

BALLUFF

BIC 1B0-IT1A7-Q40KFU-SM4A4A
BIC 2B0-IT1A7-Q40KFU-SM4A5A

User's Guide



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1 General

1.1. Structure of the guide

This guide is arranged so that one chapter builds upon the other.
Chapter 1: General
Chapter 2: Safety
.....

1.2. Typographical Conventions

The following typographical conventions are used in this manual.

Enumerations

Enumerations are shown in the form of bulleted lists.

- Entry 1
- Entry 2

1.3. Symbols



Note

This symbol indicates general notes.



Attention!

This symbol indicates a security note that must be observed.



Attention!

This symbol indicates a security note that must be observed. This is a fire hazard!



Attention!

This symbol indicates a security note that must be observed. Important for persons with physical aids, such as Pacemaker.

2 Safety

2.1 Installation and Startup



Attention!

Installation and startup are to be performed by trained technical personnel only. Skilled specialists are people who are familiar with the work such as installation and the operation of the product and have the necessary qualifications for these tasks. Any damage resulting from unauthorized tampering or improper use shall void warranty and liability claims against the manufacturer. The operator is responsible for ensuring that the valid safety and accident prevention regulations are observed in specific individual cases.

2.2 General Safety Notes

Commissioning and inspection

The operating company shall be responsible for observance of locally applicable safety regulations.

Before commissioning, carefully read the User's Guide.

The system must not be used in applications in which the safety of persons depends on the function of the device.

Intended use

Warranty and liability claims against the manufacturer shall be rendered void by damage from:

- Unauthorized tampering
- Improper use
- Use, installation or handling contrary to the instructions provided in this User's Guide.

Obligations of the owner/operator

The device is a piece of equipment in accordance with EMC Class A. Such equipment may generate RF noise. The owner/operator must take appropriate precautionary measures against this for its use. The device may be used only with a power supply approved for this. Only approved cables may be connected.

Malfunctions

In the event of defects and device malfunctions that cannot be rectified, the device must be taken out of operation and protected against unauthorized use.

Dangerous Voltage



Attention!

Before working on the device, switch off its power supply.

Proper Use

Attention!

Inductive coupling systems (BIC) are devices for contact-free energy and signal transmission in industrial environments.



Use is particularly not allowed:

- In environments with explosive atmospheres,
- in application in which the safety of people or machines can be affected by transmitted signals. (Safety-related circuits).

2.3 Safety Notes



Caution!

Risk of burning on hot surfaces! The sensing surface heats up even under normal operating conditions. Keep hands and objects away from the sensing surface. Metallic objects are not permitted in the in the zones defined by A and B or between the sensing surfaces of the Base and Remote. Fire hazard!

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2 Safety

**Protection from
Electromagnetic
Fields**



Protection from electromagnetic fields during operation and At a assembly

At a distance of 300 mm the limits for electrical and magnetic field strength are met. Based on the EU Council recommendation 1999/519/EC, in accordance with EN 62311:2008, this distance is regarded as the basic limit value or reference value for the safety of persons in electromagnetic fields.

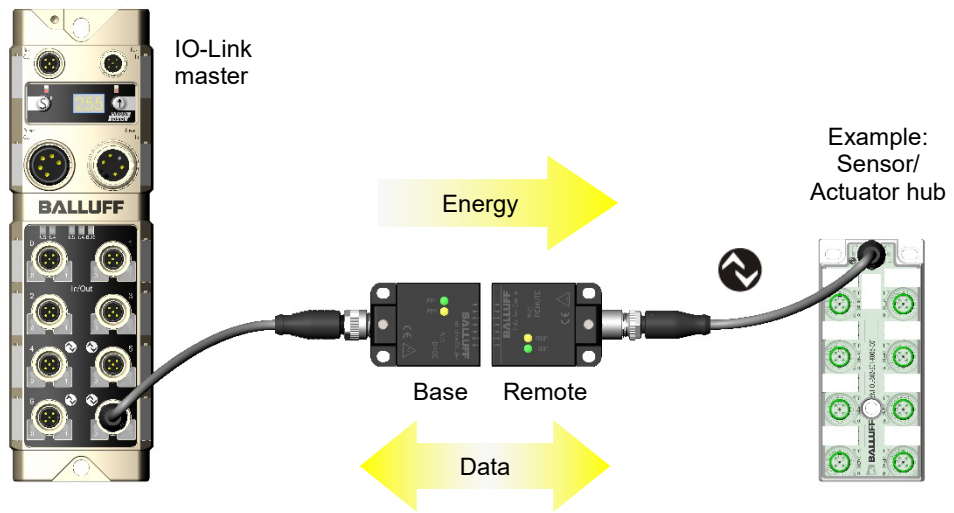
For persons with active medical implants (e.g. heart pacemakers) additional (operating) limits may apply.



Note

In the interest of continuous improvement of the product, Balluff GmbH reserves the right to change the technical data of the product and the content of these instructions at any time without notice.

3.1 System Overview



System description:

The BIC system consists of two components. It transmits electrical power from the stationary components (base) to the mobile components (remote) via the air gap. The Transmission distance of Base and Remote is then 0 to 5 mm. In addition the BIC system transmits the data from the IO-Link port from the IO-Link master to the BIC system Remote component. In this way, the IO-Link functionality of the IO-Link port on the master is made available without contact on the remote. Pin 2 in the system is transparent.

The BIC system can only be operated using Balluff IO-Link masters. Reliable operation on IO-Link masters from other manufacturers cannot be guaranteed.

When using a Profibus IO-Link master module from Balluff GmbH only modules having the following hardware version are compatible.

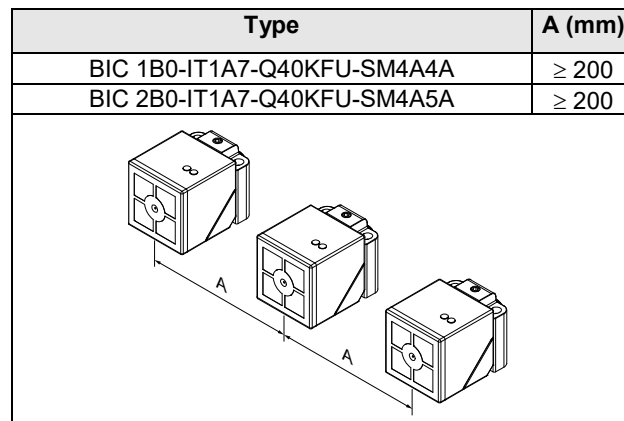
PBS Master	Hardware version
BNI PBS-502-101-Z001	HW07
BNI PBS-504-002-K008	HW03
BNI PBS-507-002-Z011	HW06

Balluff Inductive Coupler
BIC 1B0-IT1A7-Q40KFU-SM4A4A (Base)
BIC 2B0-IT1A7-Q40KFU-SM4A5A (Remote)

4 Installation

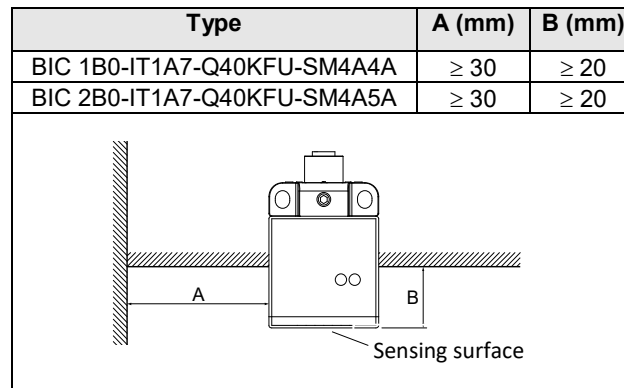
4.1 Mutual Interference

To prevent mutual interference with adjacent Bases or Remotes, the specified minimum distances must be adhered to. The minimum distance is depending on mounting and operating conditions, it can be possibly smaller, but not less than 110mm. The limiting conditions are for Balluff not known, the application should be tested from customer's side. The qualified minimum distance of 200mm for the failure-free operation is based on static installation, normal room temperature and COM3 data communication.



4.2 Installation in Metal

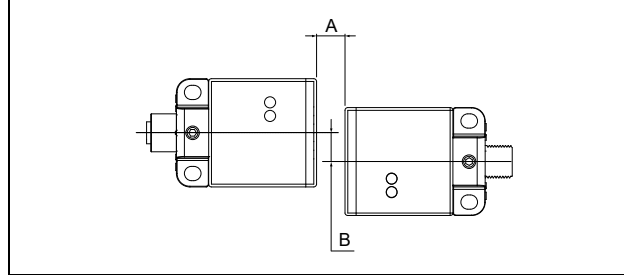
Device damage due to induction effects!
 Metallic objects in front of and on the coil cap cause the sensing surface to be heated. The sensing surface is marked by the crosshairs on the housing. Install the components so that no metallic objects are in the zone produced by distances A and B. Distances A and B must be maintained independently of each other!



4 Installation

4.3 Distances / Offset

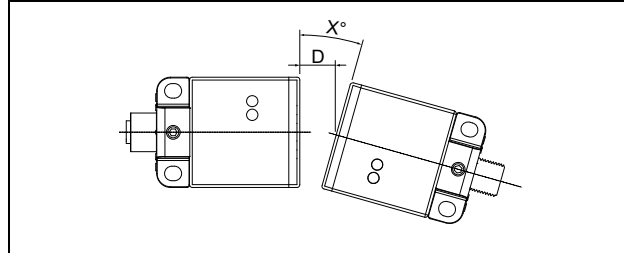
Type	A (mm)	B (mm)
BIC 1B0-IT1A7-Q40KFU-SM4A4A	≤ 5	≤ 5
BIC 2B0-IT1A7-Q40KFU-SM4A5A	≤ 5	≤ 5



The system may be operated at a greater distance and/or offset. What is defining is the power transmitted by the system.

4.4 Permitted Angle Offset

Distance D (mm)	Angle x (°)
1	11
2	8
3	6
4	3
5	0



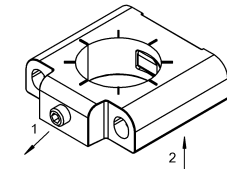
Balluff Inductive Coupler
BIC 1B0-IT1A7-Q40KFU-SM4A4A (Base)
BIC 2B0-IT1A7-Q40KFU-SM4A5A (Remote)

4 Installation

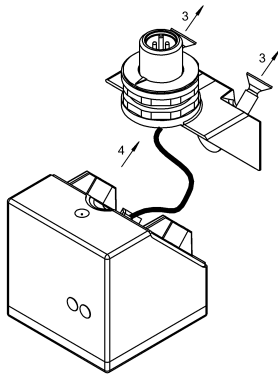
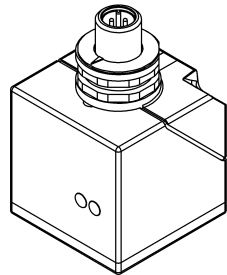
4.5 180° Rotation of the Connector Insert

The connector insert on the base and remote can be rotated 180°. To do this follow the disassembly steps (1 through 6) described in the following. After the connector insert is rotated (step 7), subsequent reassembly is performed in reverse order.

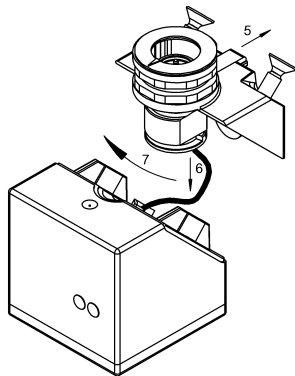
Disassembling the Holder



1. Loosen the grub screw
2. Pull off the BIC holder



3. Loosen the two countersunk screws
4. Remove the BIC base



5. Pull out the safety pin
6. Slide out the connector insert
7. 180° Rotation of the Connector Insert



Note

The design allows for disassembling/assembling to rotate the connector insert only twice.

The maximum transmittable power with the BIC system depends on the distance as well as the axial and angular offset.

At a distance of 5 mm, a lateral offset of 5 mm and no angular offset, the output current indicated in the electrical data of 1A is assured.

5.1 Derating

Explanations for increasing the maximum transmittable power as well as increasing the maximum transmission distance.

Reducing the ambient temperature as well as the distance, lateral axis offset and angular offset the maximum transmittable power can be increased. Similarly, if the power requirements are low, the transmission distance of the BIC system, for example, can be increased.

If the system is operated continually in a range over the maximum power at ambient temperature, but not so severely loaded that it collapses, the status of the resulting over-temperature is reported.

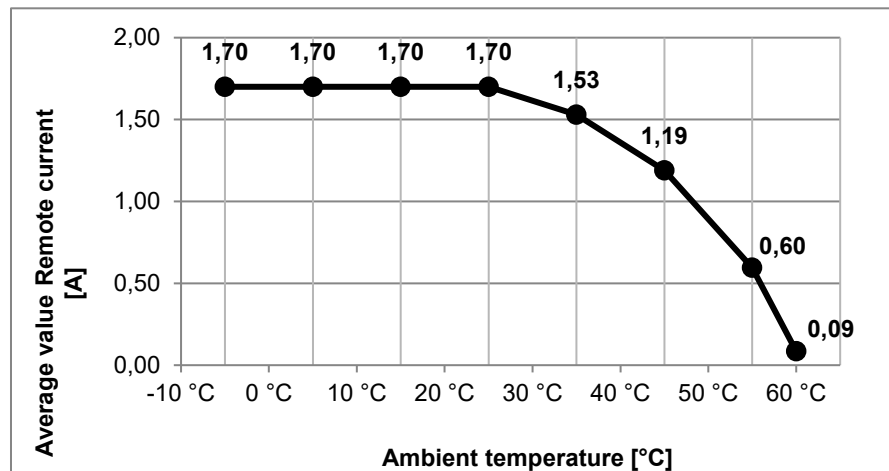


Note

If the BIC system is operated with a correspondingly severe load, the output voltage of the Remote collapses with no message.

Remote Current as a Function of Ambient Temperature

The following illustration shows the course of a typical derating curve for the BIC system at 3 mm distance.



The average of the output current is calculated as follows:

$$I_{\text{Remote}} = \frac{1}{T} \int i_{\text{Remote}}(t) dt$$

where I_{Remote} is the average, T the reference time, and $i_{\text{Remote}}(t)$ the current draw over time. Whereby time $T \approx$ should be considered to be 30..60min.

The max. available peak current is 5A.



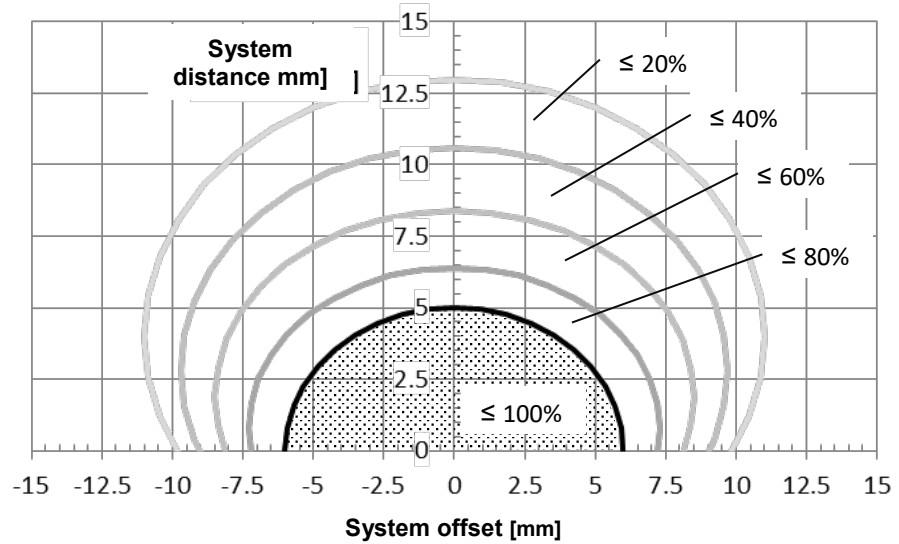
Note

If a larger average output current is required at a resulting ambient temperature, active cooling can be used to reduce the temperature surrounding the BIC so that more current is available.

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5 Energy Transmission

Output Current of the BIC in Space



Note



The measurement which the derating curve as a function of distance is based was performed with no angular offset. The value ranges of the derating curve are to be interpreted as typical values. The typical rated current depends here on the ambient temperature and may be derived from the temperature derating curve.

5.2 Reducing the Output Power on the Base with a Decoupled Remote

To protect people and the environment, the base component automatically reduces power, which is emitted in the form of electromagnetic fields, as soon as the remote component is disconnected.

Technical Utility

The technical utility is in particular the prevention of heating metallic objects that end up in front of the base when the remote is disconnected. In addition, the power reduction allows metals to remain in front of the sensing surface for long periods of time without causing damage to the base.



Note

The startup time of the BIC is described in section "Connection time".

6 IO-Link communication

6.1 Transmission Characteristics

BIC 1BO-IT1A5-Q40KFU-SM4A4A, BIC 2BO-IT1A5-Q40KFU-SM4A5A	
Transmission rate	COM2 (38.4 kBaud), COM3 (230.4 kBaud)
Min cycle time	Device + 2.8 ms
Process data cycle	Device + 2.8 ms
SIO mode	no
Type of master port	A
Process data in	0...32 bytes
Process data out	0...32 bytes

IO-Link Communication

The BIC system transmits the IO-Link version 1.1 protocol (all IO-Link input and output data as well as diagnostic data), regardless of the length of the process data. The IO-Link protocol is transmitted without any restrictions so the BIC system parameters do not need adjusting. Only the device connected to the BIC system needs to be incorporated in the controller.

This means there is no IODD for the BIC Q40 bidirectional.



Note

The BIC system can only be operated using Balluff IO-Link masters. Using IO-Link masters produced by other manufacturers can lead to disruptions in communication.

Transparent PIN2

Pin 2 on the Base and Remote is transparent and transmits the signal state "High-active" bidirectional from the IO-Link port on the master to the IO-Link device and the reverse. For every status change the direction is redetermined from the side which first generates a High level. This is then transmitted to the corresponding other side.

6.2 Connection Time

The time needed to establish the connection of base and remote is affected by many different variables. Start-up speed and angle play just as much of a role as the IO-Link device connected to the Remote and the IO-Link parameters set within it. Also the type of IO-Link master used and its parameter setting affect the connection time. These variables are all application-specific and therefore cannot be generalized.

The measurements performed by Balluff for determining the connection time were performed using a Balluff EtherNet-IP master in combination with the Balluff IO-Link device "BNI IOL-302-002-K006". The distance from base to remote was 3 mm without axis and angular offset. In total, 100,000 connection cycles comprising a variety of directions and speeds were evaluated.

Base (order code)	typical connection times in seconds
BIC007F	0.9



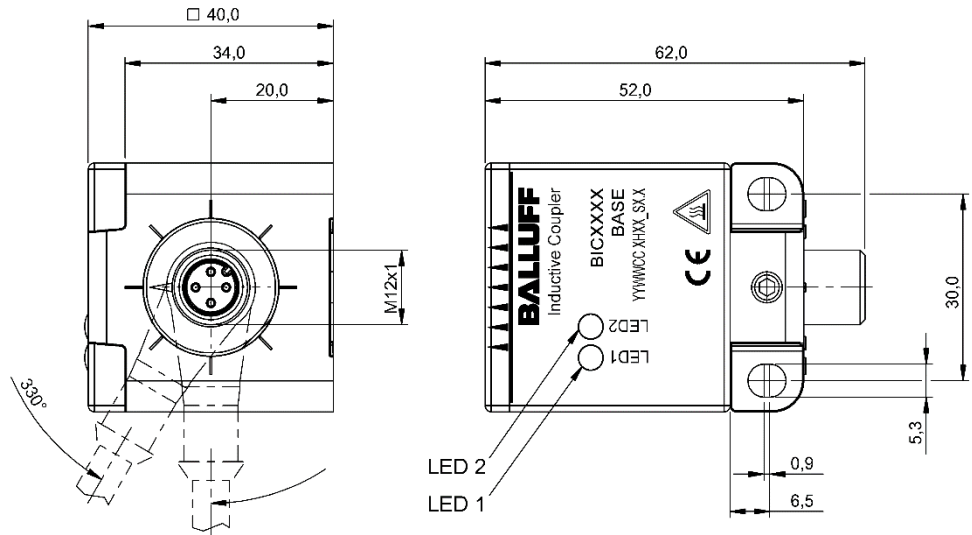
Note

The typical connection time given here corresponds to the arithmetic mean of 100,000 connection times.

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7 Technical Data

7.1 Base



LED 1 / LED 2

LED	Indicator	Function
LED1	Green, static	Supply voltage OK
	Green, inverted flashing	IO-Link communication OK
LED2	Yellow, off	Pin 2 turned off
	Yellow, static	Pin 2 turned on
	Red, flashing	Under-voltage / Over-voltage
	Red, static	Over temperature

Mechanical Data

Housing material	Black plastic, PBTP
Housing degree of protection	IP 67 (only in plugged-in and screwed-down state)
Dimensions (W x H x D in mm)	40 x 40 x 62
Weight	150 g

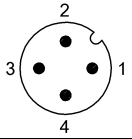
Electrical Data

Operating voltage	24 V DC $\pm 10\%$, corresponding to EN 61131-2
Power Consumption	< 3.8 A
No-load current	≤ 300 mA
Overload protection	yes
Short-circuit protected	yes

Operating Conditions

Ambient temperature	-5°C ... 55°C
Storage temperature	-25°C ... 70°C

Pin Assignment

Power (M12, 4-pin connector)		
	Pin	Signal
	1	+24 V
	2	transparent pin
	3	GND, 0 V
	4	C/Q, IO-Link

Note

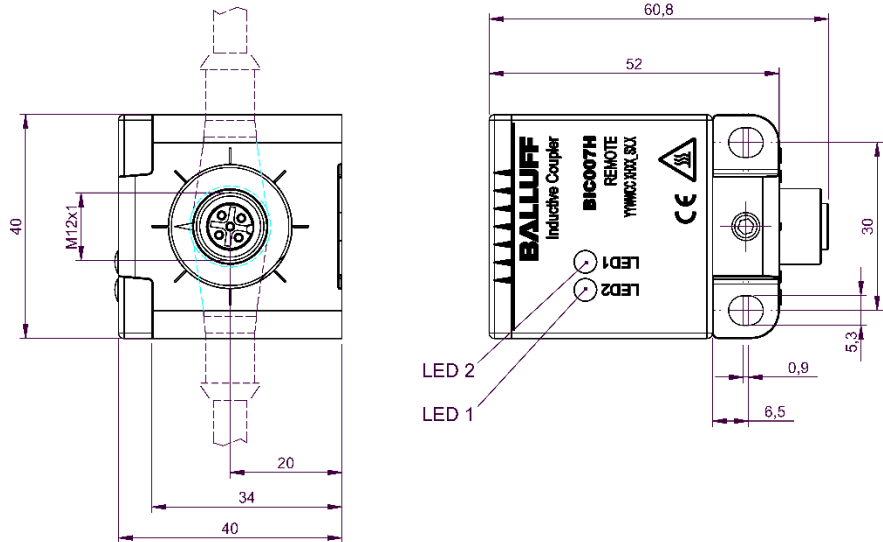


The digital I/O signal on Pin 2 can only be sent when the BIC is in IO-Link mode. If the IO-Link master is in standard I/O mode, the signal is not sent.

Balluff Inductive Coupler
BIC 1B0-IT1A7-Q40KFU-SM4A4A (Base)
BIC 2B0-IT1A7-Q40KFU-SM4A5A (Remote)

7 Technical Data

7.2 Remote



LED 1 / LED 2

LED	Indicator	Function
LED1	Green, static	Supply voltage OK
	Green, inverted flashing	IO-Link communication OK
LED2	Yellow on	Pin 2 high
	Yellow off	Pin 2 low

Mechanical Data

Housing material	Black plastic, PBTP
Housing degree of protection	IP 67 (only in plugged-in and screwed-down state)
Dimensions (W x H x D in mm)	40 x 40 x 60.8
Weight	150 g

Electrical Data

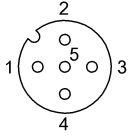
Output voltage at ≤ 5 mm distance, 25 °C and 1 A load on the Remote (24 V DC ±10%, on the Base)	24 V DC +5%/-25%
Output current average (rated) current at 25°C maximum peak current	1.7 A 5.0 A
Short-circuit protected	yes

Operating Conditions

Ambient temperature	-5°C ... 55°C
Storage temperature	-25°C ... 70°C

7 Technical Data

Pin Assignment

Power (M12, 5-pin socket)		
	Pin	Signal
	1	+24 V
	2	transparent pin
	3	GND, 0 V
	4	C/Q, IO-Link
	5	NC

Note



The digital I/O signal on Pin 2 can only be sent when the BIC is in IO-Link mode. If the IO-Link master is in standard I/O mode, the signal is not sent.

Balluff Inductive Coupler
BIC 1B0-IT1A7-Q40KFU-SM4A4A (Base)
BIC 2B0-IT1A7-Q40KFU-SM4A5A (Remote)

8 Appendix

8.1 Ordering Information

Product name	Order code
BIC 1B0-IT1A7-Q40KFU-SM4A4A	BIC007F
BIC 2B0-IT1A7-Q40KFU-SM4A5A	BIC007H

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