IB IL MBUS-PAC

**Inline M-bus master terminal,
for the connection of M-bus devices**

Data sheet
105757_en_00

1   Description

The terminal is designed for use within an Inline station.

It enables communication with standard M-bus counters according to EN 13757.

Features

– M-bus connection for up to 30 devices
– Transmission speed can be set up to 19200 baud
– Parameterization via process data
– Process data width: 16 words
– Diagnostic and status indicators

i	This data sheet is only valid in association with the IL SYS INST UM E user manual.

|	
i	Make sure you always use the latest documentation. It can be downloaded from the product at phoenixcontact.net/products.

2 **Table of contents**

3   Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Inline M-bus master terminal, for connecting M-bus devices, complete with accessories (connector plug and marking field)	IB IL MBUS-PAC	2701927	1

Accessories	Type	Order No.	Pcs. / Pkt.
Connector, for digital 1, 2 or 8-channel Inline terminals (Plug/Adapter)	IB IL SCN-8	2726337	10
Labeling field, width: 12.2 mm (Marking)	IB IL FIELD 2	2727501	10
Insert strip, Sheet, white, Unlabeled, Can be labeled with: Office printing systems, Plotter: Laser printer, Mounting type: Insert, Lettering field: 62 x 10 mm (Marking)	ESL 62X10	0809492	1

Documentation	Type	Order No.	Pcs. / Pkt.
User manual, English, Automation terminals of the Inline product range	IL SYS INST UM E	-	-
Data sheet, English, INTERBUS addressing	DB GB IBS SYS ADDRESS	-	-

4   Technical data

Dimensions (nominal sizes in mm)
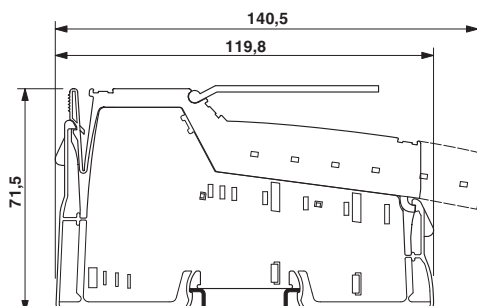
Width	24.4 mm
Height	119.8 mm
Depth	71.5 mm

General data

Color	green
Weight	125 g
Mounting type	DIN rail
Ambient temperature (operation)	-25 °C ... 55 °C
Ambient temperature (storage/transport)	-25 °C ... 85 °C
Permissible humidity (operation)	10 % ... 95 % (DIN EN 61131-2)
Permissible humidity (storage/transport)	10 % ... 95 % (DIN EN 61131-2)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1

Connection data

Name	Inline connectors
Connection method	Spring-cage connection
Conductor cross section solid / stranded	0.08 mm² ... 1.5 mm² / 0.08 mm² ... 1.5 mm²
Conductor cross section [AWG]	28 ... 16

Interface Inline local bus

Connection method	Inline data jumper
Transmission speed	500 kBit/s

Interface M-Bus

Connection method	Inline plugs
Number of M-bus unit loads	max. 30 (1.5 mA each)
Overcurrent shut-down	> 65 mA
Transmission speed	300 Baud ... 19200 Baud (configurable)
Transmission physics	Copper

Power consumption

Main circuit supply U_M	24 V DC
Current consumption from U_M	typ. 56 mA (for 10 unit loads; see example calculation)
Current consumption from U_M	max. 160 mA
Communications power U_L	7.5 V (via voltage jumper)
Current consumption from U_L	typ. 65 mA
Current consumption from U_L	max. 90 mA
Power loss	max. 1.6 W

Programming Data

ID code (hex)	BF
ID code (dec.)	191
Length code (hex)	10
Length code (dec.)	16
Process data channel	256 Bit
Input address area	32 Byte
Output address area	32 Byte
Parameter channel (PCP)	0 Byte
Register length	256 Bit

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

Electrical isolation/isolation of the voltage areas

M-Bus / 7.5 V supply (bus logic)	500 V AC, 50 Hz, 1 min
M-Bus / 24 V supply U_M	500 V AC, 50 Hz, 1 min
M-bus/functional earth ground	500 V AC, 50 Hz, 1 min
7.5 V supply (bus logics) / functional earth ground	500 V AC, 50 Hz, 1 min
24 V supply (U_M)/functional earth ground	500 V AC, 50 Hz, 1 min

i	The electrical isolation of the logic level from the M-bus is ensured through the DC/DC converter.

Error messages to the higher level control or computer system

None

Approvals

For the latest approvals, please visit phoenixcontact.net/products.

5   Supplementary data

Calculation of the current consumption from U_M (typical)

$I_M = 26$ mA + n x 3 mA

Where:

I_M Current consumption from U_M (typical)

n   Number of unit loads; n = 1 ... 30

  1 unit load = 1.5 mA

Example:

Unit loads	Formula	Current consumption from U_M (typical)
1	26 mA + 1 x 3 mA	29 mA
5	26 mA + 5 x 3 mA	41 mA
10	26 mA + 10 x 3 mA	56 mA
30	26 mA + 30 x 3 mA	116 mA

6 Internal circuit diagram
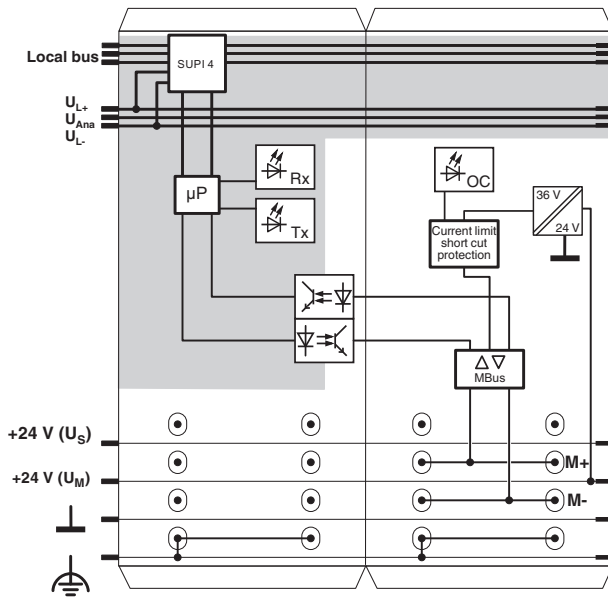
Figure 1 Internal wiring of the terminal points

Key:

SUPI 4	Protocol chip
µP	Microprocessor
▽△	M-bus driver
	Diagnostic and status indicators
	Optocoupler
	DC/DC converter with electrical isolation
	Electrically isolated area
i	Explanation for other used symbols has been provided in the IL SYS INST UM E user manual.

7 Terminal point assignment
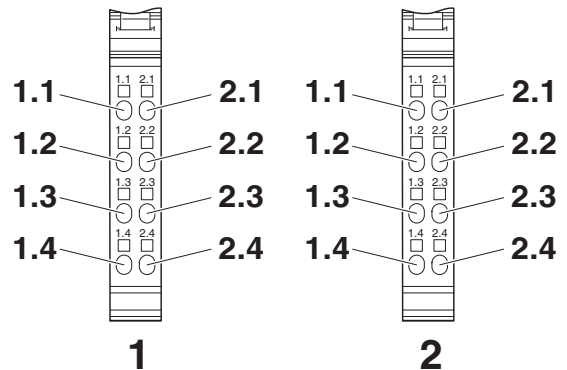
Figure 2 Terminal point assignment

Terminal point	Signal	Description
Plug 1		
1.1, 2.1	Not used	
1.2, 2.2	Not used	
1.3, 2.3	Not used	
1.4, 2.4	Shield	Shield connection, same potential as FE
Plug 2		
1.1, 2.1	Not used	
1.2, 2.2	M+	M-bus connection, positive
1.3, 2.3	M-	M-bus connection, negative
1.4, 2.4	Shield	Shield connection, same potential as FE

8 Local status and diagnostic indicators
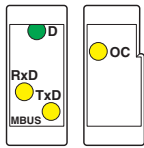
Figure 3   Local status and diagnostic indicators

Designa-tion	Color	Meaning
D	Green	Diagnostics (bus and logic voltage)
RxD	Yellow	Terminal receives data from the M-Bus
TxD	Yellow	Terminal is transmitting data to the M-bus
OC	Red	M-bus overcurrent

9 Connection example
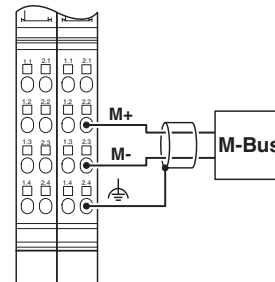
Figure 4   Connection of the M bus

10 Control

Before you can output data on the M-bus or read from the M-bus, you must correctly configure the terminal via the "Write configuration" command.

The terminal stores incoming and outgoing M-bus data in an intermediate buffer.
The receive memory is 4095 bytes; the transmit memory is 1023 bytes.

11   Process data

The process image width of the terminal consists of 16 data words in input and output direction respectively.

For reasons of compatibility, only the first 15 words can be used.

From a control perspective, the M-bus terminal corresponds to an IB IL RS UNI–PAC terminal, which is set to a data width of 15 words and operated without PCP.

You can send or read 27 bytes of user data with the terminal.

i For the assignment of the illustrated (byte.bit) view to your INTERBUS control or computer system, please refer to the DB GB IBS SYS ADDRESS data sheet.

| Word	0		1		2		3		n = 4 ... 13		14		15	
Byte in the Motorola format	0	1	2	3	4	5	6	7	2n	2n+1	28	29	30	31
Byte in the Intel format	1	0	3	2	5	4	7	6	2n+1	2n	11	10	13	12
OUT	K/P	S	L	D	D	D	D	D	D	D	D	D	D	D
IN	K/P	S	L	D	D	D	D	D	D	D	D	D	D	D

K/P   Command/parameter
S   Control bits (OUT) or status bits (IN)
L   Length: Number of characters to be written (OUT) or to be read (IN)
D   Data

i The byte representation in the Motorola format, also called Big Endian (high order byte at starting address) corresponds to the INTERBUS standard representation. All byte representations in the data sheet have this format.

The byte representation in the Intel format is also called Little Endian (low order byte at starting address).

The command is used to determine the function. The actually transmitted data depends on the command.

12   Process data word 0

12.1   Control word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Command			OUT parameter				0							

Commands

Code (bin)	Code (hex)	Command
000	0	Read number of characters received
001	1	Transmit characters
010	2	Store characters temporarily
011	3	OUT parameter = 0_{hex}: Read characters
		OUT parameter = C_{hex}: Read firmware version
		OUT parameter = D_{hex}: Read configuration
		OUT parameter = E_{hex}: Read counters
100	4	Write configuration
101	5	Toggling command 1: Transmit characters
110	6	Toggling command 2: Store characters temporarily
111	7	Toggling command 3: Read characters

Command toggling

Command toggling is used to execute a command on a terminal again. In this way, a second command code is available for the same function.

This applies for the following commands:
– Transmit characters
– Store characters temporarily
– Read characters
– Read counters

Here, bit 14 is used for toggling. If, for example, you wish to transmit character strings in sequence, use command code 001_{bin} for the first transmission and then use 101_{bin} and 001_{bin} alternately.

12.2   Status word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
St	Command			IN parameter				Status bits							

St   Error bit

Reasons for an error bit set:
– Invalid parameter for the specified command
– Failure of the I/O voltage

Status bits

7	6	5	4	3	2	1	0
x	Transmit buffer not empty	Transmit buffer full	Receive buffer full	x	x	x	Receive buffer not empty

Bits marked with x are to be ignored.

Transmit buffer not empty	
Code (bin)	Meaning
0	Empty
1	Not empty

Transmit buffer full	
Code (bin)	Meaning
0	Not full
1	Full

Receive buffer full	
Code (bin)	Meaning
0	Not full
1	Full

Code (bin)	Meaning
Receive buffer not empty	
0	Empty
1	Not empty; characters to be read are available

13 Commands

The following applies to all tables below:

Bytes marked with xx are ignored (OUT) or to be ignored (IN).

13.1 "Read number of characters received" command

The command result is the number of characters that have been received but not yet read.

This command can be used to first reach a minimum number of characters before transmitting the "Read characters" command.

Process data assignment for the "Read number of characters received" command

Word	0		1		2		3		4		...		15	
Byte	0	1	2	3	4	5	6	7	8	9	...	...	30	31
OUT	00_{hex}	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
IN	00_{hex}	Status bits	Read number of characters received		xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

"Transmit characters" command

The transmit data located in the process data is stored in the transmit memory. From there, the data is transmitted directly via the interface. A maximum of 27 characters can be transmitted. Specify the number of characters to be transmitted in the third byte. If there are characters in the intermediate buffer, these are transmitted first. After the command has been executed successfully, the intermediate buffer is cleared.

Process data assignment for the "Transmit characters" command with 11 characters (C1 - C11)

Word	0		1		2		3		4		5		6	
Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13
OUT	10_{hex}	xx	$0B_{hex}$	Z1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
IN	10_{hex}	Status bits	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

The process data words 7 ... 15 in the example are ignored by the terminal (OUT) or are to be ignored during the evaluation (IN).

Reasons for an error bit set:
– Byte 2 (number of characters to be transmitted)
  = 0 or > maximum user data length (27 characters)
– Invalid terminal parameterization

13.2 "Store characters temporarily" command

The transmit data located in the process data is stored in the terminal's intermediate buffer. No characters are transmitted to the M-bus. The "Transmit characters" command is used to transmit temporarily stored data. In this way, blocks of up to 330 characters can be compiled and transmitted in one go.

The M-bus protocol requires a continuous data stream which can be ensured in this way.

Reasons for an error bit set:
– Byte 2 (number of characters to be transmitted)
  = 0 or > maximum user data length (27 characters)
– Not enough space in the intermediate buffer

13.3 "Read characters" command

A maximum of 27 characters can be read. The third byte contains the number of valid characters available in the input data.

Process data assignment for the "Read characters" command with eleven characters (C1 - C11)

Word	0		1		2		3		4		5		6	
Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13
OUT	30_{hex}	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
IN	30_{hex}	Status bits	$0B_{hex}$	Z1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11

13.4 "Read counters" command

This command can be used to read several counters. The counters are used for interface diagnostics.

Process data assignment for the "Read counters" command

Word	0		1		2		3	
Byte	0	1	2	3	4	5	6	7
OUT	$3E_{hex}$	00_{hex}	xx	xx	xx	xx	xx	xx
IN	$3E_{hex}$	Status bits	Number of valid characters received		Number of invalid characters received (parity, overrun or framing errors)		Number of characters transmitted	

The words 4 ... 15 are reserved.

13.5 "Write configuration" command

Output words

Process data assignment for the "Write configuration" command

Word	0		1		2		3		4		...		15	
Byte	0	1	2	3	4	5	6	7	8	9	...	...	30	31
OUT	40_{hex}	0	10_{hex}	B	0	0	0	0	0	0	0	0	0	0
IN	40_{hex}	Status bits	-	-	-	-	-	-	-	-	-	-	-	-

Element value range

Byte 3 (B: baud rate)

Baud rate	
Code (hex)	**Wert (baud)**
10	300
20	600
30	1200
50	2400
60	4800
70	9600
90	19200

In line with the M-bus definition, all M-bus counters must support the baud rate of 300 baud. Other baud rates can be optionally supported.
Check which baud rates your counters support and, if necessary, how these are configured on the counter.