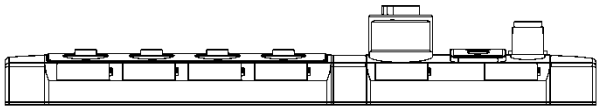
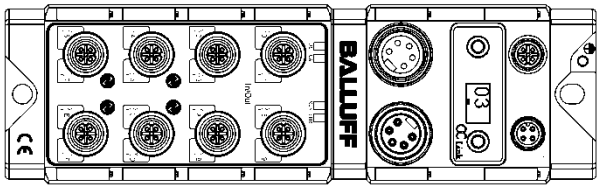
BNI CCL-502-100-Z001

Extended User Manual





Balluff Network Interface / CC-Link BNI-CCL-502-100-Z001

1 Notes for the user

1.1 About this guide

This guide describes the Balluff CC-Link Field bus Module BNI CCL-… which enables expanded communication down to the lowest level so as to provide improved process optimizing and preventive maintenance. This module is IP67 protected and features a rugged metal IP67 housing. The device is ideal for use in harsh industrial environments.

1.2 Structure of the guide

The Guide is organized so that the sections build on one another.
Section 2. Basic safety information.
Section 3: The main steps for installing the device.
Section 4: Technical data for the device.
…

1.3 Typographical Conventions

The following typographical conventions are used in this guide.

Syntax

Numbers:
- Decimal numbers are shown without additional indicators (e.g. 123),
- Hexadecimal numbers are shown with additional indicator $_{hex}$ (e.g. 00_{hex})

Cross-references

Cross-references indicate where further information on the topic can be found ("see Section 4 “).

1.4 Symbols

Note, tip
This symbol indicates general notes.

Attention!
This symbol in connection with the word "Attention" warns of a possible hazardous situation for the health of persons or for equipment damage. Disregard of these warning notes may result in injury or damage to equipment.

Always observe the described measures for preventing this danger.

1.5 Abbreviations

BNI	Balluff Network Interface
CCL	CC-Link
EMC	Electromagnetic Compatibility
FE	Function Ground
SIO	Standard Input/Output
IOL	IO-Link
X	Denotes an input
Y	Denotes an output

2 Safety

2.1 Intended Use

The BNI CCL-502-100-Z001 serves as a decentralized input/output and IO-Link master module for connecting to a CC-Link network.

2.2 General Safety Notes

Installation and start up

Installation and start-up are to be performed only by trained personnel. Any damage resulting from unauthorized manipulation or improper use voids the manufacturer's guarantee and warranty.
The device is an equipment in accordance with EMC Class A. Such equipment may generate RF noise. The operator is responsible for taking the appropriate measures before using. The device may be operated only using an approved power supply (see 0„Technical Data"). Only approved cables may be used.

Operations and testing

The operator is responsible for ensuring that local prevailing safety regulations are followed. When defects and non-clearable faults in the device occur, take it out of service and secure against unauthorized use.
Approved use is ensured only when the housing is fully installed.

2.3 Meaning of the warnings

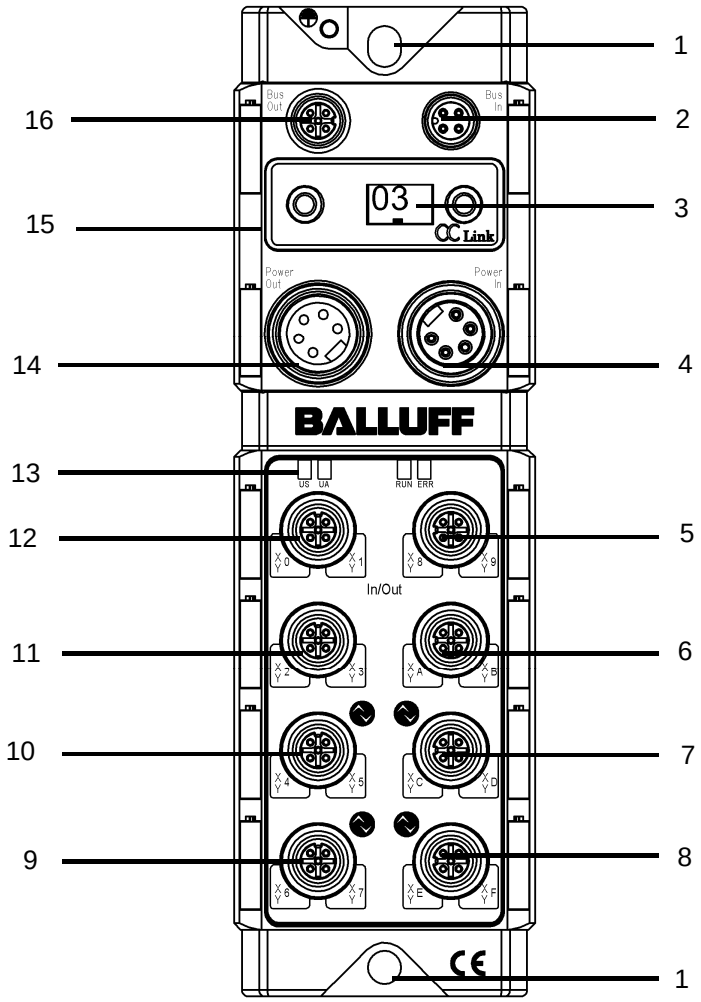
Caution!

This symbol in connection with the word "Caution" warns of a possible hazardous situation for the health of persons or for equipment damage. Disregard of these warning notes may result in injury or damage to equipment.

Always observe the described measures for preventing this danger.

3 Connection data

3.1 Connection Overview



1 Mounting hole
2 CC-Link Bus Input
3 Display
4 Power supply IN
5 Port4 : Standard I/O
6 Port5 : Standard I/O
7 Port6 : Standard I/O, IO-Link
8 Port7 : Standard I/O, IO-Link
9 Port3 : Standard I/O, IO-Link
10 Port2 : Standard I/O, IO-Link
11 Port1 : Standard I/O
12 Port0 : Standard I/O
13 Status LED
14 Power supply OUT
15 Label
16 CC-Link Bus Output

3 Connection data

3.2 Mechanical connection

The module is attached using 2 M6 screws and 2 washers.

3.3 Supply voltage connection

Power In (7/8 Mini- Change 5 pin, male)

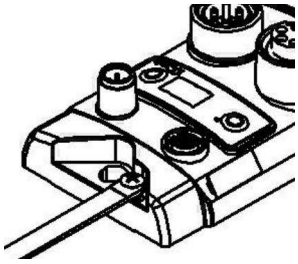
PIN	Signal	Description
1	0 V	GND Actuator supply
2	0 V	GND Module- / sensor supply
3	FE	Function Ground
4	+24V	Module- / sensor supply
5	+24V	Actuator supply

Power Out (7/8 Mini- Change, 5 pin, female)

PIN	Signal	Description
1	0 V	GND Actuator supply
2	0 V	GND Module- / sensor supply
3	FE	Function Ground
4	+24V	Module- / sensor supply
5	+24V	Actuator supply

- 24 V DC.
- Provide sensor/bus power and actuator power from separate power sources if possible.
- Total current <9A. The total current of all modules may not exceed 9A even when daisy chaining the actuator supply.

Function ground



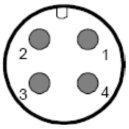
Note!
The FE connection from the housing to the machine must be low-impedance and kept as short as possible.

3 Connection data

3.4 CC-Link Connection

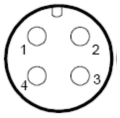
The CC-Link connection is made using the M12 sockets Bus In and Bus Out (A-coded).

Bus In: (M12, A-coded, male)



PIN	Requirement	Note
1	SLD	Shield
2	DB	B Line (white)
3	DG	Ground (yellow)
4	DA	A Line (blue)

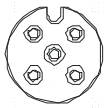
Bus Out: (M12, A-coded, female)



PIN	Requirement	Note
1	SLD	Shield
2	DB	B Line (white)
3	DG	Ground (yellow)
4	DA	A Line (blue)

3.5 Connecting sensors / actuators

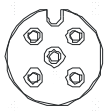
4 configurable SIO ports are provided for connecting actuators and sensors



PIN	Standard I/O-Port M12, A coded, female
1	+24V, 200mA
2	Input / Output 2A
3	0V
4	Input / Output 2A
5	FE

3.6 Connecting IO-Link devices

4 configurable SIO + IOL ports are provided for connecting actuators/ sensors / IO-Link devices



PIN	IO-Link Port M12, A coded, female
1	+24V, 1.6A
2	Input / Output 2 A
3	0V
4	IO-Link/ Input / Output 1.6A
5	-

Note!
Unused I/O or IOL port sockets must be fitted with cover caps to ensure IP67 protection rating.

Connection options for the CC-Link Modules

Module	Standard I-Port	Standard O-Port	IO-Link Port
BNI CCL-502-100-Z001	Max 16	Max 16	Max 4

4 Display

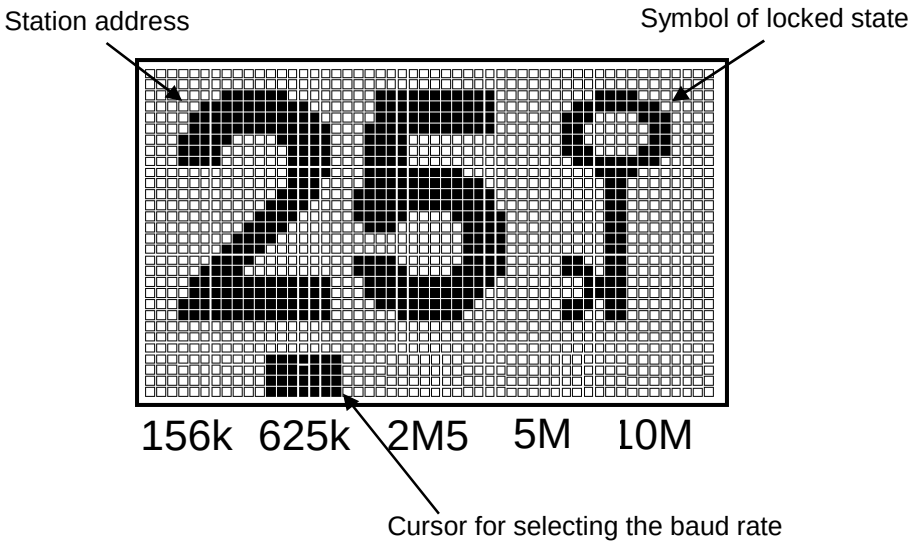
4.1 General

The BNI CCL-502-100-Z001 serves as a decentralised input/output/IO-Link gateway module for connecting to a CC-Link network. With the implemented display, the address, the communication speed and the CCL mode preset are set directly on the BNI CCL-502-100-Z001 devices.

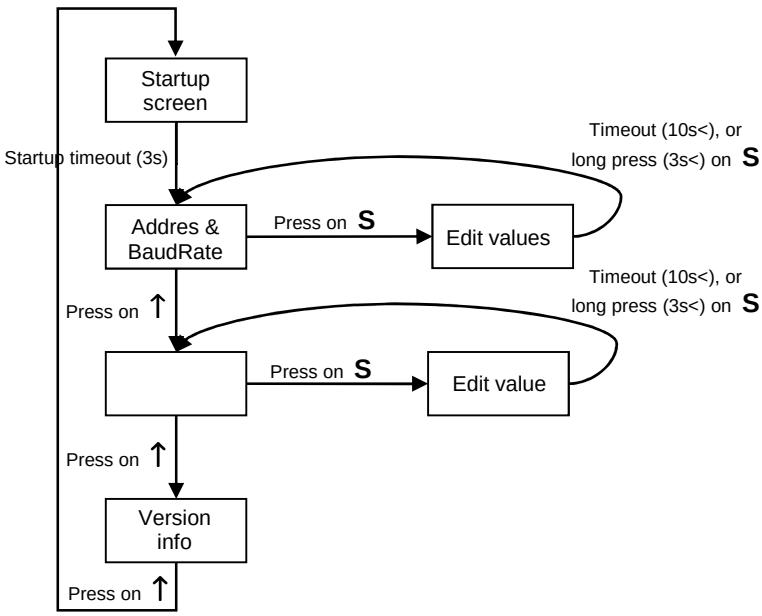
4.2 Default settings

Address: 3
Communication speed: 10Mbps
CC-Link preset: P1 (CCL Ver1.0; 3 Stations occupied)

4.3 Display information



4.4 Menu structure



4 Display

4.5 Edit mode

The BNI CCL-502-100-Z001 serves as a decentralised input/output and IO-L master module for connecting to a CC-Link network. With the implemented display, the address, the communication speed and the CCL mode preset is set directly on the BNI CCL-502-100-Z001 devices.

- push (<3s) on "↑ " → scroll to the next screen
- pus on "↑ " → increment value by one (in edit mode)
- long push on "↑" and hold it → increments value continuously (in edit mode)
- long push(>3s) on "**S**" → edit mode is activated, display information is flashing
- long push on "**S**" → leave edit mode and save the changes (in edit mode)
- push on "**S**" → change between editing Address or BaudRate (in edit mode)
- after 10 seconds without any key hit, the changes are discarded and display returns to normal displaying mode

Additional features:

- "Lock function" by PLC, edit mode is not accessible
- "Free controllable" LEDs by PLC

The Lock function:

- when the Display Lock bit is set, user is unable to modify settings via the display buttons
- in locked state, if user wants to enter edit mode, instead, the lock symbol is going to be displayed
- after clearing the Display Lock bit, the normal display screen is restored

5 Communication interfaces and modes

5.1 CC-Link overview

The BNI CCL-502-100-Z001 module supports both CC-Link Ver1 and CC-Link Ver2 communication forms. Ver2 is capable of transmitting greater amount of data using multiple scan cycles (extended cycles).

Bus configuration is described by slave address, number of occupied stations, communication speed and -in case of Ver2 communication- number of extended cycles. All of these are adjustable via the interactive display.

		Version 2	Version 1
Maximum number of link (Data volume)		RX/RY: 8192 bits RWw/RWr: 2048 words	RX/RY: 2048 bits RWw/RWr: 256 words
Number of links per machine (Data Volume)	1 station occupied	RX/RY: 32 to 128 bits RWw/RWr: 8 to 32 words	RX/RY: 32 bits RWw/RWr: 4 words
	2 stations occupied	RX/RY: 96 to 384 bits RWw/RWr: 16 to 64 words	RX/RY: 64 bits RWw/RWr: 8 words
	3 stations occupied	RX/RY: 160 to 640 bits RWw/RWr: 24 to 96 words	RX/RY: 96 bits RWw/RWr: 12 words
	4 stations occupied	RX/RY: 224 to 896 bits RWw/RWr: 32 to 128 words	RX/RY: 128 bits RWw/RWr: 16 words
Number of occupied stations per machine		1 to 4	1 to 4
Extended cyclic setting		2x, 4x, 8x	None

	1 station occupied	2 stations ocupied	3 stations occupied	4 stations occupied
2x Settings	RX/RY: 32 bits RWw/RWr: 8 words	RX/RY: 96 bits RWw/RWr: 16 words	RX/RY: 160 bits RWw/RWr: 24 words	RX/RY: 224 bits RWw/RWr: 32 words
4x Settings	RX/RY: 64 bits RWw/RWr: 16 words	RX/RY: 192 bits RWw/RWr: 32 words	RX/RY: 320 bits RWw/RWr: 48 words	RX/RY: 448 bits RWw/RWr: 64 words
8x Settings	RX/RY: 128 bits RWw/RWr: 32 words	RX/RY: 384 bits RWw/RWr: 64 words	RX/RY: 640 bits RWw/RWr: 96 words	RX/RY: 896 bits RWw/RWr: 128 words

There are [Version, Num of stations occupied, Extended Cycle] settings stored in the module, called presets, P1 to P5. User can not change Num of stations occupied, Version or Cycle Settings one-by one. User can only select which Preset to use.
However, between limits given by the current Preset selected, user can change some data mapping settings. See section “Data mapping” for details.

		CC-Link Version	Stations occupied	Extended Cycles
Presets	P0	Ver1	2	-
	P1	Ver1	3	-
	P2	Ver1	4	-
	P3	Ver2	3	2x
	P4	Ver2	3	4x
	P5	Ver2	3	8x

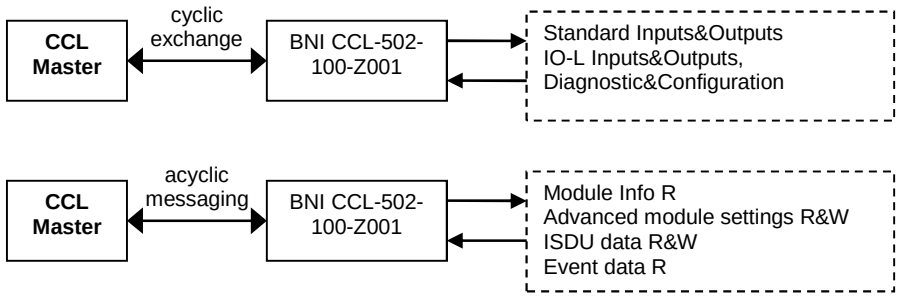
Default factory bus settings are:

- Speed: 10 Mbps
- Address: 3
- CC-Link preset: P1 (Version1, 3 Stations occupied,-)

5.2 CC-Link: cyclic and acyclic communication

Basically, data is exchanged cyclically during CC-Link communication. The BNI CCL-502-100-Z001 module also features the acyclic messaging protocol, which is an on-request type of communication. It is always initiated by the CC-Link master and it provides access to special function data areas of the module.

Figure below shows the purpose of the two different communications on CC-Link bus.



5.3 IO-Link overview

The BNI CCL-502-100-Z001 module features 4 IO-Link master ports (called IO-Link ports). When a port is enabled as IOL port, pin1, pin4 and pin3 are used for IO-Link communication as described in section “Connection data”. The remaining pin2 is still a freely configurable SIO pin.

The IO-Link master functionality of the BNI module supports IO-Link 1.0 communication standard. Input/Output data, SPDU data and Events of the IO-Link connections are all available in the BNI module.

Input/Output data:

Regular input and/or output data of the connected IO-Link slave. For example data used to turn outputs of the IO-Link slave on, or data indicating the input status of the slave. Data is refreshed every time the CC-Link data is refreshed. Maximal size of Input/Output IO-Link data is determined by module settings.

ISDU (SPDU) data:

Data transferred on-request, providing description of the IO-Link slave and access to its settings -if there are settings available-. This data can be accessed using the acyclic messaging mode of CC-Link communication.

Events:

Events are generated automatically by the IO-Link slave or master in case a specially defined condition occurs. For example a connection is established or lost (master). Low supply voltage is detected, short circuit on the slave output is detected (slave) etc. Events of a given port are described by EventMode and EventCode. Every IO-Link channel of the BNI CCL-502-100-Z001 module has an 4 elements deep FIFO type queue to store event data. So at reading, the oldest stored event data is read out. This data can be accessed using the acyclic messaging mode of CC-Link communication.

Example of ISDU data (BNI IOL-722/724-000-K023 IO-Link device):

	DPP Index	SPDU Index	SPDU Sub-Index	Object name	Length	Range	Default value
Identification Data						read only	
		0x10	0	Vendor name	7 Byte		BALLUFF
		0x11	0	Vendor text	15 Byte		www.balluff.com
		0x12	0	Product name	20 Byte		BNI IOL-722-000-K023 BNI IOL-724-000-K023
		0x13	0	Product ID	7 Byte		BNI 004C BNI 004E
		0x14	0	Product text	22 Byte		Hobbit current output Hobbit voltage output
		0x16	0	Hardware Revision	1 Byte		1
		0x17	0	Firmware Revision	23 Byte		1.0
Parameter Data		-					

Example of Events (BNI IOL-722/724-000-K023 IO-Link device):

Event Mode	Event Code (H+L)
Appears/Coming	Supply voltage low
0xC0	0x0010
Disappears/Going	Supply voltage low
0x80	0x0010

6 Acyclic messaging

6.1 Overview

Acyclic messaging is used to reach special data of the BNI CCL-502-100-Z001 module and the connected IO-Link devices. These special function data areas are organized by using so called channels.

The following channels are supported by the BNI CCL-502-100-Z001:

- Module info: 0x10
- IO-Link channel settings: 0x20…0x23
- IO-Link channel data: ISDU and event data 0x30…0x31

6.2 Message structure

For messaging, some data area of the CC-Link communication area is reserved, called “Message transmission area”. Message block structure is like the following:

Read Request		Write Request	
Block Number	L	Block Number	L
Subcommand Type	H	Subcommand Type	H
Division number	L	Division number	L
Data size	H	Data size	H
Request data		Request data	
Sum check		Sum check	

Read Response		Write Response	
Block Number	L	Block Number	L
Subcommand Type	H	Subcommand Type	H
Return status	L	Return status	L
	H		H
Division number	L	Division number	L
Data size	H	Data size	H
Response data		Response data	
Sum check		Sum check	

6.3 Request/response data

The following table shows what kind of data is transferred in the different request/response data blocks.

Gateway identification:

Byte No.	Item	Gateway
		Identification data
Byte 0	Channel	0x10
Byte 1	Length	0-64
Byte 2	Control/ Status	Read/-
Byte 3	Index	Index
Byte 4	Message data	Request/ Response Data (length = 0-64 bytes)
Byte 5		
Byte 6		
Byte 7		
Byte 8		
Byte 9		
Byte 10		
Byte 11		
Byte 12		
to		
Byte 252		

IO-Link channel settings:

Byte No.	Item	IO-Link Channel	
		Process data size	Validation data
Byte 0	Channel	0x20	0x21
Byte 1	Length	0/8	0/22
Byte 2	Control/ Status	Read/Write	Read/Write
Byte 3	Port Number	Reserved (Fixed to 0)	Channel Number
Byte 4	Message data	IO-Link Channel 1	Validation type
Byte 5		IO-Link Channel 2	Reserved (Fixed to 0)
Byte 6		IO-Link Channel 3	Vendor ID1
Byte 7		IO-Link Channel 4	Vendor ID2
Byte 8		Unused	Device ID1
Byte 9			Device ID2
Byte 10			Device ID3
Byte 11			Reserved (Fixed to 0)
Byte 12			Serial Number1
to			to
Byte 27			Serial Number16
to			Unused
Byte 252			

IO-Link channel settings:

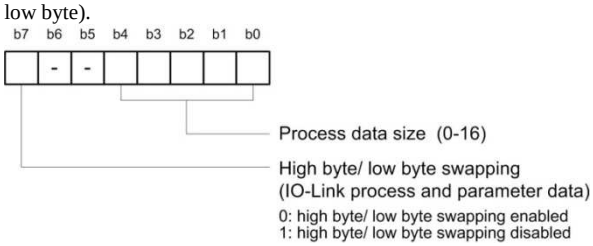
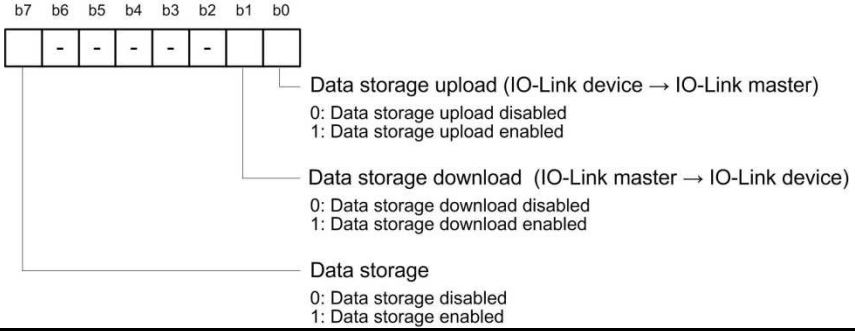
Byte No.	Item	IO-Link channel	
		Data storage	Data storage clear
Byte 0	Channel	0x22	0x23
Byte 1	Length	0/8	8
Byte 2	Control/ Status	Read/Write	-/Write
Byte 3	Port Number	Reserved (Fixed to 0)	Reserved (Fixed to 0)
Byte 4	Message data	IO-Link Channel 1	IO-Link Channel 1
Byte 5		IO-Link Channel 2	IO-Link Channel 2
Byte 6		IO-Link Channel 3	IO-Link Channel 3
Byte 7		IO-Link Channel 4	IO-Link Channel 4
		Unused	Unused
to			
Byte 252			

IO-Link channel data:

Byte No.	Item	IO-Link channel	
		ISDU	Event data
Byte 0	Channel	0x30	0x31
Byte 1	Length	0-232	0/4
Byte 2	Control/ Status	Read/Write	Read/-
Byte 3	Port Number	Channel Number	Channel Number
Byte 4	Message data	Index L	Event Qualifier
Byte 5		Index H	Reserved (Fixed to 0)
Byte 6		Subindex	EventCode L
Byte 7		Reserved (Fixed to 0)	EventCode H
Byte 8		Request/Response Data (length = 0-232 bytes)	Unused
to			
Byte 252			

Description of the request/ response data items:

<table>
<tr><td>Item</td><td>Description</td></tr>
<tr><td>Channel</td><td>Channel selects the access area</td></tr>
<tr><td>Control/ status</td><td>For request message:
0x02 = write
0x03 = read
For response message:
0x00 = OK
0xF0 = error</td></tr>
<tr><td>Index/ Channel No.</td><td>Index = address of the gateway identification data (for details refer to the next table)
Channel Number = IO-Link Channel number</td></tr>
<tr><td>Identification data</td><td>Identification data of the gateway, for details refer to the following “Description of the gateway identification data index”
<table>
<tr><th>Index</th><th>Object Name</th><th>Type</th></tr>
<tr><td>0x00-0x0A</td><td>Not used</td><td>n.a.</td></tr>
<tr><td>0x10</td><td>Vendor name</td><td rowspan="8">Read Only</td></tr>
<tr><td>0x11</td><td>Vendor text</td></tr>
<tr><td>0x12</td><td>Product name</td></tr>
<tr><td>0x13</td><td>Product code</td></tr>
<tr><td>0x14</td><td>Product text</td></tr>
<tr><td>0x15</td><td>Not used</td></tr>
<tr><td>0x16</td><td>Hardware Revision</td></tr>
<tr><td>0x17</td><td>Firmware Revision</td></tr>
</table></td></tr>
<tr><td>Process data size</td><td>The process data size setting for each IO-Link channel can be read and written. The value shows the mapped process data size for each IO-Link channel in Words (0 - 16).
The sum of all IO-Link channel’s data size + message transmission area must not exceed the maximum available Word area, which is determined by the number of occupied stations and extended cyclic setting.

The order in which IO-Link process and parameter data is mapped can be set with bit 7 (high byte/ low byte).
 
</td></tr>
<tr><td>ISDU</td><td>Reading/ Writing IO-Link parameter data</td></tr>
<tr><td>Event data</td><td>The event data (Event qualifier and event code) of a pending event indicated by the IO-Link channel event flag can be read. After reading the event data the IOLink port event flag changes to 0.</td></tr>
<tr><td>Validation data</td><td>IO-Link device validation. The validation type is defined as follows:
0x00 = validation deactivated
0x01 = validation of IO-Link Vendor ID and IO-Link Device ID
0x02 = validation of IO-Link Vendor ID, IO-Link Device ID and serial number
Depending on the configuration of the IO-Link device validation the connected device’s information is verified and the result indicated by the port valid bit.</td></tr>
<tr><td>Data storage</td><td>Configuration of the data storage function of the IO-Link master.
The configuration byte is defined as follows:
 
</td></tr>
<tr><td>Data storage clear</td><td>IO-Link master data storage clear command:
0x55 = Clear IO-Link master data storage</td></tr>
</table>

7 Data mapping

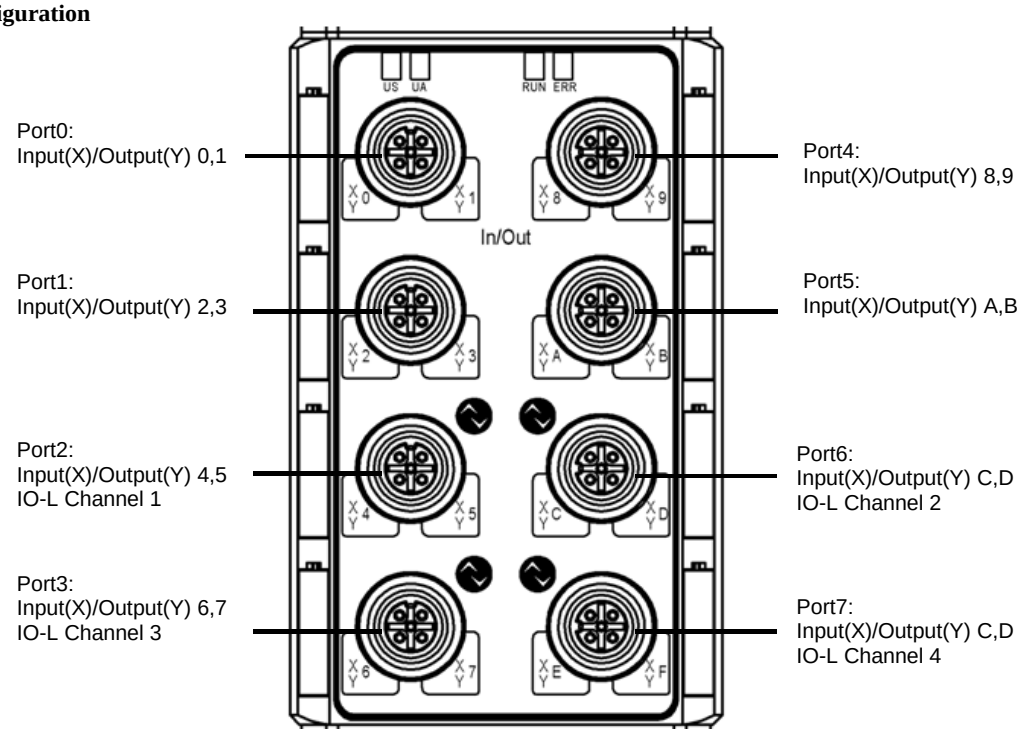
7.1 Profile Presets

Depending on the selected profile, the number of occupied stations, version and extended cyclic setting are set. These determine the data amount available for the device, so a given profile determines the number of data pro IO-Link channel too.

The listed process data size of each IO-Link channel is the default setting of the selected profile.

Profile No.	Number of IO-Link Channels	IO-Link process data size for each IO-Link Channel		Number of occupied stations	Extended cyclic setting
		Input process data size [Bytes]	Output process data size [Bytes]		
0	4	2	2	2	-
1	4	4	4	3	-
2	4	6	6	4	-
3	4	10	10	3	2
4	4	20	20	3	4
5	4	32	32	3	8

7.2 Port Configuration



7.3 RX and RY

Device No.		Slave → Master	Device No.		Master → Slave
When 2 stations are occupied	When 3 or 4 stations are occupied	Signal name	When 2 stations are occupied	When 3 or 4 stations are occupied	Signal name
RXm0	RXm0	Input 0, Port0 pin 4	RYm0	RYm0	Output 0 , Port0 pin 4
RXm1	RXm1	Input 1 , Port1 pin 2	RYm1	RYm1	Output 1 , Port1 pin 2
RXm2	RXm2	Input 2 , Port2 pin 4	RYm2	RYm2	Output 2 , Port2 pin 4
RXm3	RXm3	Input 3 , Port3 pin 2	RYm3	RYm3	Output 3 , Port3 pin 2
RXm4	RXm4	Input 4 , Port4 pin 4	RYm4	RYm4	Output 4 , Port4 pin 4
RXm5	RXm5	Input 5 , Port5 pin 2	RYm5	RYm5	Output 5 , Port5 pin 2
RXm6	RXm6	Input 6 , Port6 pin 4	RYm6	RYm6	Output 6 , Port6 pin 4
RXm7	RXm7	Input 7 , Port7 pin 2	RYm7	RYm7	Output 7 , Port7 pin 2
RXm8	RXm8	Input 8 , Port8 pin 4	RYm8	RYm8	Output 8 , Port8 pin 4
RXm9	RXm9	Input 9 , Port9 pin 2	RYm9	RYm9	Output 9 , Port9 pin 2
RXmA	RXmA	Input A , PortA pin4	RYmA	RYmA	Output A , PortA pin4
RXmB	RXmB	Input B , PortB pin 2	RYmB	RYmB	Output B , PortB pin 2
RXmC	RXmC	Input C , PortC pin 4	RYmC	RYmC	Output C , PortC pin 4
RXmD	RXmD	Input D , PortD pin 2	RYmD	RYmD	Output D , PortD pin 2
RXmE	RXmE	Input E , PortE pin 4	RYmE	RYmE	Output E , PortE pin 4
RXmF	RXmF	Input F , PortF pin 2	RYmF	RYmF	Output F , PortF pin 2
RX(m+1)0	RX(m+1)0	Diagnostic Input / Output 0	RY(m+1)0	RY(m+1)0	Port direction Input / Output 0
RX(m+1)1	RX(m+1)1	Diagnostic Input / Output 1	RY(m+1)1	RY(m+1)1	Port direction Input / Output 1
RX(m+1)2	RX(m+1)2	Diagnostic Input / Output 2	RY(m+1)2	RY(m+1)2	Port direction Input / Output 2
RX(m+1)3	RX(m+1)3	Diagnostic Input / Output 3	RY(m+1)3	RY(m+1)3	Port direction Input / Output 3
RX(m+1)4	RX(m+1)4	Diagnostic Input / Output 4	RY(m+1)4	RY(m+1)4	Port direction Input / Output 4
RX(m+1)5	RX(m+1)5	Diagnostic Input / Output 5	RY(m+1)5	RY(m+1)5	Port direction Input / Output 5
RX(m+1)6	RX(m+1)6	Diagnostic Input / Output 6	RY(m+1)6	RY(m+1)6	Port direction Input / Output 6
RX(m+1)7	RX(m+1)7	Diagnostic Input / Output 7	RY(m+1)7	RY(m+1)7	Port direction Input / Output 7
RX(m+1)8	RX(m+1)8	Diagnostic Input / Output 8	RY(m+1)8	RY(m+1)8	Port direction Input / Output 8
RX(m+1)9	RX(m+1)9	Diagnostic Input / Output 9	RY(m+1)9	RY(m+1)9	Port direction Input / Output 9
RX(m+1)A	RX(m+1)A	Diagnostic Input / Output A	RY(m+1)A	RY(m+1)A	Port direction Input / Output A
RX(m+1)B	RX(m+1)B	Diagnostic Input / Output B	RY(m+1)B	RY(m+1)B	Port direction Input / Output B
RX(m+1)C	RX(m+1)C	Diagnostic Input / Output C	RY(m+1)C	RY(m+1)C	Port direction Input / Output C
RX(m+1)D	RX(m+1)D	Diagnostic Input / Output D	RY(m+1)D	RY(m+1)D	Port direction Input / Output D
RX(m+1)E	RX(m+1)E	Diagnostic Input / Output E	RY(m+1)E	RY(m+1)E	Port direction Input / Output E
RX(m+1)F	RX(m+1)F	Diagnostic Input / Output F	RY(m+1)F	RY(m+1)F	Port direction Input / Output F
RX(m+2)0	RX(m+2)0	Diagnostic port 0	RY(m+2)0	RY(m+2)0	Display Red LED
RX(m+2)1	RX(m+2)1	Diagnostic port 1	RY(m+2)1	RY(m+2)1	Display Green LED
RX(m+2)2	RX(m+2)2	Diagnostic port 2	RY(m+2)2	RY(m+2)2	Display Lock
RX(m+2)3	RX(m+2)3	Diagnostic port 3	RY(m+2)3	RY(m+2)3	Unused
RX(m+2)4	RX(m+2)4	Diagnostic port 4	RY(m+2)4	RY(m+2)4	
RX(m+2)5	RX(m+2)5	Diagnostic port 5	RY(m+2)5	RY(m+2)5	
RX(m+2)6	RX(m+2)6	Diagnostic port 6	RY(m+2)6	RY(m+2)6	
RX(m+2)7	RX(m+2)7	Diagnostic port 7	RY(m+2)7	RY(m+2)7	
	RX(m+2)8	US undervoltage		RY(m+2)8	
	RX(m+2)9	UA undervoltage		RY(m+2)9	
	RX(m+2)A	Unused		RY(m+2)A	
	RX(m+2)B			RY(m+2)B	
	RX(m+2)C			RY(m+2)C	
	RX(m+2)D			RY(m+2)D	
	RX(m+2)E			RY(m+2)E	
	RX(m+2)F			RY(m+2)F	

Device No.		Slave → Master	Device No.		Master → Slave
When 2 stations are occupied	When 3 or 4 stations are occupied	Signal name	When 2 stations are occupied	When 3 or 4 stations are occupied	Signal name
RX(m+2)8	RX(m+3)0	IO-Link Channel 1 valid	RY(m+2)8	RY(m+3)0	IO-Link Channel 1 enable
RX(m+2)9	RX(m+3)1	IO-Link Channel 2 valid	RY(m+2)9	RY(m+3)1	IO-Link Channel 2 enable
RX(m+2)A	RX(m+3)2	IO-Link Channel 3 valid	RY(m+2)A	RY(m+3)2	IO-Link Channel 3 enable
RX(m+2)B	RX(m+3)3	IO-Link Channel 4 valid	RY(m+2)B	RY(m+3)3	IO-Link Channel 4 enable
	RX(m+3)4	Reserved		RY(m+3)4	Reserved
	RX(m+3)5			RY(m+3)5	
	RX(m+3)6			RY(m+3)6	
	RX(m+3)7			RY(m+3)7	
RX(m+2)C	RX(m+3)8	IO-Link Channel 1 event flag	RY(m+2)C	RY(m+3)8	IO-Link Channel 1 event clear
RX(m+2)D	RX(m+3)9	IO-Link Channel 2 event flag	RY(m+2)D	RY(m+3)9	IO-Link Channel 2 event clear
RX(m+2)E	RX(m+3)A	IO-Link Channel 3 event flag	RY(m+2)E	RY(m+3)A	IO-Link Channel 3 event clear
RX(m+2)F	RX(m+3)B	IO-Link Channel 4 event flag	RY(m+2)F	RY(m+3)B	IO-Link Channel 4 event clear
	RX(m+3)C	Reserved		RY(m+3)C	Reserved
	RX(m+3)D			RY(m+3)D	
	RX(m+3)E			RY(m+3)E	
	RX(m+3)F			RY(m+3)F	
	to	Unused		to	Unused
RX(m+3)0	RX(m+n)0	Reserved	RY(m+3)0	RY(m+n)0	Reserved
RX(m+3)1	RX(m+n)1		RY(m+3)1	RY(m+n)1	
RX(m+3)2	RX(m+n)2		RY(m+3)2	RY(m+n)2	
RX(m+3)3	RX(m+n)3		RY(m+3)3	RY(m+n)3	
RX(m+3)4	RX(m+n)4	Message transmission size	RY(m+3)4	RY(m+n)4	
RX(m+3)5	RX(m+n)5		RY(m+3)5	RY(m+n)5	
RX(m+3)6	RX(m+n)6		RY(m+3)6	RY(m+n)6	
RX(m+3)7	RX(m+n)7	Reserved	RY(m+3)7	RY(m+n)7	
RX(m+3)8	RX(m+n)8	Initial data processing request	RY(m+3)8	RY(m+n)8	Initial data processing completion flag
RX(m+3)9	RX(m+n)9	Initial data setting completion flag	RY(m+3)9	RY(m+n)9	Initial data setting request flag
RX(m+3)A	RX(m+n)A	Error state flag	RY(m+3)A	RY(m+n)A	Error reset request flag
RX(m+3)B	RX(m+n)B	Remote ready flag	RY(m+3)B	RY(m+n)B	Reserved
RX(m+3)C	RX(m+n)C	Message transmission	RY(m+3)C	RY(m+n)C	Message transmission request flag
RX(m+3)D	RX(m+n)D	Message handshake flag	RY(m+3)D	RY(m+n)D	Message handshake flag
RX(m+3)E	RX(m+n)E	Reserved	RY(m+3)E	RY(m+n)E	Reserved
RX(m+3)F	RX(m+n)F		RY(m+3)F	RY(m+n)F	

m: Address assigned to the master module by the station number setting
n: Dependent on the number of occupied stations and extended cyclic setting:

- 3 stations + no extended cyclic setting: 5
- 4 stations + no extended cyclic setting: 7
- 3 stations + 2 extended cyclic setting: 9
- 3 stations + 4 extended cyclic setting: 13
- 3 stations + 8 extended cyclic setting: 27
- 4 stations + 8 extended cyclic setting: 37

7.4 RX and RY signal details

Device No.		Signal name	Description
When 2 stations are occupied	When 3 or 4 stations are occupied		
RXm0 to RXmF	RXm0 to RXmF	Input 0 – F	Digital Input signal 0 – F
RX(m+1)0 to RX(m+1)F	RX(m+1)0 to RX(m+1)F	Diagnostic input/ output	Error on the corresponding input/ output line e.g. over-current, short-circuit, output override
RX(m+2)0 to RX(m+2)7	RX(m+2)0 to RX(m+2)7	Diagnostic port	Error on the corresponding port's power supply line e.g. over-current, short-circuit
	RX(m+2)8	US undervoltage	US voltage is low
	RX(m+2)9	UA undervoltage	UA voltage is low
RX(m+2)8 to RX(m+2)B	RX(m+3)0 to RX(m+3)7	IO-Link channel valid	In IO-Link mode this signal = 1 if an IO-Link device is connected, the IO-Link communication is operating and the IO-Link device's PDinvalid flag is not set. Further if IO-Link device validation is activated the result of the validation is indicated by this bit.
RX(m+2)C to RX(m+2)F	RX(m+4)8 to RX(m+4)F	IO-Link channel event flag	Event from the connected IO-Link device. After reading out all event information via message transmission function the IO-Link channel event flag clears automatically.
RYm0 to RYmF	RYm0 to RYmF	Output 0 – F	Digital Output signal 0 – F
RY(m+1)0 to RY(m+1)F	RY(m+1)0 to RY(m+1)F	Port direction	When setting the port direction bit = 0 the corresponding signal line is operating as a digital input. In the case that the port direction bit = 1 the corresponding signal line is operating as a digital output.
RY(m+2)0	RY(m+2)0	Display Red LED	Setting bit to 1 turns on the red LEDs of the display
RY(m+2)1	RY(m+2)1	Display Green LED	Setting bit to 1 turns on the green LEDs of the display
RY(m+2)3	RY(m+2)3	Display LOCK	When set to 1, Preset, Address and Speed settings of the module are locked
RY(m+2)8 to RY(m+2)B	RY(m+3)0 to RY(m+3)7	IO-Link channel enable	By setting the IO-Link channel enable bit = 1 the corresponding port is operating in IO-Link mode
RY(m+2)C to RY(m+2)F	RY(m+3)8 to RY(m+3)F	IO-Link channel event clear	By setting the IO-Link channel event clear bit = 1 all events of the corresponding IO-Link channel are cleared. By keeping it set to 1 all new events are automatically cleared.

7.5 RWr and RWw

Profile 0 [2 occupied stations + no extended cyclic setting]

Slave → Master		Master → Slave	
Address	Description	Address	Description
RWrn	Input process data IO-Link Channel1	RWwn	Output process data IO-Link Channel1
RWrn+1	Input process data IO-Link Channel 2	RWwn+1	Output process data IO-Link Channel 2
RWrn+2	Input process data IO-Link Channel 3	RWwn+2	Output process data IO-Link Channel 3
RWrn+3	Input process data IO-Link Channel4	RWwn+3	Output process data IO-Link Channel4
RWrn+4	Message transmission area	RWwn+4	Message transmission area
RWrn+5		RWwn+5	
RWrn+6		RWwn+6	
RWrn+7		RWwn+7	

n: Address assigned to the master module by the station number setting

Profile 1 [3 occupied stations + no extended cyclic setting]

Slave → Master		Master → Slave	
Address	Description	Address	Description
RWrn	Input process data IO-Link Channel1	RWwn	Output process data IO-Link Channel1
RWrn+1		RWwn+1	
RWrn+2	Input process data IO-Link Channel 2	RWwn+2	Output process data IO-Link Channel 2
RWrn+3		RWwn+3	
RWrn+4	Input process data IO-Link Channel 3	RWwn+4	Output process data IO-Link Channel 3
RWrn+5		RWwn+5	
RWrn+6	Input process data IO-Link Channel4	RWwn+6	Output process data IO-Link Channel4
RWrn+7		RWwn+7	
RWrn+8	Message transmission area	RWwn+8	Message transmission area
RWrn+9		RWwn+9	
RWrn+A		RWwn+A	
RWrn+B		RWwn+B	

n: Address assigned to the master module by the station number setting

Profile 2 [4 occupied stations + no extended cyclic setting]

Slave → Master		Master → Slave	
Address	Description	Address	Description
RWrn	Input process data IO-Link Channel1	RWwn	Output process data IO-Link Channel1
RWrn+1		RWwn+1	
RWrn+2		RWwn+2	
RWrn+3	Input process data IO-Link Channel 2	RWwn+3	Output process data IO-Link Channel 2
RWrn+4		RWwn+4	
RWrn+5		RWwn+5	
RWrn+6	Input process data IO-Link Channel 3	RWwn+6	Output process data IO-Link Channel 3
RWrn+7		RWwn+7	
RWrn+8		RWwn+8	
RWrn+9	Input process data IO-Link Channel 4	RWwn+9	Output process data IO-Link Channel 4
RWrn+A		RWwn+A	
RWrn+B		RWwn+B	
RWrn+C	Message transmission area	RWwn+C	Message transmission area
RWrn+D		RWwn+D	
RWrn+E		RWwn+E	
RWrn+F		RWwn+F	

n: Address assigned to the master module by the station number setting

Profile 3 [3 occupied stations + 2 extended cyclic setting]

Slave → Master		Master → Slave	
Address	Description	Address	Description
RWrn	Input process data IO-Link Channel1	RWwn	Output process data IO-Link Channel1
to		to	
RWrn+4		RWwn+4	
RWrn+5	Input process data IO-Link Channel 2	RWwn+5	Output process data IO-Link Channel 2
to		to	
RWrn+9		RWwn+9	
RWrn+A	Input process data IO-Link Channel 3	RWwn+A	Output process data IO-Link Channel 3
to		to	
RWrn+E		RWwn+E	
RWrn+F	Input process data IO-Link Channel 4	RWwn+F	Output process data IO-Link Channel 4
to		to	
RWrn+13		RWwn+1	
RWrn+14	Message transmission area	RWwn+1	Message transmission area
RWrn+15		RWwn+1	
RWrn+16		RWwn+1	
RWrn+17		RWwn+1	

n: Address assigned to the master module by the station number setting

Profile 4 [3 occupied stations + 4 extended cyclic setting]

Slave → Master		Master → Slave	
Address	Description	Address	Description
RWrn	Input process data IO-Link Channel1	RWwn	Output process data IO-Link Channel1
to		to	
RWrn+9		RWwn+9	
RWrn+A	Input process data IO-Link Channel 2	RWwn+A	Output process data IO-Link Channel 2
to		to	
RWrn+13		RWwn+13	
RWrn+14	Input process data IO-Link Channel 3	RWwn+14	Output process data IO-Link Channel 3
to		to	
RWrn+1D		RWwn+1D	
RWrn+1E	Input process data IO-Link Channel 4	RWwn+1E	Output process data IO-Link Channel 4
to		to	
RWrn+27		RWwn+27	
RWrn+28	Unused	RWwn+28	Unused
RWrn+29	Message transmission area	RWwn+29	Message transmission area
RWrn+2A		RWwn+2A	
RWrn+2B		RWwn+2B	
RWrn+2C		RWwn+2C	
RWrn+2D		RWwn+2D	
RWrn+2E		RWwn+2E	
RWrn+2F		RWwn+2F	

n: Address assigned to the master module by the station number setting

Profile 5 [3 occupied stations + 8 extended cyclic setting]

Slave → Master		Master → Slave	
Address	Description	Address	Description
RWrn	Input process data IO-Link Channel1	RWwn	Output process data IO-Link Channel1
to		to	
RWrn+F		RWwn+F	
RWrn+10	Input process data IO-Link Channel 2	RWwn+10	Output process data IO-Link Channel 2
to		to	
RWrn+1F		RWwn+1F	
RWrn+20	Input process data IO-Link Channel 3	RWwn+20	Output process data IO-Link Channel 3
to		to	
RWrn+2F		RWwn+2F	
RWrn+30	Input process data IO-Link Channel 4	RWwn+30	Output process data IO-Link Channel 4
to		to	
RWrn+3F		RWwn+3F	
RWrn+40	Unused	RWwn+40	Unused
to		to	
RWrn+58		RWwn+58	
RWrn+59	Message transmission area	RWwn+59	Message transmission area
RWrn+5A		RWwn+5A	
RWrn+5B		RWwn+5B	
RWrn+5C		RWwn+5C	
RWrn+5D		RWwn+5D	
RWrn+5E		RWwn+5E	
RWrn+5F		RWwn+5F	

n: Address assigned to the master module by the station number setting

7.6 RWr and RWw signal details

Process data in IO-Link mode of the specified port.

The size of the process data area is set by selecting one of the default profiles (1-10) or by programming the gateway via the message transmission function. Input and output process data areas of one IO-Link channel have both the same size.

The IO-Link data is mapped in the format shown below if high byte/ low byte swapping is enabled:

Address	High Byte	Low Byte
RWn	Byte 0	Byte 1
RWn+1	Byte 2	Byte 3
to	To	To
RWn+15	Byte 30	Byte 31

The IO-Link data is mapped in the format shown below if high byte/ low byte swapping is disabled:

Address	High Byte	Low Byte
RWn	Byte 1	Byte 0
RWn+1	Byte 3	Byte 2
to	to	to
RWn+15	Byte 31	Byte 30

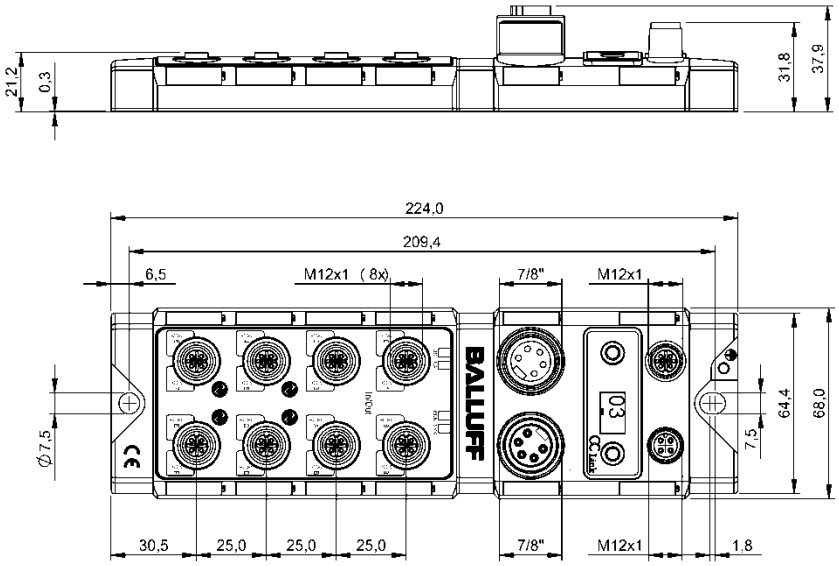
Message transmission area:

The message transmission area is used for the acyclic message transmission function, described in section 6.

High byte/low byte swapping also affects ISDU data.

8 Technical Data

8.1 Dimensions



8.2 Mechanical data

Housing material	Die-case zinc, matte nickel plated
Enclosure rating per IEC 60529	IP 67 (only when plugged-in and threaded-in)
Supply voltage	7/8” 5-pin male and female
Input ports / Output ports	M12, A coded (8 x female)
Dimensions (W x H x D in mm)	68 x 224 x 37.9
Mounting type	2-hole screw mount
Ground strap attachment	M4
Weight	Approx. 580gr.

8.3 Operating conditions

Operating temperature T_a Storage temperature	-5 ℃ … 70 ℃ -25 C … 70 ℃
EMC - EN 61000-4-2/3/4/5/6 - EN 55011	 - Severity level 4A/3A/4B/2A/3A - Gr.1, CL. A
Shock / vibration	EN 60068-2-6, EN 60068-2-27 EN 60068-2-29, EN 60068-2-64

8.4 Electrical data

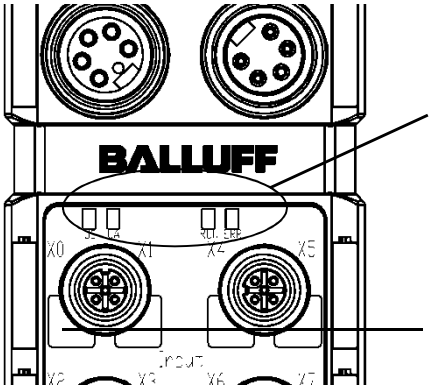
Supply voltage	18…30.2 V DC, per EN 61131-2
Ripple	<1%
Input current at 24 V	100 mA @ 24V

8 Technical Data

8.5 CC-Link Port

CC-Link port	EIA RS485 compatible
Connection for CC-Link port	M12, A coded
Cable type	CC-Link dedicated cable (shielded 3-core twisted pair cable)
Data transmission rate	10M / 5M / 2,5M / 625k / 156kbps
Max. cable length	up to 1200m (by 156kbps)
Supported modes	CC-Link Ver1 and CC-Link Ver2
Number of occupied stations	2 to 4 station
Extended cycle settings (Ver2)	2x, 4x, 8x
Station type	Remote device station

8.6 Function Indicators



LED 2-9, Status LED

Port/Pin LED: status of input/output/IOL ports

Status LED

LED	Indicator	Function
LED 1	Green / Red	US Power supply OK / undervoltage
LED 2	Green / Red	UA Power supply OK / undervoltage
LED 6	Green / Off	Bus connection status
LED 7	Red flashing Red Off	CC-Link version error / Module settings have been changed Communication error Normal communication

LED indicators input ports

Each M12 Port (digital input/output, IO-Link) is assigned two 2-color LEDs which indicate the configuration or operating states.

LED	Function LED Pin 2 / Pin 4
Off	Input signal = 0
Yellow	Input signal = 1
Red	Input signal = SC Short circuit*

LED indicators output ports

LED	Function LED Pin 2 / Pin 4
Off	Output signal = 0
Yellow	Output signal = 1
Red	Output signal = Override / Overload

LED indicators
IO-Link channels

LED	Function LED Pin 4
Off	IOL port not enabled
Green flashing	No IO-Link communication
Green	IO-Link connection established
Red flashing	Validation failed
Red	Short-circuit

9 Included Material

9.1 Included Material

The BNI CCL consists of the following components:

- IO-block
- 4 blind plugs M12
- Ground strap
- Screw M4x6
- 20 labels
- Short guide

Appendix

Ordering code

BNI CCL-502-100-Z001

Balluff Network Interface

CC-Link interface

Functions
502= IP 67 SIO+IOL module, max 16 Inputs/Outputs, max 4 IO-Link connections

Variant
100 = Display version

Mechanical version
Z001 = Die-cast zinc housing
Material: 1. Balluff housing version
Bus In: 1 x M12x1 internal thread
Bus Out: 1 x M12x1 internal thread
Power: 7/8“ external thread
I/O Ports: 8 x M12x1 internal thread

Order information

Type code	Ordering code
BNI CCL-502-100-Z001	BNI0040

BALLUFF

sensors worldwide

www.balluff.com

Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a.d.F.
Germany
Tel. +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de
www.balluff.com

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