

# Inline IO-Link master, 4 IO-Link ports, 12 digital inputs, 24 V DC

**R911332206**  
Edition 02

**Data sheet R-IB IL 24 IOL 4 DI 12-PAC**

4 IO-Link ports  
12 digital inputs  
DC 24V  
2-, 3-wire technology

08 / 2019



## 1 Description

The terminal is designed for use within an Inline station.

The terminal is used to operate IO-Link-compatible sensors and actuators (devices). It is also used to acquire digital signals.

IO-Link is the standard for consistent communication from the controller to the lowest field level. In IO-Link communication, the process data is forwarded during parallel service data transmission.

IO-Link is a point-to-point connection between an IO-Link port and the sensor or actuator. IO-Link technology uses the familiar signal technology of the 0 V and 24 V binary interface in order to transmit data using pulse modulation. IO-Link offers full backward compatibility with standard sensors/actuators.

Using this terminal, IO-Link-compatible devices from any manufacturer can be operated on INTERBUS, PROFIBUS, and PROFINET.

## Features

- 4 type A IO-Link ports
- Optional use of the IO-Link ports in SIO mode as standard inputs or standard outputs
- Connections for 12 digital sensors
- Connection of sensors in 2 or 3-wire technology
- IO-Link specification V1.0



This data sheet is only valid in association with the "Automation terminals of the Inline product range" application description (DOK-CONTRL-ILSYSINS\*\*\*-AW..-EN-P, MNR R911317021).



Make sure you always use the latest documentation.

It can be downloaded under [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics).

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### 3 Ordering data

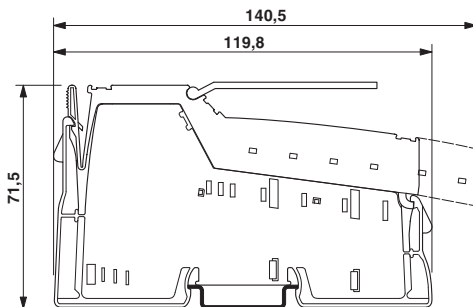
Description	Type	MNR	Pcs./Pkt.
Inline IO-Link master, complete with accessories (connector and marking field), 4 IO-Link ports, 12 digital inputs, 24 V DC, 2 and 3-wire connection technology	R-IB IL 24 IOL 4 DI 12-PAC	R911171971	1
Documentation	Type	MNR	Pcs./Pkt.
Application description Automation terminals of the Inline product range	DOK-CONTRL-ILSYSINS***- AW..-EN-P	R911317021	1

#### Additional ordering data

For additional ordering data (accessories), please refer to the product catalog at [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics).

### 4 Technical data

#### Dimensions (nominal sizes in mm)



Width	48.8 mm
Height	119.8 mm
Depth	71.5 mm

#### General data

Color	gray
Weight	200 g (with connectors)
Operating mode	Process data operation with 6 words, PCP with 1 word
Ambient temperature (operation)	-25 °C ... 55 °C
Ambient temperature (storage/transport)	-25 °C ... 85 °C
Permissible humidity (operation)	10 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	10 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1

#### Connection data: Inline connector

Connection method	Spring-cage connection
Conductor cross section solid / stranded	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup> / 0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm

**Interface: Inline local bus**

Number	2
Connection method	Inline data jumper
Transmission speed	500 kbps

**Communications power ( $U_L$ )**

Supply voltage	7.5 V (via voltage jumper)
Current consumption	max. 100 mA

**Segment circuit supply ( $U_S$ )**

Supply voltage	24 V DC (via voltage jumper)
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	max. 52 mA (without load) max. 2 A (with load and port supply)

**IO-Link ports**

Number of ports	4
Connection method	Inline connector
Connection technology	2, 3-wire

**IO-Link port supply L+**

I/O supply voltage	min. $U_S - 1$ V
Nominal current for every IO-Link port	max. 200 mA
Nominal current per device	max. 800 mA
Permissible conductor length to the sensor	20 m

**Digital inputs in the SIO mode**

Number of inputs	max. 4
Connection method	Inline connector
Input voltage	24 V DC
Input voltage range	0 V DC ... 30 V DC
Nominal input current	5.5 mA (at 24 V DC)
Current flow	linear in the range of 0 V ... 7 V, constant in the range of 7 V ... 30 V
Maximum voltage of the LOW level	< 5 V
Minimum high-level voltage	> 15 V
Delay at signal change from 0 to 1	3 ms
Delay at signal change from 1 to 0	3 ms
Permissible conductor length to the sensor	20 m

**Digital outputs in the SIO mode**

Number of outputs	max. 4
Nominal output voltage	$U_S - 3$ V ( $U_{OUT}$ at $I_{CQ} \leq 200$ mA)
Nominal current per channel	max. 200 mA ( $I_{Nominal}$ )
Maximum total current consumption	max. 800 mA
Limitation of the voltage induced on circuit interruption	approx. -1 V
Behavior with overload	Output may be damaged
Behavior in case of short-circuit	Short-circuit protection
Short-circuit protection	yes
Switching frequency	max. 300 Hz

**Digital inputs**

Number of inputs	12
Connection method	Inline connector
Connection technology	3-wire
Description of the input	IEC 61131-2 type 1
Nominal input voltage	24 V DC
Input voltage range	0 V DC ... 30 V DC
Nominal input current	2.2 mA
Current flow	linear in the range of 0 V ... 10 V, constant in the range of 10 V ... 30 V
Input voltage range "0" signal	< 5 V (typ.)
Input voltage range "1" signal	> 11 V (typ.)
Delay at signal change from 0 to 1	typ. 3 ms
Delay at signal change from 1 to 0	typ. 3 ms
Permissible conductor length to the sensor	20 m

**Programming data (INTERBUS, local bus)**

ID code (hex)	DF
ID code (dec.)	223
Length code (hex)	06
Length code (dec.)	6
Process data channel	96 Bit
Input address area	12 Byte
Output address area	12 Byte
Parameter channel (PCP)	2 Byte
Register length (bus)	112 Bit



For the programming data/configuration data of other bus systems, please refer to the corresponding electronic device data sheet (e.g., GSD, EDS).

**Configuration and parameter data in a PROFIBUS system**

Required parameter data	35 Byte
Required configuration data	5 Byte

**Error messages to the higher level control or computer system**

Short-circuit of a digital output in the SIO mode	Yes
Sensor supply short-circuit	No
Sensor supply overload	No

**Electrical isolation/isolation of the voltage areas**

Test section	Test voltage
24 V supply $U_S$ (IO-Link and digital inputs) / functional earth ground	500 V AC, 50 Hz, 1 min.
24 V supply $U_S$ (IO-Link and digital inputs) / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min.
7.5 V supply (bus logics) / functional earth ground	500 V AC, 50 Hz, 1 min.

**Approvals**

For the latest approvals, please visit [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics).

5 Additional tables

Input characteristic curve of digital inputs at 23 °C	
Input voltage U [V]	Typical input current I [mA]
0	0
2	0.3
4	1.30
5	1.83
6	2.20
7	2.26
8	2.27
10	2.29
14	2.30
20	2.32
24	2.34
28	2.36
30	2.37

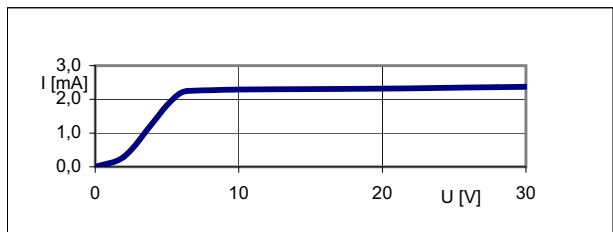


Fig. 1 Input characteristic curve of digital inputs

Input characteristic curve IO-Link/SIO mode at 23 °C	
Input voltage U [V]	Typical input current I [mA]
0	0
2	0,85
4	1.80
5	2.25
6	2.80
7	3.23
8	3.70
10	4.60
11	5.10
12	5.35
13	5.36
14	5.37
20	5.45
24	5.49
28	5.54
30	5.56

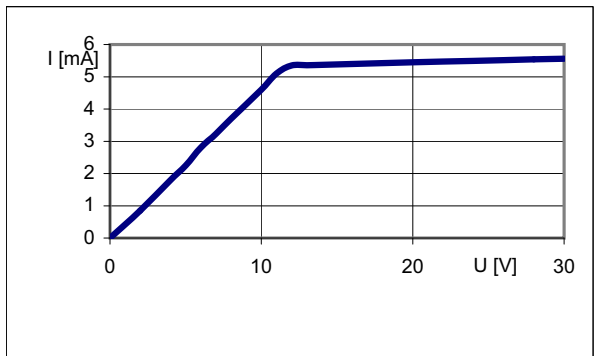


Fig. 2 Input characteristic curve IO-Link/SIO mode

Formula to calculate the power dissipation of the electronics

$$P_{EL} = 2 \text{ W} + (n \cdot 60 \text{ mW} + m \cdot 132 \text{ mW})$$

Where:

- n                      Number of set digital inputs
- m                      Number of set IO-Link/SIO inputs

## 6 Basic circuit diagram

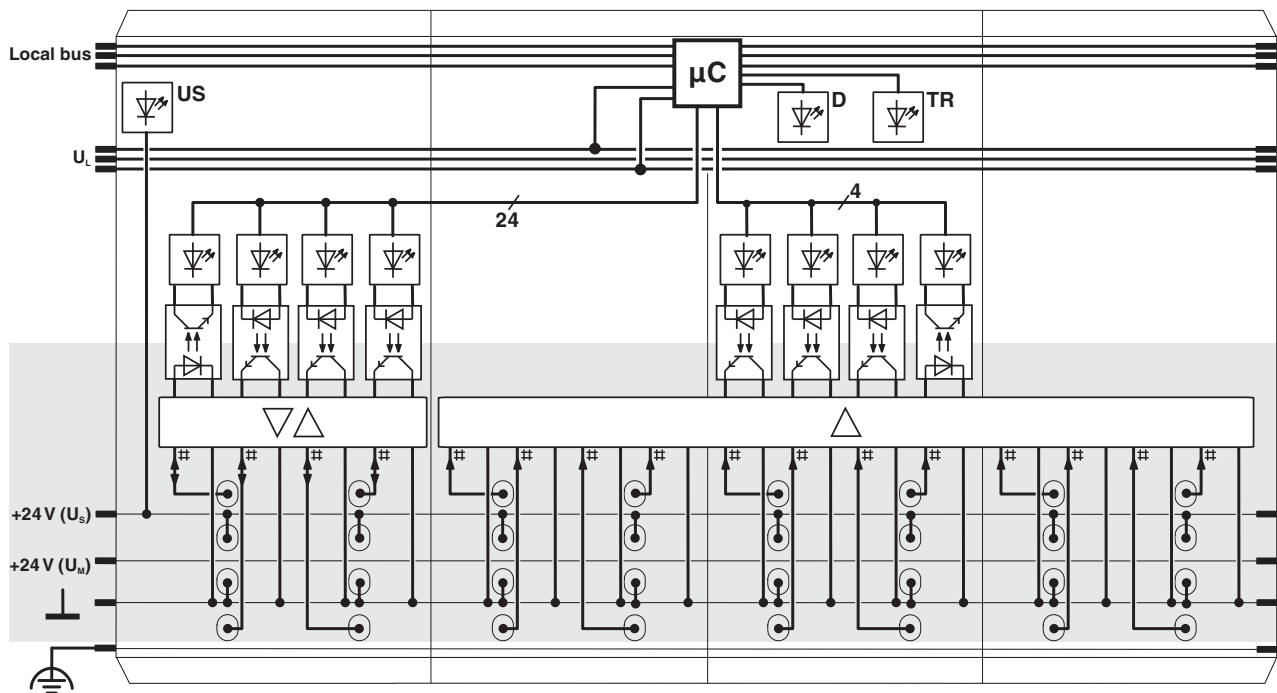







Fig. 3 Internal wiring of the terminal points

Key:

	Microprocessor
	LED
	Optocoupler
	Digital input and output
	Digital input



For an explanation of the other symbols used, please refer to the "Automation terminals of the Inline product range" application description (DOK-CTRL-ILSYSINS\*\*\*-AW..-EN-P, MNR R911317021).

7 Local diagnostic and status indicators

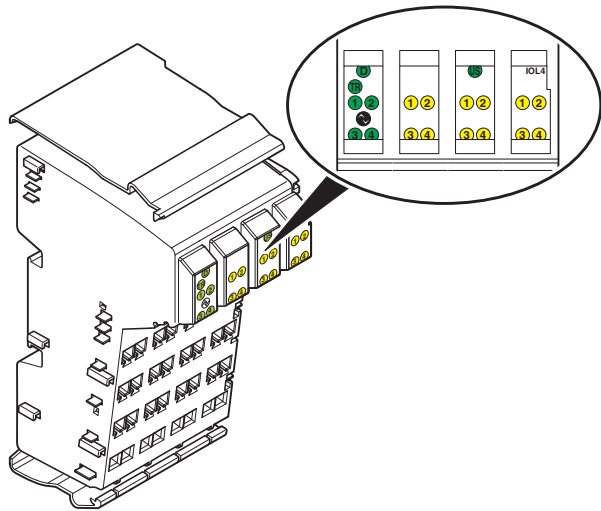


Fig. 4 Local diagnostic and status indicators

Designation	Color	Meaning
D	green	Diagnostics (bus and logic voltage)
TR	green	PCP communication
US	green/red	Diagnostics for sensor voltage
	green on	$U_S > 18\text{ V}$ (typ.)
	red on	$18\text{ V} \geq U_S \geq 3\text{ V}$ (typ.)
	green/red off	$U_S < 3\text{ V}$
IOL: Diagnostics and status of the IO-Link ports		
1 ... 4	green/red/yellow	Diagnostics and status of the IO-Link ports
	green on	IO-Link communication is active.
	yellow on	In the SIO mode: The digital input or output is set.
	yellow off	In the SIO mode: The digital input or output is not set.
	red on	In the scan mode: IO-Link communication error Short-circuit of the C/Q line
	red on	In the SIO mode: Short-circuit of the C/Q line
I1 ... I3: Status of digital inputs		
1 ... 4	yellow	Status indicator of the inputs

Function identification

Orange

8 Terminal point assignment

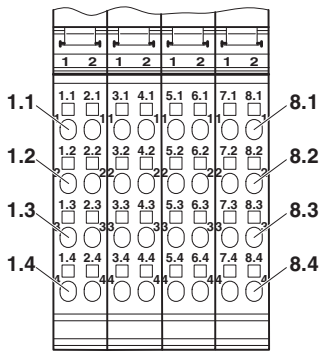


Fig. 5 Terminal point assignment

Terminal point	Assignment
1.1 / 2.1	IO-Link (Port 1 / Port 2)
1.2 / 2.2	Segment voltage $U_S$ for 2 and 3-wire connection
1.3 / 2.3	Ground contact (GND) for 3-wire connection
1.4 / 2.4	IO-Link (Port 3 / Port 4)
3.1 / 4.1	Signal input (IN01 / IN02)
3.2 / 4.2	Segment voltage $U_S$ for 2 and 3-wire connection
3.3 / 4.3	Ground contact (GND) for 3-wire connection
3.4 / 4.4	Signal input (IN03 / IN04)
5.1 / 6.1	Signal input (IN05 / IN06)
5.2 / 6.2	Segment voltage $U_S$ for 2 and 3-wire connection
5.3 / 6.3	Ground contact (GND) for 3-wire connection
7.1 / 8.1	Signal input (IN09 / IN10)
5.4 / 6.4	Signal input (IN07 / IN08)
7.2 / 8.2	Segment voltage $U_S$ for 2 and 3-wire connection
7.3 / 8.3	Ground contact (GND) for 3-wire connection
7.4 / 8.4	Signal input (IN11 / IN12)



When connecting the sensors observe the assignment of the terminal points to the process data.



## 9 Brief description of the function

The C/Q line is in the SIO mode digital input (DI) directly after a power-on. In this condition, the binary status of the C/Q line is displayed in the process data.

In the SCAN mode, an attempt is made cyclically approx. every second to establish communication with an IO-Link device at each port.

If the communication at a port has been successful, the status of the C/Q line of this port changes to the IO-Link mode and remains in this status until the communication is interrupted. In the IO-Link mode, the IO-Link process data byte is displayed in the process data.

After a communication interruption (e.g. line defective), an attempt is made cyclically approx. every second to establish communication.

In the SIO mode DI, the C/Q line behaves like a digital input.

In the SIO mode DO, the C/Q line behaves like a digital output.

## 10 Connection notes and examples

Supply the sensors and  $U_S$  from the power supply.

The following options are available for this:

- Use of terminal blocks for potential distribution
- Use of long connectors as per the ordering data
- Use of external busbars

### Connection when using terminal blocks for potential distribution

Wire the 24 V connections of the sensors to the IB IL PD 24V-PAC terminal block and the GND connections to the IB IL PD GND-PAC terminal block. The sensors are thus supplied from the potential jumpers of the In-line station.

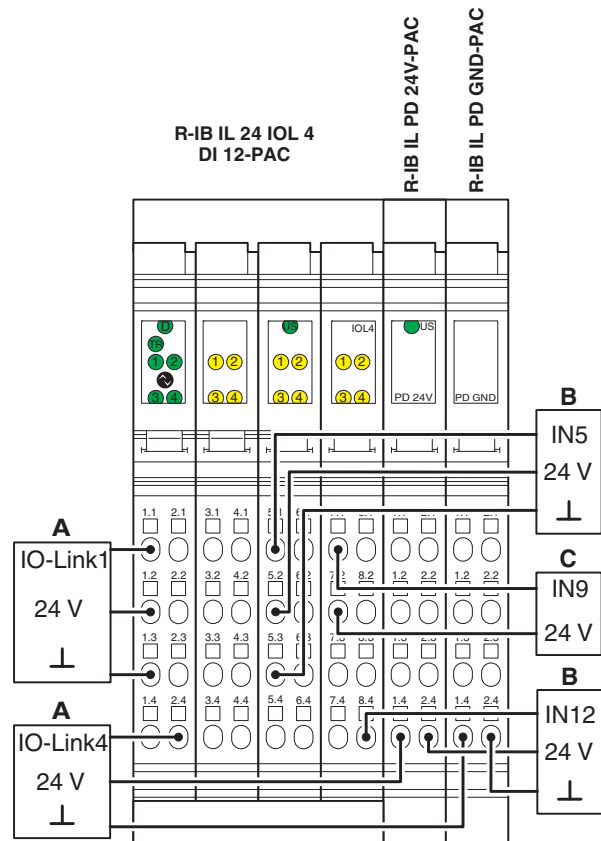


Fig. 6 Typical connection of sensors when terminals for potential distribution are used

Key:

A: IO-Link connection

B: Sensor connection in 3-wire technology

C: Sensor connection in 2-wire technology

### Connection when using long connectors

To connect the sensors, use long plugs corresponding to the ordering data (refer to the product catalog at [www.boschrexroth.com/electrics](http://www.boschrexroth.com/electrics)). For these plugs, the respective 24 V terminal points and GND are internally jumpered. In this way, the sensors are supplied from the potential jumpers of the Inline station.

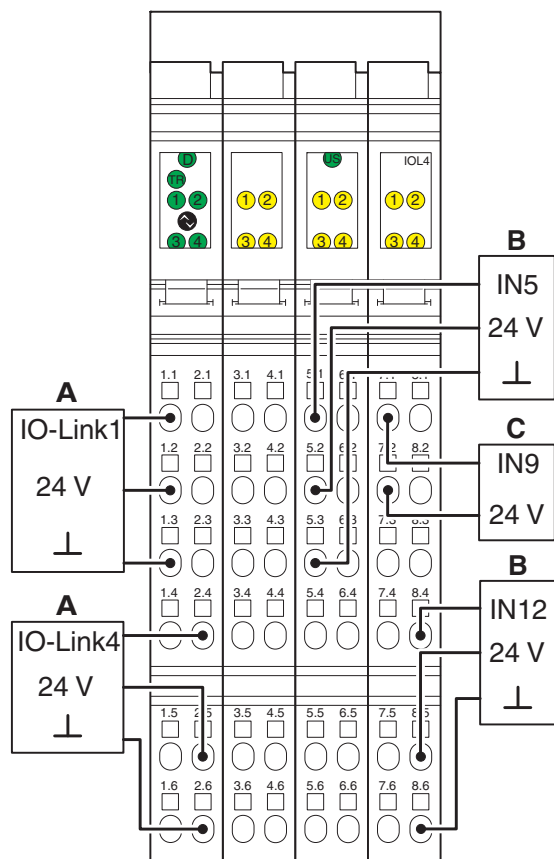


Fig. 7 Example of a connection of sensors when using long connectors

Key:

A: IO-Link connection

B: Sensor connection in 3-wire technology

C: Sensor connection in 2-wire technology

### Connection when using external busbars

The sensors can also be connected via external busbars. Ensure that the sensors and  $U_S$  are supplied from the same voltage supply.

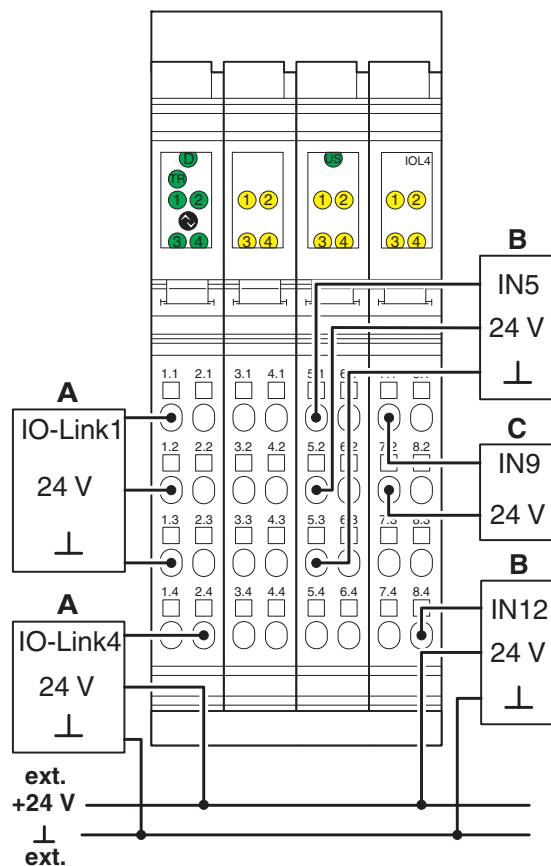


Fig. 8 Example of a connection of sensors when using external busbars

Key:

A: IO-Link connection

B: Sensor connection in 3-wire technology

C: Sensor connection in 2-wire technology

Word	Word 4															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	IO-Link device process data								IO-Link device process data							
	High byte port 4								Low byte port 4							

Word	Word 5															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	Digital inputs												SIO inputs (C/Q)			
	12	11	10	9	8	7	6	5	4	3	2	1	4	3	2	1
Slot	4				3				2				1			
Signal	8.4	7.4	8.1	7.1	6.4	5.4	6.1	5.1	4.4	3.4	4.1	3.1	2.4	1.4	2.1	1.1
U <sub>S</sub> (24 V DC)			8.2	7.2			6.2	5.2			4.2	3.2			2.2	1.2
GND			8.3	7.3			6.3	5.3			4.3	3.3			2.3	1.3
LED	4	3	2	1	4	3	2	1	4	3	2	1	4	3	2	1

## 11.2 OUT process data

SIO Outputs (C/Q)	Status of the C/Q cable of an IO-Link port, when the port is in SIO DO mode.	
	0	Output is not set.
	1	Output is set.
IO-Link device process data	<p>Only for IO-Link devices with an IO-Link process data length of up to 16 bits is the output process data written to the IO-Link device.</p> <p>If an IO-Link device has more than 16 bits of output data, this data must be written with a PCP object.</p>	

Word	Word 0															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
IO-Link port	4	3	2	1	0	0	0	0	0	0	0	0	4	3	2	1
Assignment	Port config				Not used				Not used				SIO Outputs (C/Q)			

[illegible]

Word	Word 2															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	IO-Link device process data								IO-Link device process data							
	High byte port 2								Low byte port 2							

Word	Word 3															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	IO-Link device process data								IO-Link device process data							
	High byte port 3								Low byte port 3							

Word	Word 4															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	IO-Link device process data								IO-Link device process data							
	High byte port 4								Low byte port 4							

Word	Word 5															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Assignment	Not used								Not used							

## Port Config

If the IO-Link port is configured for the "digital input" operating mode via the PCP object 0080<sub>hex</sub>, you can switch it to "Scan" operating mode via process data. To do so, set the corresponding "Port config" bit to 1 in the process output data.

If you reset this bit to 0, the port switches to the "Digital input" operating mode.

If the IO-Link port is configured for the "digital output" operating mode via the PCP object 0080<sub>hex</sub> or if "Scan mode" is configured, the "Port config" output data bits are irrelevant.

The "Port config" bits control the following ports:

Bit	15	14	13	12
IO-Link port	4	3	2	1

Bit = 0      Digital input

Bit = 1      IO-Link communication active (Scan mode)