

# IB IL 332-128

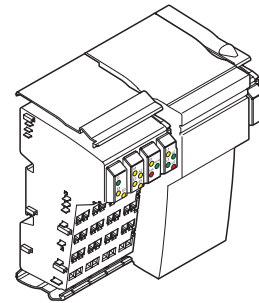
## IB IL 332-128-PAC

**Freely Programmable Inline CPU  
With 128 KB RAM**

Data Sheet 621502

02/2004

6215B000



The IB IL 332-128 and IB IL 332-128-PAC only differ in the scope of supply (see "Ordering Data" on page 16). Their function and technical data are identical.

For greater clarity, the order designation IB IL 332-128 is used throughout this document.



This data sheet is only valid in association with the IB IL SYS PRO UM E User Manual or the Inline user manual for your bus system.

## Product Description

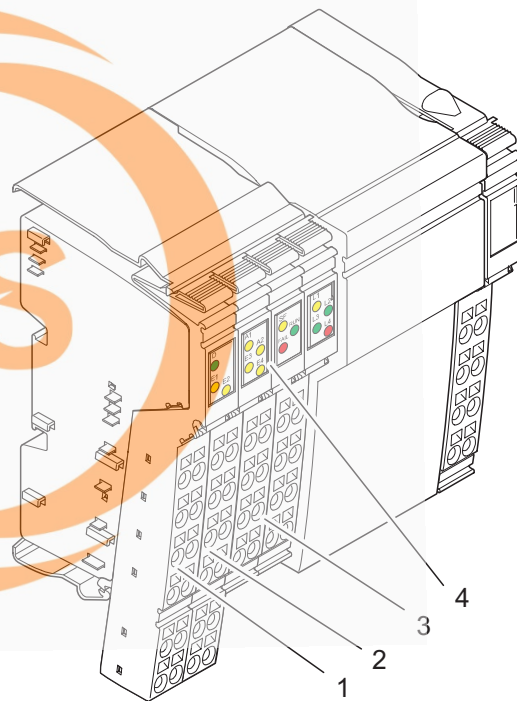
The Inline CPU is a freely programmable device for use within an Inline station.

### Features

- 128 KB RAM
- 128 KB flash program storage memory
- Freely programmable in "C-Cross Compiler" for Motorola 68000
- Two-processor system
- Debugging and programming of the Inline CPU via BDM interface
- Separate master and slave interfaces
- INTERBUS Loop 2 modules can be connected via Loop 2 branch terminal

## Applications

Distributed modular automation control (function units) in machines and systems.

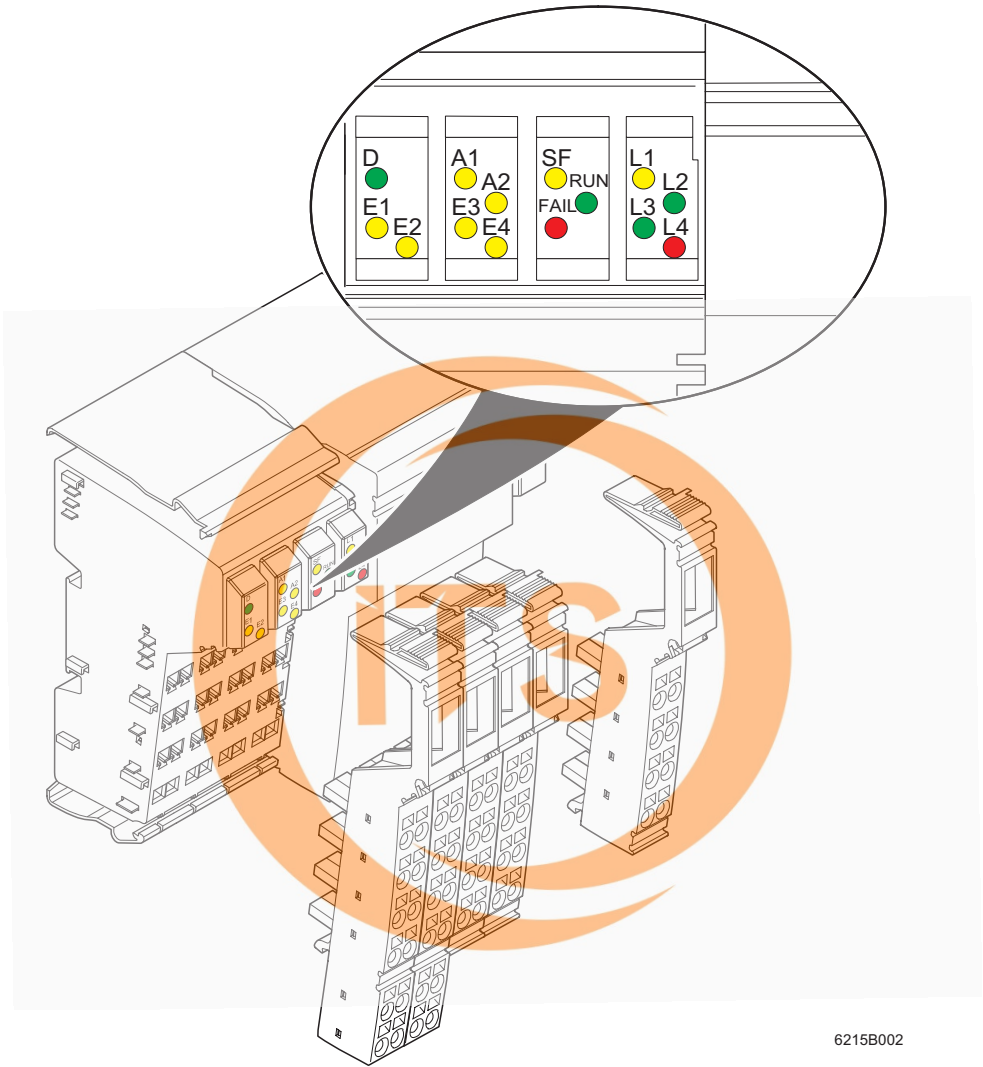


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Figure 1 Structure of the IB IL 332-128-PAC Inline CPU

- 1 Inputs
- 2 Inputs and outputs
- 3 BDM interface
- 4 LED Diagnostics and status indicators

## Local LED Diagnostic and Status Indicators



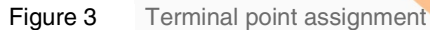
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Figure 2 Local LED Diagnostic and Status Indicators




Power is supplied through the supply of the Inline station (bus terminal and/or power terminal).

Des.	Color	Meaning
<b>D</b>	<b>Green LED</b>	Diagnostics for higher-level bus
	<b>ON:</b>	Communications power present, module function error-free, bus active
	<b>Flashing:</b>	
	<b>0.5 Hz (slow):</b>	Communications power present, bus not active
	<b>2Hz (medium):</b>	Communications power present, I/O error (programmable function, error can also be triggered by the application program)
	<b>4 Hz (fast):</b>	Communications power present, Error at the interface between previous and flashing terminal (the terminals after the flashing terminal cannot be addressed) (e. g., loose contact at the bus interface, terminal before the flashing terminal has failed, another terminal was snapped on during operation [not permitted])
	<b>OFF:</b>	No communications power
<b>E1, E2, E3, E4</b>	<b>Yellow LED</b>	Fast inputs 1 to 4
	<b>ON:</b>	Input signal present
	<b>OFF:</b>	Input signal is not present
<b>A1, A2</b>	<b>Yellow LED</b>	Fast outputs 1 and 2
	<b>ON:</b>	Output signal present
	<b>OFF:</b>	Output signal is not present
<b>SF</b>	<b>Yellow LED</b>	System failure
	<b>ON:</b>	The application CPU has run through a second reset after a power-ON reset, check the application program.
	<b>OFF:</b>	No error
<b>RUN</b>	<b>Green LED</b>	Bus Running
	<b>ON:</b>	The lower-level bus is ready to operate and data is being transmitted
	<b>Flashing:</b>	The lower-level bus is ready to operate but no data is being transmitted
	<b>OFF:</b>	The lower-level bus is not ready to operate
<b>FAIL</b>	<b>Red LED</b>	Controller failure
	<b>ON:</b>	<ul style="list-style-type: none"> <li>– Error in the lower-level bus (bus error)</li> <li>– Invalid command from the application program (user error)</li> <li>– Internal controller error</li> </ul>
	<b>OFF:</b>	No error
<b>L1</b>	<b>Yellow LED</b>	Programmable Function is controlled by the program.
<b>L2</b>	<b>Green LED</b>	Programmable Function is controlled by the program.



Terminal Point	Assignment		Remark
Connector 1 Inputs			
1.1	E1	Input 1 for 5 V	This input is electrically coupled with E1 for 24 V.  <div>Do not use inputs 1.1 and 1.4 at the same time.</div>
2.1	E2	Input 2 for 5 V	This input is electrically coupled with E2 for 24 V.  <div>Do not use inputs 2.1 and 2.4 at the same time.</div>
1.2, 2.2 1.5, 2.5	24 V	Supply voltage	Segment voltage $U_S$ for the initiator supply for 2 or 3-wire termination
1.3, 2.3 1.6, 2.6	GND	Ground	Ground signal as reference potential for inputs
1.4	E1	Input 1 for 24 V	This input is electrically coupled with E1 for 5 V.  <div>Do not use inputs 1.4 and 1.1 at the same time.</div>
2.4	E2	Input 2 for 24 V	This input is electrically coupled with E2 for 5 V.  <div>Do not use inputs 2.4 and 2.1 at the same time.</div>
Connector 2 Outputs/Inputs			
1.1	A1	Output 1	Output 1 for 24 V DC and 500 mA
2.1	A2	Output 2	Output 2 for 24 V DC and 500 mA
1.2, 2.2 1.5, 2.5	24 V	Supply voltage	Segment voltage $U_S$ for the initiator supply for 2 or 3-wire termination
1.3, 2.3 1.6, 2.6	GND	Ground	Ground signal as reference potential for inputs and outputs
1.4	E3	Input 3	Input 3 for 24 V DC
2.4	E4	Input 4	Input 4 for 24 V DC
Connector 3 Supply Voltage for IBS BD32-ADAPTER			
1.1, 2.1, 1.2, 2.2	–		Reserved
1.3	5 V	Communications power	Alternative supply voltage for IBS BD32-ADAPTER
2.3	LGND	Logic ground	Not electrically isolated
1.4, 2.4	–		Reserved

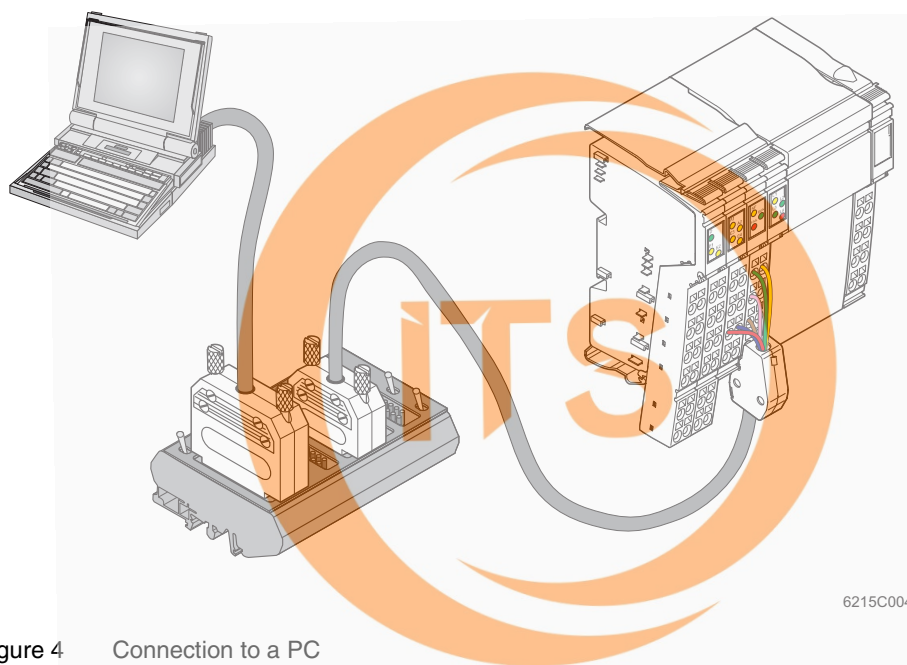
Terminal Point	Assignment		Remark
Connector 4	BDM Interface		
	The terminal contains components that can be damaged or destroyed by electrostatic discharge. When handling this terminal, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and EN 61340-5-2, as well as IEC 61340-5-1 and IEC 61340-5-2.		
1.1	IFETCH		Data line to the processor. The signal is synchronized to the CLK on BKPT.
2.1	IPIPE		Data line to the processor. The signal is synchronized to the CLK on BKPT.
1.2	LGND	Logic ground	Not electrically isolated
2.2	RESET		The Reset signal resets the processor.
1.3	BKPT	Breakpoint signal	The processor can be stopped with this signal. The CLK for the data is also transmitted via this signal.
2.3	FREEZE		The processor indicates that the Background Debug Mode (BDM) is active.
1.4, 2.4	FE		Functional earth ground
Connector 5	Reserved		

## BDM Connection



For connecting the IBS BD32-ADAPTER to the BDM interface, an interface cable is required (BDM CAB, order no. 28 19 19 2). This cable has a shield connector and a standard connector that are connected on slot 3 and 4 (instead of the present connectors) when programming via the BDM interface.

During normal operation, standard connectors without shielding must be connected on slot 3 and 4.



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Figure 4 Connection to a PC

The BDM connection is primarily used to load the application program.

A IBS BD32-ADAPTER is required for programming via the BDM interface [program download] (see "Ordering Data" on page 16). The IBS BD32-ADAPTER includes the appropriate loader software, which currently can be run under Microsoft DOS® or under Microsoft Windows® 95/98 in a DOS box. Under Microsoft Windows® NT, the program is downloaded directly from the software debugger.

When debugging, the BDM CAB interface cable only offers a limited function, i.e. a single debugging step may comprise several assembler commands (this must be taken into account during source-code debugging in "C").

For the complete debug function a flat-ribbon cable is required to connect the IBS BD32-ADAPTER to the BDM interface of the IB IL 332-128. This flat-ribbon cable is supplied as standard with the IBS BD32-ADAPTER.

Connection Example

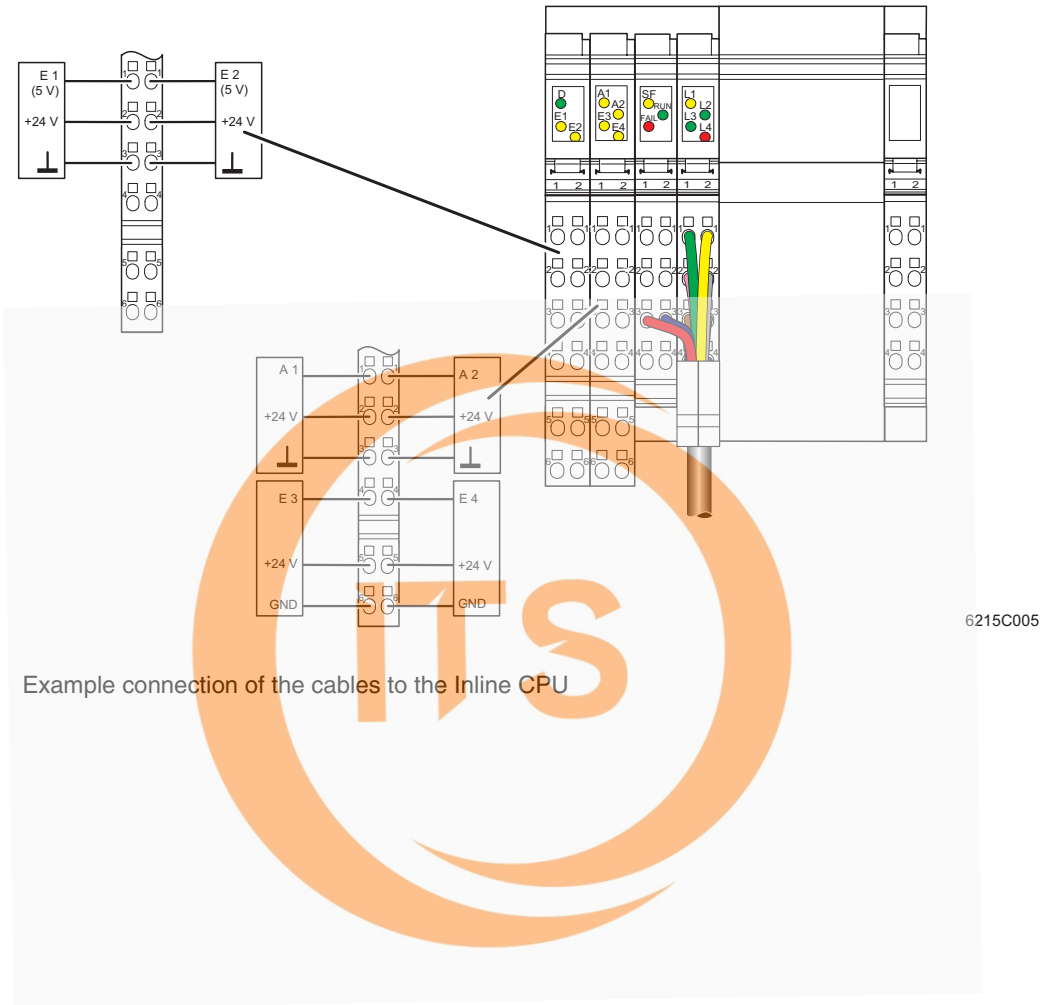


Figure 5 Example connection of the cables to the Inline CPU



## Internal Circuit Diagram

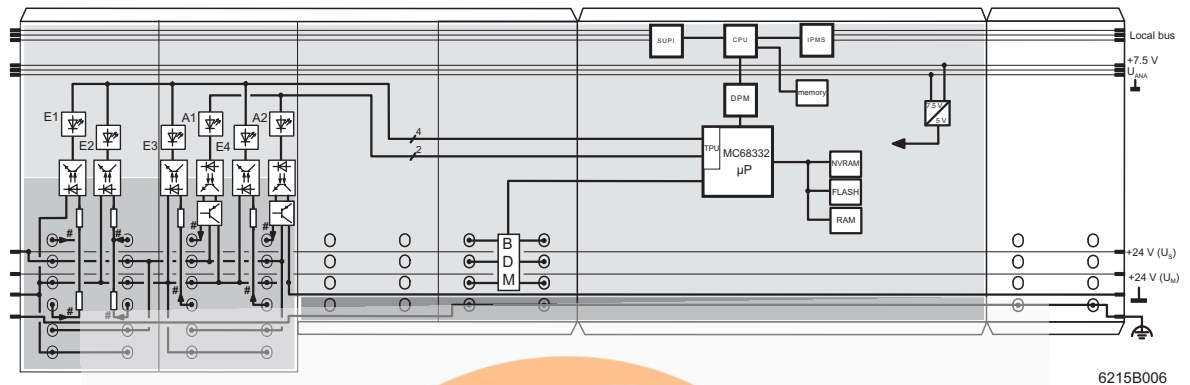
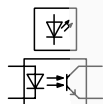
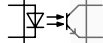


Figure 6 Internal wiring of the terminal points

### Key:



LED with function information



Optocoupler



Resistor



Transistor



Input



Output



BDM interface



SUPI 3 OPC slave protocol chip



Microcontroller for controlling the local bus interfaces



IPMS3 master protocol chip



Dual Port Memory (coupling memory)



Local main memory of the CPU



Power supply unit



Application processor for editing the application program



Non-volatile main memory of the application processor



Program memory of the application processor



Volatile main memory of the application processor



Ground (GND)



Functional earth ground



Electrically isolated area

## Requirements for C-Cross Compilers

On request Phoenix Contact provides a CD-ROM with application examples. Compilers, loaders und debuggers can be ordered from the following companies:

Wind River ([www.windriver.com](http://www.windriver.com)): DIAB compiler and single-step debugger

The Wind-River environment provides a uniform development environment for convenient compiling and debugging processes.

### Freeware

Ash Ware ([www.ashware.com](http://www.ashware.com)): GNU compiler

Phoenix Contact ([www.phoenixcontact.com](http://www.phoenixcontact.com)): DOS loader

Motorola ([www.motorola.com](http://www.motorola.com)): Hex debugger



The DOS loader and Hex debugger can only be operated under Microsoft DOS® and Microsoft Windows® 98.

## Programming Data/Configuration Data

### INTERBUS


ID code	Set by the user (Default: DD <sub>hex</sub> (221 <sub>dec</sub> ))
Length code	Configurable: 00 <sub>hex</sub> to 0C <sub>hex</sub> (0 <sub>dec</sub> to 12 <sub>dec</sub> ) (Default: 04 <sub>hex</sub> (4 <sub>dec</sub> ))
Process data channel	Configurable: 0 bits to 96 bits (Default: 32 bits)
Input address area	Configurable: 0 bytes to 12 bytes (Default: 4 bytes)
Output address area	Configurable: 0 bytes to 12 bytes (Default: 4 bytes)
Parameter channel (PCP)	Configurable: 0, 1, 2 or 4 words (Default: 4 words)
Register length (bus)	1 to 6 words


### Other Bus Systems



For creating an electronic device data sheet (GSD, EDS) for other bus systems, please contact Phoenix Contact.

## Technical Data

General Data	
Order designation (order no.)	IB IL 332-128 (28 19 13 4) IB IL 332-128-PAC (28 61 73 9)
Dimensions (width x height x depth)	
Without connectors	110 mm x 120 mm x 71.5 mm (4.331 in. x 4.724 in. x 2.815 in.)
With connectors	110 mm x 141.1 mm x 71.5 mm (4.331 in. x 5.555 in. x 2.815 in.)
Weight	
Without connectors	400 g, approximately
With connectors	490 g, approximately
Operating mode	PCP and process data operation with the higher-level controller board
Transmission speed	500 kbaud
Permissible temperature (according to EN 60204-1) (operation)	0°C to 70°C (-13°F to 158°F) <b>(Deviation from the Inline specifications)</b>
Permissible temperature (according to EN 60204-1); Storage and transport	-25°C to +75°C (-13°F to 167°F)
Permissible humidity (according to EN 60204-1)	75 % on average, 85 % occasionally (EN 60204-1); no condensation
 In the range from -25°C to +55°C (-13°F to +131°F) appropriate measures against increased humidity (> 85%) must be taken.	
Permissible air pressure (operation)	70 kPa to 108 kPa (up to 3,000 m [9,843 ft.] above sea level)
Permissible air pressure (storage and transport)	66 kPa to 108 kPa (up to 3,500 m [11,483 ft.] above sea level)
Degree of protection	IP20 according to IEC 60529
Mechanical Requirements (Deviation From the Inline Specifications)	
Vibration	2g, criterion 1 according to IEC 60068-2-6

Interfaces	
Bus	
Local bus	Through data routing
BDM interface	
Cable length up to IBS BD32-ADAPTER	0.5 m maximum (only for debug single-step) 1.5 m, maximum (for program download only)
	The terminal contains components that can be damaged or destroyed by electrostatic discharge. When handling this terminal, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and EN 61340-5-2, as well as IEC 61340-5-1 and IEC 61340-5-2.

Performance Data	
Memory	
NV-RAM	8 KB (8k * 8)
RAM	128 KB (64k * 16)
Flash EPROM	128 KB (128k * 8)
Processor	
Type	MC68332
Clock frequency	20 MHz
Power Consumption	
Communications Power (Potential Jumper)	
Nominal value	7.5 V DC
Tolerance	±5 %
Ripple	±1,5 %
Maximum current consumption	0.5 A
Communications Power (BDM)	
Nominal value	5 V DC
Tolerance	±5 %
Ripple	±1,5 %
Maximum current consumption	0.1 A

Supply of the Module Electronics Through the Bus Terminal	
Connection method	Potential routing

Bus Interface Lower-Level Bus	
Interface	Inline local bus
Electrical isolation	No
Maximum current of the bus terminal in the logic area	2 A
Number of devices of an Inline station	63, maximum

Bus Interface Lower-Level Bus (Continued)	
Number of I/O points	512, maximum
Number of PCP devices	8, max. (Firmware version < 1.16) 24, max. (Firmware version ≥ 1.16)
Connection of Loop 2 devices	Via INTERBUS Loop 2 branch terminal

Local LED Diagnostic and Status Indicators	
Bus	RUN, FAIL, D, SF
Application processor	L1, L2, L3, L4
Inputs and outputs	E1, E2, E3, E4, A1, A2

Digital Inputs	
Number	4 (2 for 24 V DC, 2 for 24 V DC or 5 V DC)
Input design	According to DIN EN 61131-2 Type 1
Definition of switching thresholds at 24 V DC	
Maximum low-level voltage	$U_{Lmax} < 5 \text{ V}$
Minimum high-level voltage	$U_{Hmin} > 15 \text{ V}$
Definition of switching thresholds at 5 V DC	
Maximum low-level voltage	$U_{Lmax} < 2 \text{ V}$
Minimum high-level voltage	$U_{Hmin} > 3.5 \text{ V}$
Common Potentials	Ground
Nominal input voltage $U_{IN}$	24 V DC / 5 V DC
Permissible range at $U_{IN} = 24 \text{ V DC}$	$-30 \text{ V} < U_{IN} < +30 \text{ V DC}$
Permissible range at $U_{IN} = 5 \text{ V DC}$	$-1 \text{ V} < U_{IN} < +6 \text{ V DC}$
Nominal input current for $U_{IN}$	5 mA
Maximum Frequency	200 kHz
Permissible cable length to the sensor	30 m (98.43 ft.) (to ensure conformance with EMC Directive 89/336/EEC)

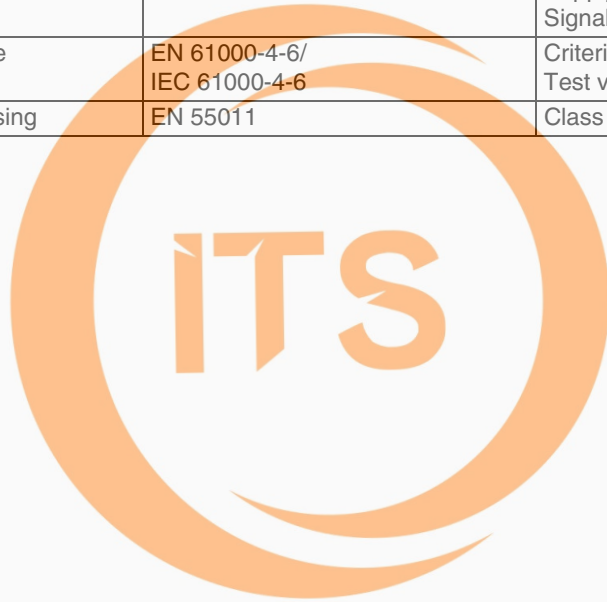
Digital Outputs	
Number	2
Nominal output voltage $U_{OUT}$	24 V DC
Differential voltage for $I_{nom}$	≤1 V
Nominal current $I_{nom}$ per channel	0.5 A
Total current	1 A
Protection	Short circuit; overload
Nominal load	
– Ohmic	48 Ω/12 W
– Lamps	12 W
– Inductive	12 VA (1.2 H, 50 Ω)

Digital Outputs (Continued)	
Signal delay upon power up of a nominal ohmic load	5 $\mu$ s, typical
Signal delay upon power down of a nominal ohmic load	12 $\mu$ s, typical
Switching frequency with	
– Nominal ohmic load	50 kHz, maximum
– Nominal lamp load	50 kHz, maximum
– Nominal inductive load	0.5 Hz, maximum (1.2 H, 48 $\Omega$ )
Overload response	Auto restart
Response time with ohmic overload (12 $\Omega$ )	3 s, approximately
Restart frequency with ohmic overload	65 Hz, approximately
Restart frequency with lamp overload	65 Hz, approximately
Response with inductive overload	Output may be damaged
Response time in the event of a short circuit	400 ms, approximately
Resistance to polarity reversal of the supply voltage	Protective elements in the bus terminal or the power terminal
Resistance to permanently applied surge voltage	No
Response upon power down	The output follows the supply voltage without delay.
Limitation of the voltage induced on circuit interruption	$-15 \text{ V} \leq U_{\text{demag}} \leq -26 \text{ V}$ ( $U_{\text{demag}}$ = demagnetization voltage)
Single maximum energy in free running	400 mJ, maximum
Protective circuit type	15 V Zener diode in output
Output current when switched off	300 $\mu$ A, maximum
Output voltage when switched off	2 V, maximum
Output current when ground connection interrupted	25 mA, maximum
Switching power with ground connection interrupted	100 mW at 1 k $\Omega$ load resistance, typical
Inrush current with lamp load	1.5 A for 20 ms, maximum


Electrical Isolation/Isolation of the Voltage Areas	
Common Potentials	
24 V main power, 24 V segment voltage, and GND have the same potential. FE is a separate potential area.	
Separate Potentials in the System Comprising Bus Terminal/Power Terminal and Inline CPU	
- Test Distance	- Test Voltage
Digital outputs / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min
Digital Outputs / functional earth ground	500 V AC, 50 Hz, 1 min
Functional earth ground / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min

Error Messages to the Higher-Level Control or Computer System
Application-specific

Conformance With EMC Directive 89/336/EEC		
Noise Immunity Test According to EN 61000-6-2		
Electrostatic discharge (ESD)	EN 61000-4-2/ IEC 61000-4-2	Criterion B 6 kV contact discharge 8 kV air discharge
Electromagnetic fields	EN 61000-4-3/ IEC 61000-4-3	Criterion A Field strength: 10 V/m
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	Criterion B Supply lines: 2 kV Signal/data lines: 2 kV
Conducted interference	EN 61000-4-6/ IEC 61000-4-6	Criterion A Test voltage 10 V
Noise emission of housing	EN 55011	Class A



Ordering Data

Description	Order Designation	Order No.
Inline CPU, with connectors and labeling fields	IB IL 332-128-PAC	28 61 73 9
Inline CPU, without connectors and labeling fields	IB IL 332-128	28 19 13 4
 The listed connector set is needed for the complete fitting of the IB IL 332-128 terminal.		
Connector set with five connectors (green); with connections in spring-cage technology Pack of 1 set	IB IL 332-PLSET	28 19 26 0
BDM cable with shield connector and standard connector, for connecting the target system Length: 1.5 m	BDM CAB	28 19 19 2
Adapter for BDM interface	IBS BD32-ADAPTER	27 46 42 7
"Configuring and Installing INTERBUS" user manual	IBS SYS PRO INST UM E	27 43 80 2
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	27 43 04 8

