146	0	UIntegerT (8 Bit)	R/W	Yes	255
G-Value Color 3	147	0	UIntegerT (8 Bit)	R/W	Yes	0
B-Value Color 3	148	0	UIntegerT (8 Bit)	R/W	Yes	255
Buzzer Volume	150	0	UIntegerT (8 Bit)	R/W	Yes	0 (Controlled via Process-Data)
Buzzer Sound Mode	151	0	UIntegerT (8 Bit)	R/W	Yes	0 (Controlled via Process-Data)
Mode I/O 1	170	0	UIntegerT (8 Bit)	R/W	Yes	2 (Constant 24 V)
Mode I/O 2	171	0	UIntegerT (8 Bit)	R/W	Yes	0 (Input)
Mode I/O 3	172	0	UIntegerT (8 Bit)	R/W	Yes	2 (Constant 0 V)
Mode I/O 4	173	0	UIntegerT (8 Bit)	R/W	Yes	0 (Input)
Emergency Stop Configuration	180	0	UIntegerT (8 Bit)	R/W	Yes	0 (Adjustable Emergency Stop illumination)
Firmware-Update Configuration	190	0	UIntegerT (8 Bit)	R/W	No	0 (FW-Update enabled)

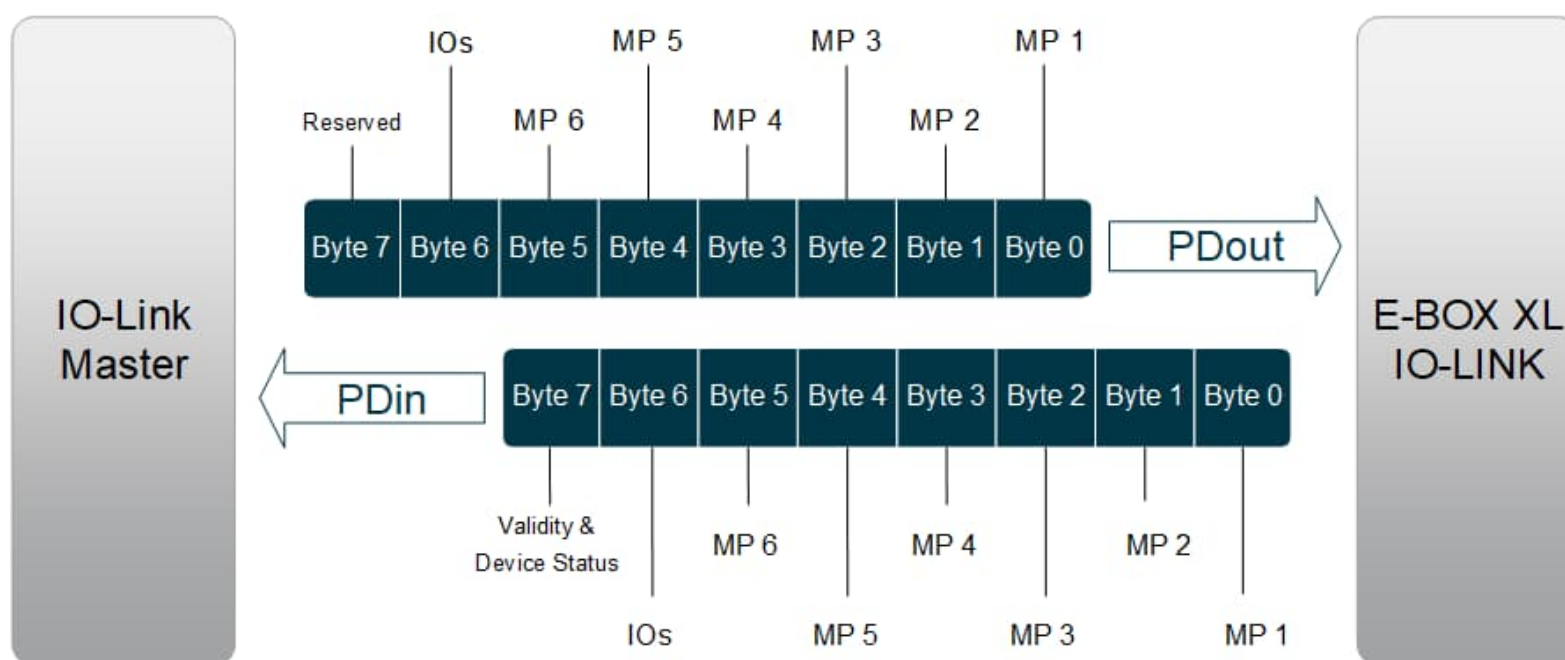
5 System commands

Address Index 2, Subindex 0
 Datatype UIntegerT (8 Bit)
 Access right Write Only (W)

Commands (hex.)	Commands (dec.)	Text	Description
0x01	1	ParamUploadStart	Start parameter upload
0x02	2	ParamUploadEnd	Stop parameter upload
0x03	3	ParamDownloadStart	Start parameter download
0x04	4	ParamDownloadEnd	Stop parameter download
0x05	5	ParamDownloadStore	Finalize parameterization and start Data Storage
0x06	6	ParamBreak	Cancel all parameter commands
0x7E	126	Locator Start	The visual indicators of the device are switched to the localization display pattern, which makes it easier to spot a device in an application.
0x7F	127	Locator Stop	The localization indication pattern is stopped. The optical indicators of the device will show again the device specific states of operation.
0x80	128	Device reset	Reset to initial state
0x81	129	Application reset	Reset the application specific parameters
0x83	131	Back-to-box	Restore parameters to the original delivery values without any interaction with upper-level mechanisms
0xA0	160	Disable Firmware-Update Feature	Permanently disable the FW-Update feature

6 Process data overview

The E-BOX XL IO-LINK has eight bytes of process input as well as process output data. The first six bytes describe the mounting positions in the order described in chapter 2.1. For variants featuring digital I/Os, Byte 6 is used to read and control the I/O signals. Byte 7 of the process input data contains information about the device status.



6.1 Process data in (PDin)

6.1.1 Byte 0-5: Mounting positions

The first six bytes of process data are used to get the switching signal of the actuators on mounting position 1 to 6. Each byte represents one mounting position. If no switching function is to be expected for the mounting position the corresponding byte always returns the value 0x00.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Contact 1								1/0
Contact 2							1/0	

6.1.2 Byte 6: I/Os

Byte 6 represents the status of the digital input signals. The first four bits are each mapped to one pin of the M12 I/O connector.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Digital Input 1								1/0
Digital Input 2							1/0	
Digital Input 3						1/0		
Digital Input 4					1/0			

6.1.3 Byte 7: Validity & Device Status Index

Byte 7 is used to communicate the device status.

The Validity Bit 0 is used to communicate errors which result in the process data losing validity. If this bit has the value 0 failures are pending and the device does not work properly. If a 1 is sent, no failures are pending.

The remaining seven bits are used to cyclically transmit the device status additionally to its implementation in parameter 36.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Validity								1/0
Device Status	According to 7.11 Diagnosis Parameter							

6.2 Process data out (PDout)

6.2.1 Byte 0-5: Mounting positions

Similar to the mapping of the PDin data, the first six bytes of the process output data each represents one mounting position. Depending on the type of actuator either acoustic or visual feedback can be activated and configured individually for each mounting position via the corresponding PDout byte. A detailed description on how to use process and parameter data to configure the illumination and acoustic feedback is given in chapter 7.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Activate Illumination/Buzzer								1/0
Color/Volume					1/0	1/0	1/0	
Blink Mode/Sound Mode		1/0	1/0	1/0				
Night Mode	1/0							

6.2.2 Byte 6: I/Os

Byte 6 is used to set the level of the digital output pins on the M12 I/O connector. Per default all digital I/Os are configured as input only. For the values of this process data byte to take effect, they first have to be set as an output. A detailed description of the digital outputs and how to use them is given in chapter 7.5.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output 1								1/0
Output 2							1/0	
Output 3						1/0		
Output 4					1/0			

6.2.3 Byte 7: Reserved

Byte 7 of the process output data is currently reserved, therefore any values transmitted on this byte will not be interpreted by the device.

6.2.4 Reaction on invalid process data

If the IO-Link master sets the process data output (PDout) to invalid, the E-BOX XL IO-LINK retains the last valid state of all illumination outputs at the respective mounting positions, as well as the current levels of all configured IO connector pins. No changes to any output will be applied for as long as the invalid state persists. Valid process data must be restored by the master to resume normal output control.

7 Operation

7.1 Device Identification Parameters

Name	Index	Sub-index	Data type	Access rights	Default value	Description
Vendor Name	16	0	StringT (20 Byte)	R	RAFI GmbH and Co. KG	
Vendor Text	17	0	StringT (18 Byte)	R	www.rafi-group.com	
Product Name	18	0	StringT (27 Byte)	R	See product variants	
Product ID	19	0	StringT (18 Byte)	R	See product variants	
Product Text	20	0	StringT (64 Byte)	R	See product variants	Additional product information for the device
Serial Number	21	0	StringT (16 Byte)	R		16-digit serial number
Hardware Revision	22	0	StringT (64 Byte)	R		Hardware Revision in the format: xx (e.g., 01)
Firmware Revision	23	0	StringT (64 Byte)	R		Firmware Revision in the format: x.x.x (e.g., 1.0.0)
Application Specific Tag	24	0	StringT (32 Byte)	R/W	***	Possibility to mark a device with user-specific application identification
Function Tag	25	0	StringT (32 Byte)	R/W	***	Possibility to mark a device with user-specific function identification
Location Tag	26	0	StringT (32 Byte)	R/W	***	Possibility to mark a device with user-specific location identification
Hardware Identification Key	17342	0	StringT (19 Byte)	R	IO-Link control box	Unique hardware identifier

7.2 Contacts of mounting positions

Each mounting position of the E-BOX XL IO-LINK is represented by a single byte in the process output data. As shown in chapter 6 those bytes transmit the status of up to two contacts.

Pushbuttons

If the button is pressed down the value of the first contact bit is 1. Upon release this value changes to 0.

The second contact bit is not used and always returns 0.

Emergency stop

If the emergency stop is pressed, the value of the first contact bit is 1. Upon reset this value changes to 0 again.

In addition to the normally-open signal transmitted via the IO-Link process input data, two normally-closed contacts are wired directly to the second M12 connector. Following characteristics apply to those normally-closed contacts:

- Rated voltage, min.: 20 mV
- Rated voltage, max.: 35 V
- Rated current, min.: 1 mA
- Rated current, max.: 100 mA
- Rated power, max.: 0.25 W
- Categories of use: AC-15, DC-13

Selector and key switch

In the default position the byte representing the selector and key switch has the value 0x00. When the switch is moved counterclockwise contact 1 (bit 0) changes to 1. If the switch is moved clockwise contact 2 (bit 1) changes to 1.

Buzzer and indicator light

Since buzzer and indicator lights do not feature contact functionalities the PDout byte for those mounting positions always returns the value 0x00.

Operating cycles counter

For each switch and pushbutton, the number of operating cycles is automatically monitored by the device. The current operating cycles count can be accessed via index 130-135. When the operating cycle count exceeds 90% of the maximum operating cycles specified for the actuator and contact block in use, a warning is triggered. Upon reaching 100% of operating cycles, an error event is triggered. A more detailed description of this mechanism is given in chapter 7.7.

Name	Index (dec.)	Sub-index	Data type	Access right
Operating Cycles Position 1	130	0	UIntegerT (32 Bit)	R
Operating Cycles Position 2	131	0	UIntegerT (32 Bit)	R
Operating Cycles Position 3	132	0	UIntegerT (32 Bit)	R
Operating Cycles Position 4	133	0	UIntegerT (32 Bit)	R
Operating Cycles Position 5	134	0	UIntegerT (32 Bit)	R
Operating Cycles Position 6	135	0	UIntegerT (32 Bit)	R

7.3 Illumination

The RGB illumination of pushbuttons, selector switches and the emergency stop can be fully configured via the IO-Link interface.

By default, the illumination is activated and configured via the process data.

Each control element is represented by a single byte in the process output data.

To turn on the illumination set bit 0 of the corresponding process output data byte to 1, set it to 0 to deactivate the illumination.

The combination of bit 1 to 3 is used to set the color. The respective coding can be taken from the table below. Depending on which bit combination is sent, the actuator illuminates in a different color. The colors red, green, blue, white and yellow are fixed. Default values are set for the variable colors, but those can be changed via parameter data.

For the three variable colors, the RGB values are freely configurable. If the parameters of the variable colors are not changed, the colors orange, cyan and magenta are available as default values.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Red					0	0	0	(1)
Green					0	0	1	(1)
Blue					0	1	0	(1)
White					0	1	1	(1)
Yellow					1	0	0	(1)
Variable Color 1					1	0	1	(1)
Variable Color 2					1	1	0	(1)
Variable Color 3					1	1	1	(1)

Different blinking patterns can be selected by bit 4 to 6 of the process output data. The coding of these bits is described in the table below:

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Mode 1: Constant light up		0	0	0				(1)
Mode 2: 1 Hz / 50 % Duty Cycle		0	0	1				(1)
Mode 3: 2 Hz / 50 % Duty Cycle		0	1	0				(1)
Mode 4: 1 Hz / 80 % Duty Cycle		0	1	1				(1)
Mode 5: 2 Hz / 80 % Duty Cycle		1	0	0				(1)

By setting the parameter at index 120 to 1, it is also possible to set the blink mode via parameter data. In this mode the blinking pattern for each illuminable mounting position is determined by the value of parameter 121-126, meanwhile the corresponding process data bits are ignored.

Name	Index (dec.)	Sub-index	Data type	Access right	Default value	Value range
Blink Mode Mounting Position 1	121	0	UIntegerT (8 Bit)	R/W	0 (Constant light)	0 (Constant light) 1 (1 Hz / 50% Duty Cycle) 2 (2 Hz / 50% Duty Cycle) 3 (1 Hz / 80% Duty Cycle) 4 (2 Hz / 80% Duty Cycle)
Blink Mode Mounting Position 2	122	0	UIntegerT (8 Bit)	R/W	0 (Constant light)	0 (Constant light) 1 (1 Hz / 50% Duty Cycle) 2 (2 Hz / 50% Duty Cycle) 3 (1 Hz / 80% Duty Cycle) 4 (2 Hz / 80% Duty Cycle)

Blink Mode Mounting Position 3	123	0	UIntegerT (8 Bit)	R/W	0 (Constant light)	0 (Constant light) 1 (1 Hz / 50% Duty Cycle) 2 (2 Hz / 50% Duty Cycle) 3 (1 Hz / 80% Duty Cycle) 4 (2 Hz / 80% Duty Cycle)
Blink Mode Mounting Position 4	124	0	UIntegerT (8 Bit)	R/W	0 (Constant light)	0 (Constant light) 1 (1 Hz / 50% Duty Cycle) 2 (2 Hz / 50% Duty Cycle) 3 (1 Hz / 80% Duty Cycle) 4 (2 Hz / 80% Duty Cycle)
Blink Mode Mounting Position 5	125	0	UIntegerT (8 Bit)	R/W	0 (Constant light)	0 (Constant light) 1 (1 Hz / 50% Duty Cycle) 2 (2 Hz / 50% Duty Cycle) 3 (1 Hz / 80% Duty Cycle) 4 (2 Hz / 80% Duty Cycle)
Blink Mode Mounting Position 6	126	0	UIntegerT (8 Bit)	R/W	0 (Constant light)	0 (Constant light) 1 (1 Hz / 50% Duty Cycle) 2 (2 Hz / 50% Duty Cycle) 3 (1 Hz / 80% Duty Cycle) 4 (2 Hz / 80% Duty Cycle)

Night mode

The night mode setting allows to configure the brightness of the illumination. The brightness can be set globally or individually for each button.

The night mode configuration parameter at index 100 is used to configure how to set the brightness level.

Per default bit 7 of the corresponding process output data byte is used to activate the night mode. The brightness for each mounting position then can be configured via indices 101 to 106.

Alternatively, by setting the night mode configuration to 1, the process data bit will be ignored and the brightness values defined in parameter 101-106 are taken into account directly.

The third possibility is to set the same brightness for all mounting positions by writing the values 2-5 into index 100. In this case bit 7 of the PDout data as well as the values in index 101 to 106 are ignored.

Name	Index (dec.)	Sub- index	Data type	Access right	Default value	Value range
Night Mode Configuration	100	0	UIntegerT (8 Bit)	R/W	0 (Activation with Process Data)	0 (Activation with Process Data) 1 (Activation with Parameter-Data) 2 (Brightness Global 100%) 3 (Brightness Global 75%) 4 (Brightness Global 50%) 5 (Brightness Global 25%)
Night Mode Mounting Position 1	101	0	UIntegerT (8 Bit)	R/W	2 (Brightness 50%)	0 (Brightness 100%) 1 (Brightness 75%) 2 (Brightness 50%) 3 (Brightness 25%)
Night Mode Mounting Position 2	102	0	UIntegerT (8 Bit)	R/W	2 (Brightness 50%)	0 (Brightness 100%) 1 (Brightness 75%) 2 (Brightness 50%) 3 (Brightness 25%)
Night Mode Mounting Position 3	103	0	UIntegerT (8 Bit)	R/W	2 (Brightness 50%)	0 (Brightness 100%) 1 (Brightness 75%) 2 (Brightness 50%) 3 (Brightness 25%)
Night Mode Mounting Position 4	104	0	UIntegerT (8 Bit)	R/W	2 (Brightness 50%)	0 (Brightness 100%) 1 (Brightness 75%) 2 (Brightness 50%) 3 (Brightness 25%)
Night Mode Mounting Position 5	105	0	UIntegerT (8 Bit)	R/W	2 (Brightness 50%)	0 (Brightness 100%) 1 (Brightness 75%) 2 (Brightness 50%) 3 (Brightness 25%)
Night Mode Mounting Position 6	106	0	UIntegerT (8 Bit)	R/W	2 (Brightness 50%)	0 (Brightness 100%) 1 (Brightness 75%) 2 (Brightness 50%) 3 (Brightness 25%)

Illumination emergency stop

The illumination of the emergency stop can by default be controlled like every other position. However, two additional modes can be activated using the parameter “Emergency Stop Configuration” at index 180.

Choosing value 1 ensures that the emergency stop is constantly red illuminated when it is not actuated. Upon actuation, the illumination switches to blink mode 1, signaling its active state.

By setting the value of this parameter to 2 the emergency stop will be illuminated in the color red regardless of other parameter settings or the process data.

Name	Index (dec.)	Sub-index	Data type	Access right	Default value	Value range
Emergency Stop Configuration	180	0	UIntegerT (8 Bit)	R/W	0 (Activation with Process Data)	0 (Adjustable Emergency Stop illumination) 1 (Blink Mode 1 to signal activation, constant red when not actuated) 2 (Constantly red illuminated)

7.4 Buzzer

The buzzer can be used to emit an acoustic signal in two volume levels and different patterns.

By default, process data is used to control the buzzer.

To activate the buzzer set bit 0 of the corresponding process output data byte to 1.

The volume is controlled by switching bit 1 of the process data byte.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100% volume					0	0	0	(1)
50% volume					0	0	1	(1)

Different sound modes are available. By default, those can be set via bit 4-6 of the process data byte. The coding of the sound modes can be taken from the following table.

Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Mode 1: Constant 2.85 kHz		0	0	0				(1)
Mode 2: Interrupted 970 Hz		0	0	1				(1)
Mode 3: Interrupted 2.85 kHz		0	1	0				(1)
Mode 4: Fast pulsating 2.85 kHz		0	1	1				(1)
Mode 5: Alternating between 2.4 kHz and 2.85 kHz		1	0	0				(1)
Mode 6: Fast alternating between 2.4 kHz and 2.85 kHz		1	0	1				(1)
Mode 7: Falling from 2.85 kHz to 2.4 kHz		1	1	0				(1)
Mode 8: Rising from 2.4 kHz to 2.85 kHz		1	1	1				(1)

Alternatively, the sound of the buzzer can also be configured via parameter data.

Using parameter 150 the volume can be set to 100% by writing the value 1 to this parameter or to 50% by setting the parameter to 2.

Selecting the buzzer mode is done using parameter 151.

Name	Index (dec.)	Sub-index	Data type	Access right	Default value	Value range
Buzzer Volume	150	0	UIntegerT (8 Bit)	R/W	0 (Controlled via process data)	0 (Activation with process data) 1 (100% volume) 2 (50% volume)
Buzzer Sound Mode	151	0	UIntegerT (8 Bit)	R/W	0 (Controlled via process data)	0 (Controlled via Process-Data) 1 (Continuous 2.85 kHz) 2 (Interrupted 970 Hz) 3 (Interrupted 2.85 kHz) 4 (Fast pulsating 2.85 kHz) 5 (Alternating between 2.4 kHz and 2.85 kHz) 6 (Fast alternating between 2.4 kHz and 2.85 kHz) 7 (Falling from 2.85 kHz to 2.4 kHz) 8 (Rising from 2.85 kHz to 2.4 kHz)

7.5 I/Os

The E-BOX XL IO-LINK features a total of four I/O pins. Each pin represents one I/O and can be individually configured using parameter 170 to 173.

Per default all pins are configured as input. This mode allows for reading the voltage level (high/low) on each of the four pins of the I/O connector. In input mode, attempts to set the I/O to high via process data will be ignored. The inputs are defined according to type 3 of IEC 61131-2 and have the following characteristics:

- Low to High state input voltage: 9.4 V (typ.), 11 V (max.)
- High to Low state input voltage: 7.5 V (typ.), 5 V (min.)
- Input current: 2.5 – 4 mA
- Overvoltage and reverse polarity protection -36 V to 40 V

When an I/O is configured as output, byte 6 of the process output data can be used to toggle the level of this pin. Setting the bit value to 1 will switch the output to approx. 24 V (Input Voltage – 0.7 V) while writing 0 will switch off the output again. The outputs are protected by a fuse and allow a maximum current draw of 200 mA.

Reading the level of each pin via PDin is possible in all modes.

In addition to the input and output mode, which are available on all four I/Os, I/O 1 can be used as a constant 24 V power source. In this mode bit 0 of the I/Os PDout byte is ignored.

In similar fashion I/O 3 can be set to a constant 0 V level by writing the value 0x02 at index 172.

When using Pin 3 in constant 0 V mode, the current must be strictly limited to a maximum of 4 A, as exceeding this limit will cause irreparable damage to the device. It is therefore recommended to use the 24 V supply on Pin 1 or any other output with an equivalent current rating.

Name	Index (dec.)	Sub-index	Data type	Access right	Default value	Value range
Mode I/O 1	170	0	UIntegerT (8 Bit)	R/W	2 (Constant 24 V)	0 (Input) 1 (Output) 2 (Constant 24 V)
Mode I/O 2	171	0	UIntegerT (8 Bit)	R/W	0 (Input)	0 (Input) 1 (Output)
Mode I/O 3	172	0	UIntegerT (8 Bit)	R/W	2 (Constant 0 V)	0 (Input) 1 (Output) 2 (Constant 0 V)
Mode I/O 4	173	0	UIntegerT (8 Bit)	R/W	0 (Input)	0 (Input) 1 (Output)

Note that depending on the current through the output pins the devices maximum current consumption can exceed 200 mA. Check if the master can support the total current.

The current consumption of each E-BOX XL IO-LINK variant can be found in the respective technical datasheet.

7.6 Firmware Update

All product variants are supporting and are equipped with the IO-Link Application Profile Firmware-Update Profile. Therefore, the installed E-BOX XL IO-LINK with its firmware is updatable.

To ensure the highest safety requirements, the following two sections must always be considered.

7.6.1 Updating scenario

RAFI proactively contacts all affected customers when a firmware update is necessary. It is also recommended that only IO-Link firmware update files (.iolfw) obtained directly from RAFI are used and installed on the devices. Furthermore, a 64-digit password is required for the update process, which will then be provided by your known RAFI contact.

7.6.2 Manual disabling of the update capability / interface

If in your planned application for the E-BOX XL IO-LINK the firmware update interface is considered and evaluated critical from a security point of view, there is the possibility of a shutdown function. If this process is performed manually by the user, this update capability is physically deleted and no longer possible with this product. This means that these products can also be used in security-critical environments.

To disable the firmware update feature finally and irreversibly, you first have to set the parameter Index 190 "Firmware Update Configuration" to 0x01 "Disable FW Update". Then the function can be deleted by executing the system command (Index 2, Subindex 0) 0xA0 "Disable Firmware-Update Feature". Now it is no longer possible to perform a firmware update for this product. This can also be recognized via the "Firmware Update Configuration" parameter, as this is now set to 0x02 "FW updates disabled". It should be explicitly noted that this technical and deliberate deactivation of the update function and thus also interface cannot be reversed in the executed product.

Thus, this possibility represents another feature for a user of the E-BOX XL IO-LINK products. Please note, however, that an IO-Link engineering tool will display the update function even if this is no longer physically possible.

7.7 Diagnosis

7.7.1 Status LED

The status LED of the E-BOX XL IO-LINK is used to visualize and detect the current status of the individual device. More detailed error messages can be obtained from the event code and its meaning in the event overview.

Indicator	Meaning
Red Flashing 2 Hz, 90% on	Device has an error event and is not working properly.
Yellow Flashing 2 Hz, 90% on	There is IO-Link communication, but at the same time there is an error event
Orange Flashing 2 Hz, 90% on	There is no active IO-Link connection to the device in COM mode.
Green Flashing 1 Hz, 90% on	Device has an active and functioning IO-Link connection in COM mode and no failures are pending.

7.7.2 Events

If no IO-Link event code is specified, no error message can be transmitted via IO-Link itself. A visual display via status LED is nevertheless provided.

Error text	EventCode (hex.)	Validity Bit	Status LED	Device Status	Detailed Device Status	Meaning
Illumination error	0x1810	0	red	0x04 (Error)	244, 24, 16	The illumination is not working properly and fails
Warning operating life cycles at mounting position 1	0x1820	1	green	0x00 (Operating)	228, 24, 32	90% of the actuators maximum operating cycles are reached
Warning operating life cycles at mounting position 2	0x1821	1	green	0x00 (Operating)	228, 24, 33	90% of the actuators maximum operating cycles are reached
Warning operating life cycles at mounting position 3	0x1822	1	green	0x00 (Operating)	228, 24, 34	90% of the actuators maximum operating cycles are reached
Warning operating life cycles at mounting position 4	0x1823	1	green	0x00 (Operating)	228, 24, 35	90% of the actuators maximum operating cycles are reached
Warning operating life cycles at mounting position 5	0x1824	1	green	0x00 (Operating)	228, 24, 36	90% of the actuators maximum operating cycles are reached
Warning operating life cycles at mounting position 6	0x1825	1	green	0x00 (Operating)	228, 24, 37	90% of the actuators maximum operating cycles are reached
Error operating life cycles at mounting position 1	0x1830	1	yellow	0x04 (Error)	244, 24, 48	The actuators maximum operating cycles have been exceeded
Error operating life cycles at mounting position 2	0x1831	1	yellow	0x04 (Error)	244, 24, 49	The actuators maximum operating cycles have been exceeded
Error operating life cycles at mounting position 3	0x1832	1	yellow	0x04 (Error)	244, 24, 4A	The actuators maximum operating cycles have been exceeded
Error operating life cycles at mounting position 4	0x1833	1	yellow	0x04 (Error)	244, 24, 4B	The actuators maximum operating cycles have been exceeded
Error operating life cycles at mounting position 5	0x1834	1	yellow	0x04 (Error)	244, 24, 4C	The actuators maximum operating cycles have been exceeded
Error operating life cycles at mounting position 6	0x1835	1	yellow	0x04 (Error)	244, 24, 4D	The actuators maximum operating cycles have been exceeded
Failure I/O Output 1	0x1840	1	yellow	0x04 (Error)	244, 24, 64	Error at digital output 1
Failure I/O Output 2	0x1841	1	yellow	0x04 (Error)	244, 24, 65	Error at digital output 2
Failure I/O Output 3	0x1842	1	yellow	0x04 (Error)	244, 24, 66	Error at digital output 3
Failure I/O Output 4	0x1843	1	yellow	0x04 (Error)	244, 24, 67	Error at digital output 4

Primary supply voltage overrun: Check valid voltage range	0x5110	0	red	0x02 (Warning)	244, 81, 16	The voltage measurement results in a value that is above the permitted range.
Primary supply voltage underrun: Check valid voltage range	0x5111	0	red	0x02 (Warning)	244, 81, 17	The voltage measurement results in a value that is below the permitted range.
Temperature fault - overload	0x4000	0	red	0x04 (Error)	244, 64, 00	The temperature measurement results in a value that is above the permitted range.
Device temperature under-run	0x4220	0	red	0x02 (Warning)	244, 66, 32	The temperature measurement results in a value that is below the permitted range (insulate device)
General malfunction: Unknown error	0x1000	0	red	0x04 (Error)	244, 16, 00	Device has a failure event and is not working properly. Please exchange the device.
-	-	-	orange	-	-	There is no active IO-Link connection to the device in COM mode.

7.7.3 Error Types

Error Types (used for the ISDU response) consist of two octets, the main error cause "ErrorCode" and more specific information "AdditionalCode".

Name	ErrorCode (hex.)	AdditionalCode (hex.)	Description
Device application (error – no details)	0x80	0x00	Service has been refused by the device application and no detailed information of the incident is available
Index not available	0x80	0x11	Access occurs to a not existing index
Subindex not available	0x80	0x12	Access occurs to a not existing subindex
Service temporarily not available	0x80	0x20	Parameter is not available due to the current state of the device application
Service temporarily not available – local control	0x80	0x21	Parameter is not available due to the current state of the device application – local operating unit has control
Service temporarily not available – device control	0x80	0x22	Parameter is not available due to the current state of the device application – local device has control
Access denied	0x80	0x23	Write access on a read-only parameter
Parameter value out of range	0x80	0x30	Written parameter value is outside its permitted value range
Parameter value above limit	0x80	0x31	Written parameter value is above its permitted value limit

Parameter value below limit	0x80	0x32	Written parameter value is below its permitted value limit
Parameter length overrun	0x80	0x33	Written parameter length is above its predefined length
Parameter length underrun	0x80	0x34	Written parameter length is below its predefined length
Function not available	0x80	0x35	Written command is not supported by the device application
Function temporarily unavailable	0x80	0x36	Written command is not available due to the current state of the device application
Invalid parameter set	0x80	0x40	Written single parameter collides with other actual parameter settings
Inconsistent parameter set	0x80	0x41	Parameter inconsistencies were found at the end of block parameter transfer, device plausibility check failed
Application not ready	0x80	0x82	Read or write service is refused due to a temporarily unavailable application

7.7.4 Diagnosis Parameters

Name	Index (dec.)	Sub-index	Data type	R/W	Value & meaning
Device Status	36	0	UIntegerT (8 Bit)	ReadOnly	0: Device is OK 1: Maintenance required 2: Out of specification 3: Functional check 4: Failure
Detailed Device Status Detailed Device Status [1] Detailed Device Status [2] Detailed Device Status [3] Detailed Device Status [4]	37	0	ArrayT (length 4) each element with OctetStringT (3 Byte)	ReadOnly	Per ArrayT element: Octet 1: EventQualifier Octet 2+3: EventCode in hex. contains identifier of event Dynamic list is implemented to get all present errors (up to 4)
Error Count	32		UIntegerT (2 Byte)	ReadOnly	Counts all occurred error events since the boot up / power up process

8 Support

If you have any questions regarding the IO-Link products of RAFI, please contact the technical hotline:

E-mail: info@rafi-group.com

Phone: +49 751 / 89-6500

Our technical hotline will be happy to answer any questions you may have at the following times (local time Germany):

Monday to Thursday

- 08:00 am to 12:00 am
- 01:00 pm to 05:00 pm

Friday

- 08:00 am to 12:00 am
- 01:00 pm to 03:00 pm



Furthermore, you will find more technical data or drawings in our [eCatalog](#) for the specified products. Downloads such as the IODD or IO-Link manufacturer's declaration of conformity are also available there.

9 Disclaimer

Publisher

RAFI GmbH & Co. KG

Ravensburger Str. 128-134, D-88276 Berg / Ravensburg

Tel.: +49 751 89-0, Fax: +49 751 89-1300

www.rafi-group.com, info@rafi-group.com

Copyright

© RAFI GmbH & Co. KG, 2026. All rights reserved.

The contents of this documents must not be reproduced or transmitted to other persons without prior written approval from RAFI GmbH & Co. KG.

The use of tradenames, brand names etc. in this document does not allow these names to be construed as free of protection.

Exclusion of liability

All necessary steps have been taken to ensure that this document is complete and correct. If questions arise regarding specific points despite this, please contact RAFI GmbH & Co. KG or an authorized representative.

The information in this document may be changed without prior notification and does not represent any binding obligation on RAFI GmbH & Co. KG. RAFI GmbH & Co. KG accepts no liability for any errors in this document.