



### Highlights

- Open, fieldbus-neutral I/O system
- 12 fieldbus systems, 24 signal types
- Compact and robust
- Mounting directly on machines, outside of control cabinet or terminal box
- IO-Link box modules for inexpensive point-to-point connections

# Fieldbus Box

The compact IP 67 modules

► [www.beckhoff.com/FieldbusBox](http://www.beckhoff.com/FieldbusBox)

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# Product overview Compact Box, Coupler Box, PLC Box, Extension Box

Fieldbus Box	Compact Box	Coupler Box	PLC Box
Fieldbus	Fieldbus Box without IP-Link interface	Fieldbus Box with IP-Link interface	Controller for TwinCAT 2 (IEC 61131-3) with IP-Link interface
EtherCAT <sup>®</sup>		IL230x-B110 559	
LIGHTBUS	IPxxxx-B200 559	IL230x-B200 559	
PROFINET <sup>®</sup>	IPxxxx-B310 560 IPxxxx-B318 560 with integrated tee-connector	IL230x-B310 560 IL230x-B318 560 with integrated tee-connector	IL230x-C310 561 IL230x-C318 561 with integrated tee-connector
INTERBUS	IPxxxx-B400 561	IL230x-B400 561	
CANopen	IPxxxx-B510 562 IPxxxx-B518 562 with integrated tee-connector	IL230x-B510 562 IL230x-B518 562 with integrated tee-connector	
DeviceNet	IPxxxx-B520 563 IPxxxx-B528 563 with integrated tee-connector	IL230x-B520 563 IL230x-B528 563 with integrated tee-connector	
Modbus	IPxxxx-B730 564	IL230x-B730 564	
RS485	IPxxxx-B800 564	IL230x-B800 565	
RS232	IPxxxx-B810 565	IL230x-B810 565	IL230x-C810 565
Ethernet TCP/IP		IL230x-B900 566 IL230x-B901 566	IL230x-C900 566
PROFINET <sup>®</sup>		IL230x-B903 567	
EtherNet/IP		IL230x-B905 567	

Fieldbus Box   Compact Box and Extension Box: Digital I/O							
Input		8 mm		M8		M12	
24 V DC	8-channel filter 3.0 ms	IP1000-Bxxx, IE1000	578	IP1001-Bxxx, IE1001	579	IP1002-Bxxx, IE1002	579
	8-channel filter 0.2 ms	IP1010-Bxxx, IE1010	578	IP1011-Bxxx, IE1011	579	IP1012-Bxxx, IE1012	579
Counter	2-channel up/down counter 24 V DC, 100 kHz					IP1502-Bxxx, IE1502	579
Output		8 mm		M8		M12	
24 V DC	8-channel I <sub>max</sub> = 0.5 A	IP2000-Bxxx, IE2000	580	IP2001-Bxxx, IE2001	580	IP2002-Bxxx, IE2002	581
	8-channel I <sub>max</sub> = 2 A, $\Sigma$ 4 A	IP2020-Bxxx, IE2020	581	IP2021-Bxxx, IE2021	581	IP2022-Bxxx, IE2022	581
	8-channel I <sub>max</sub> = 2 A, $\Sigma$ 12 A	IP2040-Bxxx, IE2040	582	IP2041-Bxxx, IE2041	582	IP2042-Bxxx, IE2042	582
	16-channel I <sub>max</sub> = 0.5 A, $\Sigma$ 4 A, D-sub					IE2808 IE2808-0001	583 583
PWM	2-channel PWM, 24 V DC, I <sub>max</sub> = 2.5 A					IP2512-Bxxx, IE2512	583

## Fieldbus Box | Compact Box, Coupler Box, PLC Box and Extension Box: Digital I/O

Combi		8 mm		M8		M12		Other	
24 V DC	8-channel 4 inputs + 4 outputs, filter 3.0 ms, I <sub>max</sub> = 0.5 A	IL2300-Bxxx	570	IL2301-Bxxx	570	IL2302-Bxxx	570	IE2403 IP 20 plug	585
		IL2300-Cxxx	572	IL2301-Cxxx	572	IL2302-Cxxx	572		
		IP2300-Bxxx	584	IP2301-Bxxx	585	IP2302-Bxxx	585		
		IE2300	584	IE2301	585	IE2302	585		
	8-channel 4 inputs + 4 outputs, filter 0.2 ms, I <sub>max</sub> = 0.5 A	IP2310-Bxxx	584	IP2311-Bxxx	585	IP2312-Bxxx	585		
		IE2310	584	IE2311	585	IE2312	585		
	8-channel 4 inputs + 4 outputs, filter 3.0 ms, I <sub>max</sub> = 2 A, Σ 4 A	IP2320-Bxxx	586	IP2321-Bxxx	586	IP2322-Bxxx	587		
		IE2320	586	IE2321	586	IE2322	587		
	8-channel 4 inputs + 4 outputs, filter 0.2 ms, I <sub>max</sub> = 2 A, Σ 4 A	IP2330-Bxxx	586	IP2331-Bxxx	586	IP2332-Bxxx	587		
		IE2330	586	IE2331	586	IE2332	587		
	16-channel combi inputs/outputs, filter 3.0 ms, I <sub>max</sub> = 0.5 A	IP2400-Bxxx	587	IP2401-Bxxx	587				
		IE2400	587	IE2401	587				

## Fieldbus Box | Compact Box and Extension Box: Analog I/O

Input		M12
±10 V	4-channel differential inputs, 16 bit	IP3102-Bxxx, IE3102588
0/4...20 mA	4-channel differential inputs, 16 bit	IP3112-Bxxx, IE3112589
Resistance thermometer	4-channel PT100, PT200, PT500, PT1000, Ni100, 16 bit	IP3202-Bxxx, IE3202589
Thermocouple/mV	4-channel type J, K, L, B, E, N, R, S, T, U, 16 bit	IP3312-Bxxx, IE3312589
Output		M12
±10 V	4-channel 16 bit	IP4132-Bxxx, IE4132590
0/4...20 mA	4-channel 16 bit	IP4112-Bxxx, IE4112590

## Fieldbus Box | Compact Box and Extension Box: Special functions

Function		M12	M23
Position measurement	1-channel SSI encoder interface		IP5009-Bxxx, IE5009 592
	1-channel incremental encoder interface, 1 MHz		IP5109-Bxxx, IE5109 593
	1-channel SinCos encoder interface		IP5209-Bxxx (1 V <sub>pp</sub> ) 593
			IP5209-Bxxx-1000 (11 μA <sub>pp</sub> )
Communication	1-channel serial interface, RS232	IP6002-Bxxx, IE6002 594	
	1-channel serial interface, 0...20 mA (TTY)	IP6012-Bxxx, IE6012 595	
	1-channel serial interface, RS422/RS485	IP6022-Bxxx, IE6022 595	



# Product overview IO-Link box

Fieldbus Box   IO-Link box: Digital I/O					
Input		8 x M8	16 x M8	4 x M12	8 x M12
24 V DC	8-channel filter 3.0 ms	EPI1008-0001 598 ERI1008-0001 598		EPI1008-0002 598 ERI1008-0002 598	
	16-channel filter 3.0 ms		EPI1809-0021 599 ERI1809-0021 599		EPI1809-0022 599 ERI1809-0022 599
Output		8 x M8	16 x M8	4 x M12	8 x M12
24 V DC	8-channel $I_{max} = 0.5 A$	EPI2008-0001 600 ERI2008-0001 600		EPI2008-0002 600 ERI2008-0002 600	
	16-channel $I_{max} = 0.5 A, \Sigma 4 A$		EPI2809-0021 601 ERI2809-0021 601		EPI2809-0022 601 ERI2809-0022 601
Combi		8 x M8	16 x M8	4 x M12	8 x M12
24 V DC	8-channel 8 inputs/outputs, filter 3.0 ms, $I_{max} = 0.5 A$	EPI2338-0001 602 ERI2338-0001 602		EPI2338-0002 602 ERI2338-0002 602	
	16-channel 16 inputs/outputs, filter 3.0 ms, $I_{max} = 0.5 A, \Sigma 4 A$		EPI2339-0021 603 ERI2339-0021 603		EPI2339-0022 603 ERI2339-0022 603

Fieldbus Box   IO-Link box: Analog I/O				
Input			M12	
±10 V, 0/4...20 mA	4-channel parameterisable, differential input, 16 bit	EPI3174-0002	604	
		ERI3174-0002	604	
Output			M12	
±10 V, 0/4...20 mA	4-channel 2 inputs + 2 outputs, parameterisable, 16 bit	EPI4374-0002	605	
		ERI4374-0002	605	

EPIxxxx: industrial housing in IP 67, ERIxxxx: zinc die-cast housing in IP 67



# The Fieldbus Box

**The Beckhoff Fieldbus Box system is the culmination of the fieldbus concept:**

## Robust

Robust construction allows fieldbus modules to be fitted directly to machines. Control cabinets and terminal boxes are now no longer required.

## Sealed

The modules meet the protection class IP 65, IP 66 and IP 67, are fully casted and thus ideally prepared for use in wet, dirty and dusty working environments.

## Small

The modules are extremely small and are thus suitable for use in applications where there is very little space available. The low weight of the Fieldbus Box modules makes them useful in applications where the I/O interface is in motion (e.g. on a robot arm).

## Open

All the most important fieldbus systems are supported. This substantially frees electrical design from the particular bus system in use. Fast, flexible reactions to customers' requirements are possible. The Fieldbus Box modules are, of course, certified by the respective fieldbus user organisations, and can be combined with Beckhoff Bus Terminals and with devices from third-party manufacturers.

## Modular

Conventional fieldbuses such as PROFIBUS or CANopen are connected via Coupler Box modules. These are modularly extendable through cost-effective extension modules.

## Quickly wired

The wiring of the fieldbus and of signals is significantly simplified through the use of pre-assembled cables. Wiring errors are minimised and the system setup is finished quickly.

## Flexible

In addition to the pre-assembled cables, field wireable connectors and cables are also available for maximum flexibility.

## Economical

Combined I/O modules and fine signal granularity lead to low system costs – you only have to buy what you really need.

## Intelligent

Even the standard modules are intelligent fieldbus devices – with self-diagnosis and versatile functions. The Fieldbus Box is furthermore available as a small local controller – the PLC Box: programmable in all five languages in accordance with IEC 61131-3, with floating point arithmetic and with sufficient performance and memory for the majority of decentralised control and regulation tasks.

## Complete

The wide variety of signal types allows the connection of almost any kind of sensor. The communication modules enable decentralised connection of, e.g., label printers, identification systems or special equipment. The Fieldbus Box range also includes encoder interfaces for displacement and angle measurement.

## Fitting

Sensors and actuators are connected through 8 mm diameter snap type or through screw type connectors (M8 or M12). The snap type connectors lock in place positively, forming a vibration-proof connection, while the screw type connectors offer the advantage of high resistance to being pulled out.

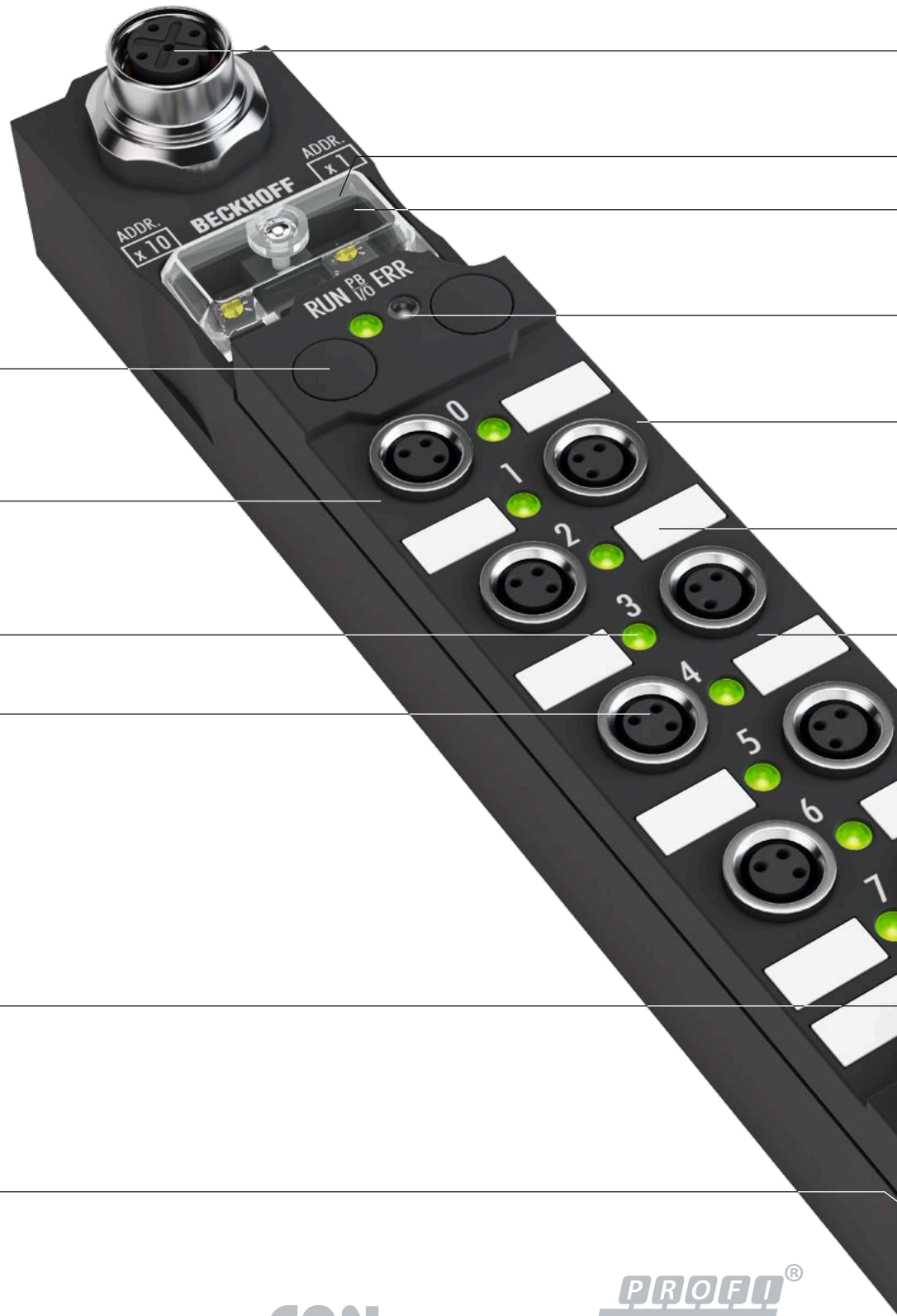
## Compatible

The Fieldbus Box devices behave very much like the Beckhoff Bus Terminals – this means that the ideal distributed peripheral device can be used, whatever the particular application.

## IO-Link

The Fieldbus Box modules with IO-Link interface complement the connection possibilities at the sensor/actuator level. This way, IO-Link and standard sensors can be acquired with one IO-Link master.

# Fieldbus Box features



IP-Link interface on the Coupler Box and PLC Box for the connection of extension modules

Watertight and dust-proof, due to protection class IP 65/66/67 (fully potted)

Signal status display

Connection of sensors/ actuators via connector:

- M8, screw type
- M12, screw type
- 8 mm, snap type

Power supply input

- box supply
- auxiliary voltage

Mounting holes

Modbus

EtherNet/IP™

CANopen

PROFI<sup>®</sup>  
NET

INTERBUS

PROFI<sup>®</sup>  
BUS

LIGHTBUS

RS232  
↔  
RS485



Fieldbus interface  
(connection depends on  
the particular fieldbus)

Hinged inspection window

Address selection switch  
and diagnostic interface

Fieldbus status display  
Module or IP-Link  
status display

Robust housing for  
industrial application

Standard labels

Ultra compact dimensions  
175 x 30 x 26.5 mm (L x W x H)

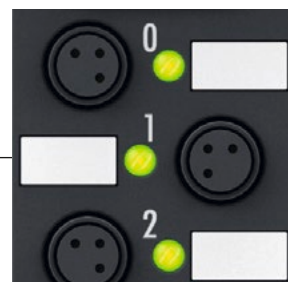
Power supply status display:  
box supply and auxiliary  
voltage

Power supply downstream  
connection

M8 screw type connector

M12 screw type connector

8 mm snap type connector



EtherCAT®

IO-Link

Ethernet TCP/IP

DeviceNet™

# Housing types Fieldbus Box

## Industrial housing

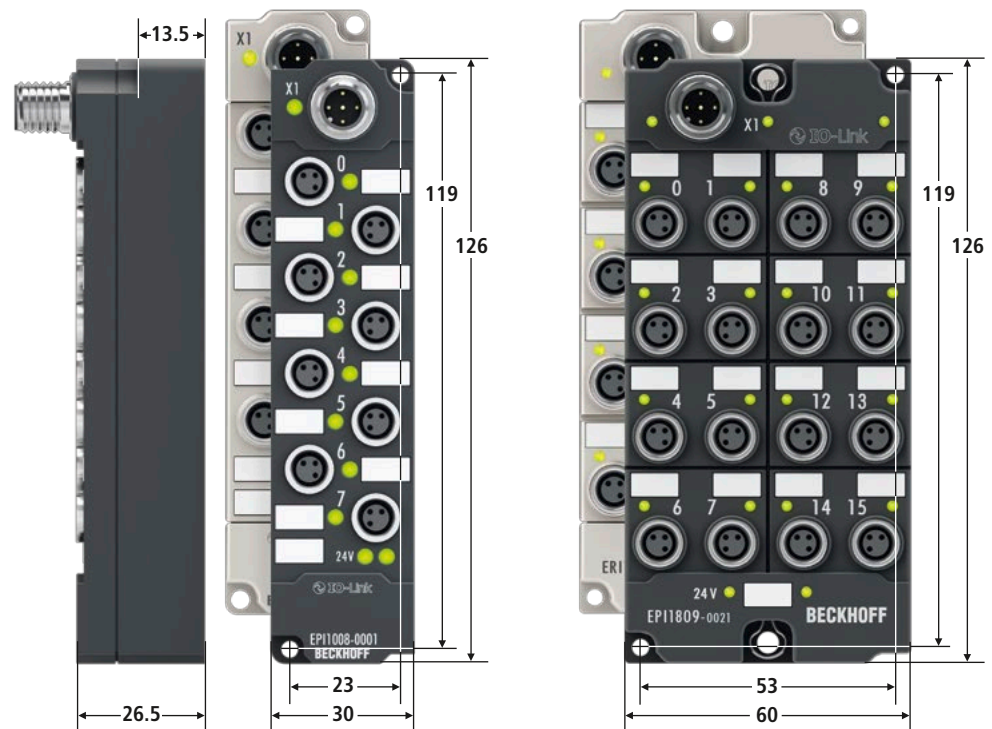


Technical data	Standard housing	XXL housing	Extension Box
Dimensions (W x H x D)	30 mm x 175 mm x 26.5 mm	30 mm x 210 mm x 26.5 mm	30 mm x 126 mm x 26.5 mm
Weight	depending on device	depending on device	depending on device (typ. 150 g)
Material	PA6 (polyamide)		
Installation	2 fixing holes 3 mm diameter for M3		
Operating/storage temperature	0...+55 °C/-25...+85 °C		
Vibration resistance	conforms to EN 60068-2-6		
Shock resistance	conforms to EN 60068-2-27		
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4		
Protect. class/installation pos.	IP 65/66/67 (conforms to EN 60529)/variable		
Approvals	UL E172151, CE		
Power feedthrough	$I_{max} = 4 \text{ A}$		



# Housing types IO-Link box

## Industrial and zinc die-cast housing



Technical data	8 x M8, 4 x M12	16 x M8, 8 x M12
Dimensions (W x H x D)	30 mm x 126 mm x 26.5 mm	60 mm x 126 mm x 26.5 mm
Weight	depending on device (typ. 150 g)	depending on device (typ. 310 g)
Material	PA6 (polyamide) for EPIxxxx or zinc die-cast for ERIxxxx	
Installation	2 fixing holes 3 mm diameter for M3	2 fixing holes 3 mm diameter for M3; 2 fixing holes 4.5 mm diameter for M4
Operating/storage temperature	-25...+60 °C/-40...+85 °C	
Vibration resistance	conforms to EN 60068-2-6: 1 g (extended range: 5 g)	
Shock resistance	conforms to EN 60068-2-27: 15 g, 11 ms (extended range: 35 g, 11 ms); 1000 shocks per direction, 3 axes	
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4	
Protect. class/installation pos.	IP 65/66/67 (conforms to EN 60529)/variable	
Approvals	CE, UL in preparation	
Power feedthrough	—	

# Fieldbus Box

► [www.beckhoff.com/FieldbusBox](http://www.beckhoff.com/FieldbusBox)



## IL230x-Bxxx | Coupler Box

- corresponds to the Bus Coupler in the Beckhoff Bus Terminal system
- bus module with IP-Link extension interface
- for 120 extension modules (IExxxx)
- combines four digital inputs and four digital outputs in one device

See page 568

## IExxxx | Extension Box

- connection via IP-Link for all signal types
- 8 mm or screw type M8 and M12 connectors
- wide range of I/O functionalities
- support of all relevant industrial signals

See page 576





#### IL230x-Cxxx | **PLC Box**

- IEC 61131-3 intelligence in the smallest amount of space
- extendable with 120 IP-Link modules
- 16-bit controller, 32/96 kbyte program memory, 32/64 kbyte data memory
- 512 bytes non-volatile memory
- combines four digital inputs and four digital outputs in one device

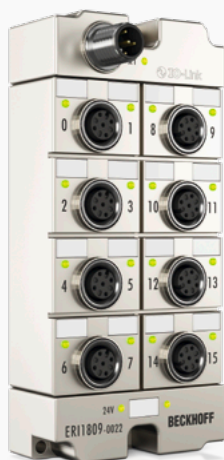
See page **568**



#### IPxxxx-Bxxx | **Compact Box**

- rugged signal variety
- for 12 bus systems
- 8 mm or screw type M8 and M12 connectors
- wide range of I/O functionalities
- support of all relevant industrial signals

See page **574**



#### EPIxxxx, ERIxxxx | **IO-Link box**

- cost-effective and flexible sensor connections in extremely harsh environments
- suitable IO-Link masters in IP 67 (EP6224, EP6228, EPP6228) and IP 20 (EL6224/EL6224-0090, EJ6224/EJ6224-0090, KL6224)
- 28 module variants in plastic or zinc die-cast housing
- M8 or M12 screw type connection
- digital and analog I/O modules
- IO-Link specification V1.1

See page **596**



#### FM33xx | **Fieldbus Modules**

- high-speed EtherCAT communication or PROFIBUS DP
- direct connection of 12 or 32 thermocouples
- compact, splash-proof housing

See page **606**

# Fieldbus systems

► [www.beckhoff.com/Fieldbus-systems](http://www.beckhoff.com/Fieldbus-systems)

The Beckhoff Fieldbus Box modules are available for various fieldbuses. The Compact Box serves as a fieldbus station – without expansion options – with a wide variety of I/O functions.

The Coupler Box and PLC Box can be extended by the Extension Box modules. Communication takes place via IP-Link. IP-Link is a fibre optic communication link with a transmission rate of 2 Mbits/s which is capable of transmitting 1000 items of binary I/O data in approx. 1 ms, rapidly and securely. Smaller configurations are corre-

spondingly faster. Because of the high usable data rate, the IP-Link coupling does not reduce the performance of the fieldbus at all.

The Coupler Box gathers the I/O data and corresponds to the Bus Coupler from the Beckhoff Bus Terminal system.

The PLC Box is an intelligent fieldbus module for local pre-processing of the I/O signals and thus corresponds to the Bus Terminal Controller in the Bus Terminal system. This is a way of removing parts of the application out of the central control system

to relieve the CPU and the fieldbus. Decentralised counting, control or switching are typical applications for the Fieldbus Box with integrated small controller. The reaction times are independent of the bus communication and of the supervising controller. In the event of a bus or controller failure, maintenance of function (e.g. bringing the process to a safe state in an orderly manner) is possible.

For further information on the individual fieldbuses see page **18**



IPxxx-Bzzz | Compact Box






IL230y-Bzzz | Coupler Box



IL230y-Czzz | PLC Box


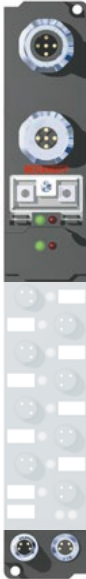


# EtherCAT, Lightbus | Fieldbus Box modules

**EtherCAT**
**LIGHTBUS**



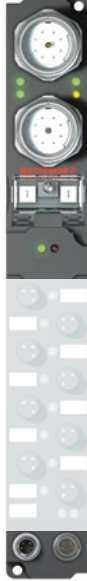

	EtherCAT Coupler Box	Lightbus Compact Box	Lightbus Coupler Box
<b>Technical data</b>	<b>IL230x-B110</b>	<b>IPxxxx-B200</b>	<b>IL230x-B200</b>
<b>Extension modules</b>	max. 78 with max. 512 byte input and 512 byte output data	–	max. 120 with max. 512 byte input and 512 byte output data
<b>Data transfer rates</b>	100 Mbaud	2.5 Mbaud	2.5 Mbaud
<b>Configuration possibility</b>	via KS2000	via KS2000 or the controller	via KS2000 or the controller
	 <p>A station consists of an IL230x-B110 Coupler Box and any number of up to 78 Extension Box modules that are connected via IP-Link.</p>	 <p>Compact Box modules for Lightbus are available for all relevant industrial signals.</p>	 <p>The Lightbus Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.</p>
<b>Bus interface</b>	2 x M12 socket, 4-pin (D-coded)	2 x fibre optic socket for plug ZS1020-0010	2 x fibre optic socket for plug ZS1020-0010
<b>Digital peripheral signals</b>	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules
<b>Analog peripheral signals</b>	max. 127 inputs and 127 outputs	according to I/O type, see page 588	max. 124 inputs and 124 outputs
<b>Approvals</b>	CE, UL	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IL230x-B110">www.beckhoff.com/IL230x-B110</a>	<a href="http://www.beckhoff.com/IPxxxx-B200">www.beckhoff.com/IPxxxx-B200</a>	<a href="http://www.beckhoff.com/IL230x-B200">www.beckhoff.com/IL230x-B200</a>
<b>Accessories</b>			
<b>Cordsets and connectors</b>	see page 634	see page 634	see page 634
<b>TwinCAT 2 PLC</b>	–	–	–

# PROFIBUS, Interbus | Fieldbus Box modules







	PROFIBUS Compact Box	PROFIBUS Compact Box with integrated tee-connector	PROFIBUS Coupler Box	PROFIBUS Coupler Box with integrated tee-connector
Technical data	IPxxxx-B310	IPxxxx-B318	IL230x-B310	IL230x-B318
Extension modules	–	–	max. 120 with max. 128 byte input and 128 byte output data	
Data transfer rates	automatic detection up to 12 Mbaud		automatic detection up to 12 Mbaud	
Configuration possibility	via KS2000 or the controller, DP-V1 extensions are supported		via KS2000 or the controller, DP-V1 extensions are supported	
	 <p>Compact Box modules for PROFIBUS are available for all relevant industrial signals.</p>	 <p>In the Compact Box with integrated tee-connector, the PROFIBUS is relayed forward in the module.</p>	 <p>The PROFIBUS Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.</p>	 <p>In the Coupler Box with integrated tee-connector, the PROFIBUS is relayed forward in the module.</p>
Bus interface	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, 1 x M12 plug, 5-pin (tee-connector integrated), B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, 1 x M12 plug, 5-pin (tee-connector integrated), B-coded
Digital peripheral signals	according to I/O type, see page 578	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules	
Analog peripheral signals	according to I/O type, see page 588	according to I/O type, see page 588	max. 60 inputs and 60 outputs	max. 60 inputs and 60 outputs
Approvals	CE, UL	CE, UL	CE, UL	CE, UL
Further information	<a href="http://www.beckhoff.com/IPxxxx-B310">www.beckhoff.com/IPxxxx-B310</a>	<a href="http://www.beckhoff.com/IPxxxx-B318">www.beckhoff.com/IPxxxx-B318</a>	<a href="http://www.beckhoff.com/IL230x-B310">www.beckhoff.com/IL230x-B310</a>	<a href="http://www.beckhoff.com/IL230x-B318">www.beckhoff.com/IL230x-B318</a>
Accessories				
Cordsets and connectors	see page 634	see page 634	see page 634	see page 634
TwinCAT 2 PLC	–	–	–	–







	PROFIBUS PLC Box	PROFIBUS PLC Box with integrated tee-connector	Interbus Compact Box	Interbus Coupler Box
	IL230x-C310	IL230x-C318	IPxxx-B400	IL230x-B400
	max. 120 with max. 128 byte input and 128 byte output data		–	max. 120 with max. 64 byte input and 64 byte output data
	automatic detection up to 12 Mbaud		500 kbaud	500 kbaud
	via KS2000 or the controller, DP-V1 extensions are supported		via KS2000	via KS2000
	 <p>The PLC Box is an intelligent PROFIBUS node that can perform decentralised processing of I/O data and execute control tasks independently of the function of the PROFIBUS network.</p>	 <p>In the PLC Box with integrated tee-connector, the PROFIBUS is relayed forward in the module.</p>	 <p>Compact Box modules for Interbus are available for all relevant industrial signals.</p>	 <p>The Interbus Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.</p>
	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, 1 x M12 plug, 5-pin (tee-connector integrated), B-coded	1 x M23 socket, 9-pin, 1 x M23 plug, 9-pin	1 x M23 socket, 9-pin, 1 x M23 plug, 9-pin
	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules
	max. 60 inputs and 60 outputs	max. 60 inputs and 60 outputs	according to I/O type, see page 588	max. 28 inputs and 28 outputs
	CE, UL	CE, UL	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/IL230x-C310">www.beckhoff.com/IL230x-C310</a>	<a href="http://www.beckhoff.com/IL230x-C318">www.beckhoff.com/IL230x-C318</a>	<a href="http://www.beckhoff.com/IPxxx-B400">www.beckhoff.com/IPxxx-B400</a>	<a href="http://www.beckhoff.com/IL230x-B400">www.beckhoff.com/IL230x-B400</a>
	see page 634	see page 634	see page 634	see page 634
	see page 1 520	see page 1 520	–	–

# CANopen, DeviceNet | Fieldbus Box modules

## CANopen

	CANopen Compact Box	CANopen Compact Box with integrated tee-connector	CANopen Coupler Box	CANopen Coupler Box with integrated tee-connector
Technical data	IPxxxx-B510	IPxxxx-B518	IL230x-B510	IL230x-B518
Extension modules	–	–	max. 120 with max. 128 byte input and 128 byte output data	
Data transfer rates	automatic detection of 10 kbaud up to 1 Mbaud		automatic detection of 10 kbaud up to 1 Mbaud	
Configuration possibility	through KS2000 or the controller (service data objects)	through KS2000 or the controller (service data objects)	through KS2000 or the controller (service data objects)	through KS2000 or the controller (service data objects)
	 <p>Compact Box modules for CANopen are available for all relevant industrial signals.</p>	 <p>In the Compact Box with integrated tee-connector, CANopen is relayed forward in the module.</p>	 <p>The CANopen Coupler Box has four digital inputs and four digital outputs. Other kinds of signals are available in the Extension Box modules.</p>	 <p>In the Coupler Box with integrated tee-connector, CANopen is relayed forward in the module.</p>
Bus interface	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin (tee-connector integrated)	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin (tee-connector integrated)
Digital peripheral signals	according to I/O type, see page 578	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules	
Analog peripheral signals	according to I/O type, see page 588	according to I/O type, see page 588	max. 60 inputs and 60 outputs	max. 60 inputs and 60 outputs
Approvals	CE, UL	CE, UL	CE, UL	CE, UL
Further information	<a href="http://www.beckhoff.com/IPxxxx-B510">www.beckhoff.com/ IPxxxx-B510</a>	<a href="http://www.beckhoff.com/IPxxxx-B518">www.beckhoff.com/ IPxxxx-B518</a>	<a href="http://www.beckhoff.com/IL230x-B510">www.beckhoff.com/ IL230x-B510</a>	<a href="http://www.beckhoff.com/IL230x-B518">www.beckhoff.com/ IL230x-B518</a>
Accessories				
Cordsets and connectors	see page 634	see page 634	see page 634	see page 634
TwinCAT 2 PLC	–	–	–	–

## DeviceNet™




	DeviceNet Compact Box	DeviceNet Compact Box with integrated tee-connector	DeviceNet Coupler Box	DeviceNet Coupler Box with integrated tee-connector
	IPxxxx-B520	IPxxxx-B528	IL230x-B520	IL230x-B528
	–	–	max. 120 with max. 512 byte input and 512 byte output data	
	automatic detection up to 500 kbaud		automatic detection up to 500 kbaud	
	through KS2000 or the controller (explicit messaging)	through KS2000 or the controller (explicit messaging)	through KS2000 or the controller (explicit messaging)	through KS2000 or the controller (explicit messaging)
	 <p>Compact Box modules for DeviceNet are available for all relevant industrial signals.</p>	 <p>In the Compact Box with integrated tee-connector, DeviceNet is relayed forward in the module.</p>	 <p>The DeviceNet Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.</p>	 <p>In the Coupler Box with integrated tee-connector, DeviceNet is relayed forward in the module.</p>
	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin (tee-connector integrated)	1 x M12 plug, 5-pin	1 x M12 plug, 5-pin, 1 x M12 socket, 5-pin (tee-connector integrated)
	according to I/O type, see page 578	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules
	according to I/O type, see page 588	according to I/O type, see page 588	max. 252 inputs and 252 outputs	max. 252 inputs and 252 outputs
	CE, UL	CE, UL	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/IPxxxx-B520">www.beckhoff.com/ IPxxxx-B520</a>	<a href="http://www.beckhoff.com/IPxxxx-B528">www.beckhoff.com/ IPxxxx-B528</a>	<a href="http://www.beckhoff.com/IL230x-B520">www.beckhoff.com/ IL230x-B520</a>	<a href="http://www.beckhoff.com/IL230x-B528">www.beckhoff.com/ IL230x-B528</a>
	see page 634	see page 634	see page 634	see page 634
	–	–	–	–







# Modbus, RS485/RS232 | Fieldbus Box modules

## Modbus






	Modbus Compact Box	Modbus Coupler Box	RS485 Compact Box
<b>Technical data</b>	IPxxxx-B730	IL230x-B730	IPxxxx-B800
<b>Extension modules</b>	–	max. 120 with max. 512 byte input and 512 byte output data	–
<b>Data transfer rates</b>	150 to 38,400 baud RTU/ASCII	150 to 38,400 baud RTU/ASCII	9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)
<b>Configuration possibility</b>	by means of address selection switch or KS2000	by means of address selection switch or KS2000	via KS2000
	 <p>Compact Box modules for Modbus are available for all relevant industrial signals.</p>	 <p>The Modbus Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable.</p>	 <p>Compact Box modules for RS485 are available for all relevant industrial signals.</p>
<b>Bus interface</b>	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded
<b>Digital peripheral signals</b>	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 578
<b>Analog peripheral signals</b>	according to I/O type, see page 588	max. 255 inputs and 255 outputs	according to I/O type, see page 588
<b>Approvals</b>	CE, UL	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IPxxxx-B730">www.beckhoff.com/IPxxxx-B730</a>	<a href="http://www.beckhoff.com/IL230x-B730">www.beckhoff.com/IL230x-B730</a>	<a href="http://www.beckhoff.com/IPxxxx-B800">www.beckhoff.com/IPxxxx-B800</a>
<b>Accessories</b>			
<b>Cordsets and connectors</b>	see page 634	see page 634	see page 634
<b>TwinCAT 2 PLC</b>	–	–	–

	RS485 Coupler Box	RS232 Compact Box	RS232 Coupler Box	RS232 PLC Box
	IL230x-B800	IPxxxx-B810	IL230x-B810	IL230x-C810
	max. 120 with max. 512 byte input and 512 byte output data	–	max. 120 with max. 512 byte input and 512 byte output data	
	9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)	9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)	9.6 kbaud, 19.2 kbaud, 38.4 kbaud (default)	
	via KS2000	via KS2000	via KS2000	via KS2000
	 <p>The serial Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable. It detects the connected modules and automatically allocates the input and output data to the process image.</p>	 <p>Compact Box modules for RS232 are available for all relevant industrial signals.</p>	 <p>The serial Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link fibre optic cable. It detects the connected modules and automatically allocates the input and output data to the process image.</p>	 <p>The PLC Box is an intelligent RS232 coupler that can perform non-central decentralised processing of I/O data and execute control tasks. Like the Coupler Box, it has four digital inputs and four digital outputs.</p>
	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded	1 x M12 socket, 5-pin, B-coded
	4 x digital input + 4 x digital output on-board + extension modules	according to I/O type, see page 578	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules
	max. 252 inputs and 252 outputs	according to I/O type, see page 588	max. 252 inputs and 252 outputs	max. 252 inputs and 252 outputs
	CE, UL	CE, UL	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/IL230x-B800">www.beckhoff.com/IL230x-B800</a>	<a href="http://www.beckhoff.com/IPxxxx-B810">www.beckhoff.com/IPxxxx-B810</a>	<a href="http://www.beckhoff.com/IL230x-B810">www.beckhoff.com/IL230x-B810</a>	<a href="http://www.beckhoff.com/IL230x-C810">www.beckhoff.com/IL230x-C810</a>
	see page 634	see page 634	see page 634	see page 634
	–	–	–	see page 1 520



# Ethernet, PROFINET, EtherNet/IP | Fieldbus Box modules

## Ethernet

	Ethernet Coupler Box with RJ45 connection	Ethernet Coupler Box with M12 connection	Ethernet PLC Box with RJ45 connection
Technical data	IL230x-B900	IL230x-B901	IL230x-C900
Extension modules	max. 120 with max. 512 byte input and 512 byte output data		max. 120 with max. 512 byte input and 512 byte output data
Data transfer rates	10/100 Mbaud, automatic recognition of the transmission rate		10/100 Mbaud, automatic recognition of the transmission rate
Configuration possibility	via KS2000	via KS2000	via KS2000
	 <p>The Ethernet Coupler Box with RJ45 connection gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image.</p>	 <p>The Ethernet Coupler Box with M12 connection gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image.</p>	 <p>The PLC Box is an intelligent Ethernet node that can perform decentralised processing of I/O data and execute control tasks independently of the function of the Ethernet network. The PLC Box, like the Coupler Box, has four digital inputs and four digital outputs.</p>
Bus interface	1 x RJ45 socket	1 x M12 socket, 4-pin (D-coded)	1 x RJ45 socket
Digital peripheral signals	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules	4 x digital input + 4 x digital output on-board + extension modules
Analog peripheral signals	max. 127 inputs and 127 outputs	max. 127 inputs and 127 outputs	max. 127 inputs and 127 outputs
Approvals	CE, UL	CE, UL	CE, UL
Further information	<a href="http://www.beckhoff.com/IL230x-B900">www.beckhoff.com/IL230x-B900</a>	<a href="http://www.beckhoff.com/IL230x-B901">www.beckhoff.com/IL230x-B901</a>	<a href="http://www.beckhoff.com/IL230x-C900">www.beckhoff.com/IL230x-C900</a>
Accessories			
Cordsets and connectors	see page 634	see page 634	see page 634
TwinCAT 2 PLC	—	—	see page 1 520



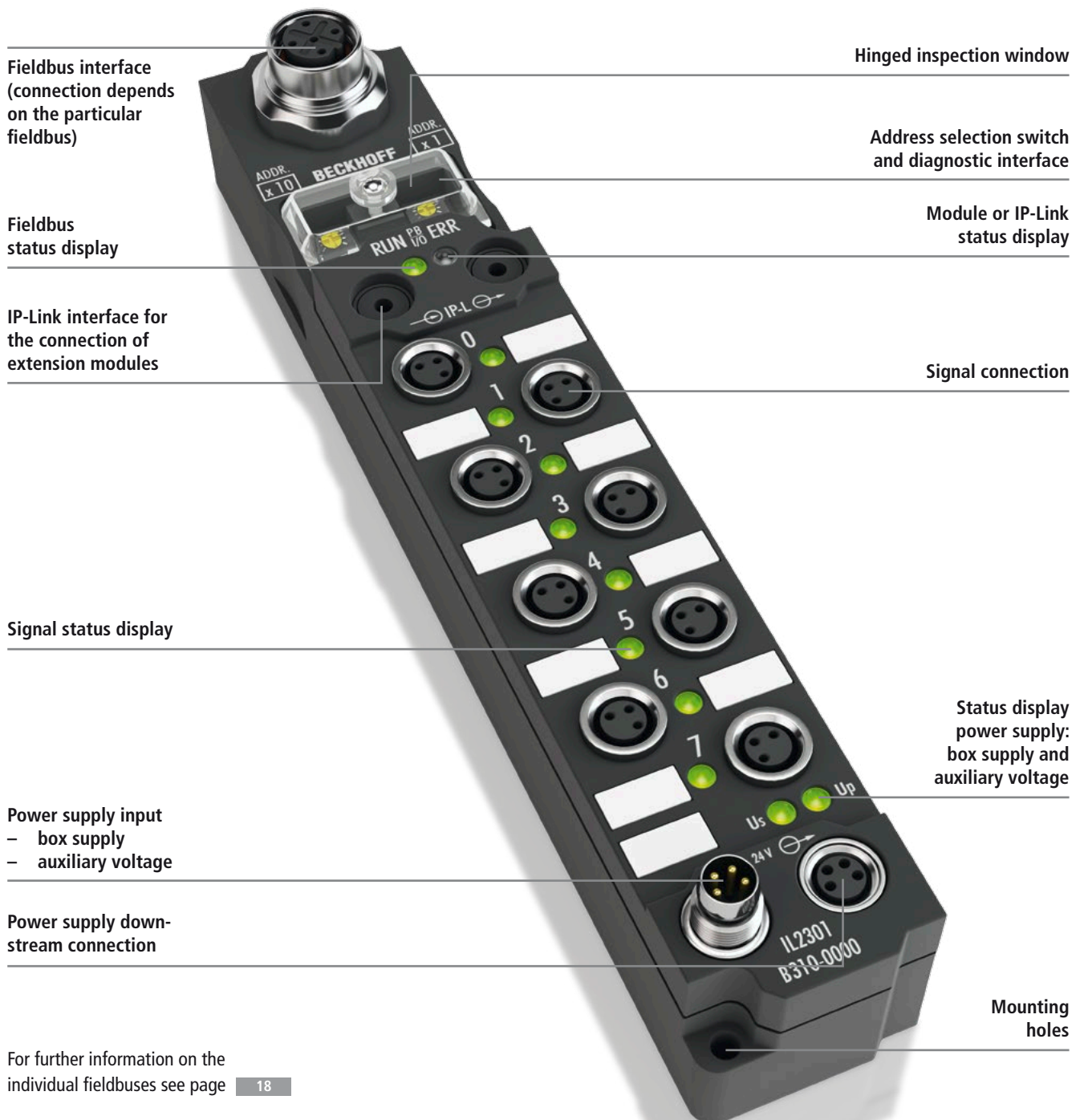
## EtherNet/IP™

PROFINET Coupler Box		EtherNet/IP Coupler Box	
<b>IL230x-B903</b>		<b>IL230x-B905</b>	
max. 120 with max. 512 byte input and 512 byte output data		max. 120 with max. 512 byte input and 512 byte output data	
10/100 Mbaud, automatic recognition of the transmission rate		10/100 Mbaud, automatic recognition of the transmission rate	
via KS2000		via KS2000	
 <p>The PROFINET Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image. The Coupler Box has four digital inputs and four digital outputs.</p>		 <p>The EtherNet/IP Coupler Box gathers the I/O data from the Extension Box modules over the interference-free IP-Link optical fibre cable. It detects the connected modules and automatically allocates the input and output data to the process image. The Coupler Box has four digital inputs and four digital outputs.</p>	
1 x M12 socket, 4-pin (D-coded)		1 x M12 socket, 4-pin (D-coded)	
4 x digital input + 4 x digital output on-board + extension modules		4 x digital input + 4 x digital output on-board + extension modules	
max. 127 inputs and 127 outputs		max. 127 inputs and 127 outputs	
CE, UL		CE, UL	
<a href="http://www.beckhoff.com/IL230x-B903">www.beckhoff.com/IL230x-B903</a>		<a href="http://www.beckhoff.com/IL230x-B905">www.beckhoff.com/IL230x-B905</a>	
see page 634		see page 634	
—		—	

# Signal types | Coupler Box and PLC Box

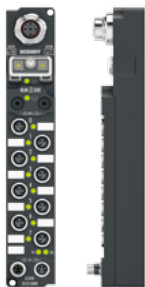
► [www.beckhoff.com/Coupler-Box](http://www.beckhoff.com/Coupler-Box)

► [www.beckhoff.com/PLC-Box](http://www.beckhoff.com/PLC-Box)



For further information on the  
individual fieldbuses see page

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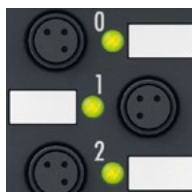


Standard housing

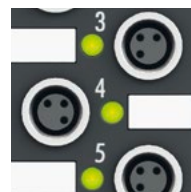


XXL housing

## Signal connections



Connector 8 mm,  
snap type, 3-pin



Connector M8,  
screw type, 3-pin



Connector M12,  
screw type, 5-pin

## Coupler Box

Up to 120 extension modules, spaced up to 15 metres apart, can be connected to one Coupler Box. The Coupler Box modules are capable of automatically recognising the extension modules connected to them during start-up, and map the I/O data automatically into the fieldbus process image – it is not necessary to configure them. The coupler appears, from the fieldbus point of view, along with all of the networked extension modules, as a single participating bus device with a corresponding number of I/O signals.

The Coupler Box corresponds to the Bus Coupler in the Beckhoff Bus Terminal system. Beckhoff fieldbus devices with protection class IP 20 (Bus Terminals) and IP 67 (Fieldbus Box) can be combined without difficulty – the data is handled in the same way in either case.

Low-priced plug connectors with protection class IP 67 can be used for the rapid and simple preparation of the IP-Link fibre optic cable. The connection does not require special tools and can be performed quickly and simply. The IP-Link cables can also be obtained with prepared plugs if required.

## PLC Box

Almost unlimited I/O application possibilities result from the extendable Coupler Box with PLC functionality and IP-Link. Up to 120 extension modules, with 960 I/Os, can be directly addressed from the PLC program. The programmable PLC Box modules are therefore particularly suitable as autonomous small PLCs for the control of parts of a plant or of small machines.

Programming is carried out with TwinCAT in accordance with IEC 61131-3, using the same programming environment as for the TwinCAT PC control system. Five different manufacturer independent programming languages are available: Instruction List (IL), Function Block Diagram (FBD), Ladder Diagram (LD), Sequential Function Chart (SFC) and the high-level language Structured Text (ST). The program download occurs either via the fieldbus or via the programming interface. Extensive debugging functions (breakpoint, single step, monitoring, etc.) are also available.

## Coupler Box

### IL230y-Bzzz

- 110 = EtherCAT
- 200 = Lightbus
- 310/318 = PROFIBUS
- 400 = Interbus
- 510/518 = CANopen
- 520/528 = DeviceNet
- 730 = Modbus
- 800 = RS485
- 810 = RS232
- 900/901 = Ethernet TCP/IP
- 903 = PROFINET
- 905 = Ethernet/IP

- 0 = connector 8 mm,  
snap type, 3-pin
- 1 = connector M8,  
screw type, 3-pin
- 2 = connector M12,  
screw type, 5-pin

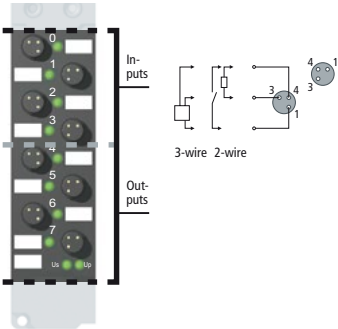
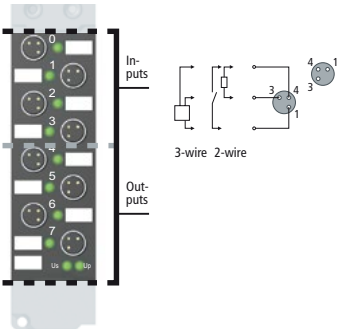
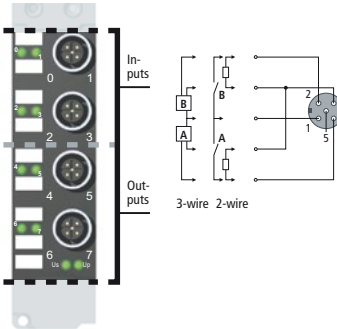
## PLC Box

### IL230y-Czzz

- 310/318 = PROFIBUS
- 810 = RS232
- 900 = Ethernet TCP/IP

- 0 = connector 8 mm,  
snap type, 3-pin
- 1 = connector M8,  
screw type, 3-pin
- 2 = connector M12,  
screw type, 5-pin

## Coupler Box | Digital combi, 24 V DC

	4 x digital input + 4 x digital output, 24 V DC, 8 mm, $I_{\max} = 0.5 \text{ A}$	4 x digital input + 4 x digital output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$	4 x digital input + 4 x digital output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$
<b>Technical data</b>	<b>IL2300-Bxxx</b>	<b>IL2301-Bxxx</b>	<b>IL2302-Bxxx</b>
<b>Connection technology</b>	8 mm, snap type	M8, screw type	M12, screw type
<b>Specification</b>	EN 61131-2, type 2	EN 61131-2, type 2	EN 61131-2, type 2
<b>Number of channels</b>	4 inputs + 4 outputs	4 inputs + 4 outputs	4 inputs + 4 outputs
<b>Input filter</b>	3.0 ms	3.0 ms	3.0 ms
	 <p>The IL2300 Coupler Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via 8 mm snap type connectors.</p>	 <p>The IL2301 Coupler Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.</p>	 <p>The IL2302 Coupler Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.</p>
<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
<b>Sensor supply</b>	from control voltage, max. 0.5 A, short-circuit proof in total	from control voltage, max. 0.5 A, short-circuit proof in total	from control voltage, max. 0.5 A, short-circuit proof in total
<b>Max. output current</b>	0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof
<b>Load type</b>	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
<b>Short-circuit current</b>	typ. 1.5 A	typ. 1.5 A	typ. 1.5 A
<b>Auxiliary power current</b>	typ. 20 mA	typ. 20 mA	typ. 20 mA
<b>Current consumption from <math>U_s</math></b>	see documentation	see documentation	see documentation
<b>Special features</b>	IP-Link coupler	IP-Link coupler	IP-Link coupler
<b>Approvals</b>	CE, UL	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IL2300-Bxxx">www.beckhoff.com/IL2300-Bxxx</a>	<a href="http://www.beckhoff.com/IL2301-Bxxx">www.beckhoff.com/IL2301-Bxxx</a>	<a href="http://www.beckhoff.com/IL2302-Bxxx">www.beckhoff.com/IL2302-Bxxx</a>

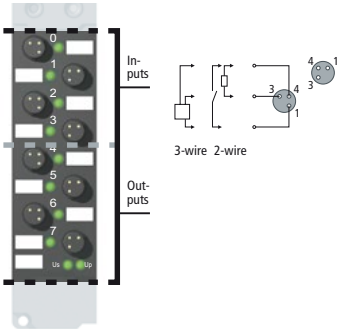
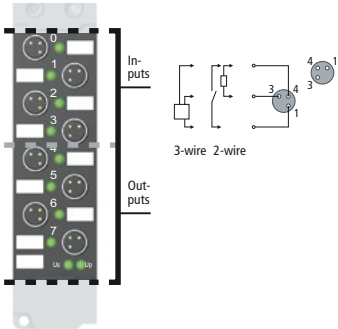
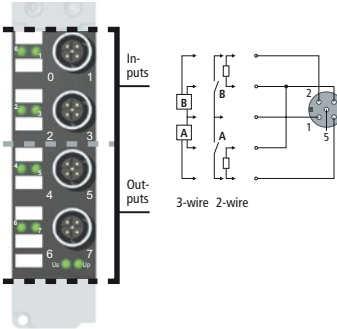


# Extension Box

Up to 120 Extension Box modules can be connected to the Coupler Box via the IP-Link communication facility. The Extension Box modules cover the full spectrum of I/O signals with various connection techniques. See page **576**

IExxxx	Extension Box	Plug	Page
<b>Digital input</b>			
IE1000	Extension Box, 8 digital inputs 24 V DC, 3.0 ms	8 mm	578
IE1001	Extension Box, 8 digital inputs 24 V DC, 3.0 ms	M8	579
IE1002	Extension Box, 8 digital inputs 24 V DC, 3.0 ms	M12	579
IE1010	Extension Box, 8 digital inputs 24 V DC, 0.2 ms	8 mm	578
IE1011	Extension Box, 8 digital inputs 24 V DC, 0.2 ms	M8	579
IE1012	Extension Box, 8 digital inputs 24 V DC, 0.2 ms	M12	579
IE1502	Extension Box, up/down counter 24 V DC, 100 kHz	M12	579
<b>Digital output</b>			
IE2000	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	8 mm	580
IE2001	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	M8	580
IE2002	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	M12	581
IE2020	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	8 mm	581
IE2021	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	M8	581
IE2022	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	M12	581
IE2040	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 12 \text{ A}$ )	8 mm	582
IE2041	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 12 \text{ A}$ )	M8	582
IE2042	Extension Box, 8 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 12 \text{ A}$ )	M12	582
IE2808	Extension Box, 16 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	D-sub	583
IE2512	Extension Box, 2 digital pulse width outputs 24 V DC, $I_{\max} = 2.5 \text{ A}$	M12	583
<b>Digital combi</b>			
IE2300	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	8 mm	584
IE2301	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	M8	585
IE2302	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	M12	585
IE2310	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	8 mm	584
IE2311	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	M8	585
IE2312	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{\max} = 0.5 \text{ A}$	M12	585
IE2320	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	8 mm	586
IE2321	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	M8	586
IE2322	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	M12	587
IE2330	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	8 mm	586
IE2331	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	M8	586
IE2332	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	M12	587
IE2400	Extension Box, 16 digital combi inputs/outputs 24 V DC, 3.0 ms, $I_{\max} = 0.5 \text{ A}$	8 mm	587
IE2401	Extension Box, 16 digital combi inputs/outputs 24 V DC, 3.0 ms, $I_{\max} = 0.5 \text{ A}$	M8	587
IE2403	Extension Box, 16 digital combi inputs/outputs 24 V DC, 3.0 ms, $I_{\max} = 0.5 \text{ A}$ (without plug)	KM	585
<b>Analog input</b>			
IE3102	Extension Box, 4 analog differential inputs -10...+10 V, 16 bit	M12	588
IE3112	Extension Box, 4 analog differential inputs 0/4...20 mA, 16 bit	M12	589
IE3202	Extension Box, 4 analog inputs for resistance thermometer (RTD), PT100...1000, Ni100, 16 bit	M12	589
IE3312	Extension Box, 4 analog inputs for thermoelement, types J, K, L...U, 16 bit	M12	589
<b>Analog output</b>			
IE4112	Extension Box, 4 analog outputs 0/4...20 mA, 16 bit	M12	590
IE4132	Extension Box, 4 analog outputs $\pm 10 \text{ V}$ , 16 bit	M12	590
<b>Special functions</b>			
IE5009	Extension Box, SSI sensor interface	M23	592
IE5109	Extension Box, incremental encoder interface with differential inputs, 1 MHz	M23	593
IE6002	Extension Box, serial interface RS232	M12	594
IE6012	Extension Box, serial interface 0...20 mA (TTY)	M12	595
IE6022	Extension Box, serial interface RS422, RS485	M12	595

# PLC Box | Digital combi, 24 V DC

	4 x digital input + 4 x digital output, 24 V DC, 8 mm, $I_{\max} = 0.5 \text{ A}$	4 x digital input + 4 x digital output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$	4 x digital input + 4 x digital output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$
<b>Technical data</b>	<b>IL2300-Cxxx</b>	<b>IL2301-Cxxx</b>	<b>IL2302-Cxxx</b>
<b>Connection technology</b>	8 mm, snap type	M8, screw type	M12, screw type
<b>Specification</b>	EN 61131-2, type 2	EN 61131-2, type 2	EN 61131-2, type 2
<b>Number of channels</b>	4 inputs + 4 outputs	4 inputs + 4 outputs	4 inputs + 4 outputs
<b>Input filter</b>	3.0 ms	3.0 ms	3.0 ms
	 <p>The IL2300 PLC Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via 8 mm snap type connectors.</p> <p>Unlike the Coupler Box, the PLC Box can be programmed via TwinCAT and thus used as a small controller.</p>	 <p>The IL2301 PLC Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.</p> <p>Unlike the Coupler Box, the PLC Box can be programmed via TwinCAT and thus used as a small controller.</p>	 <p>The IL2302 PLC Box module combines four digital inputs and four digital outputs in one device. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.</p> <p>Unlike the Coupler Box, the PLC Box can be programmed via TwinCAT and thus used as a small controller.</p>
<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
<b>Sensor supply</b>	from control voltage, max. 0.5 A, short-circuit proof in total	from control voltage, max. 0.5 A, short-circuit proof in total	from control voltage, max. 0.5 A, short-circuit proof in total
<b>Max. output current</b>	0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof
<b>Load type</b>	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
<b>Short-circuit current</b>	typ. 1.5 A	typ. 1.5 A	typ. 1.5 A
<b>Auxiliary power current</b>	typ. 20 mA	typ. 20 mA	typ. 20 mA
<b>Current consumption from <math>U_s</math></b>	see documentation	see documentation	see documentation
<b>Special features</b>	IP-Link coupler	IP-Link coupler	IP-Link coupler
<b>Approvals</b>	CE, UL	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IL2300-Cxxx">www.beckhoff.com/IL2300-Cxxx</a>	<a href="http://www.beckhoff.com/IL2301-Cxxx">www.beckhoff.com/IL2301-Cxxx</a>	<a href="http://www.beckhoff.com/IL2302-Cxxx">www.beckhoff.com/IL2302-Cxxx</a>

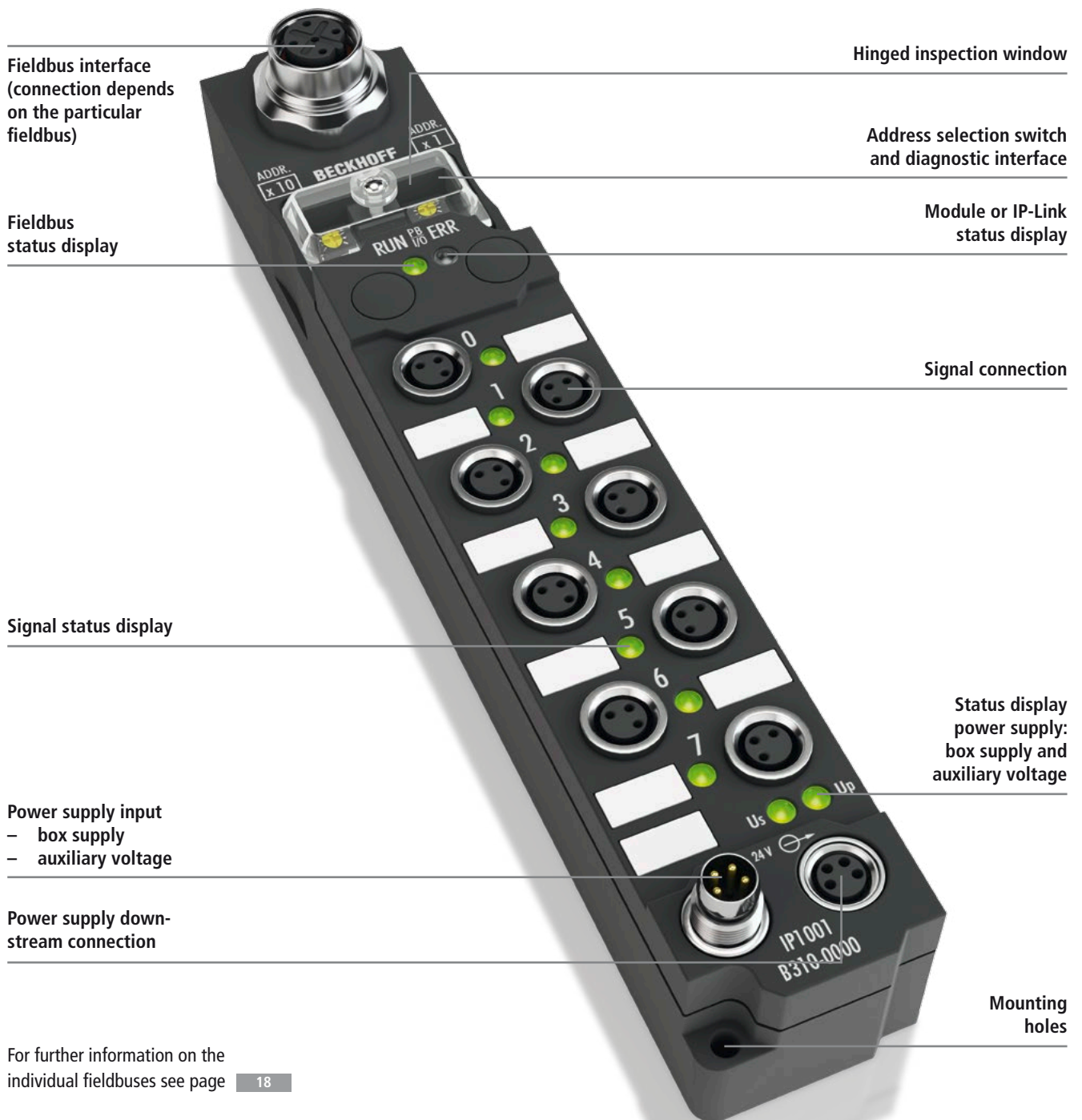
# Extension Box

Up to 120 Extension Box modules can be connected to the PLC Box via the IP-Link communication facility. The Extension Box modules cover the full spectrum of I/O signals with various connection techniques. See page [576](#)

IExxxx	Extension Box	Plug	Page
<b>Digital input</b>			
IE1000	Extension Box, 8 digital inputs 24 V DC, 3.0 ms	8 mm	578
IE1001	Extension Box, 8 digital inputs 24 V DC, 3.0 ms	M8	579
IE1002	Extension Box, 8 digital inputs 24 V DC, 3.0 ms	M12	579
IE1010	Extension Box, 8 digital inputs 24 V DC, 0.2 ms	8 mm	578
IE1011	Extension Box, 8 digital inputs 24 V DC, 0.2 ms	M8	579
IE1012	Extension Box, 8 digital inputs 24 V DC, 0.2 ms	M12	579
IE1502	Extension Box, up/down counter 24 V DC, 100 kHz	M12	579
<b>Digital output</b>			
IE2000	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 0.5$ A	8 mm	580
IE2001	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 0.5$ A	M8	580
IE2002	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 0.5$ A	M12	581
IE2020	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	8 mm	581
IE2021	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	M8	581
IE2022	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	M12	581
IE2040	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 12 A)	8 mm	582
IE2041	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 12 A)	M8	582
IE2042	Extension Box, 8 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 12 A)	M12	582
IE2808	Extension Box, 16 digital outputs 24 V DC, $I_{max} = 0.5$ A ( $\Sigma$ 4 A)	D-sub	583
IE2512	Extension Box, 2 digital pulse width outputs 24 V DC, $I_{max} = 2.5$ A	M12	583
<b>Digital combi</b>			
IE2300	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{max} = 0.5$ A	8 mm	584
IE2301	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{max} = 0.5$ A	M8	585
IE2302	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{max} = 0.5$ A	M12	585
IE2310	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{max} = 0.5$ A	8 mm	584
IE2311	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{max} = 0.5$ A	M8	585
IE2312	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{max} = 0.5$ A	M12	585
IE2320	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	8 mm	586
IE2321	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	M8	586
IE2322	Extension Box, 4 digital inputs 24 V DC, 3.0 ms, 4 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	M12	587
IE2330	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	8 mm	586
IE2331	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	M8	586
IE2332	Extension Box, 4 digital inputs 24 V DC, 0.2 ms, 4 digital outputs 24 V DC, $I_{max} = 2$ A ( $\Sigma$ 4 A)	M12	587
IE2400	Extension Box, 16 digital combi inputs/outputs 24 V DC, 3.0 ms, $I_{max} = 0.5$ A	8 mm	587
IE2401	Extension Box, 16 digital combi inputs/outputs 24 V DC, 3.0 ms, $I_{max} = 0.5$ A	M8	587
IE2403	Extension Box, 16 digital combi inputs/outputs 24 V DC, 3.0 ms, $I_{max} = 0.5$ A (without plug)	KM	585
<b>Analog input</b>			
IE3102	Extension Box, 4 analog differential inputs -10...+10 V, 16 bit	M12	588
IE3112	Extension Box, 4 analog differential inputs 0/4...20 mA, 16 bit	M12	589
IE3202	Extension Box, 4 analog inputs for resistance thermometer (RTD), PT100...1000, Ni100, 16 bit	M12	589
IE3312	Extension Box, 4 analog inputs for thermoelement, types J, K, L...U, 16 bit	M12	589
<b>Analog output</b>			
IE4112	Extension Box, 4 analog outputs 0/4...20 mA, 16 bit	M12	590
IE4132	Extension Box, 4 analog outputs $\pm 10$ V, 16 bit	M12	590
<b>Special functions</b>			
IE5009	Extension Box, SSI sensor interface	M23	592
IE5109	Extension Box, incremental encoder interface with differential inputs, 1 MHz	M23	593
IE6002	Extension Box, serial interface RS232	M12	594
IE6012	Extension Box, serial interface 0...20 mA (TTY)	M12	595
IE6022	Extension Box, serial interface RS422, RS485	M12	595

# Signal types | Compact Box

► [www.beckhoff.com/Compact-Box](http://www.beckhoff.com/Compact-Box)



For further information on the  
individual fieldbuses see page

18

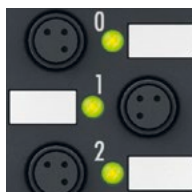


Standard housing



XXL housing

## Signal connections



Connector 8 mm,  
snap type, 3-pin



Connector M8,  
screw type, 3-pin



Connector M12,  
screw type, 5-pin

Compact Box modules are robust fieldbus stations for different fieldbus systems. They offer a wide range of I/O functionality. All relevant industrial signals are supported. In addition to digital and analog inputs and outputs including thermocouple and RTD inputs, there are also incremental encoder interfaces available for displacement and angle measurement in addition to serial interfaces to solve a large number of communication tasks. The digital inputs and outputs can be connected with snap type 8 mm diameter plugs, screw type M8 connectors, or with screw type M12 pendants. The M12 version is provided for analog signals.

Special input and output channels on the combination I/O modules can be used for either input or output. It is not necessary to configure them, since the

fieldbus provides both input and output data for each combination channel. The combination modules give the user all of the advantages of fine signal granularity.

The processor logic, the input circuitry and the sensor power supply are fed from the box supply voltage, the auxiliary power for the outputs can be routed separately. In this way it is possible to achieve cascadable emergency off concepts. In Fieldbus Box modules in which only inputs are available the auxiliary power supply  $U_P$  can optionally be connected in order to pass it on downstream.

The state of the fieldbus connection, the module status, the status of the power supply and of the signals is indicated by LEDs. The label strips can be machine printed elsewhere and then inserted.

## IPxxxy-Bzzz

200 = Lightbus  
310/318 = PROFIBUS  
400 = Interbus  
510/518 = CANopen  
520/528 = DeviceNet  
730 = Modbus  
800 = RS485  
810 = RS232

0 = connector 8 mm,  
snap type, 3-pin  
1 = connector M8,  
screw type, 3-pin  
2 = connector M12,  
screw type, 5-pin  
8 = D-sub, 25-pin

Signals see page 578

# Signal types | Extension Box

► [www.beckhoff.com/Extension-Box](http://www.beckhoff.com/Extension-Box)

Fieldbus  
status display

Module or IP-Link  
status display

IP-Link interface  
for the connection of  
extension modules

Signal connection  
8 mm, M8 or M12

Signal status display

Status display  
power supply:  
box supply and  
auxiliary voltage

Power supply input  
– box supply  
– auxiliary voltage

Power supply down-  
stream connection

Mounting  
holes







Digital input



Digital output



Analog input



Analog output



Special functions

The Extension Box modules cover the full spectrum of I/O signals: digital inputs with different filters, digital outputs with 0.5 and 2 A output currents, analog inputs and outputs with a 16 bit resolution, thermocoupler and RTD inputs, serial interfaces and encoder inputs.

Similarly to the Compact Box modules, the digital inputs and outputs can be connected either through 8 mm snap type connectors or screw type connectors (M8 and M12). Analog

signal types are provided with the M12 version. The snap type connectors lock in place positively, forming a vibration-proof connection, while the screw type connectors offer the advantage of high resistance to being pulled out.

The extension modules are connected to the process level via the fieldbus coupler. Up to 120 extension modules can be connected at distances of 15 m from box to box via the IP-Link communication connection.

## IExxxy

- 0 = connector 8 mm, snap type, 3-pin
- 1 = connector M8, screw type, 3-pin
- 2 = connector M12, screw type, 5-pin
- 3 = IP 20 connector
- 8 = D-sub, 25-pin
- 9 = connector M23, screw type, 12-pin

Signals see page 578



# Digital input | 24 V DC, positive switching

The digital inputs on a 24 V supply are among the most frequently used signals. The EN 61131-2 standard describes the input characteristic and distinguishes three types. Type 1 has a small input current with low power dissipation. This input is optimised for mechanical switches and actively-switched electronic outputs. Type 2 has a significantly larger input current and is optimised for 2-wire sensors with a high quiescent current consumption. Type 3 is a combination between type 1, with low current in switched-on state, and a satisfactorily high quiescent current for the majority of modern 2-wire sensors. The type 3 input can be used in almost all applications as

a replacement for type 1. The diagram shows the typical current/voltage curves of the module inputs and the allowable range of conformity in accordance with the standard.

The input circuits differ in their filtering functions. The filtering has the task of suppressing electromagnetic interference. However, this does have the drawback of signal deceleration. The filter time of 3 ms is comparatively slow, but it can suppress the bouncing of a mechanical switch and delivers a stable signal for simple PLC applications. Filter times of 0.2 ms are suitable for applications with shortest possible reaction times and should be used for mechanical switches only in a restricted manner.

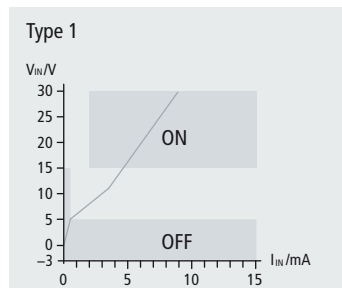
8-channel digital input,  
24 V DC, 8 mm, type 2

Compact Box	IP1000-Bxxx	IP1010-Bxxx
Extension Box	IE1000	IE1010
Connection technology	8 mm, snap type	
"0" signal voltage	-3...+5 V (EN 61131-2, type 2)	
"1" signal voltage	11...30 V (EN 61131-2, type 2)	
Input filter	3.0 ms	0.2 ms
Number of inputs	8	
Nominal voltage	24 V DC (-15 %/+20 %)	

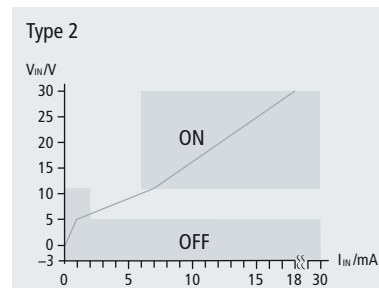


The IP10x0 and IE10x0 digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit. The signals are connected via 8 mm snap type connectors.

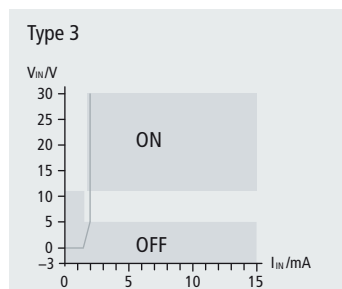
The sensors are supplied from the box supply voltage  $U_s$ .



Signal voltage "0": -3...5 V DC  
Signal voltage "1": 15...30 V DC



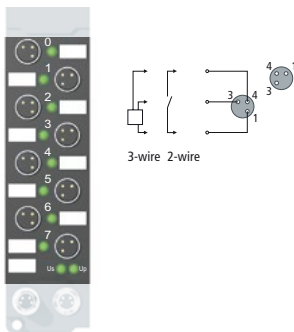
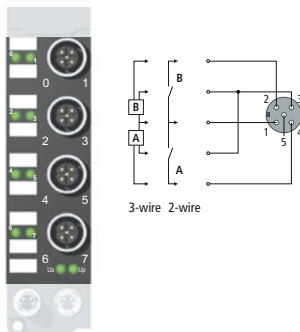
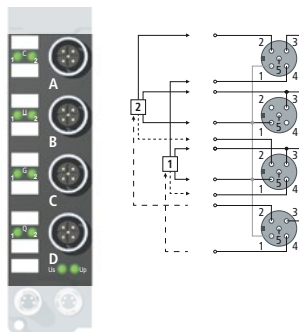
Signal voltage "0": -3...5 V DC  
Signal voltage "1": 11...30 V DC



Signal voltage "0": -3...5 V DC  
Signal voltage "1": 11...30 V DC

Characteristics of the 3 input types  
according to EN 61131-2 (24 V DC)

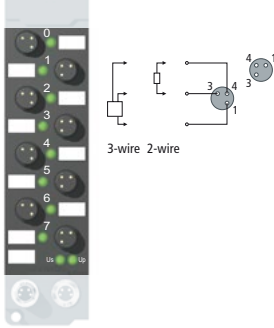
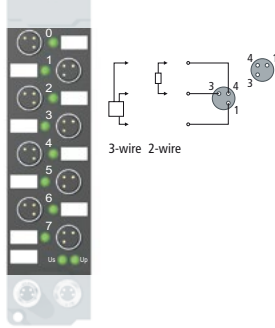
Number of counters	—
Counting frequency	—
Sensor supply	from control voltage, max. 0.5 A, short-circuit proof in total
Current consumption from $U_s$ (without sensor current)	IP10x0-Bxxx: see document. IE10x0: 25 mA
Bit width in the process image	8 inputs
Electrical isolation	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system
Approvals	CE, UL
Further information	<a href="http://www.beckhoff.com/IP1000">www.beckhoff.com/IP1000</a> <a href="http://www.beckhoff.com/IE1000">www.beckhoff.com/IE1000</a>

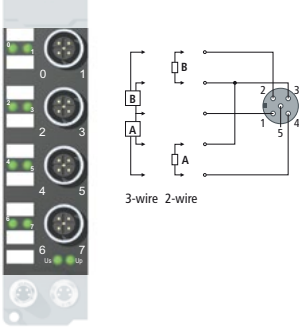
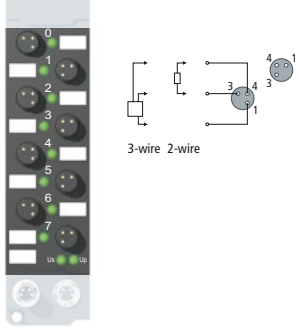
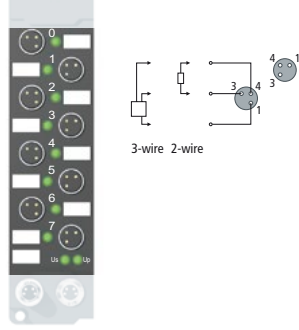
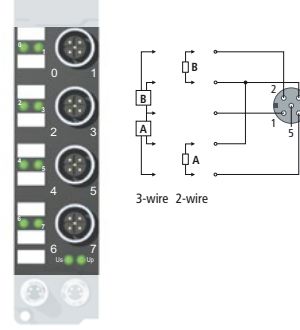
8-channel digital input, 24 V DC, M8, type 2		8-channel digital input, 24 V DC, M12, type 2		2-channel up/down counter, 24 V DC, 100 kHz, type 2
<b>IP1001-Bxxx</b> <b>IE1001</b>	<b>IP1011-Bxxx</b> <b>IE1011</b>	<b>IP1002-Bxxx</b> <b>IE1002</b>	<b>IP1012-Bxxx</b> <b>IE1012</b>	<b>IP1502-Bxxx</b> <b>IE1502</b>
M8, screw type		M12, screw type		M12, screw type
-3...+5 V (EN 61131-2, type 2)		-3...+5 V (EN 61131-2, type 2)		-3...+5 V (EN 61131-2, type 2)
11...30 V (EN 61131-2, type 2)		11...30 V (EN 61131-2, type 2)		11...30 V (EN 61131-2, type 2)
3.0 ms	0.2 ms	3.0 ms	0.2 ms	—
8		8		2 counter inputs + 2 gate inputs + 2 up/down switches
24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)
 <p>The IP10x1 and IE10x1 digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit. The signals are connected via M8 screw type connectors. These versions are distinguished by input filters of different speeds.</p> <p>The sensors are supplied from the box supply voltage <math>U_s</math>. The auxiliary voltage <math>U_P</math> is not used in the input module, but may be connected in order to be relayed downstream.</p>		 <p>The IP10x2 and IE10x2 digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit. The signals are connected via M12 screw type connectors. These versions are distinguished by input filters of different speeds.</p> <p>The sensors are supplied from the box supply voltage <math>U_s</math>. The auxiliary voltage <math>U_P</math> is not used in the input module, but may be connected in order to be relayed downstream.</p>		 <p>The counter module has two fast counters running at up to 100 kHz. It counts binary pulses and transmits the counter state to the higher-level automation unit. The up/down input allows the counters to be switched between upwards and downwards counting (in 32 bits). The gate signals (gate inputs) allow the counters to be triggered: Depending on the level at the gate input, the counting function is halted or enabled. The outputs can be switched according to the counter state. From the controller it is possible to set the counter state, to start or halt the counter function, and to set the outputs.</p>
—		—		2, each with a depth of 32 bits
—		—		100 kHz (2 kHz for switching between up and down)
from control voltage, max. 0.5 A, short-circuit proof in total		from control voltage, max. 0.5 A, short-circuit proof in total		from control voltage, max. 0.5 A, short-circuit proof in total
IP10x1-Bxxx: see documentation IE10x1: 25 mA		IP10x2-Bxxx: see documentation IE10x2: 25 mA		IP1502-Bxxx: see documentation IE1502: 25 mA
8 inputs		8 inputs		80 inputs/outputs: 2 x 32 bit data (2 x 8 bit control/status)
channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system		channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system		channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system
CE, UL		CE, UL		CE, UL
www.beckhoff.com/IP1001 www.beckhoff.com/IE1001		www.beckhoff.com/IP1002 www.beckhoff.com/IE1002		www.beckhoff.com/IP1502 www.beckhoff.com/IE1502

# Digital output | 24 V DC, positive switching

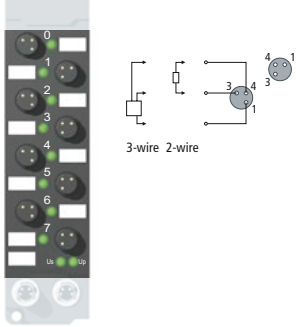
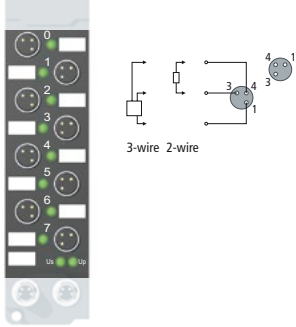
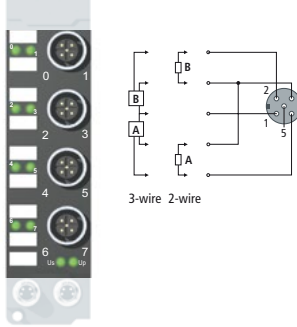
Many actuators are driven or controlled with 24 V DC. The Fieldbus Box modules in the category positive switching switch all output channels to 24 V DC. The output circuit offers further functions such as short-circuit current limitation, short-circuit switch-off and the depletion of inductive energy from the coil.

The most common output circuit delivers a maximum continuous current of 0.5 A. Special Fieldbus Box modules are available for higher currents. Any type of load (ohmic, capacitive, inductive) can be connected to an output module.

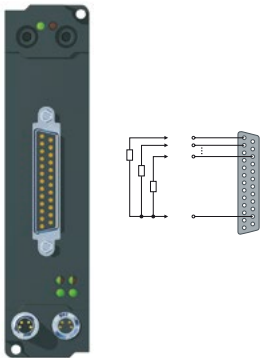
	8-channel digital output, 24 V DC, 8 mm, $I_{\max} = 0.5 \text{ A}$	8-channel digital output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$
<b>Compact Box</b>	<b>IP2000-Bxxx</b>	<b>IP2001-Bxxx</b>
<b>Extension Box</b>	<b>IE2000</b>	<b>IE2001</b>
<b>Connection technology</b>	8 mm, snap type	M8, screw type
<b>Load type</b>	ohmic, inductive, lamp load	ohmic, inductive, lamp load
<b>Max. output current</b>	max. 0.5 A per channel, individually short-circuit proof	max. 0.5 A per channel, individually short-circuit proof
<b>Number of outputs</b>	8	8
<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	 <p>The IP2000/IE2000 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The IP2001/IE2001 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.</p>
<b>Current consumption from <math>U_s</math> (without sensor current)</b>	IP2000-Bxxx: see documentation IE2000: 25 mA	IP2001-Bxxx: see documentation IE2001: 25 mA
<b>Short-circuit current</b>	typ. 1.5 A	typ. 1.5 A
<b>Auxiliary power current</b>	typ. 20 mA per channel	typ. 20 mA per channel
<b>Bit width in the process image</b>	8 outputs	8 outputs
<b>Electrical isolation</b>	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system
<b>Approvals</b>	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IP2000">www.beckhoff.com/IP2000</a> <a href="http://www.beckhoff.com/IE2000">www.beckhoff.com/IE2000</a>	<a href="http://www.beckhoff.com/IP2001">www.beckhoff.com/IP2001</a> <a href="http://www.beckhoff.com/IE2001">www.beckhoff.com/IE2001</a>

	8-channel digital output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$	8-channel digital output, 24 V DC, 8 mm, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	8-channel digital output, 24 V DC, M8, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	8-channel digital output, 24 V DC, M12, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )
	<b>IP2002-Bxxx</b> <b>IE2002</b>	<b>IP2020-Bxxx</b> <b>IE2020</b>	<b>IP2021-Bxxx</b> <b>IE2021</b>	<b>IP2022-Bxxx</b> <b>IE2022</b>
	M12, screw type	8 mm, snap type	M8, screw type	M12, screw type
	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
	max. 0.5 A per channel, individually short-circuit proof	2 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$	2 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$	2 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$
	8	8	8	8
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	 <p>The IP2002/IE2002 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The IP2020/IE2020 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The IP2021/IE2021 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The IP2022/IE2022 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.</p>
	IP2002-Bxxx: see documentation IE2002: 25 mA	IP2020-Bxxx: see documentation IE2020: 25 mA	IP2021-Bxxx: see documentation IE2021: 25 mA	IP2022-Bxxx: see documentation IE2022: 25 mA
	typ. 1.5 A	max. 4 A	max. 4 A	max. 4 A
	typ. 20 mA per channel	typ. 30 mA per channel	typ. 30 mA per channel	typ. 30 mA per channel
	8 outputs	8 outputs	8 outputs	8 outputs
	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system
	CE, UL	CE, UL	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/IP2002">www.beckhoff.com/IP2002</a> <a href="http://www.beckhoff.com/IE2002">www.beckhoff.com/IE2002</a>	<a href="http://www.beckhoff.com/IP2020">www.beckhoff.com/IP2020</a> <a href="http://www.beckhoff.com/IE2020">www.beckhoff.com/IE2020</a>	<a href="http://www.beckhoff.com/IP2021">www.beckhoff.com/IP2021</a> <a href="http://www.beckhoff.com/IE2021">www.beckhoff.com/IE2021</a>	<a href="http://www.beckhoff.com/IP2022">www.beckhoff.com/IP2022</a> <a href="http://www.beckhoff.com/IE2022">www.beckhoff.com/IE2022</a>

# Digital output | 24 V DC, positive switching

	8-channel digital output, 24 V DC, 8 mm, $I_{\max} = 2 \text{ A}$ ( $\Sigma 12 \text{ A}$ )	8-channel digital output, 24 V DC, M8, $I_{\max} = 2 \text{ A}$ ( $\Sigma 12 \text{ A}$ )	8-channel digital output, 24 V DC, M12, $I_{\max} = 2 \text{ A}$ ( $\Sigma 12 \text{ A}$ )
<b>Compact Box</b>	<b>IP2040-Bxxx</b>	<b>IP2041-Bxxx</b>	<b>IP2042-Bxxx</b>
<b>Extension Box</b>	<b>IE2040</b>	<b>IE2041</b>	<b>IE2042</b>
<b>Connection technology</b>	8 mm, snap type	M8, screw type	M12, screw type
<b>Load type</b>	ohmic, inductive, lamp load	ohmic, inductive, lamp load	ohmic, inductive, lamp load
<b>Max. output current</b>	2 A per channel, individually short-circuit proof, total current max. 12 A (channel 0...3: $\Sigma 4 \text{ A}$ , 4+5: $\Sigma 4 \text{ A}$ , 6+7: $\Sigma 4 \text{ A}$ )	2 A per channel, individually short-circuit proof, total current max. 12 A (channel 0...3: $\Sigma 4 \text{ A}$ , 4+5: $\Sigma 4 \text{ A}$ , 6+7: $\Sigma 4 \text{ A}$ )	2 A per channel, individually short-circuit proof, total current max. 12 A (channel 0...3: $\Sigma 4 \text{ A}$ , 4+5: $\Sigma 4 \text{ A}$ , 6+7: $\Sigma 4 \text{ A}$ )
<b>Number of outputs</b>	8	8	8
<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	 <p>The IP2040/IE2040 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are supplied by three load circuits; for this reason these modules do not relay the supply voltage. The outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The IP2041/IE2041 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are supplied by three load circuits; for this reason these modules do not relay the supply voltage. The outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The IP2042/IE2042 digital output modules connect the binary control signals from the automation unit on to the actuators at the process level. The outputs are supplied by three load circuits; for this reason these modules do not relay the supply voltage. The outputs are short-circuit proof and protected against inverse connection.</p>
<b>Current consumption from <math>U_s</math> (without sensor current)</b>	IP2040-Bxxx: see documentation IE2040: 25 mA	IP2041-Bxxx: see documentation IE2041: 25 mA	IP2042-Bxxx: see documentation IE2042: 25 mA
<b>Short-circuit current</b>	typ. 4 A	typ. 4 A	typ. 4 A
<b>Auxiliary power current</b>	typ. 50 mA per channel	typ. 50 mA per channel	typ. 50 mA per channel
<b>Bit width in the process image</b>	8 outputs	8 outputs	8 outputs
<b>Electrical isolation</b>	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system
<b>Approvals</b>	CE, UL	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IP2040">www.beckhoff.com/IP2040</a> <a href="http://www.beckhoff.com/IE2040">www.beckhoff.com/IE2040</a>	<a href="http://www.beckhoff.com/IP2041">www.beckhoff.com/IP2041</a> <a href="http://www.beckhoff.com/IE2041">www.beckhoff.com/IE2041</a>	<a href="http://www.beckhoff.com/IP2042">www.beckhoff.com/IP2042</a> <a href="http://www.beckhoff.com/IE2042">www.beckhoff.com/IE2042</a>

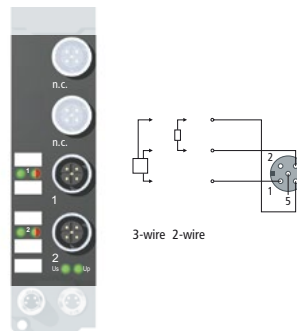
	16-channel digital output, 24 V DC, D-sub, $I_{\max} = 0.5 \text{ A}$ ( $\Sigma 4 \text{ A}$ )
	<b>IE2808, IE2808-0001</b>
	D-sub socket, 25-pin
	ohmic, inductive, lamp load
	0.5 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$
	16
	24 V DC (-15 %/+20 %)



In the IE2808 digital output module an output short circuit is recognised and passed on to the controller. After a fault, e.g. a short circuit at an output, the IE2808-0001 version starts up again automatically. The IE2808 version waits for the fault to be reset by the master (CTRL byte).

	25 mA
	max. 1.5 A
	typ. 30 mA
	16 outputs, 16 inputs (diagnostics) optional: control/status
	channels/control voltage: no, between the channels: no, control voltage/fieldbus: yes, via IP-Link
	CE, UL
	<a href="http://www.beckhoff.com/IE2808">www.beckhoff.com/IE2808</a>

	2-channel pulse width output, 24 V DC, M12, $I_{\max} = 2.5 \text{ A}$
<b>Compact Box Extension Box</b>	<b>IP2512-Bxxx IE2512</b>
<b>Connection technology</b>	M12, screw type
<b>Load type</b>	ohmic, inductive
<b>Max. output current</b>	2.5 A per channel, individually short-circuit proof
<b>Number of outputs</b>	2
<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)



The outputs of the IP2512/IE2512 module provide a pulse width modulated version of a binary signal. The keying ratio is prescribed by a 16 bit value from the automation unit. The output is protected against overload and short circuit.

<b>Current consumption from <math>U_s</math> (without sensor current)</b>	IP2512-Bxxx: see documentation IE2512: 25 mA
<b>Up/down channel</b>	24 V DC, 0.5 A, short-circuit proof
<b>Base frequency</b>	8 Hz...40 kHz, default: 250 Hz
<b>Duty factor</b>	0...100 % ( $T_{\text{ON}} > 750 \text{ ns}$ , $T_{\text{OFF}} > 500 \text{ ns}$ )
<b>Resolution</b>	max. 10 bit
<b>Bit width in the process image</b>	48 inputs/outputs: 2 x 16 bit data + 2 x 8 bit status
<b>Electrical isolation</b>	channels/control voltage: no, between the channels: no, control voltage/fieldbus: depends on the bus system
<b>Approvals</b>	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IP2512">www.beckhoff.com/IP2512</a> <a href="http://www.beckhoff.com/IE2512">www.beckhoff.com/IE2512</a>



# Digital combi | 24 V DC, positive switching

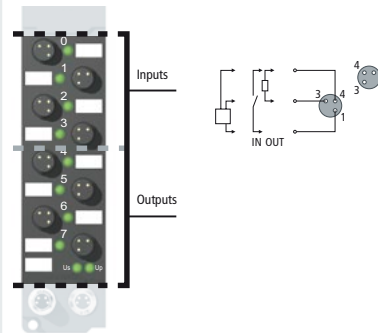
The digital combination modules combine inputs and outputs in one module. The input circuits differ in their filtering functions. The filtering has the task of suppressing electromagnetic interference. However, this does have the drawback of signal deceleration. The filter time of 3 ms is comparatively slow, but it can suppress the bouncing of a mechanical switch and delivers a stable signal for simple PLC applications. Filter times of 0.2 ms are suitable for applications with shortest possible reaction times and should be used for mechanical switches only in a restricted manner.

The output channels supply a max. continuous current of 0.5 A. Special output modules are available for higher currents. Any type of load (ohmic, capacitive, inductive) can be connected to an output module. As lamp and capacitive loads are critical due to their high starting currents, they are limited by the output circuits of the modules. This ensures that the upstream circuit-breaker is not triggered. Inductive loads are problematic at switch-off, as high induction voltages develop, if the current is interrupted too fast. An integrated freewheeling diode prevents this voltage peak. However, the current is reduced so slowly that it leads to faults in many technical control applications. A valve remains open for many milliseconds. The modules represent a compromise between prevention of overvoltage and switch-off. They suppress the induction voltage to about 24 V DC and realise switch-off times which approximately correspond to the switch-on time of the coil.

In the event of a short circuit, the module switches the corresponding output off and cyclically attempts to switch it on again. This continues until either the short circuit is eliminated or the controller resets the output. The clock frequency depends on the ambient temperature and the loads on the other channels. The total current specified should be observed.

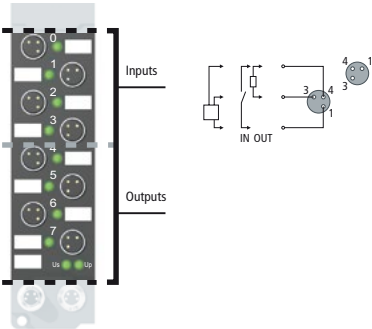
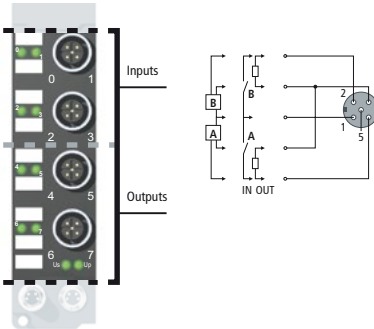
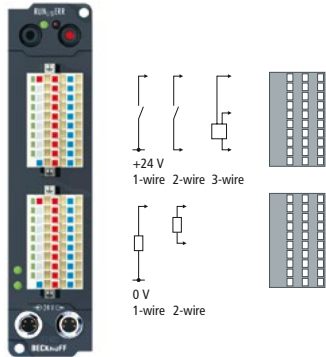
4 x digital input +  
4 x digital output,  
24 V DC, 8 mm,  $I_{\max} = 0.5 \text{ A}$

Compact Box Extension Box	IP2300-Bxxx IE2300	IP2310-Bxxx IE2310
Connection technology	8 mm, snap type	
Input filter	3.0 ms	0.2 ms
Number of channels	4 inputs + 4 outputs	

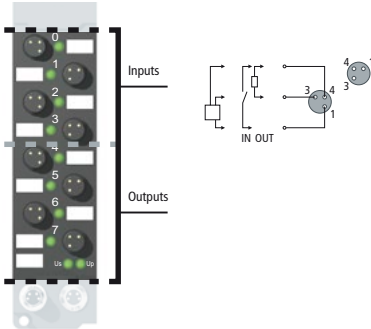
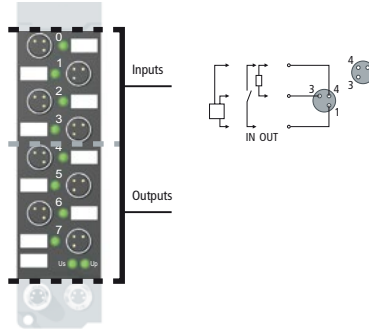


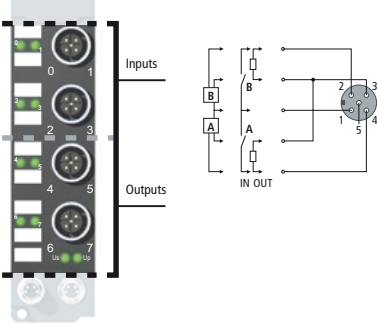
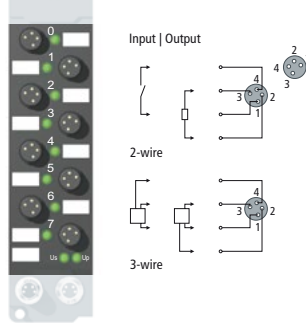
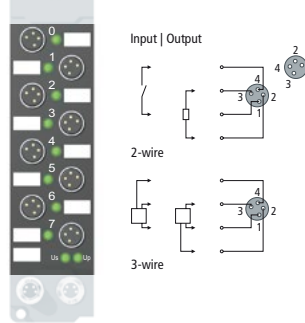
The IP23x0/IE23x0 digital I/O module combines four digital inputs and four digital outputs in one device. The outputs are short-circuit proof and protected against inverse polarity. The signals are connected via 8 mm diameter snap type connectors.

Nominal voltage	24 V DC (-15 %/+20 %)
"0" signal voltage	-3...+5 V
"1" signal voltage	11...30 V, 6 mA input current (EN 61131-2, type 2)
Max. output current	0.5 A per channel, individually short-circuit proof
Load type	ohmic, inductive, lamp load
Sensor supply	from control voltage, max. 0.5 A, short-circuit proof in total
Short-circuit current	typ. 1.5 A
Auxiliary power current	typ. 20 mA per channel
Current consumption from $U_s$ (without sensor current)	IP23x0-Bxxx: see documentation IE23x0: 25 mA
Approvals	CE, UL
Further information	<a href="http://www.beckhoff.com/IP2300">www.beckhoff.com/IP2300</a> <a href="http://www.beckhoff.com/IE2300">www.beckhoff.com/IE2300</a>

4 x digital input + 4 x digital output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$		4 x digital input + 4 x digital output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$		16-channel digital combi input/output, 24 V DC, IP 20 connector, $I_{\max} = 0.5 \text{ A}$
<b>IP2301-Bxxx</b> <b>IE2301</b>	<b>IP2311-Bxxx</b> <b>IE2311</b>	<b>IP2302-Bxxx</b> <b>IE2302</b>	<b>IP2312-Bxxx</b> <b>IE2312</b>	<b>IE2403</b>
M8, screw type		M12, screw type		connector with spring-loaded technique
3.0 ms	0.2 ms	3.0 ms	0.2 ms	3.0 ms
4 inputs + 4 outputs		4 inputs + 4 outputs		16 channels (8 inputs and 8 outputs)
 <p>The IP23x1/IE23x1 digital I/O module combines four digital inputs and four digital outputs in one device. The outputs are short-circuit proof and protected against inverse polarity. The signals are connected via screw type M8 connectors.</p>		 <p>The IP23x2/IE23x2 digital I/O module combines four digital inputs and four digital outputs in one device. The outputs are short-circuit proof and protected against inverse polarity. The signals are connected via screw type M12 connectors.</p>		 <p>The digital IE2403 I/O module has sixteen channels with eight inputs and eight outputs. The device can therefore be flexibly adapted to the requirements of the application. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. For the signal connection IP 20 connectors with a spring-loaded system are used, optionally available with 1 or 3 pins. The module is supplied without connectors.</p> <p>Accessories:</p> <ul style="list-style-type: none"> <li>– ZS2001-0001: connector, 1-pin, without LED</li> <li>– ZS2001-0002: connector, 1-pin, with LED</li> <li>– ZS2001-0004: connector, 3-pin, with LED</li> </ul>
24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)
-3...+5 V		-3...+5 V		-3...+5 V
11...30 V, 6 mA input current (EN 61131-2, type 2)		11...30 V, 6 mA input current (EN 61131-2, type 2)		11...30 V, 6 mA input current (EN 61131-2, type 2)
0.5 A per channel, individually short-circuit proof		0.5 A per channel, individually short-circuit proof		max. 0.5 A per channel, individually short-circuit proof
ohmic, inductive, lamp load		ohmic, inductive, lamp load		ohmic, inductive, lamp load
from control voltage, max. 0.5 A, short-circuit proof in total		from control voltage, max. 0.5 A, short-circuit proof in total		from control voltage, max. 0.5 A, short-circuit proof in total
typ. 1.5 A		typ. 1.5 A		typ. 1.5 A
typ. 20 mA per channel		typ. 20 mA per channel		typ. 20 mA per channel
IP23x1-Bxxx: see documentation IE23x1: 25 mA		IP23x2-Bxxx: see documentation IE23x2: 25 mA		25 mA
CE, UL		CE, UL		CE
www.beckhoff.com/IP2301 www.beckhoff.com/IE2301		www.beckhoff.com/IP2302 www.beckhoff.com/IE2302		www.beckhoff.com/IE2403

# Digital combi | 24 V DC, positive switching

	4 x digital input + 4 x digital output, 24 V DC, 8 mm, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )		4 x digital input + 4 x digital output, 24 V DC, M8, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	
<b>Compact Box</b>	IP2320-Bxxx	IP2330-Bxxx	IP2321-Bxxx	IP2331-Bxxx
<b>Extension Box</b>	IE2320	IE2330	IE2321	IE2331
<b>Connection technology</b>	8 mm, snap type		M8, screw type	
<b>Input filter</b>	3.0 ms	0.2 ms	3.0 ms	0.2 ms
<b>Number of channels</b>	4 inputs + 4 outputs		4 inputs + 4 outputs	
	 <p>The IP23x0/IE23x0 digital I/O modules combine four digital inputs and four digital outputs in one device. The outputs are short-circuit proof and protected against inverse polarity. The signals are connected via 8 mm diameter snap type connectors.</p>		 <p>The IP23x1/IE23x1 digital I/O modules combine four digital inputs and four digital outputs in one device. The outputs are short-circuit proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.</p>	
<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	
<b>"0" signal voltage</b>	-3...+5 V		-3...+5 V	
<b>"1" signal voltage</b>	11...30 V, 6 mA input current (EN 61131-2, type 2)		11...30 V, 6 mA input current (EN 61131-2, type 2)	
<b>Max. output current</b>	2 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$		2 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$	
<b>Load type</b>	ohmic, inductive, lamp load		ohmic, inductive, lamp load	
<b>Sensor supply</b>	from control voltage, max. 0.5 A, short-circuit proof in total		from control voltage, max. 0.5 A, short-circuit proof in total	
<b>Short-circuit current</b>	typ. 4 A		typ. 4 A	
<b>Auxiliary power current</b>	typ. 30 mA per channel		typ. 30 mA per channel	
<b>Current consumption from <math>U_s</math> (without sensor current)</b>	IP23x0-Bxxx: see documentation IE23x0: 25 mA		IP23x1-Bxxx: see documentation IE23x1: 25 mA	
<b>Approvals</b>	CE, UL		CE, UL	
<b>Further information</b>	<a href="http://www.beckhoff.com/IP2320">www.beckhoff.com/IP2320</a> <a href="http://www.beckhoff.com/IE2320">www.beckhoff.com/IE2320</a>		<a href="http://www.beckhoff.com/IP2321">www.beckhoff.com/IP2321</a> <a href="http://www.beckhoff.com/IE2321">www.beckhoff.com/IE2321</a>	

4 x digital input + 4 x digital output, 24 V DC, M12, $I_{\max} = 2 \text{ A}$ ( $\Sigma 4 \text{ A}$ )		16-channel digital combi input/output, 24 V DC, 8 mm, $I_{\max} = 0.5 \text{ A}$	16-channel digital combi input/output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$
<b>IP2322-Bxxx</b> <b>IE2322</b>	<b>IP2332-Bxxx</b> <b>IE2332</b>	<b>IP2400-Bxxx</b> <b>IE2400</b>	<b>IP2401-Bxxx</b> <b>IE2401</b>
M12, screw type		8 mm, snap type	M8, screw type
3.0 ms	0.2 ms	3.0 ms	3.0 ms
4 inputs + 4 outputs		16 channels, useable optionally as input and output	16 channels, useable optionally as input and output
 <p>The IP23x2/IE23x2 digital I/O modules combine four digital inputs and four digital outputs in one device. The outputs are short-circuit proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.</p>		 <p>The IP2400/IE2400 digital I/O modules have sixteen channels that can be used as eight inputs and eight outputs. The signals are connected through snap type 8 mm diameter connectors, which have four pins (with separate input and output pins). This makes it possible to connect antivalent sensors. Adapter cables are available for use in input-only or output-only cases, as well as connectors for field wireable. It is also possible to use the power supply cable directly as the sensor cable. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity.</p>	 <p>The IP2401/IE2401 digital I/O modules have sixteen channels that can be used as eight inputs and eight outputs. The signals are connected through M8 screw type connectors, which have four pins (with separate input and output pins). This makes it possible to connect antivalent sensors. Adapter cables are available for use in input-only or output-only cases, as well as connectors for field wireable. It is also possible to use the power supply cable directly as the sensor cable. The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity.</p>
24 V DC (-15 %/+20 %)		24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
-3...+5 V		-3...+5 V	-3...+5 V
11...30 V, 6 mA input current (EN 61131-2, type 2)		11...30 V, 6 mA input current (EN 61131-2, type 2)	11...30 V, 6 mA input current (EN 61131-2, type 2)
2 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$		0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof
ohmic, inductive, lamp load		ohmic, inductive, lamp load	ohmic, inductive, lamp load
from control voltage, max. 0.5 A, short-circuit proof in total		from control voltage, max. 0.5 A, short-circuit proof in total	from control voltage, max. 0.5 A, short-circuit proof in total
typ. 4 A		typ. 1.5 A	typ. 1.5 A
typ. 30 mA per channel		typ. 20 mA per channel	typ. 20 mA per channel
IP23x2-Bxxx: see documentation IE23x2: 25 mA		IP2400-Bxxx: see documentation IE2400: 25 mA	IP2401-Bxxx: see documentation IE2401: 25 mA
CE, UL		CE, UL	CE, UL
www.beckhoff.com/IP2322 www.beckhoff.com/IE2322		www.beckhoff.com/IP2400 www.beckhoff.com/IE2400	www.beckhoff.com/IP2401 www.beckhoff.com/IE2401

# Analog input | -10...+10 V, 0/4...20 mA, PT100, temperature

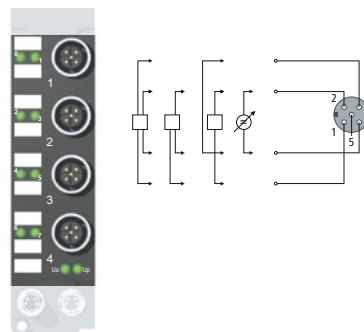
The IP/IE3102 Fieldbus Box modules evaluate analogue standard signals in the range of -10/0 V to +10 V with 16-bit resolution and the IP/IE3112 modules in the range of 0/4 mA to 20 mA.

The IP/IE3202 analog input module is intended for the direct connection of resistance thermometers. The resistance is measured with a low signal current, linearised and represented in 0.1 °C. The module supports 2-, 3- and 4-wire measurement on all four channels. The measurements serve to eliminate or deduct the parasitic resistance of the sensor cable. All inputs are separately configurable for a wide range of sensors, for the three measurement procedures and for the direct measurement of resistance.

The IP/IE3312 Fieldbus Box enables the measurement of temperature using thermocouples. The measured thermovoltage is linearised in accordance with the characteristic of the respective type and transferred to the controller as a temperature value in 1/10 °C or 1/100 °C. The inputs are separately configurable for a wide range of different sensor types. Parasitic thermovoltages arise at the interface of the measuring cable and the module, significantly falsifying the measurement. This error is eliminated by the ZS2000-3712 compensation plug.

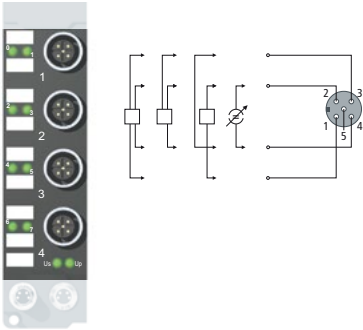
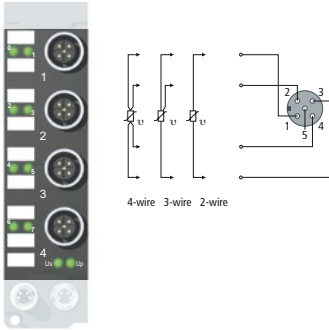
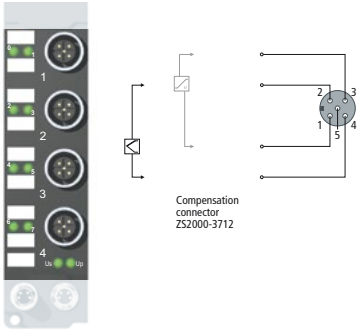
4-channel analog input,  
-10...+10 V, M12, 16 bit

<b>Compact Box</b>	<b>IP3102-Bxxx</b>
<b>Extension Box</b>	<b>IE3102</b>
<b>Connection technology</b>	M12, screw type
<b>Signal type</b>	-10/0...+10 V
<b>Resolution</b>	16 bit (for 0...+10 V range: resolution 15 bit)
<b>Conversion time</b>	250 ms, configurable to 5 ms
<b>Number of inputs</b>	4



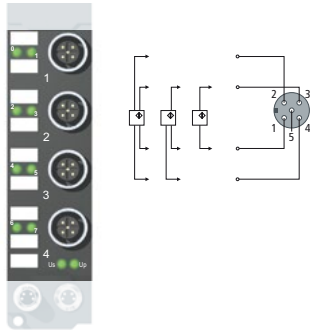
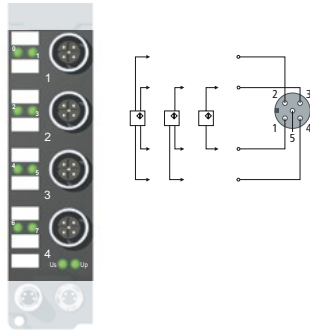
The IP3102/IE3102 analog input module handles signals in the range from -10 to +10 V. The voltage is digitised to a resolution of 16 bits and is transmitted, electrically isolated, to the higher-level automation device. The four input channels have differential inputs and possess a common, internal ground potential. The applied auxiliary voltage (which can be any value up to 30 V DC) is fed through to supply the sensor. It is thus possible, for instance, to supply a measuring potentiometer with 10 V DC from an external voltage source.

<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)
<b>Measuring accuracy</b>	< ±0.3 % (relative to full scale value)
<b>Sensor types</b>	2-, 3-, 4-wire
<b>Measuring range</b>	-10...+10 V, 0...+10 V, user scale
<b>Internal resistance</b>	> 100 kΩ
<b>Sensor supply</b>	from load supply voltage U <sub>P</sub>
<b>Current consumption from U<sub>S</sub> (without sensor current)</b>	IP3102-Bxxx: see documentation IE3102: 55 mA
<b>Approvals</b>	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IP3102">www.beckhoff.com/IP3102</a> <a href="http://www.beckhoff.com/IE3102">www.beckhoff.com/IE3102</a>

	4-channel analog input, 0/4...20 mA, M12, 16 bit	4-channel analog input, PT100 (RTD), M12	4-channel analog input, thermocouple, M12
	<b>IP3112-Bxxx</b> <b>IE3112</b>	<b>IP3202-Bxxx</b> <b>IE3202</b>	<b>IP3312-Bxxx</b> <b>IE3312</b>
	M12, screw type	M12, screw type	M12, screw type
	0/4...20 mA	PT100, resistance	thermocouple, mV
	16 bit	0.1 °C per digit	0.1 °C per digit
	250 ms, configurable to 5 ms	approx. 250 ms, configurable up to 65 ms	approx. 250 ms, configurable up to 70 ms
	4	4	4
	 <p>The IP3112/IE3112 analog input module handles signals in the range from 0/4 to 20 mA. The input current is digitised to a resolution of 16 bits (the default is 15 bits), and is transmitted, electrically isolated, to the higher-level automation device. The four input channels have differential inputs and possess a common, internal ground potential. The applied load voltage (which can be any value up to 30 V DC) is fed through to supply the sensor.</p>	 <p>The IP3202/IE3202 analog input module allows resistance sensors to be connected directly. The module's circuitry can operate the sensors using 2-, 3- or 4-wire connection techniques. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The module can also be used for simple resistance measurement with the output in ohms. The module's standard settings are: resolution 0.1 °C in the temperature range of PT100 sensors in 4-wire connection.</p>	 <p>The IP3312/IE3312 analog input module permits four thermocouples to be directly connected. The module's circuitry can operate thermocouple sensors using the 2-wire technique. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. Compensation for the cold junction is made through a temperature measurement in the connecting plugs. This means that standard extension leads can be connected. The IE3312 can also be used for mV measurement.</p> <p>Accessories:</p> <ul style="list-style-type: none"> <li>— ZS2000-3712: connector with temperature compensation</li> </ul>
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	< ±0.3 % (relative to full scale value)	< ±1 °C	< ±0.5 % (relative to full scale value)
	2-, 3-, 4-wire	PT100, PT200, PT500, PT1000, Ni100, Ni120, Ni1000 resistance measurement (e.g. potentiometer)	types J, K, L, B, E, N, R, S, T, U (default setting type K), mV measurement
	0...20 mA, 4...20 mA, user scale	-200...+850 °C (PT sensors); -60...+250 °C (Ni sensors)	depending on sensor type; preset value is type K, -100...+1370 °C
	80 Ω measuring shunt from load supply voltage $U_P$	—	—
	IP3112-Bxxx: see documentation IE3112: 55 mA	IP3202-Bxxx: see documentation IE3202: 40 mA	IP3312-Bxxx: see documentation IE3312: 40 mA
	CE, UL	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/IP3112">www.beckhoff.com/IP3112</a> <a href="http://www.beckhoff.com/IE3112">www.beckhoff.com/IE3112</a>	<a href="http://www.beckhoff.com/IP3202">www.beckhoff.com/IP3202</a> <a href="http://www.beckhoff.com/IE3202">www.beckhoff.com/IE3202</a>	<a href="http://www.beckhoff.com/IP3312">www.beckhoff.com/IP3312</a> <a href="http://www.beckhoff.com/IE3312">www.beckhoff.com/IE3312</a>



# Analog output | 0/4...20 mA, -10...+10 V

	4-channel analog output, 0/4...20 mA, M12, 15/16 bit	4-channel analog output, -10...+10 V, M12, 16 bit
<b>Compact Box</b>	<b>IP4112-Bxxx</b>	<b>IP4132-Bxxx</b>
<b>Extension Box</b>	<b>IE4112</b>	<b>IE4132</b>
<b>Connection technology</b>	M12, screw type	M12, screw type
<b>Signal type</b>	0/4...20 mA	-10/0...+10 V
<b>Resolution</b>	15 bit, configurable to 16 bit	16 bit
<b>Conversion time</b>	< 4 ms	< 4 ms
<b>Number of outputs</b>	4	4
	 <p>The IP4112/IE4112 analog output module generates analog output signals in the range from 0/4 to 20 mA. The power is supplied to the process level with a resolution of 15 bits (default), and is electrically isolated. If the input is transmitted without an arithmetical sign, 16 bit resolution may also be selected. If necessary, the output scaling can be altered. Ground potential for the four output channels is common with the 24 V DC supply. The analog actuators are powered by the load voltage. The applied load voltage (which can be any value up to 30 V DC) is fed through to supply the actuators.</p>	 <p>The IP4132/IE4132 analog output module generates analog output signals in the range from -10 to +10 V. The voltage is supplied to the process level with a resolution of 16 bits, and is electrically isolated. If necessary, the output scaling can be altered. Ground potential for the four output channels is common with the 24 V DC supply. The analog actuators are powered by the control voltage. The applied load voltage (which can be any value up to 30 V DC) is available for supply of the actuators.</p>
<b>Nominal voltage</b>	24 V DC	24 V DC
<b>Load</b>	< 500 Ω	> 5 kΩ
<b>Measuring error</b>	< ±0.1 % (relative to full scale value)	< ±0.1 % (relative to full scale value)
<b>Actuator supply</b>	from the auxiliary voltage U <sub>P</sub>	from the auxiliary voltage U <sub>P</sub>
<b>Current consumption from U<sub>S</sub> (without sensor current)</b>	IP4112-Bxxx: see documentation IE4112: 40 mA	IP4132-Bxxx: see documentation IE4132: 40 mA
<b>Approvals</b>	CE, UL	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IP4112">www.beckhoff.com/IP4112</a> <a href="http://www.beckhoff.com/IE4112">www.beckhoff.com/IE4112</a>	<a href="http://www.beckhoff.com/IP4132">www.beckhoff.com/IP4132</a> <a href="http://www.beckhoff.com/IE4132">www.beckhoff.com/IE4132</a>




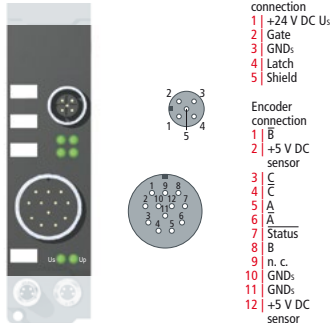
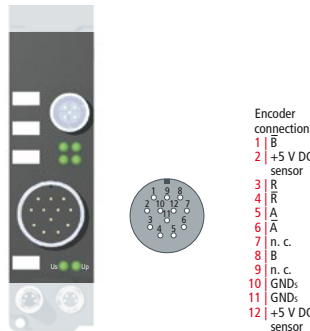
# Position measurement | SSI encoder, incremental encoder

The IP5009/IE5009 SSI encoder interface is used for the direct connection of an SSI encoder that is powered via the SSI interface. The interface circuit generates a pulse for reading the sensor, and makes the incoming data stream available to the controller as a data word in the process image. Various operating modes, transmission frequencies and bit widths can be permanently stored in a control register.

The IP5109/IE5109 Fieldbus Box processes differential signals according to the RS422/RS485 standard. This method of transmission is particularly resistant to interference and is suitable for high transmission frequencies. The incremental encoder interface uses a quadrature decoder. Gate and latch inputs enable pre-processing in the module in order to be able to transfer positional values to the controller exactly upon an external event and thus support the referencing of a drive.

1-channel SSI  
encoder interface,  
M23

Compact Box Extension Box	IP5009-Bxxx IE5009
Connection technology	M23 connector with outer thread, 12-pin
Nominal voltage	24 V DC (-15 %/+20 %)
Number of channels	1
	 <p>1   GND; 2   +24 V DC U<sub>S</sub> 3   Clock + 4   Clock - 5   Data + 6   Data - 7   n. c. 8   n. c. 9   n. c. 10   n. c. 11   n. c. 12   n. c.</p>
	<p>The IP5009/IE5009 SSI interface module allows an SSI encoder to be connected directly. The encoder is powered via the SSI interface. The interface circuit generates a pulse for reading the encoder and makes the incoming data stream available to the controller as a data word in the process image. The module can optionally provide the data as binary numbers or as a binary gray code. Various operating modes, transmission frequencies and bit widths can be permanently stored in a control register.</p>
Signal input	difference signal (RS485)
Encoder supply	24 V DC, from load voltage
Data transfer rates	variable up to 1 MHz, 250 kHz default
Counter	–
Limit frequency	–
Resolution	32 bit counter value
Commands	–
Sensor supply	from control voltage, max. 0.5 A, short-circuit proof in total
Current consumption from U <sub>S</sub> (without sensor current)	IP5009-Bxxx: see documentation IE5009: 55 mA
Approvals	CE, UL
Further information	<a href="http://www.beckhoff.com/IP5009">www.beckhoff.com/IP5009</a> <a href="http://www.beckhoff.com/IE5009">www.beckhoff.com/IE5009</a>

	1-channel incremental encoder interface, 1 MHz, M23	1-channel SinCos encoder interface, M23	
	<b>IP5109-Bxxx IE5109</b>	<b>IP5209-Bxxx</b>	<b>IP5209-Bxxx-1000</b>
	encoder/sensor: M23 connector with outer thread, 12-pin, gate/latch: M12, screw type	M23 connector with outer thread, 12-pin	
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)	
	1	1	
	<div></div> <p>The IP5109/IE5109 module is an interface for the direct connection of incremental encoders with differential inputs (RS485) or with single inputs. A 16 bit counter with a quadrature decoder and a 16 bit latch for the zero pulse can be read, set or enabled. The inputs can optionally be used as complementary or as single inputs. Incremental encoders with alarm outputs can be connected at the interface's status input. Interval measurement with a resolution of 200 ns is possible. The gate input allows the counter to be halted (high = stop). The value is read with a rising edge at the latch input.</p>	<div></div> <p>The SinCos module IP5209-Bxxx serves as interface for the direct connection of a measuring sensor, for example a measuring probe with sinusoidal voltage output 1 V<sub>PP</sub> to the higher-level fieldbus. In contrast to the standard version, instead of a voltage input the special IP5209-Bxxx-1000 version has a current input for 11 µA<sub>PP</sub> measuring probes. The measuring signal is processed, interpolated and made available as a 32 bit value. The signal period resolution is 10 bits, i.e. 1024 steps. The reference mark is also stored in a 32 bit value. The current count and the reference mark value can be read. The limit frequency for the measuring signal inputs is 100 kHz.</p>	
	difference signal (RS485)	1 V <sub>PP</sub>	11 µA <sub>PP</sub>
	5 V DC	5 V DC	
	—	—	
	16 bit, binary	—	
	1 MHz (with 4-fold evaluation)	100 kHz (scanning of the input signals with 500 kHz)	
	16 bit binary value	10 bit, 1024 steps per period	
	read, set, enable	set count, evaluate reference mark latch, change of direction, frequency control	
	from control voltage, max. 0.5 A, short-circuit proof in total	5 V DC from control voltage, max. 0.5 A	
	IP5109-Bxxx: see documentation IE5109: 55 mA	130 mA	
	CE, UL	CE, UL	
	<a href="http://www.beckhoff.com/IP5109">www.beckhoff.com/IP5109</a> <a href="http://www.beckhoff.com/IE5109">www.beckhoff.com/IE5109</a>	<a href="http://www.beckhoff.com/IP5209">www.beckhoff.com/IP5209</a>	

# Communication | Serial interfaces

The IP60x2/IE60x2 serial interfaces enable the connection of devices with RS232 or RS422/RS485 interfaces to the control level. The active communication channel operates independently of the higher-level bus system in full duplex mode at up to 115.2 kbaud. This way, any desired number of serial interfaces can be used in the application without having to consider structural restrictions in the control device. The serial interface can be positioned close to the place of use, this way reducing the necessary cable lengths.

The RS232 interface enables high resistance to interference by means of electrically isolated signals, which in the case of the IP6022/IE6022 module is additionally supported by differential signal transmission according to RS422.

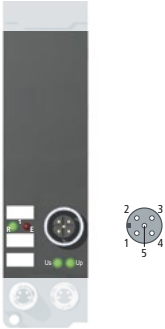
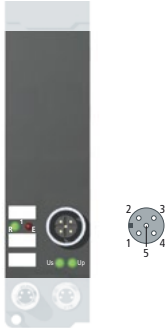
1-channel serial interface,  
RS232, M12

<b>Compact Box Extension Box</b>	<b>IP6002-Bxxx IE6002</b>
<b>Connection technology</b>	M12, screw type
<b>Data transfer rates</b>	1200...115,200 baud, 9600 baud (8 bits, no parity, 1 stop bit) is preset
<b>Data transfer channels</b>	2 (1/1), TxD and RxD, full duplex



The IP6002/IE6002 serial interface module allows the connection of devices with an RS232 interface, which operates in conformity with the CCITT V.28/DIN 66 259-1 standards. The module transmits the data in a fully transparent manner to the higher-level automation device. The data is transferred via the fieldbus using a simple handshake protocol. This does not have any effect on the protocol of the serial interface. The RS232 interface guarantees high immunity to interference through electrically isolated signals.

<b>Nominal voltage</b>	24 V DC (-15 %/+20 %)
<b>Bit transfer</b>	RS232 (EIA-232)
<b>Specification</b>	"0": -18...+3 V; "1": 3...18 V
<b>Cable length</b>	max. 15 m
<b>Data buffer</b>	128 bytes receive buffer, 16 bytes transmit buffer
<b>Bit width in the process image</b>	input/output: 3 x 8 bit user data, 1 x 8 bit control/status (up to 5 x 8 bit user data are possible)
<b>Current consumption from U<sub>s</sub> (without sensor current)</b>	IP6002-Bxxx: see documentation IE6002: 40 mA
<b>Approvals</b>	CE, UL
<b>Further information</b>	<a href="http://www.beckhoff.com/IP6002">www.beckhoff.com/IP6002</a> <a href="http://www.beckhoff.com/IE6002">www.beckhoff.com/IE6002</a>

	1-channel serial interface TTY, 20 mA current loop, M12	1-channel serial interface, RS422/RS485, M12
	<b>IP6012-Bxxx</b> <b>IE6012</b>	<b>IP6022-Bxxx</b> <b>IE6022</b>
	M12, screw type	M12, screw type
	1200...115,200 baud, 9600 baud (8 bits, no parity, 1 stop bit) is preset	1200...115,200 baud, 9600 baud (8 bits, no parity, 1 stop bit) is preset
	2 (1/1), TxD and RxD	TxD and RxD, full/half duplex
	 <p>The IP6012/IE6012 serial interface module allows the connection of devices with a 20 mA current interface. The interface operates passively. The module transmits the data in a fully transparent manner to the higher-level automation device. The data is transferred via the fieldbus using a simple handshake protocol. This does not have any effect on the protocol of the serial interface. The current interface guarantees high immunity to interference through electrically isolated signals with injected current.</p>	 <p>The IP6022/IE6022 serial interface module allows the connection of devices with a RS422 or RS485 interface. The module transmits the data in a fully transparent manner to the higher-level automation device. The data is transferred via the fieldbus using a simple handshake protocol. This does not have any effect on the protocol of the serial interface. The transmission of differential signals according to RS232 guarantees high immunity to interference through electrically isolated signals.</p>
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	2 x 20 mA	RS422/RS485
	load: < 500 Ω	line impedance: 120 Ω
	max. 1000 m twisted pair	max. 500 m twisted pair
	128 bytes receive buffer, 16 bytes transmit buffer	128 bytes receive buffer, 16 bytes transmit buffer
	input/output: 3 x 8 bit user data, 1 x 8 bit control/status (up to 5 x 8 bit user data are possible)	input/output: 3 x 8 bit user data, 1 x 8 bit control/status (up to 5 x 8 bit user data are possible)
	IP6012-Bxxx: see documentation IE6012: 40 mA	IP6022-Bxxx: see documentation IE6022: 40 mA
	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/IP6012">www.beckhoff.com/IP6012</a> <a href="http://www.beckhoff.com/IE6012">www.beckhoff.com/IE6012</a>	<a href="http://www.beckhoff.com/IP6022">www.beckhoff.com/IP6022</a> <a href="http://www.beckhoff.com/IE6022">www.beckhoff.com/IE6022</a>



# EPIxxxx, ERIxxxx | IO-Link box

► [www.beckhoff.com/IO-Link-box](http://www.beckhoff.com/IO-Link-box)

IO-Link interface



Signal status

Robust (EPIxxxx) or  
metal housing (ERIxxxx)  
for industrial application

Signal status display

Standard labels

Connection of sensors/  
actuators via connector:  
– M8, screw type  
– M12, screw type

Watertight and dust-proof,  
due to protection class  
IP 65/66/67 (fully potted)

Ultra compact  
dimensions (L x W x H)  
126 x 30 x 26.5 mm

Power supply  
status display:  
24V L+

Load status display:  
24V P24



Extended operating/  
storage temperature



Extended mechanical  
load

Mounting holes



Industrial housing (EPIxxxx)



Zinc die-cast housing (ERIxxxx)

## I/O connections



Connector M8,  
screw type, 3-pin



Connector M12,  
screw type, 5-pin

Since 2013, the IO-Link communication system has been available worldwide as an international standard according to IEC 61131-9 and is thus the first globally standardised technology for communication with sensors and actuators below the fieldbus level. Based on this standard Beckhoff offers a new, extensive range of IO-Link box modules with IP 67 protection for the implementation of inexpensive point-to-point connections directly in the field.

The EPIxxxx and ERIxxxx IO-Link box modules enable the connection of binary and complex sensors and actuators in the field. The connection between the modules and the respective IO-Link master is made via an M12 connecting line (port class A). In case of modules with increased power consumption, an additional voltage infeed is possible (port class B). Economical wiring is possible through the use of unshielded industrial cables. The modules are designed according to IO-Link specification V1.1; the range of the point-to-point connection is 20 m in accordance with the specification. All connected IO-Link devices can be identified, diagnosed and if

necessary simply replaced without parameterisation having to be carried out again.

With their compact and space-saving design the IO-Link box modules are suitable for the most diverse applications. The IO-Link connections are integrated both in the proven plastic housings (EPI) and in the die-cast zinc housings (ERI) for additional protection in extremely harsh environments. Binary sensors can be connected to 8- or 16-channel modules with an M8 or M12 screw connection. The universal digital I/O modules with 8 or 16 freely usable input/output channels are particularly flexible in use. Analog signals can be acquired and output with the 4-channel analog input box or combi box with two analog inputs and two analog outputs. In combination with a V1.1 master this allows the sensor parameters to be saved in the master and reloaded.

Apart from process data, acyclic data such as device information (parameters, identification data, diagnosis, etc.) and events (e.g. error message, warning) can be transmitted with the IO-Link box modules. Beckhoff offers IO-Link masters in IP 20 and IP 67 execution:

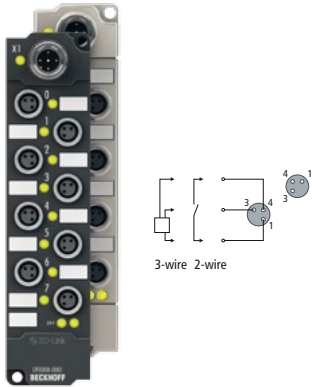
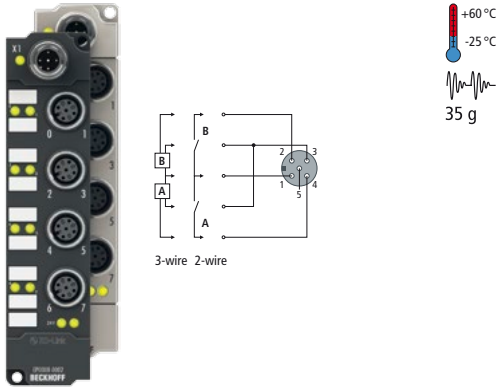
- EL6224 EtherCAT Terminal (IP 20)
  - EP6224 EtherCAT Box (IP 67)
  - KL6224 Bus Terminal (IP 20)
- The IO-Link configuration tool is directly integrated into the TwinCAT software system. Apart from the programming of the control system, cyclic data from various fieldbuses are collected in process images in TwinCAT, including data from the IO-Link devices, and thus no separate configuration tool is required. With TwinCAT, higher-level fieldbuses such as EtherCAT can be

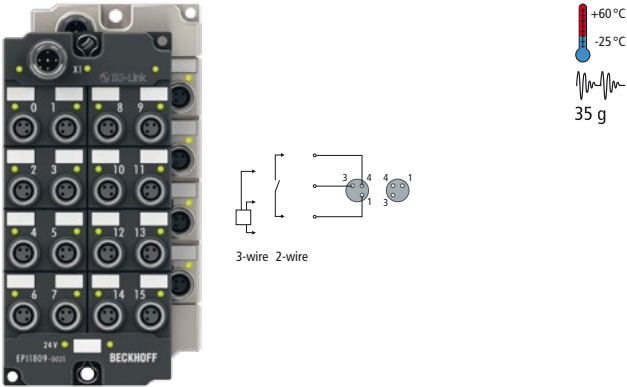
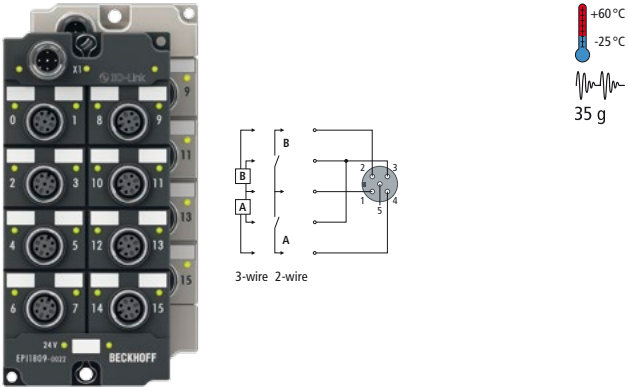
conveniently connected to the sensor/actuator level and simply configured via one software platform. Moreover, the scan function of the IO-Link devices facilitates their integration. In connection with the import of the device description file IODD (IO Device Description), parameters and diagnostic data can be accessed directly via the configuration tool. With the aid of the TwinCAT software system, IO-Link parameters and diagnostic data can also be accessed simply and conveniently from a user program.

### EXIxxxx-00yz

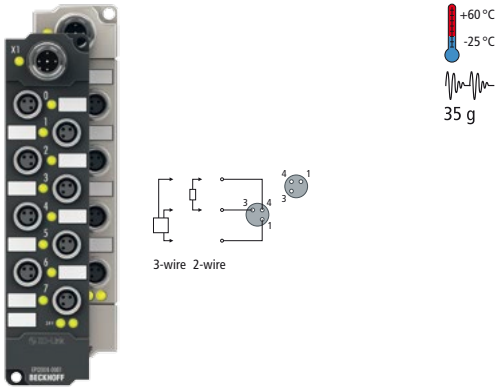
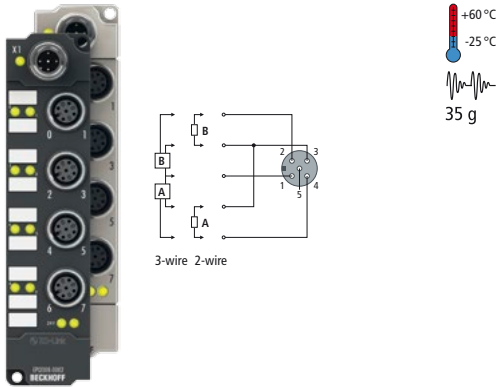
- 1 = connector M8, screw type, 3-pin
- 2 = connector M12, screw type, 5-pin
- 0 = width: 30 mm
- 2 = width: 60 mm
- Signals see page 598
- I = IO-Link
- P = industrial housing
- R = zinc die-cast housing

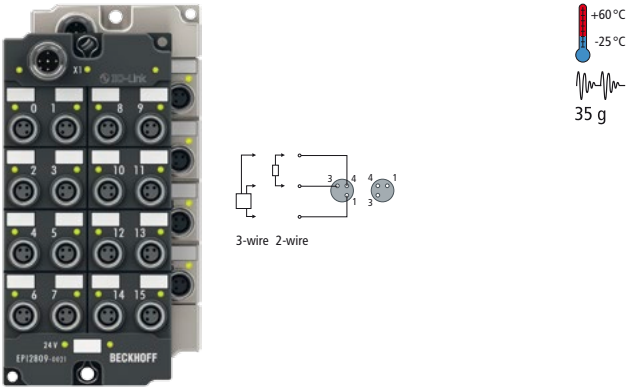
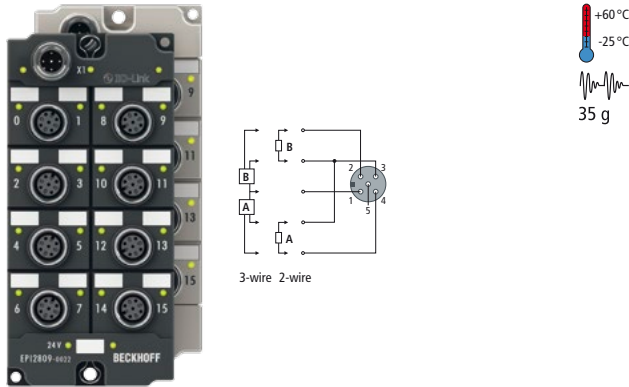
# Digital input | 24 V DC, positive switching

	8-channel digital input, 24 V DC, M8, positive switching	8-channel digital input, 24 V DC, M12, positive switching
Industrial housing	EPI1008-0001	EPI1008-0002
Zinc die-cast housing	ERI1008-0001	ERI1008-0002
Connection technology	M8, screw type	M12, screw type
Specification version	IO-Link V1.1, Class A	IO-Link V1.1, Class A
Input filter	3.0 ms (default), adjustable 0...20 ms	3.0 ms (default), adjustable 0...20 ms
Number of inputs	8	8
	 <p>The EPI1008/ERI1008 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M8 screw type connectors.</p>	 <p>The EPI1008/ERI1008 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M12 screw type connectors.</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Data transfer rates	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
Interfaces	1 x M12 plug, A-coded	1 x M12 plug, A-coded
Sensor supply	max. 0.5 A, U <sub>S1</sub> (derived from L+), short-circuit proof in total	max. 0.5 A, U <sub>S1</sub> (derived from L+), short-circuit proof in total
Current consumption	typ. 100 mA from L+	typ. 100 mA from L+
Operating temperature	-25...+60 °C	-25...+60 °C
Approvals	CE, UL	CE, UL
Further information	<a href="http://www.beckhoff.com/EPI1008">www.beckhoff.com/EPI1008</a> <a href="http://www.beckhoff.com/ERI1008">www.beckhoff.com/ERI1008</a>	<a href="http://www.beckhoff.com/EPI1008">www.beckhoff.com/EPI1008</a> <a href="http://www.beckhoff.com/ERI1008">www.beckhoff.com/ERI1008</a>

	16-channel digital input, 24 V DC, M8, positive switching	16-channel digital input, 24 V DC, M12, positive switching
	<b>EPI1809-0021</b> <b>ERI1809-0021</b>	<b>EPI1809-0022</b> <b>ERI1809-0022</b>
	M8, screw type	M12, screw type
	IO-Link V1.1, Class A	IO-Link V1.1, Class A
	3.0 ms (default), adjustable 0...20 ms	3.0 ms (default), adjustable 0...20 ms
	16	16
	 <p>The EPI1809/ERI1809 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M8 screw type connectors.</p>	 <p>The EPI1809/ERI1809 IO-Link box with digital inputs acquires the binary control signals from the process level and transmits them, in an electrically isolated form, to the controller. The state of the signals is indicated by light emitting diodes. The signals are connected via M12 screw type connectors.</p>
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
	1 x M12 plug, A-coded	1 x M12 plug, A-coded
	max. 0.5 A, $U_{S1}$ (derived from $L_+$ ), short-circuit proof in total	max. 0.5 A, $U_{S1}$ (derived from $L_+$ ), short-circuit proof in total
	typ. 100 mA from $L_+$	typ. 100 mA from $L_+$
	-25...+60 °C	-25...+60 °C
	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/EPI1809">www.beckhoff.com/EPI1809</a> <a href="http://www.beckhoff.com/ERI1809">www.beckhoff.com/ERI1809</a>	<a href="http://www.beckhoff.com/EPI1809">www.beckhoff.com/EPI1809</a> <a href="http://www.beckhoff.com/ERI1809">www.beckhoff.com/ERI1809</a>

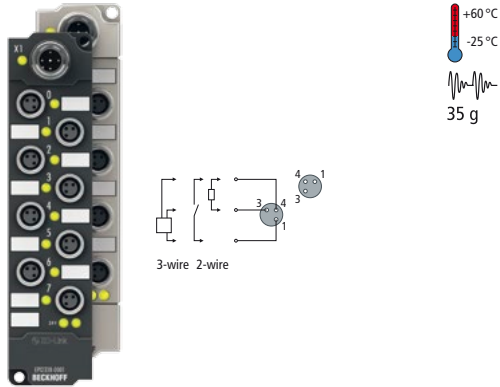
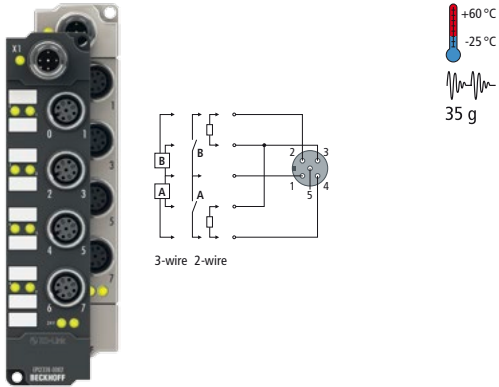
# Digital output | 24 V DC, positive switching

	8-channel digital output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$	8-channel digital output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$
Industrial housing	EPI2008-0001	EPI2008-0002
Zinc die-cast housing	ERI2008-0001	ERI2008-0002
Connection technology	M8, screw type	M12, screw type
Specification version	IO-Link V1.1, Class B	IO-Link V1.1, Class B
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Max. output current	0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof
Number of outputs	8	8
	 <p>The EPI2008/ERI2008 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The eight outputs handle load currents of up to 0.5 A each.</p> <p>The signals are optionally connected via M8 screw type connectors. All outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The EPI2008/ERI2008 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The eight outputs handle load currents of up to 0.5 A each.</p> <p>The signals are optionally connected via M12 screw type connectors. All outputs are short-circuit proof and protected against inverse connection.</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Data transfer rates	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
Short-circuit current	typ. 1.5 A	typ. 1.5 A
Current consumption	typ. 100 mA from L+	typ. 100 mA from L+
Auxiliary power current	typ. 20 mA + load	typ. 20 mA + load
Interfaces	1 x M12 plug, A-coded	1 x M12 plug, A-coded
Electrical isolation	L-/2L+: yes	L-/2L+: yes
Operating temperature	-25...+60 °C	-25...+60 °C
Approvals	CE, UL	CE, UL
Further information	<a href="http://www.beckhoff.com/EPI2008">www.beckhoff.com/EPI2008</a> <a href="http://www.beckhoff.com/ERI2008">www.beckhoff.com/ERI2008</a>	<a href="http://www.beckhoff.com/EPI2008">www.beckhoff.com/EPI2008</a> <a href="http://www.beckhoff.com/ERI2008">www.beckhoff.com/ERI2008</a>

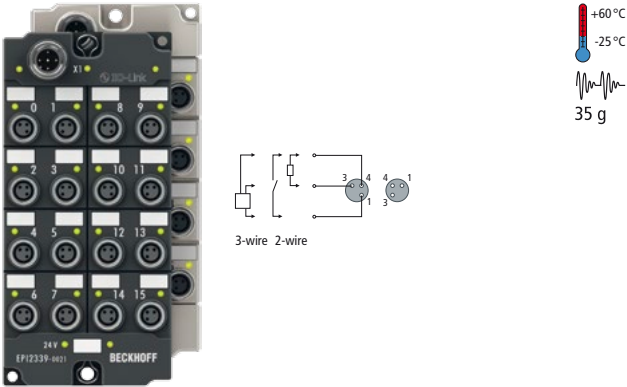
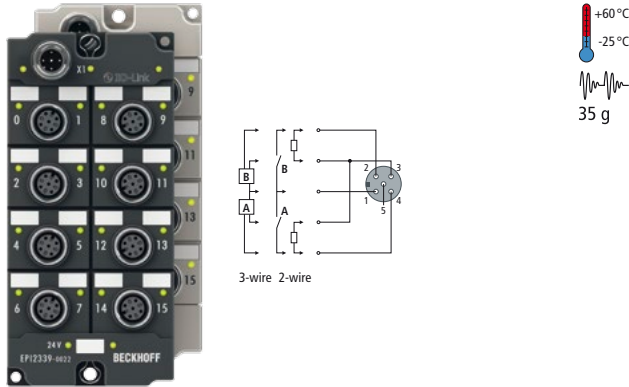
	16-channel digital output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	16-channel digital output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$ ( $\Sigma 4 \text{ A}$ )
	<b>EPI2809-0021</b> <b>ERI2809-0021</b>	<b>EPI2809-0022</b> <b>ERI2809-0022</b>
	M8, screw type	M12, screw type
	IO-Link V1.1, Class B	IO-Link V1.1, Class B
	ohmic, inductive, lamp load	ohmic, inductive, lamp load
	0.5 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$	0.5 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$
	16	16
	 <p>The EPI2809/ERI2809 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The 16 outputs handle load currents of up to 0.5 A each, although the total current is limited to 4 A. This makes these modules particularly suitable for applications in which not all of the outputs are active at the same time, or in which not all of the actuators draw 0.5 A current.</p> <p>The signals are optionally connected via M8 screw type connectors. All outputs are short-circuit proof and protected against inverse connection.</p>	 <p>The EPI2809/ERI2809 IO-Link box with digital outputs connects the binary control signals from the controller on to the actuators at the process level. The 16 outputs handle load currents of up to 0.5 A each, although the total current is limited to 4 A. This makes these modules particularly suitable for applications in which not all of the outputs are active at the same time, or in which not all of the actuators draw 0.5 A current.</p> <p>The signals are optionally connected via M12 screw type connectors. All outputs are short-circuit proof and protected against inverse connection.</p>
	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
	typ. 1.5 A	typ. 1.5 A
	typ. 100 mA from L+	typ. 100 mA from L+
	typ. 20 mA + load	typ. 20 mA + load
	1 x M12 plug, A-coded	1 x M12 plug, A-coded
	L+/2L+: yes	L+/2L+: yes
	-25...+60 °C	-25...+60 °C
	CE, UL	CE, UL
	<a href="http://www.beckhoff.com/EPI2809">www.beckhoff.com/EPI2809</a> <a href="http://www.beckhoff.com/ERI2809">www.beckhoff.com/ERI2809</a>	<a href="http://www.beckhoff.com/EPI2809">www.beckhoff.com/EPI2809</a> <a href="http://www.beckhoff.com/ERI2809">www.beckhoff.com/ERI2809</a>



# Digital combi | 24 V DC, positive switching

	8-channel digital input or output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$	8-channel digital input or output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$
Industrial housing	EPI2338-0001	EPI2338-0002
Zinc die-cast housing	ERI2338-0001	ERI2338-0002
Connection technology	M8, screw type	M12, screw type
Specification version	IO-Link V1.1, Class B	IO-Link V1.1, Class B
Input filter	3.0 ms (default), adjustable 0...20 ms	3.0 ms (default), adjustable 0...20 ms
Number of channels	8 digital inputs or outputs	8 digital inputs or outputs
	 <p>The EPI2338/ERI2338 IO-Link box has eight digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image.</p> <p>The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.</p>	 <p>The EPI2338/ERI2338 IO-Link box has eight digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image.</p> <p>The outputs handle load currents of up to 0.5 A, are short-circuit proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.</p>
Nominal voltage	24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
Data transfer rates	230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
Max. output current	0.5 A per channel, individually short-circuit proof	0.5 A per channel, individually short-circuit proof
Load type	ohmic, inductive, lamp load	ohmic, inductive, lamp load
Sensor supply	from load supply voltage, max. 0.5 A, short-circuit proof in total	from load supply voltage, max. 0.5 A, short-circuit proof in total
Short-circuit current	max. 1.5 A	max. 1.5 A
Interfaces	1 x M12 plug, A-coded	1 x M12 plug, A-coded
Auxiliary power current	typ. 20 mA + load	typ. 20 mA + load
Current consumption	typ. 100 mA from L+	typ. 100 mA from L+
Electrical isolation	L-/2L+: yes	L-/2L+: yes
Operating temperature	-25...+60 °C	-25...+60 °C
Approvals	CE, UL	CE, UL
Further information	<a href="http://www.beckhoff.com/EPI2338">www.beckhoff.com/EPI2338</a> <a href="http://www.beckhoff.com/ERI2338">www.beckhoff.com/ERI2338</a>	<a href="http://www.beckhoff.com/EPI2338">www.beckhoff.com/EPI2338</a> <a href="http://www.beckhoff.com/ERI2338">www.beckhoff.com/ERI2338</a>



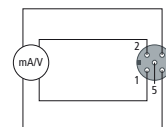
16-channel digital input or output, 24 V DC, M8, $I_{\max} = 0.5 \text{ A}$ ( $\Sigma 4 \text{ A}$ )	16-channel digital input or output, 24 V DC, M12, $I_{\max} = 0.5 \text{ A}$ ( $\Sigma 4 \text{ A}$ )
<b>EPI2339-0021</b> <b>ERI2339-0021</b>	<b>EPI2339-0022</b> <b>ERI2339-0022</b>
M8, screw type	M12, screw type
IO-Link V1.1, Class B	IO-Link V1.1, Class B
3.0 ms (default), adjustable 0...20 ms	3.0 ms (default), adjustable 0...20 ms
16 digital inputs or outputs	16 digital inputs or outputs
 <p>The EPI2339/ERI2339 IO-Link box has 16 digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image.</p> <p>The outputs handle load currents of up to 0.5 A (the total current is limited to 4 A). They are short-circuit proof and protected against inverse polarity. The signals are connected via M8 screw type connectors.</p>	 <p>The EPI2339/ERI2339 IO-Link box has 16 digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image.</p> <p>The outputs handle load currents of up to 0.5 A (the total current is limited to 4 A). They are short-circuit proof and protected against inverse polarity. The signals are connected via M12 screw type connectors.</p>
24 V DC (-15 %/+20 %)	24 V DC (-15 %/+20 %)
230.4 kbaud (COM 3)	230.4 kbaud (COM 3)
0.5 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$	0.5 A per channel, individually short-circuit proof, $\Sigma 4 \text{ A}$
ohmic, inductive, lamp load	ohmic, inductive, lamp load
from load supply voltage, max. 0.5 A, short-circuit proof in total	from load supply voltage, max. 0.5 A, short-circuit proof in total
max. 1.5 A	max. 1.5 A
1 x M12 plug, A-coded	1 x M12 plug, A-coded
typ. 20 mA + load	typ. 20 mA + load
typ. 100 mA from L+	typ. 100 mA from L+
L+/2L+: yes	L+/2L+: yes
-25...+60 °C	-25...+60 °C
CE, UL	CE, UL
<a href="http://www.beckhoff.com/EPI2339">www.beckhoff.com/EPI2339</a> <a href="http://www.beckhoff.com/ERI2339">www.beckhoff.com/ERI2339</a>	<a href="http://www.beckhoff.com/EPI2339">www.beckhoff.com/EPI2339</a> <a href="http://www.beckhoff.com/ERI2339">www.beckhoff.com/ERI2339</a>

# Analog input | -10...+10 V, 0/4...20 mA

The EPI3174 and ERI3174 IO-Link box modules evaluate analog standard signals within the range of -10/0 V to +10 V or 0/4 mA to 20 mA with 16-bit resolution. The signal form is separately configurable for each channel. The EPI3174/ERI3174 evaluates the difference between the two input signals Input+ and Input-. These must be referred to the ground potential of the load voltage  $U_P$ . The DC component does not affect the measurement, as long as it is in the common mode range.

4-channel analog input,  
-10/0...+10 V or 0/4...20 mA,  
parameterisable, 16 bit

Industrial housing	EPI3174-0002
Zinc die-cast housing	ERI3174-0002
Connection technology	M12, screw type
Specification version	IO-Link V1.1, Class B
Signal type	-10/0...+10 V   0/4...20 mA
Resolution	16 bit (incl. sign)
Conversion time	~ 100 $\mu$ s
Number of inputs	4



+60 °C  
-25 °C  
35 g

The IO-Link box EPI3174/ERI3174 has four analog inputs which can be individually parameterised, so that they process signals either in the -10 to +10 V or the 0/4 to 20 mA range. The voltage or input current is digitised with a resolution of 16 bits, and is transmitted (electrically isolated) to the higher-level automation device. The four input channels have a common, internal ground potential. The input filter/conversion times are configurable in a wide range.

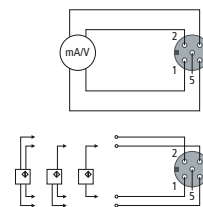
Measuring error	< $\pm 0.3$ % (relative to full scale value)
Data transfer rates	230.4 kbaud (COM 3)
Internal resistance	> 200 k $\Omega$   typ. 85 $\Omega$ + diode voltage
Sensor supply	from additional power supply 2L+, DC, freely selectable up to 30 V
Current consumption	typ. 100 mA from L+
Interfaces	1 x M12 plug, A-coded
Special features	current or voltage parameterisable (0/4...20 mA, -10/0...10 V)
Electrical isolation	L+/2L+: yes
Operating temperature	-25...+60 °C
Approvals	CE, UL
Further information	<a href="http://www.beckhoff.com/EPI3174">www.beckhoff.com/EPI3174</a> <a href="http://www.beckhoff.com/ERI3174">www.beckhoff.com/ERI3174</a>

# Analog output | -10...+10 V, 0/4...20 mA

The EPI4374 and ERI4374 IO-Link box modules acquire/output analog standard signals within the range of -10/0 V to +10 V or 0/4 mA to 20 mA with 16-bit resolution. The type of signal is separately configurable for each channel. The output signals  $U_s$ ,  $U_p$  and the fieldbus are electrically isolated from one another and have a common ground potential (output-).

2-channel analog input +  
2-channel analog output,  
-10/0...+10 V or 0/4...20 mA,  
parameterisable, 16 bit

Industrial housing	EPI4374-0002
Zinc die-cast housing	ERI4374-0002
Connection technology	M12, screw type
Specification version	IO-Link V1.1, Class B
Signal type	-10/0...+10 V   0/4...20 mA
Resolution	16 bit (incl. sign)
Conversion time	input: ~ 100 $\mu$ s, output: ~ 40 $\mu$ s
Number of outputs	2
Number of inputs	2



+60 °C  
-25 °C  
35 g

The EPI4374/ERI4374 IO-Link box combines two analog inputs and two analog outputs which can be individually parameterised, so that they process/generate signals either in the -10 to +10 V or the 0/4 to 20 mA range. The resolution for the current and voltage signals is 16 bit (signed).

The voltage or output current is supplied to the process level with a resolution of 15 bit (default), and is electrically isolated. Ground potential for the two output channels is common with the 24 V DC supply.

Measuring error	< 0.1 % (relative to full scale value)
Data transfer rates	230.4 kbaud (COM 3)
Load	> 5 k $\Omega$   < 500 $\Omega$
Internal resistance	input: > 200 k $\Omega$   typ. 85 $\Omega$ + diode voltage
Sensor supply	from load supply voltage $U_p$
Current consumption	typ. 100 mA from $L_+$
Interfaces	1 x M12 plug, A-coded
Special features	combi module, current or voltage parameterisable per channel
Electrical isolation	$L_-/2L_+$ : yes
Operating temperature	-25...+60 °C
Approvals	CE, UL
Further information	<a href="http://www.beckhoff.com/EPI4374">www.beckhoff.com/EPI4374</a> <a href="http://www.beckhoff.com/ERI4374">www.beckhoff.com/ERI4374</a>



Housing type A



Housing type B



## FM33xx-B110 | Thermocouple Fieldbus Modules with EtherCAT interface

**EtherCAT** 

i.e. several modules can be wired in series in a line topology.

The module's circuit can operate thermocouple sensors using a 2-wire connection. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The error LEDs indicate a broken wire. Compensation for the cold junction is made through a temperature measurement in the connecting plugs. This means that standard extension leads can be connected. The Fieldbus Modules have back-voltage protection circuitry to protect against external voltages applied to the thermocouple inputs.

Voltages of up to 230 V AC are withstood without damage to the module. Those thermocouple inputs that are not affected remain functionally operative or are only affected for a short time.

The extended parameterisation is carried out via EtherCAT. The parameters are stored in the module. The status of the Fieldbus Module is indicated via LEDs.

The different versions of the FM33xx Fieldbus Module differ in terms of the number of available thermocouple input channels (12 or 32 channels) and the housing type (clip-on housing A or add-on housing B). The add-on housing (type B) features two locking latches and a continuous rubber seal to provide an IP 65

connection to the socket element. In addition, housing type B features two cast brackets with holes for attaching the FM module to mounting plates (through-hole mounting).

The FM33xx-B110 fieldbus modules allow 12 or 32 thermocouples to be connected to a module. The connecting circuitry for these multiple thermocouples is housed in a compact, splash-proof housing and has an EtherCAT IN and an EtherCAT OUT interface. The modules are supplied with power via separate M8 connections and are "daisy-chain"-capable on both the power supply and EtherCAT sides,



### Ordering information

### FM33xx-B110

FM3312-B110-0010	Fieldbus Module, thermocouple, 12-channel, type J, EtherCAT IN/OUT interface, housing type A
FM3312-B110-1010	Fieldbus Module, thermocouple, 12-channel, type J, EtherCAT IN/OUT interface, housing type B
FM3332-B110-0010	Fieldbus Module, thermocouple, 32-channel, type J, EtherCAT IN/OUT interface, housing type A
FM3332-B110-1010	Fieldbus Module, thermocouple, 32-channel, type J, EtherCAT IN/OUT interface, housing type B

Technical data	FM3312-B110	FM3332-B110
Fieldbus	EtherCAT	
Data transfer rates	100 Mbit/s	
Configuration possibility	via the controller	
Fieldbus connection method	2 x M12 socket, 4-pin (D-coded)	
Thermocouple channels	12	32
Thermocouple connections	industrial plug-in connection (Han24E, Han64D), 2-wire connection	
Cable length	max. 30 m	
Sensor types	type J, mV measurement (other types on request)	
Measuring range	type J: -10...+900 °C	
Resolution	0.1 °C per digit	
Conversion time	approx. 250 ms	
Measuring error	< ±0.5 % (of the full scale value)	
Input filter	5 variations, configurable	
Power supply	24 V DC (-15 %/+20 %), feed: 1 x M8 plug, 4-pin; downstream connection: 1 x M8 socket, 4-pin	
Current consumption	typ. 120 mA/max. 150 mA	typ. 150 mA/max. 180 mA
Bit width in the process image	input: 1 x 16 bit data, 2 x 8 bit status (per channel), 1 bit WcState, 10 bytes InfoData	
Electrical isolation	channels/control voltage: 500 V, between the channels: no, control voltage/fieldbus: 500 V (EtherCAT)	
Housing type A	industrial plug-in connector, Han24B	
Housing type B	add-on housing AGG + locking bracket	
Housing pin insert	Han24E	Han64D
Contacts	hard gold plated	
Dimensions (L x W x H)	type A: 120 mm x 52 mm x 129 mm, type B: 150 mm x 52 mm x 129 mm	
Weight	type A: 950 g, type B: 1030 g	
Operating/storage temperature	0...+55 °C/-25...+85 °C	
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27	
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4	
Protect. class/installation pos.	housing to IP 65 (EtherCAT connector: IP 67)/variable	
Approvals	CE, UL	
Further information	<a href="http://www.beckhoff.com/FM3312-B110">www.beckhoff.com/FM3312-B110</a>	<a href="http://www.beckhoff.com/FM3332-B110">www.beckhoff.com/FM3332-B110</a>

## Accessories

Ordering information		
ZK1090-6xxx-xxxx	M12 EtherCAT/Ethernet cables	646
ZK2020-3xxx-xxxx	M8 power cables	651





Housing type A



Housing type B



## FM33xx-B310 | Thermocouple Fieldbus Modules with PROFIBUS interface



The FM33xx-B310 Fieldbus Modules allow 12 or 32 thermocouples to be connected to a module. The connecting circuitry for these multiple thermocouples is housed in a compact, splash-proof housing and has a PROFIBUS DP interface with a transmission rate of 12 Mbaud. Data are mainly exchanged cyclically, although acyclic services ("DP-V1") are also available for parameterisation and diagnosis.

The module's circuit can operate thermocouple sensors using a 2-wire connection. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The error LEDs indicate a broken wire. Compensation for the cold junction is made through a temperature measurement in the connecting plugs. This means that standard extension leads can be connected. The Fieldbus Modules have back-voltage protection circuitry to protect against external voltages applied to the thermocouple inputs. Voltages of up to 230 V AC are withstood without damage to the module. Those thermo-

couple inputs that are not affected remain functionally operative or are only affected for a short time.

The extended parameterisation may be carried out either via the fieldbus or, using the KS2000 software tool, through the configuration interface. The parameters are stored in the module. The status of the Fieldbus Module is indicated via LEDs.

The different versions of the FM33xx-B310 Fieldbus Module differ in terms of the number of available thermocouple input channels (12 or 32 channels), the type of thermocouple that is implemented (type J or K), and the housing type (clip-on housing A or

add-on housing B). The add-on housing (type B) features two locking latches and a continuous rubber seal to provide an IP 65 connection to the socket element. In addition, housing type B features two cast brackets with holes for attaching the FM module to mounting plates (through-hole mounting).



Ordering information	FM33xx-B310
FM3312-B310-0000	Fieldbus Module, thermocouple, 12-channel, type K, PROFIBUS interface, housing type A
FM3312-B310-0010	Fieldbus Module, thermocouple, 12-channel, type J, PROFIBUS interface, housing type A
FM3312-B310-1000	Fieldbus Module, thermocouple, 12-channel, type K, PROFIBUS interface, housing type B
FM3312-B310-1010	Fieldbus Module, thermocouple, 12-channel, type J, PROFIBUS interface, housing type B
FM3332-B310-0000	Fieldbus Module, thermocouple, 32-channel, type K, PROFIBUS interface, housing type A
FM3332-B310-0010	Fieldbus Module, thermocouple, 32-channel, type J, PROFIBUS interface, housing type A
FM3332-B310-1000	Fieldbus Module, thermocouple, 32-channel, type K, PROFIBUS interface, housing type B
FM3332-B310-1010	Fieldbus Module, thermocouple, 32-channel, type J, PROFIBUS interface, housing type B

Technical data	FM3312-B310	FM3332-B310
Fieldbus	PROFIBUS DP	
Data transfer rates	max. 12 Mbaud	
Configuration possibility	via KS2000 or the controller	
Fieldbus connection method	DIN 45322, 6-pin, screw type	
Thermocouple channels	12	32
Thermocouple connections	industrial plug-in connection (Han24E, Han64D), 2-wire connection	
Cable length	max. 10 m	
Sensor types	type J, K, mV measurement	
Measuring range	type J: -10...+900 °C; type K: -100...+1370 °C	
Resolution	0.1 °C per digit	
Conversion time	approx. 250 ms	
Measuring error	< ±0.5 % (of the full scale value)	
Input filter	5 variations, configurable	
Power supply	24 V DC (-15 %/+20 %)	
Current consumption	typ. 90 mA/max. 120 mA	typ. 100 mA/max. 130 mA
Bit width in the process image	input: 4 x 16 bit data, optional: 4 x 8 bit control/status	
Electrical isolation	channels/control voltage: 500 V, between the channels: no, control voltage/fieldbus: 100 V (PROFIBUS)	
Housing type A	industrial plug-in connector, Han24B	
Housing type B	add-on housing AGG + locking bracket	
Housing pin insert	Han24E	Han64D
Contacts	hard gold plated	
Dimensions (L x W x H)	type A: 120 mm x 52 mm x 129 mm, type B: 150 mm x 52 mm x 129 mm	
Weight	type A: 950 g, type B: 1030 g	
Operating/storage temperature	0...+55 °C/-25...+85 °C	
Vibration/shock resistance	conforms to EN 60068-2-6/EN 60068-2-27	
EMC immunity/emission	conforms to EN 61000-6-2/EN 61000-6-4	
Protect. class/installation pos.	housing to IP 65 (PROFIBUS connector: IP 67)/variable	
Approvals	CE, UL	
Further information	<a href="http://www.beckhoff.com/FM3312-B310">www.beckhoff.com/FM3312-B310</a>	<a href="http://www.beckhoff.com/FM3332-B310">www.beckhoff.com/FM3332-B310</a>

## Accessories

Ordering information	
ZS3100-0831	M16, plug, metal, shielded, soldered, angled, male, 6-pin, DIN 45322, PROFIBUS
ZS3100-0841	M16, socket, metal, shielded, soldered, angled, female, 6-pin, DIN 45322, PROFIBUS
ZS3100-1810	PROFIBUS terminating resistor, plug, straight, 6-pin
ZB3300	PROFIBUS cable, 12 Mbaud, 2 x 0.25 mm <sup>2</sup> + 3 x 0.75 mm <sup>2</sup> , 5-wire, suitable as trailing cable
KS2000	configuration software for project design, commissioning and parameterisation of Beckhoff Fieldbus Box modules and Bus Terminals

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