SOLVIMUS
METERING SOLUTIONS

MBUS-PS
Level converter for the M-Bus

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1 Notes and conventions

1.1 About this document

This manual provides guidance and procedures for a fast and efficient installation and start-up of the units described in this manual. It is imperative to read and carefully follow the safety guidelines.

1.2 Legal basis

1.2.1 Placing on the market

Manufacturer of the MBUS-PS is the solvimus GmbH, Ratsteichstraße 5, 98693 Ilmenau, Germany.

1.2.2 Copyright protection

1.2.3 Personnel qualification

The product use described in this documentation is intended exclusively for qualified electricians or persons instructed by these. They must all have good knowledge in the following areas:

- Applicable standards
- Use of electronic devices

1.2.4 Intended use

If necessary, the components or assemblies are delivered ex works with a fixed hardware and software configuration for the respective application. Modifications are only permitted within the scope of the possibilities shown in the documentation. All other changes to the hardware or software as well as the non-intended use of the components result in the exclusion of liability on the part of solvimus GmbH. Please send any requests for a modified or new hardware or software configuration to solvimus GmbH.

1.2.5 Exclusion of liability

Study this manual and all instructions thoroughly prior to the first use of this product and respect all safety warnings, even if you are familiar with handling and operating electronic devices.

The solvimus GmbH accepts no liability for damage to objects and persons caused by erroneous operation, inappropriate handling, improper or non-intended use or disregard for this manual, especially the safety guidelines, and any warranty is void.

1.2.6 Disclaimer

All products, company names, trademarks and brands are the property of their respective holders. Their use serves only to describe and identify the respective company, product or service. Use of them does not imply any affiliation with, commercial relationship with or endorsement by them.

1.3 Symbols

- Danger: It is essential to observe this information in order to protect persons from injury.
- Caution: It is essential to observe this information in order to prevent damage to the device.
- Notice: Boundary conditions that must always be observed to ensure smooth and efficient operation.
- ESD (Electrostatic Discharge): Warning of danger to components due to electrostatic discharge. Observe precautionary measures when handling components at risk of electrostatic discharge.
- Note: Routines or advice for efficient equipment use.
- Further information: References to additional literature, manuals, data sheets and internet pages.

1.4 Font conventions

Names of paths and files are marked in italics. According to the system the notation is using slash or backslash.
e. g.: *D: \Data*

Menu items or tabs are marked in bold italics.
e. g.: ***Save***

An arrow between two menu items or tabs indicates the selection of a sub-menu item from a menu or a navigation process in the web browser.
e. g.: ***File*** → ***New***

Buttons and input fields are shown in bold letters.
e. g.: **Input**

Key labels are enclosed in angle brackets and shown in bold with capital letters.
e. g.: ⟨**F5**⟩

Programme codes are printed in Courier font.
e. g.: `ENDVAR`

Variable names, identifiers and parameter entries are marked in italics.
e. g.: *Value*

1.5 Number notation

Numbers a noted according to this table:

Numbering system	Example	Comments
Decimal	100	Normal notation
Hexadecimal	0x64	C-like notation
Binary	'100' '0110.0100'	In apostrophes Nibbles separated by dots

Table 1: Numbering systems

1.6 Safety guidelines

- Observe the recognized rules of technology and the legal requirements, standards and norms, and other recommendations.
- Study the instructions for the extinction of fire in electrical installations.
- The power supply must be switched off before replacing components and modules.

If the contacts are deformed, the affected module or connector must be replaced, as the function is not guaranteed in the long term.

The components are not resistant to substances that have creeping and insulating properties. These include e.g. aerosols, silicones, triglycerides (ingredient of some hand creams). If the presence of these substances in the vicinity of the components cannot be excluded, additional measures must be taken:

- Install the components in an appropriate casing.
- Handle components with clean tools and materials only.

- Only use a soft, wet cloth for cleaning. Soapy water is allowed. Pay attention to ESD.
- Do not use solvents like alcohol, acetone etc. for cleaning.
- Do not use a contact spray, because in an extreme case the function of the contact point is impaired and may lead to short circuits.
- Assemblies, especially OEM modules, are designed for installation in electronic housings. Do not touch the assembly when it is live. In each case, the valid standards and directives applicable to the construction of control cabinets must be observed.
- The components are populated with electronic parts which can be destroyed by an electrostatic discharge. When handling the components, ensure that everything in the vicinity is well earthed (personnel, workplace and packaging). Do not touch electrically conductive components, e.g. data contacts.

1.7 Scope

This documentation describes the device manufactured by solvimus GmbH, Ilmenau, and stated on the title page.

1.8 Abbreviations

Abbreviation	Meaning
2G	Mobile radio standard, synonym for GSM or GPRS
3G	Mobile radio standard, synonym for UMTS
4G	Mobile radio standard, synonym for LTE
ACK	Acknowledge
AES	Advanced Encryption Standard
AFL	Authentication and Fragmentation Layer
AI	Analog Input
ANSI	American National Standards Institute
AO	Analog Output
APN	Access Point Name
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BACnet	Building Automation and Control networks
BBMD	BACnet Broadcast Management Device
BCD	Binary-coded decimal numbers
BDT	Broadcast Distribution Table
BMS	Building Management System
CA	Certification Authority
CHAP	Challenge Handshake Authentication Protocol
CI	Control Information
CLI	Command line interface
COSEM	COmpanion Specification for Energy Metering
CPU	Central processing unit
CRC	Cyclic redundancy check
CSV	Character-Separated Values

Continued on next page

Table 2 – *Continued from previous page*

Abbreviation	Meaning
CTS	Clear to send
D0	D0 interface (optical interface, IEC 62056-21)
DDC	Direct Digital Control
DHCP	Dynamic Host Configuration Protocol
DI	Digital Input, digital input terminal
DIF	Data information field
DIFE	Data information field extensions
DIN	Deutsches Institut für Normung, German Institute for Standardization
DLDE	Direct Local Data Exchange (EN 62056-21, IEC 1107)
DLDERS	DLDE communication via RS-232 or RS-485
DLMS	Device Language Message Specification
DNS	Domain Name System
DO	Digital Output, digital output terminal
EEG	German Renewable Energy Sources Act
EIA/TIA	Electronic Industries Alliance/Telecommunications Industry Association
ELL	Extended Link Layer
EMC	Electromagnetic compatibility
EN	European norm
ESD	Electrostatic Discharge
FCB	Frame Count Bit
FCV	Frame Count Valid Bit
FNN	Forum Netztechnik/Netzbetrieb, subgroup of VDE
FSK	Frequency Shift Keying
FTP	File Transfer Protocol
FTPS	FTP via TLS
GB	Gigabyte
GMT	Greenwich Mean Time
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HCA	Heat cost allocator
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
I2C	Inter-Integrated Circuit
I/O	Input/Output
ICCID	Integrated Circuit Card Identifier
ICMP	Internet Control Message Protocol
ID	Identification, Identifier, unique marking
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
IP	Internet Protocol or IP address
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
LAN	Local area network
LED	Light-Emitting Diode
LSB	Least significant byte
LSW	Least significant word
LTE	Long Term Evolution
M2M	Machine-to-Machine
M-Bus	Meter-Bus (EN 13757, part 2, 3 and 7)
MAC	Medium Access Control or MAC-Adresse
MB	Megabyte
MCR	Multi Channel Reporting
MCS	Modulation and Coding Scheme
MDM	Meter Data Management
MEI	Modbus Encapsulated Interface
MHz	Megahertz
MQTT	Message Queuing Telemetry Transport
MSB	Most Significant Byte
MSW	Most Significant Word
MUC	Multi Utility Communication, MUC controller
NB-IoT	Narrow Band Internet of Things
OBIS	Object Identification System
OEM	Original Equipment Manufacturer
OMS	Open Metering System
PAP	Password Authentication Protocol
PEM	Privacy Enhanced Mail
PIN	Personal Identification Number
PKI	Public Key Infrastructure
PLC	Programmable Logic Controller
PLMN	Public Land Mobile Network

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Table 2 – *Continued from previous page*

Abbreviation	Meaning
PPP	Point-to-Point Protocol
PPPoE	Point-to-Point Protocol over Ethernet
PUK	Personal Unblocking Key
RAM	Random Access Memory
REQ_UD	Request User Data (Class 1 or 2)
RFC	Requests For Comments
RSP_UD	Respond User Data
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indicator
RTC	Real-Time Clock
RTOS	Real-Time Operating System
RTS	Request to send
RTU	Remote Terminal Unit
S0	S0 interface (pulse interface, EN 62053-31)
SCADA	Supervisory Control and Data Acquisition
SCP	Secure Copy
SFTP	SSH File Transfer Protocol
SIM	Subscriber Identity Module
SML	Smart Message Language
SMTP	Simple Mail Transfer Protocol
SND_NKE	Send Link Reset
SND_UD	Send User Data to slave
SNTP	Simple Network Time Protocol
SPST	Single Pole Single Throw Relay (closing switch)
SRD	Short Range Device
SSH	Secure Shell
SSID	Service Set Identifier
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
THT	Through-Hole Technology
TLS	Transport Layer Security
U	Unit width of the housing (1 U = 18 mm)
UART	Universal Asynchronous Receiver Transmitter
UDP	User Datagram Protocol
UL	Unit load for M-Bus
UMTS	Universal Mobile Telecommunications System
UTC	Universal Time Coordinated
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V., German Association for Electrical, Electronic & Information Technologies
VHF	Very high frequency
VIF	Value information field
VIFE	Value information field extensions
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
WAN	Wide Area Network
WLAN	Wireless Local Area Network
wM-Bus	Wireless Meter-Bus (EN 13757, part 3, 4 and 7)
XML	eXtensible Markup Language
XSLT	eXtensible Stylesheet Language Transformation

Table 2: Abbreviations

2 Introducing the device

2.1 General information

The M-Bus (Meter-Bus) is an established and well-known interface for automated meter reading. Especially the ease of installation (simple two-wire system with powering by the bus) and the robustness are important features. These are also special attributes that are of interest for use in industrial environments.

The M-Bus is defined in the standard EN 13757. It establishes an own physics as well as an own protocol. For connecting it to other systems, a translation is necessary.

The bit transmission in the M-Bus corresponds to the one in a UART interface. The data are transferred according to the common time response. Exclusively the levels of voltage respectively current are characteristic for the M-Bus. The levels are very robust and permit a continuous supply of the connected devices (slaves) by the bus master.

Any UART is compatible to M-Bus by a conversion of the physical layer, that is the level. Hence, any PC with an RS-232 interface can be made a (physical) bus master. This is the task of level converters (in the sequel MBUS-PS for simplicity). They convert the typical RS-232 levels to M-bus levels. The M-Bus protocol can thus be mapped in a PC software. This enables simple meter reading and meter configuration using a PC. In automation, also a typical PLC can access meters via MBUS-PS, provided the PLC supports the protocol.

The MBUS-PS comes, depending on the model, in a housing 1 U (module) wide (MBUS-PS6, MBUS-PS32, MBUS-PS64) or 3 U wide (MBUS-PS125, MBUS-PS250, MBUS-PS500) and is intended for top hat rail mounting (DIN rail 35 mm).

The serial number of the devices of the solvimus GmbH can be read from the housing.

2.2 Delivery variants and scope of delivery

The MBUS-PS is offered in a range of variants, and so can easily be adapted to the requirements of the particular property.

Variant	Order number	M-Bus interface
MBUS-PS6	500374	max. 6 unit loads
MBUS-PS32	500375	max. 32 unit loads
MBUS-PS64	500383	max. 64 unit loads
MBUS-PS125	500359	max. 125 unit loads
MBUS-PS250	500360	max. 250 unit loads
MBUS-PS500	500351	max. 500 unit loads

Table 3: Delivery variants

The scope of delivery contains the device and a Quick Start Guide.

2.3 Connectors

The connectors and interfaces of the MBUS-PS are on different sides of the device.

The following figures show the variants. Similar in outward appearance are:

- MBUS-PS6, MBUS-PS32 and MBUS-PS64
- MBUS-PS125, MBUS-PS250 and MBUS-PS500

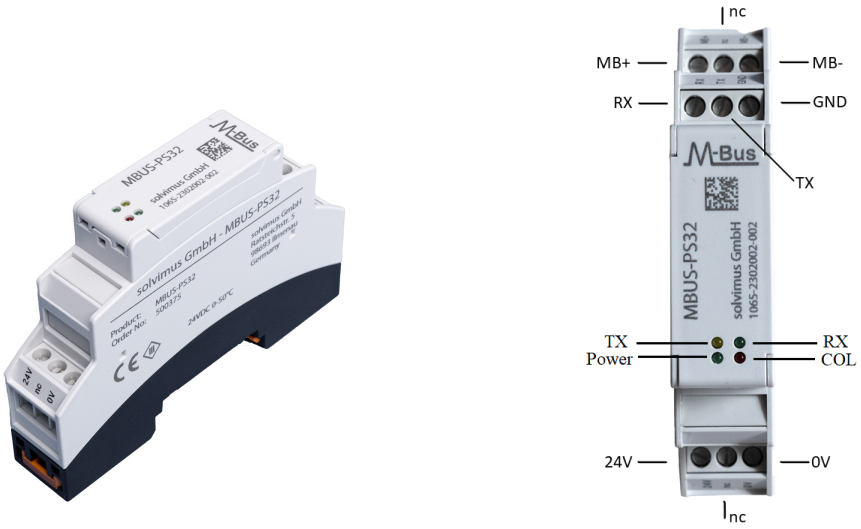

Figure 1: MBUS-PS32, view (left), connectors and LEDs (right)

Figure 2: MBUS-PS500

The following connectors are available at the MBUS-PS:

Connector	Designation	Pin assignment	Comments
Power supply	24 V 0 V	24 V: positive power supply 0 V: negative power supply	24 VDC, screw terminal cross section 2.5 mm^2
M-Bus connector	MB+ MB-	MBUS+: positive bus line MBUS-: negative bus line	screw terminal cross section 2.5 mm^2
RS"232 connector	RX TX GND	RX: signal line for receiving data from the PC, signal line for transmitting data on the M-Bus TX: signal line for transmitting data to the PC, signal line for receiving data from the M-Bus GND: reference ground	according to ANSI EIA/TIA-232-F-1997 screw terminal cross section 2.5 mm^2
—	nc	not connected	—

Table 4: Pin assignment MBUS-PS6, MBUS-PS32, MBUS-PS64

Connector	Designation	Pin assignment	Comments
Power supply	24 VDC 0 VDC	24 VDC: positive power supply 0 VDC: negative power supply	24 VDC: 12..36 VDC screw terminal cross section 2.5 mm^2
M-Bus connector	MBUS+ MBUS-	MBUS+: positive bus line MBUS-: negative bus line	screw terminal cross section 2.5 mm^2

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Table 5 – *Continued from previous page*

Connector	Designation	Pin assignment	Comments
RS-232 connector	RXD TXD GND	RXD: signal line for receiving data from the PC, signal line for transmitting data on the M-Bus TXD: signal line for transmitting data to the PC, signal line for receiving data from the M-Bus GND: reference ground	according to ANSI EIA/TIA-232-F-1997 screw terminal cross section 1.5 mm^2

Table 5: Pin assignment MBUS-PS125, MBUS-PS250, MBUS-PS500

2.4 Status LEDs

A MBUS-PS 1 U wide is equipped with 4 status LEDs (see Figure 1 right). These are not labelled and indicate the following states:

LED	Colour	Description
Power	green	Voltage detected
COL	red (flashing)	Collision respectively too large capacitive load or overload
TX	yellow	Reception of data from the master (PC) and transmission to the M-Bus (slaves)
RX	green	Reception of data from the M-Bus (slaves) and transmission to the master (PC)

Table 6: Status LEDs variants 1 U wide

A MBUS-PS 3 U wide is equipped with 3 status LEDs. These are labelled and indicate the following states:

LED	Colour	Description
COL	red (flashing) red (blinking)	Collision respectively too large capacitive load on the M-Bus Overload of the M-Bus master
TX	yellow	Reception of data from the master (PC) and transmission to the M-Bus (slaves)
RX	green	Reception of data from the M-Bus (slaves) and transmission to the master (PC)

Table 7: Status LEDs variants 3 U wide

2.5 First steps

The MBUS-PS is operational after connection to the supply voltage. After switching on the power supply all LEDs should flash briefly and then go out again.

The following figure shows a typical usage of a MBUS-PS:

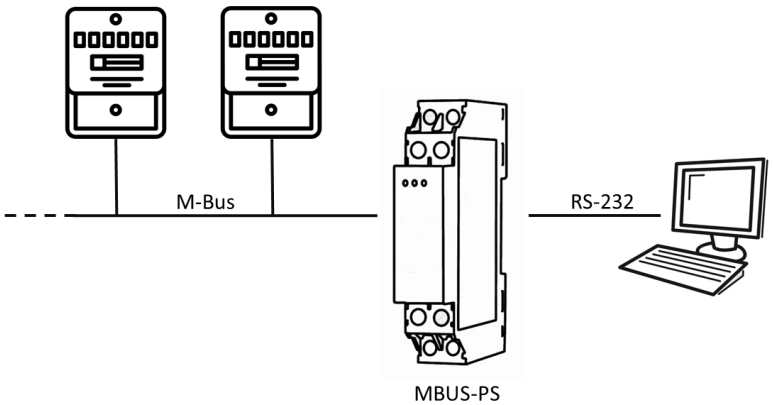

Figure 3: Typical usage of the MBUS-PS, exemplified here with a MBUS-PS6/32/64 and a PC

Further steps are not required for commissioning the device. All other settings must be performed on the logical master, e.g. a PC.

The MBUS-PS is fully transparent to the data communication on the M-Bus. This means that the device is not visible as an M-Bus slave and baud rate changes of the M-Bus master do not need any user interaction.

2.5.1 Configuration of the logical bus master

Whereas the MBUS-PS provides the physics of the M-bus master, the protocol, which is the logic of the M-bus, needs to be implemented via software on a PC or PLC.

The range of functions of such a software can be very diverse, stretching from a simple terminal programme up to a complete MDM system. In all cases the M-Bus must be driven physically. To achieve that, the MBUS-PS is connected to the RS-232 interface of the logical master. The latter one needs to be parameterised for that. The following parameters are to be used for the M-Bus:

Parameter	Value	Hint
Baud rate	2400 bps	Common are 300, 2400 and 9600 bps, 2400 bps is most widespread.
Data bits	8	The M-Bus uses 8 data bits.
Parity	Even	The M-Bus uses even parity.
Stop bits	1	The M-Bus uses 1 stop bit.

Table 8: Parameter for the RS-232 interface

✔ Consult your supplier regarding the parameterisation of your particular software solution.

2.5.2 Signalling on the M-Bus

The M-Bus is a single master multiple slave bus. Therefore, a single bus master controls the bus and the data traffic on the bus. Several slaves, i.e. meters, can be connected to the bus.

ℹ A second physical master is not allowed on the M-Bus.

On a physical level, the M-Bus uses voltage and current modulation to transmit data. The master transmits telegrams by modulating the bus voltage, the slave transmits telegrams by modulating the current through the bus. This is shown schematically in the following figure (values of current and voltage may deviate):

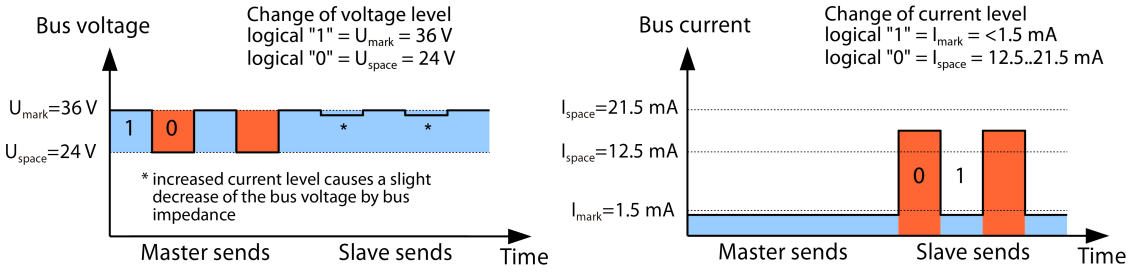

Figure 4: Signalling on the M-Bus

The M-Bus follows the principle of request-response, i.e. the master initiates the communication by a request/command which is then answered/confirmed by the slave. Spontaneous data transmission on the part of the slaves is not allowed.

Certain terms are used in the M-Bus standard. The basics of communication are taken from IEC 60870-5-101. Key terms are explained in the table below:

Term	Description
ACK	ACKnowledge, confirmation of a command, transmitted over the M-Bus as a single character telegram with content 0xE5.
Application reset	Reset of the application layer, command to reset the meter to the default state and to reset the meter for consecutive telegrams (multipaging).
Broadcast	Broadcast, command or request is sent to all slaves, special addresses 0xFE and 0xFF are used.
C-field	Command field, code that indicates the direction in which a telegram is exchanged and the meaning of the telegram.
Checksum	Check number for checking transmission errors, the checksum the M-Bus uses, results from the addition of the transmitted data (without telegram header, up to checksum).
Single character	One of the three telegram formats the M-Bus uses with a length of exactly 1 byte, telegram header and end, consisting of checksum and 0x16, are not present, used on the M-Bus for ACK.

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Table 9 – *Continued from previous page*

Term	Description
FCB	Frame Count Bit, bit in the C field, which is alternately set to 1 or 0 in consecutive telegrams, consecutive telegrams can be retrieved when the bit changes in the request.
I_{mark}	Transmit current of the slave at logical 1, usually 1 UL.
I_{space}	Transmit current of the slave at logical 0, usually 12.5-21.5 mA.
Short frame	One of the three telegram formats the M-Bus uses with a length of exactly 5 bytes, is only sent from the master to the slave (e.g. commands and instructions), the telegram header is 0x10 and the telegram ends with the checksum and 0x16.
Long frame	One of the three telegram formats the M-Bus uses with a variable length, the telegram header consists of 0x68 LL LL 0x68 (LL is the length of the telegram in each case), the telegram ends with the checksum and 0x16.
Multipaging	M-Bus method of distributing large amounts of data into several logically consecutive telegrams, use of the FCB for sequence control.
Primary address	M-Bus Link layer Address, this is used to address the requests/commands, address space 0-250, special addresses 253 (0xFD), 254 (0xFE) and 255 (0xFF).
REQ_UD2	REQuest User Data type 2, request for consumption data, transmitted over the M-Bus by the master as a short frame telegram.
RSP_UD	ReSPond User Data, response of the meter to a request for data, transmitted over the M-Bus by the slave as a long frame telegram.
Secondary address	Worldwide unique identification number of the meter, consisting of manufacturer code, 8-digit serial number, medium ID and version number.
Slave select	Procedure for extending the address space to the secondary address of the meter, use of the SND_UD for selecting the meter via the application layer, then selected meter can be addressed via special address 0xFD.
Standard load	Defined idle current that a meter may draw from the M-Bus, according to the standard 1 UL=1.5 mA.
SND_NKE	Send Link Reset, initialization command to the slave (reset FCB bit and selection), transmitted by the master as a short frame telegram on the M-Bus.
SND_UD	SeND User data, sending data or commands to the meter, transmitted by the master as a long frame telegram on the M-Bus.
U_{mark}	Mark voltage, upper voltage of the M-Bus signals at the master, representation of the logical 1, idle state, usually 24-42 V.
U_{space}	Space voltage, lower voltage of the M-Bus signals at the master, representation of the logical 0, usually 12-30 V.
UL	Unit of standard load (see above)

Table 9: M-Bus specific terms

2.6 Specific troubleshooting

In case the MBUS-PS does not work as described in this document, it is useful to locate the malfunction in order to resolve the issue and to recover the full functionality again.

2.6.1 Hardware errors

The device does not respond.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

The device does not respond after powering on. The current consumption remains at approx. 0 mA or none of the LEDs flashes briefly about powering on.

Check the power supply:

- Is there a voltage of approx. 24 VDC between the connectors 24 V and 0 V, respectively 24 VDC and 0 VDC?
- Is the polarity of the power supply correct?
- Is there a voltage of approx. 36-40 VDC (see Section 2.7.2) between the connectors MB+ and MB- respectively MBUS+ and MBUS-?

If errors could not be eliminated, please contact our customer support:
E-Mail: support@solvimus.de
Phone: +49 3677 7613065

The current consumption is too high.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

After powering on, the current consumption rises to values beyond 500 mA (MBUS-PS6, MBUS-PS32, MBUS-PS64) resp. 1000 mA (MBUS-PS125, MBUS-PS250, MBUS-PS500).

Check the M-Bus connector:

- Is there a voltage of about 36-40 VDC (see Section 2.7.2) between the connectors MB+ and MB- respectively MBUS+ and MBUS-?
- Disconnect the M-Bus from the device. Is the current consumption reduced? Can you now measure the 36 VDC (MBUS-PS6, MBUS-PS32, MBUS-PS64) resp. 40 VDC (MBUS-PS125, MBUS-PS250, MBUS-PS500)?
- Are the LEDs briefly lit after powering on?

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2.6.2 Errors while meter reading.

The transmission LED remains off while sending.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

Check the cable between MBUS-PS and the PC, and replace faulty cables if necessary. The connectors RX and TX must be crossed between the PC and MBUS-PS if need be.

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The reception LED remains off after sending.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

Check the cable between MBUS-PS and the meter, and replace faulty cables if necessary. Measure the M-Bus voltage at the device and at the meter, it should be approximately 36 VDC (MBUS-PS6, MBUS-PS32, MBUS-PS64) resp. 40 VDC (MBUS-PS125, MBUS-PS250, MBUS-PS500).

If this voltage can not be detected, check the M-Bus for a short circuit:

- Disconnect the M-Bus from the device and measure the voltage at the device again.
- Is it now the desired voltage? An internal fuse may have switched off the bus because of overload.
- Is the current consumption of the M-Bus proportionate to the number of connected slaves?

If no data are received, the cause might as well be the protocol, that is the software on the PC, or the baud rate. Check above all the logical settings.

If errors could not be eliminated and if all logical settings are correct, please contact our customer support:
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The reception LED begins to light up sporadically.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

Check the cable between MBUS-PS and the meter, and replace faulty cables if necessary. Disturbances may be present on the M-Bus and be interpreted like received data. The reception LED should be reset at the next reading (request from the master, sending from the slaves).

If errors could not be eliminated and if all logical settings are correct, please contact our customer support:
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The collision LED is blinking regularly without communication.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

The devices MBUS-PS125, MBUS-PS250 and MBUS-PS500 detect an overload if the maximum number of connected unit loads is surpassed. This is indicated by a regularly blinking collision LED. A reception of data is no longer possible then.

Check the M-Bus installation. How many meters are connected? Reduce the number of meters, if possible. Is the current consumption of the M-Bus proportionate to the number of connected slaves?

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The collision LED lights up when sending respectively when receiving.

⚠ Only trained and appropriately qualified personnel are allowed to check the electric power supply (see Section 1.2.3).

Check the M-Bus installation. How many meters are connected? Reduce the number of meters, if possible. Do several meters have identical bus addresses? What is the overall capacity of the bus? Replace the faulty cable if necessary or parameterise the meters correctly.

✔ In case of a high capacity on the bus (e.g. long cables, many meters) the data transmission remains undisturbed even though the collision LED lights up; this can be ignored.

If errors could not be eliminated, please contact our customer support:
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2.7 Technical data

2.7.1 General specifications

Dimensions/Mass

The devices have the following dimensions and the following mass:

Variant	Width (mm)	Height (mm)	Depth (mm)	Mass approx. (g)
MBUS-PS6, MBUS-PS32, MBUS-PS64	18	90	60	58
MBUS-PS125, MBUS-PS250, MBUS-PS500	54	90	60	130

Table 10: Dimensions and mass

Mounting

The device is intended for mounting in a control cabinet or a distribution board:

- Temperature range for operation: 0..50 °C (daily average)

- Temperature range for transport and storage: -20..70 °C (short-time)
- Air humidity: 0..95 % relH, non-condensing
- Degree of protection: IP20 (IEC 60529)
- Top hat rail mounting (DIN rail 35 mm, IEC 60715)

2.7.2 Electrical specifications

Power supply

The devices are powered by an external power supply (pin assignment see Section 2.3):

- MBUS-PS6, MBUS-PS32, MBUS-PS64: voltage 21.6..24.5 VDC, peak inrush-current: approx. 3 A
- MBUS-PS125, MBUS-PS250, MBUS-PS500: voltage 12..36 VDC, peak inrush-current: approx. 4 A
- Screw terminals ($\leq$2.5 mm^2, tightening torque 0.5..0.6 Nm)
- Power consumption:
  - Idle state: 1 W (all variants)
  - MBUS-PS6, MBUS-PS32, MBUS-PS64: max. 10 W
  - MBUS-PS125, MBUS-PS250, MBUS-PS500: max. 40 W
- Safety: reverse polarity protected M-Bus, overvoltage protection (transients), protection class III (IEC 61140), electronic resettable fuse

Meter interfaces

The devices have an M-Bus meter interface (pin assignment see Section 2.3):

- M-Bus:
  - compliant to EN 13757-2, screw terminals ($\leq$2.5 mm^2, tightening torque 0.5..0.6 Nm)
  - MBUS-PS6, MBUS-PS32, MBUS-PS64: Umark=36 V, Uspace=24 V
  - MBUS-PS125, MBUS-PS250, MBUS-PS500: Umark=40 V, Uspace=27 V
  - max. 6 unit loads (UL) for MBUS-PS6
  - max. 32 unit loads (UL) for MBUS-PS32
  - max. 64 unit loads (UL) for MBUS-PS64
  - max. 125 unit loads (UL) for MBUS-PS125
  - max. 250 unit loads (UL) for MBUS-PS250
  - max. 500 unit loads (UL) for MBUS-PS500
- Max. current rating permanent:
  - MBUS-PS6, MBUS-PS32, MBUS-PS64: approx. 140 mA
  - MBUS-PS125, MBUS-PS250, MBUS-PS500: 1500 mA
- Max. baud rate:
  - MBUS-PS6, MBUS-PS32, MBUS-PS64: 19200 bps
  - MBUS-PS125, MBUS-PS250, MBUS-PS500: 9600 bps

Communication interfaces

The devices have an RS-232 communication interface (pin assignment see Section 2.3):

- Compliant to ANSI EIA/TIA-232-F-1997
- Screw terminals ($\leq$1.5 mm^2, tightening torque 0.5..0.6 Nm)
- No handshake

Galvanic isolation

The RS-232 communication interface is separated from the meter interface and the supply:

- Galvanic isolation: 1000 V

3 Accessory

The solvimus GmbH recommends the external power supplies in the following table:

Module width (U)	External power supply	Order number of the solvimus GmbH
1	PHOENIX CONTACT STEP-PS/1AC/24DC/0.5	103501
3	PHOENIX CONTACT STEP-PS/1AC/24DC/1.75	103960

Table 11: External power supplies

⚠ The usage of accessories not recommended is at your own risk. It is imperative to mind Section 1.2.5.