



SOLVIMUS
METERING SOLUTIONS

MBUS-PU3 - USER MANUAL

MBUS-PU3 USB LEVEL CONVERTER FOR PORTABLE APPLICATIONS

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1 General hints 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 bases

1.2.1 Copyright

This manual, including all figures and illustrations, is copyright-protected. Any further use of this manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and photo-technical filing/archiving (e.g. photocopying) as well as any amendments require the written consent of solvimus GmbH.

Non-observance will involve the right to assert damage claims.

The solvimus GmbH reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. All rights arising from the granting of patents or from the legal protection of utility patents are owned by the solvimus GmbH. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

1.2.2 Personnel qualifications

The use of the product described in this manual requires special personnel qualifications. All responsible persons have to familiarize themselves with the underlying legal standards to be applied, i. e.:

- Valid standards
- Handling of electronic devices






The solvimus GmbH does not assume any liability whatsoever resulting from improper handling and damage incurred to both, solvimus own and third-party products, by disregarding detailed information in this manual.

1.2.3 Technical condition of specified devices

The supplied components are equipped with hardware and software configurations, which meet the individual application requirements. Changes in hardware, software and firmware are permitted exclusively within the framework of the various alternatives that are documented in the specific manuals. The solvimus GmbH will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of components.

Please send your request for modified and new hardware or software configurations directly to the solvimus GmbH.

1.3 Symbols

-  Danger: Always observe this information to protect persons from injury.
-  Warning: Always observe this information to prevent damage to the device.
-  Attention: Marginal conditions that must always be observed to ensure smooth and efficient operation
-  ESD (Electrostatic Discharge): Warning of damage to the components through electrostatic discharge. Observe the precautionary measure for handling components at risk of electrostatic discharge.
-  Note: Make important notes that are to be complied with so that a trouble-free and efficient device operation can be guaranteed.

- ➔ Additional information: References to additional literature, manuals, data sheets and internet pages.

1.4 Font conventions

Names of paths and data files are marked in italic-type. According to the system, Slashes or Backslashes are used.

i. e.: *D:\Data*

Menu items are marked in italic-type, bold letters.

i. e.: ***Save***

Sub-menu items or navigation steps within a web browser are marked by using an arrow between two menu items or tabs.

i. e.: ***File*** → ***New***

Pushbuttons or input fields are marked with bold letters.

i. e.: **Input**

Keys are marked with bold capital letters within angle brackets.

i. e.: <**F5**>

The print font for program codes is Courier.

i. e.: END_VAR

Names of variables, designators and configuration fields are marked in italic-type.

i. e.: *Value*

1.5 Number notation

Numbers are noted according to this table:

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C Notation
Binary	'100'	in quotation marks
	'0110.0100'	nibbles separated with dot

Table 1: Numbering systems

1.6 Safety guidelines

- ⚠ All power sources to the device must always be switched off before carrying out any installation, repair or maintenance work.

Replace any defective or damaged devices/modules (i.e. in the event of deformed contacts), as the functionality of the devices cannot be ensured on a long-term basis.

The components are not resistant against materials having seeping and insulating characteristics. Materials like e.g. aerosols, silicones, triglycerides (found in some hand creams) belong to this group.

If it cannot be ruled out that these materials appear in the component environment, then the components must be installed in an enclosure that is resistant against the above mentioned materials.

Clean tools and materials are generally required to operate the device/module.

- ⚠ 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 contact sprays, which could possibly impair the functioning of the contact area and may cause short circuits.

- ⚠ Components, especially OEM modules, are designed for the mounting into electronic housings. Those devices shall not be touched when powered or while in actual operation. The valid standards and guidelines applicable for the installation of switch cabinets shall be adhered to.
- ⚠ The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched. It is necessary to provide good grounding to personnel, working environment and packing. Electroconductive parts and contacts should not be touched.

1.7 Scope

This manual describes the devices mentioned in the title, supplied by solvimus GmbH, Ilmenau.

1.8 Abbreviations

Abbreviation	Description
DIN	Deutsches Institut für Normung (German standardization body)
ESD	ElectroStatic Discharge
FTP	File-Transfer Protocol
HTTP	Hypertext Transfer Protocol
ID	Identifier
LED	Light-Emitting Diode
M-Bus	Meter-Bus (EN 13757, Part 2 - 3)
MUC	Multi Utility Communication, MUC-Controller
OEM	Original Equipment Manufacturer
PID	Product ID
UART	Universal Asynchronous Receiver Transmitter
UL	Unit load, equal to 1.5 mA current draw per UL
UTC	Coordinated Universal Time
VID	Vendor ID
VCP	Virtual COM port
wM-Bus	Wireless Meter-Bus (EN 13757, Part 3 - 4)

Table 1: Abbreviations

1.9 Versions

Version	Datum	Editor	Veränderungen
1.00	2017-05-22	Remo Reichel	Initial Version
1.10	2017-05-20	Sven Ladegast	Added technical data of the USB interface Added hint of maximum load of 3 UL Added M-Bus line identifiers to the product figure

Table 2: Versions of this document

2 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. There is an own physical layer as well as an own protocol. For connecting it to other systems a translation is necessary.

The transmission of data bits on the physical layer of the M-Bus protocol is equal to a standard UART interface. The data will be transmitted with a common timing. Simply the voltage and current levels are designative for the M-Bus physical layer. A high clearance between low and high signal levels makes the M-Bus a very robust interface and enables a continuous power supply of the connected devices (slaves) through the M-Bus master.

By simply converting the signal level to the M-Bus levels, any UART interface will be M-Bus-enabled. By the use of a level converter every standard PC with a serial interface can become a (physical) M-Bus master. These level converters do translate the physical layer of the serial interface to the physical layer of the M-Bus.

Usually there are a lot of M-Bus level converters for RS-232 interfaces on the market. But certainly the distribution of these RS-232 interfaces is regressive. Modern mobile equipment such as notebooks or tablet PCs often do not offer a RS-232 interface at all.

USB has replaced the RS-232 interfaces almost completely. Therefore it is useful to offer a level converter with a direct USB interface to connect to these devices and also modern PCs. The M-Bus logical layer is then mapped by PC software. This enables easy readout and configuration of M-Bus devices through a PC.

The MBUS-PU3 is a very compact and self-powered USB level converter. It is specially designed for field-use by service technicians to configure single devices or readout very small M-Bus networks. The very compact footprint makes it a versatile tool for portable and stationary use.

The MBUS-PU3 supports the operation of up to 3 UL on its M-Bus interface. The device is mounted within a standard USB stick housing and can be connected directly to a USB type A sockets of the terminal device. All necessary voltages to supply the M-Bus are generated at the MBUS-PU3 directly from the USB power supply. There is no need for any additional external power supply.

2.1 Device variants

Das MBUS-PU3 is a compact self-powered USB to M-Bus level converter.

Variant	Ordner number	M-Bus interface
MBUS-PU3	500358	Max.3 UL

Table 3: Device variants

2.2 Connectors

The interfaces and connectors of the MBUS-PU3 are available on different sides of the device. The following figure shows the device:



Figure 1: MBUS-PU3

The MBUS-PU3 is equipped with the following connectors:

Connector	Marking	Pinning	Remark
USB connector type A	USB	VUSB: Positive power supply D-: Data line Data- D+: Data line Data+ GND: Negative power supply	USB-Stecker, Typ A, USB 1.1/2.0/3.0 Full-Speed (12 MBps)
M-Bus terminals	MBUS+, MBUS-	MBUS+: Positive bus terminal MBUS-: Negative bus terminal	Removable connector with spring terminals Connecting cable $\leq 1,5\text{mm}^2$

Table 4: Connectors

2.3 State LEDs

Within the translucent housing there are three state LEDs which show the operational state of the device:

LED	Color	Description
Power	Rot	The device is powered by the USB bus
Transmit	Gelb	Data is transmitted from the MBUS-PU3 to the slaves
Receive	Grün	Data is received by the MBUS-PU3 from the slaves

Table 5: State LEDs of the MBUS-PU3

3 Use of the device

After connecting the MBUS-PU3 to the host system via an USB interface the device will be ready for operation instantly. The red power LED shows correct operation.

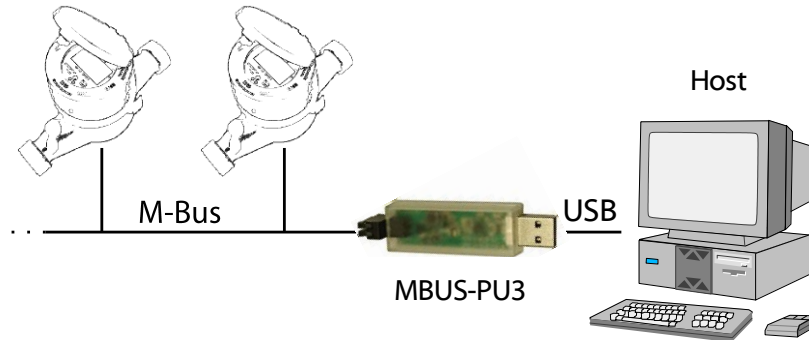


Figure 2: Typical use case scenario for the MBUS-PU3

There are no steps needed on the device side to bring the MBUS-PU3 into service. All additional steps must be carried out at the host system (for e.g. a notebook).

3.1 Driver installation

The MBUS-PU3 is based upon the USB serial converter CP2104 by Silicon Laboratories. Drivers need to be installed possibly depending on the operating system version.

The driver installation files can be obtained from the manufacturer's website:

- ➔ <http://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>

The driver installation is started by executing the installer executable:

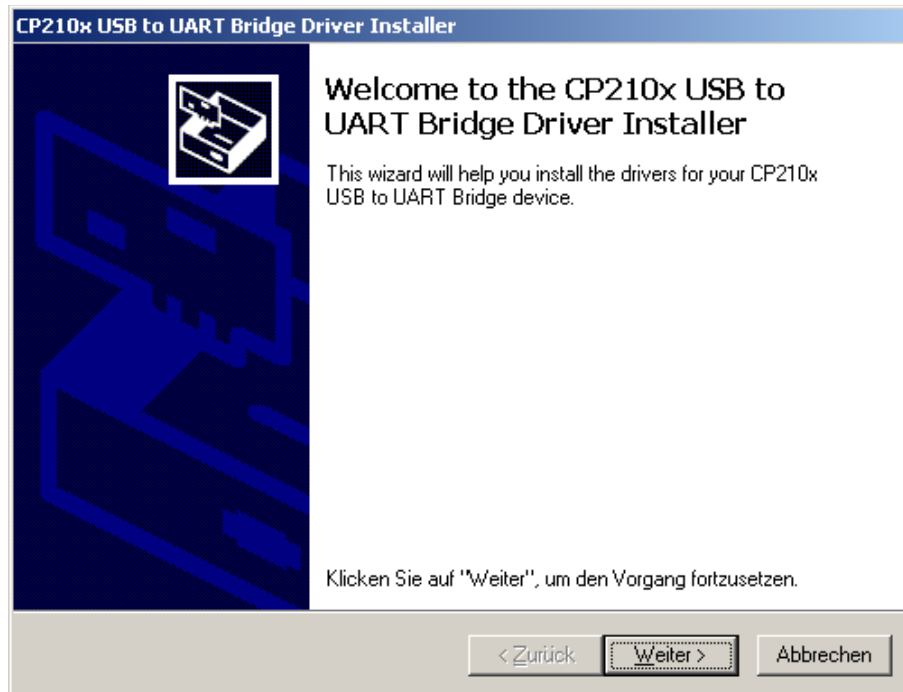


Figure 3: Dialog of the driver installer

- ✓ It is best practice to install the driver before connecting the MBUS-PU3 to the host system the first time.



Figure 4: Driver installation upon first connect of the MBUS-PU3 to the host system

Once driver installation is complete, the MBUS-PU3 is ready for operation with any software that can utilize a standard COM port of the host system.

3.2 Configuration of the logical bus master

The VCP driver creates an individual (virtual) COM port for each MBUS-PU3 that is connected to the host system. This COM port can be used as every standard COM port by any M-Bus software.

When using Microsoft Windows™, the assigned COM port number can be easily found by the use of the device manager.

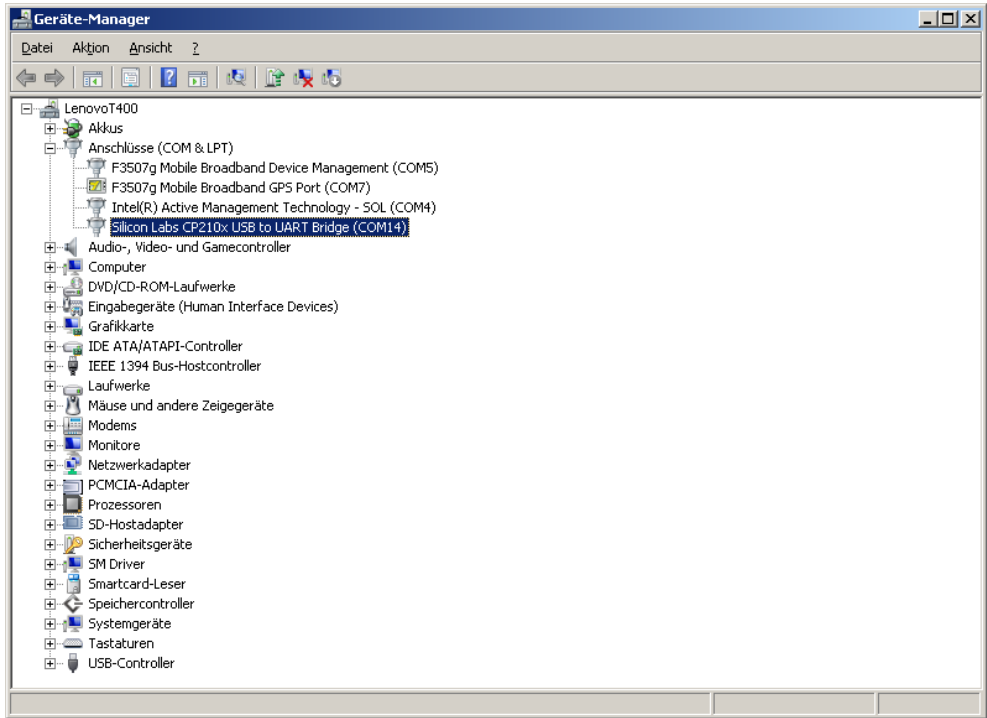


Figure 5: Windows™ device manager showing CP210x USB to UART Bridge at COM14

Additional interface parameters of the serial interface are normally configured by the communication software itself. These settings are normally inherited for the M-Bus. The following table shows the standard parameters used at the M-Bus:

Parameter	Value	Remarks
Baud rate	2400 bps	300,2400 and 9600bps are common, 2400bps is the standard baud rate
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 6: Parameters of the COM port interface

✔ Please ask your software distributor how to configure your particular software product.

3.3 Signaling at the M-Bus

The M-Bus utilizes voltage and current modulation for transmission of data on its physical layer. The following figure shows how the communication works:

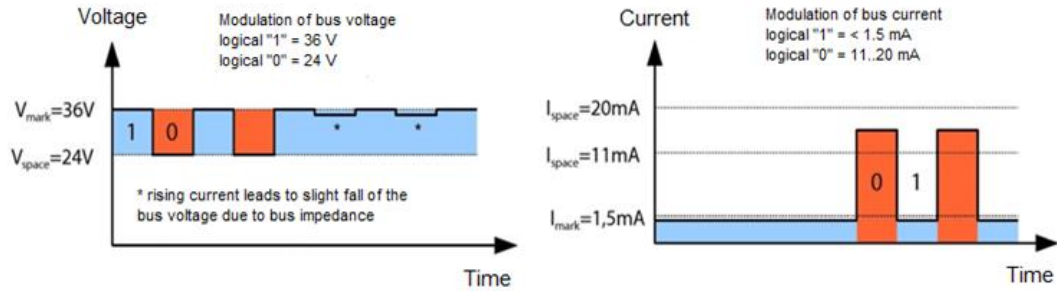


Figure 6: Signaling on the M-Bus

- ✓ Because there is no detection of the M-Bus idle current carried out at the MBUS-PU3, the maximum bus load shall not exceed 4 UL (4.5 mA bus current). In this way, safe recognition of the space signal within response packets of the M-Bus slaves is ensured.

4 Troubleshooting

In case the MBUS-PU3 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.

4.1 Hardware errors

4.1.1 The device does not respond

The device does not show any reaction after connecting it to the host system. No LEDs are lighting up and the device does not get enumerated by the host.

Please check the USB connector if it is defective or if it is activated at all.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

4.1.2 The device does not get enumerated by the host system

The red power LED is lighting up but there is no corresponding COM port available at the host system.

Please check the host system for the correct device driver:

- Is there a driver installed for the CP2104?
- Is there an additional USB device with VID = 0x10C4 and PID = 0xEA60 ?
- Is the USB connector defective or activated at all?

Please also try to connect the MBUS-PU3 to another USB port of the host system.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

4.2 Error in meter reading

4.2.1 The TX LED does not light up

Please check the USB connector at the host system.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

4.2.2 The RX LED does not light up

Please check the bus cable between the MBUS-PU3 and the M-Bus slave device. Exchange any defective cables.

Measure the voltage across the terminals MBUS+ and MBUS-. There must be a DC voltage of about 32 VDC present at these terminals.

If there is no such 32 VDC voltage, please check the M-Bus for any shorts:

- Detach the M-Bus from the device and measure the DC voltage between MBUS+ and MBUS- again.
- If the voltage is now about 32 VDC, the internal fuse may have switched off the bus caused by bus overload.
- If possible, please measure the current draw on the M-Bus

If no data is received, the problem may also originate from the protocol processing within the PC software. Please check all settings that have an influence on the protocol processing.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

5 Technical data

5.1 General characteristics

5.1.1 Physical dimensions / Weight

The housing has the following dimensions (including connector):

- Width: 19 mm
- Height: 15 mm
- Depth: 79 mm
- Weight: approx. 15 g

5.1.2 Installation / Storage

The device is intended for portable use:

- Storage temperature: -20 – 70 °C
- Operating temperature: 0 – 50 °C
- Humidity: 10 – 95 % relH, non-condensing
- Protection class: IP20

5.2 Electrical characteristics

5.2.1 Power supply

The device is a self-powered USB device:

- Voltage: 5 V(DC) \pm 5 %, USB connector, type A
- Power consumption: <0.1 W (idle state), max. 0.5 W
- Safety: Over voltage protection (transient)

5.2.2 Meter interfaces

The device is equipped with an M-Bus interface (pin assignment according to section 2.2):

- Compliant to EN 13757-2, U_{space} = 32 V, U_{mark} = 20 V, Spring terminals (\leq 1,5 mm²)
- Max. bus load: 3 UL
- Max. current draw (continuously): approx. 30 mA
- Max. baud rate: 9600 bps

5.2.3 Communication interfaces

The device is equipped with an USB communication interface (pin assignment according to section 2.2):

- USB device: CP2104 by Silicon Laboratories
- USB connector: USB connector type A, compliant to USB 1.1, 2.0 and 3.0
- USB speed: Full-Speed (12 MBps)
- USB Vendor-ID (VID): 0x10C4
- USB Product-ID (PID): 0xEA60

5.2.4 Galvanic isolation

The M-Bus interface and the USB interface are not galvanically isolated.