SOLVIMUS
METERING SOLUTIONS

MUC.one
Data concentrator
for
Smart Metering

Version: 1.11
Date: 1 August 2025

Firmware Version 1.38

Authors:
Remo Reichel, Frank Richter
solvimus GmbH
Ratsteichstr. 5
98693 Ilmenau
Germany

Page intentionally left blank

Table of Contents

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 MUC.one 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.
- Do not open the device, except to insert or replace the SIM card. It does not contain any parts to be serviced by the user.
- Study the instructions for the extinction of fire in electrical installations.
- The power supply must be switched off before replacing components and modules.
- Use exclusively flame-retardant cables/electric lines complying with IEC 60332-1-2 and IEC 60332-1-3.
- Take appropriate lightning protection measures when using an external antenna.
- This device is not suitable for use in locations where children are likely to be present.

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 Maintenance

Maintenance requires an annual inspection of the screw terminals and of the isolation of cables/electric lines and connectors. If need be, tighten screw terminals and replace damaged cables/electric lines.

1.8 Scope

This manual describes the device manufactured by solvimus GmbH, Ilmenau, as stated on the title page.

1.9 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

Continued on next page

Table 2 – *Continued from previous page*

Abbreviation	Meaning
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
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
LCD	Liquid-crystal display
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

Continued on next page

Table 2 – *Continued from previous page*

Abbreviation	Meaning
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
PID	Product ID
PIN	Personal Identification Number
PKI	Public Key Infrastructure
PLC	Programmable Logic Controller
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PPPoE	Point-to-Point Protocol over Ethernet
PTC	Polymer with positive temperature coefficient
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
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTC	Universal Time Coordinated
VCP	Virtual COM port
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V., German Association for Electrical, Electronic & Information Technologies
VHF	Very high frequency
VID	Vendor ID
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

Continued on next page

Table 2 – *Continued from previous page*

Abbreviation	Meaning

Table 2: Abbreviations

2 Introducing the device

2.1 General information

The acronym MUC (Multi Utility Communication) stands for a communication module, which automatically records customer's consumption data within the scope of Smart Metering. These are sent via a Wide Area Network (WAN) to the measuring service provider or measuring point provider and, via a local interface, it can also be displayed on a customer PC.

The so-called MUC-Controller (also MUC) is a variant of such a communication module. This is separate from the meter, and acts as the data transport interface. The MUC is the central device for the implementation of Smart Metering. Its advantage is that the measuring equipment and short-lived wide area communication are installed in separate devices, and so can be installed or exchanged independently of each other.

The MUC.one is a MUC-Controller and is intended for wall mounting.

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

2.2 Delivery variants

The MUC.one is offered in two variants, and so can easily be adapted to the requirements of the particular property.

		Meter interfaces		Communication interfaces	
Variant	**Article number**	**M-Bus**	**wM-Bus**	**WLAN***	**WAN**
MUC.one M	500381	X	-	X	X
MUC.one W	500382	-	X	X	X

*WIFI, only serving as access point for the configuration

Table 3: Delivery variants

2.3 Connectors

The various interfaces of the MUC.one are on different sides of the device.

The following figure shows the variants:

Figure 1: MUC.one M (left) and MUC.one W (right)

The following connectors are available at the MUC.one:

Connector	Designation	Pin assignment	Comments
Power supply	N, L	N: neutral conductor L: phase conductor (phase)	90..260 VAC, 50..60 Hz 130..360 VDC spring terminal cross section 1.5 mm^2
M-Bus connector *	M+, M-	M+: positive bus line M-: negative bus line	spring terminal cross section 1.5 mm^2 Only at MUC.one M
Card holder	SIM	card holder	slot for micro SIM card

* Only for MUC.one M.

Table 4: Pin assignment

2.4 Status LEDs

The MUC.one is equipped with 5 LEDs. These indicate the following states:

LED	Colour	Description
Power	green	Voltage applied
RXD	red (blinking)	Reception of data from the bus
TXD	yellow (blinking)	Sending of data to the bus
STA	blue	WAN power, modem active
NET	green	Network status

Table 5: LEDs

In the operating state, the *Power-LED* and the *STA-LED* are lit.

2.5 First steps

2.5.1 Insertion of the SIM card

The mobile connection requires the insertion of a micro SIM card for NB-IoT.

⚠ Respect the precautionary measures against electrostatic discharge (ESD) to avoid damage to the device and the SIM card (see Chapter 1).

The housing of the MUC.one can be opened for this purpose. Insert e. g. a screwdriver in the opening at the lower rim of the housing for that purpose. Insert the SIM card in the card holder in the device. Figure 2 shows on the left the orientation of the SIM card in the open card holder, and on the right the SIM card in the closed card holder. The chip of the SIM card is downward facing.

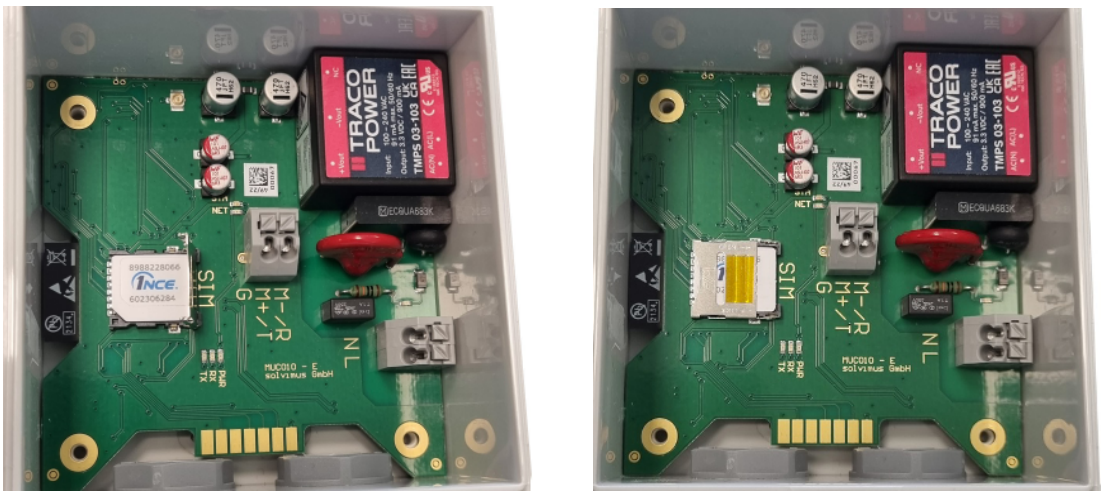


Figure 2: Insertion of the SIM card

2.5.2 Connecting the M-Bus (only MUC.one M)

The device must be opened to connect the M-Bus. The approach is explained in Section 2.5.1.

⚠ Respect the precautionary measures against electrostatic discharge (ESD) to avoid damage to the device and the SIM card (see Chapter 1).

2.5.3 Power supply

The MUC.one has an integrated power supply unit and is supplied with 230 VAC (wide input voltage range). The MUC.one starts automatically after connection to the supply voltage.

The main programme then provides the entire functionality, including the web-based front end of the MUC.one.

2.5.4 Network configuration and first steps

The MUC.one can be entirely configured via the wireless network interface (WLAN (WIFI) Access Point).

First, the administrator of the device must be created as user (see Section 4.1). Other users can be created in the ***User*** tab (see Section 4.8).

✔ The access point in the MUC.one is set by default to the static IP address 192.168.168.30 (subnet mask: 255.255.255.0), DHCP server active.

For intuitive operation, a configuration website is available on the device, which can be accessed in a web browser. The MUC.one provides a WLAN (WIFI) access point for operation. It is to be activated as follows:

- The access point needs to be activated with a magnetic switch on the lower left side of the device. Hold a magnet close to the left side of the housing for this purpose. The availability of the WLAN (WIFI) access point is indicated by a yellow LED. The access point remains active as long as a client is connected. If no client is connected, it will be switched off after the timeout set in the tab ***General***.
- The predefined name of the network is mucone<last six digits of the serial number> (e. g. serial number 68:91:d0:80:6c:4c results in SSID mucone806c4c).
- Then, a connection to the access point can be established via WLAN (WIFI). The predefined password is „adminadmin“. It can be modified in the tab ***General***.
- The device assigns an IP from the range 192.168.168.0/24 to the PC.

➔ The web interface can be launched via http://192.168.168.30/.

✔ An internet connection is required on the PC to launch the website, as the web framework needs to be loaded. For offline operation, solvimus GmbH can provide a tool for Windows to load the web framework from a local PC.

- The configuration of the access point can be modified in the tab ***General***.

When handling multiple devices under the same IP (e.g. commissioning) or with different software versions (e.g. update), you should always clear the cache of the browser (e.g. ⟨**CTRL+F5**⟩) to prevent an inconsistent display of the website.

The following page opens in the browser:

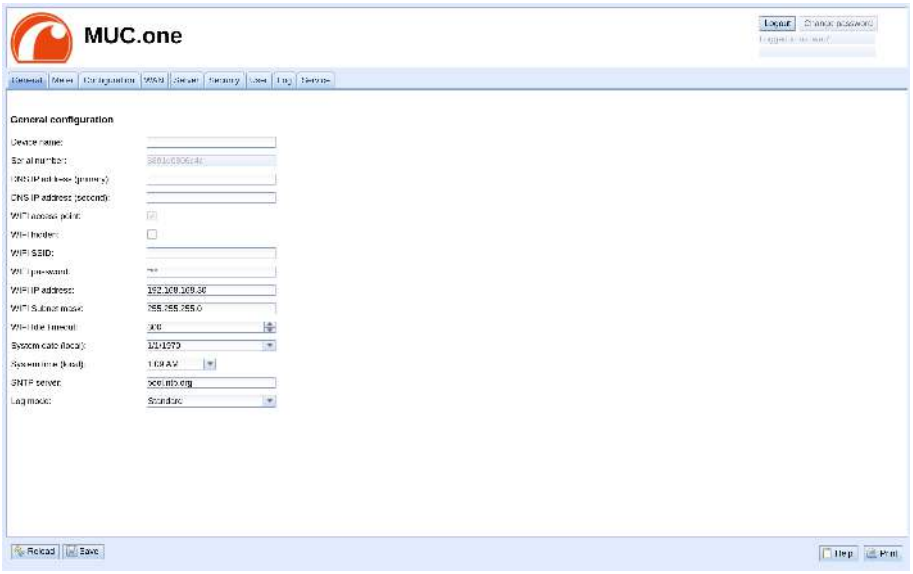


Figure 3: Website of the MUC.one

The web-based front end is described separately in Chapter 4. There you will find a detailed overview of the functionalities of the web-based front end.

2.6 Specific troubleshooting

In case the MUC.one 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 All LEDs remain off, the device does not respond.

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

Switch off the power supply and remove the device. Remove all cables and antennas. Test the MUC.one under laboratory conditions, that means at an isolated and separate measurement installation. Switch on the power supply at that measurement installation. It must adhere to the requirements given in Section 2.8.2.

If the problem persists, ensure that there are no faults in the power supply caused by the infrastructure, circuit breakers or residual current devices.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

2.6.2 The Power LED flashes red cyclically.

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

Switch off the power supply. Remove all cables and antennas except the power supply. Now switch on the power supply and check whether the *Power-LED* is now permanently on.

Now reconnect all cables and antennas one by one and check after each step whether the *Power-LED* remains permanently lit.

If the error occurs when connecting a specific cable, proceed to check this one more thoroughly. The error may reside in the external wiring, e.g. a short circuit or overload. Replace the faulty cable if necessary.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

2.7 Typical application scenarios

Below, some examples are given how the MUC.one can be used.

For using the MUC.one, the network and meter interfaces must be parameterised according to your application and your facility (see Chapter 4).

2.7.1 Local application without control system

The MUC.one can be used for local meter reading.

There is no control system (host system) required to collect and store meter data. Remote communication can therefore be deactivated.

In this case, the MUC.one is accessed via a PC that is located in the same network. The current meter values can thus be monitored via the web-based front end in the tab ***Meter***.

Users can be configured in the user management with the corresponding access rights to allow read access to the meter list (see Section 4.8).

2.7.2 Remote monitoring with TCP/HTTP transmission

The transmission of XML data via TCP or HTTP (see Section 7.5) is suitable for the direct connection of database systems. The database servers thus receive the data directly (XML format see Section 7.4.1).

- ✔ For TCP/HTTP transmission, on the one hand the internal system network (e.g. firewall, router) and on the other hand the database server must be correctly configured. Ask your administrator about this.

2.7.3 Remote monitoring with JSON/MQTT transmission

The transmission of JSON data (see Section 7.4.3) via MQTT (see Section 7.7) is suitable for the direct connection of cloud services in the IoT field.

- ✔ In order to send emails, the internal network has to be set up correspondingly (z. B. firewall, router). Ask your administrator about this.

2.8 Technical data

2.8.1 General specifications

Dimensions/Mass

The devices have the following dimensions and the following mass:

- Width: 80 mm
- Height: 113 mm (without cable entry)
- Depth: 60 mm
- Mass: MUC.one M approx. 296 g, MUC.one W approx. 290 g

Mounting

The device is intended for wall mounting (screws 3x50 mm):

- Temperature range for operation: 0..50 °C (daily average); -20..70 °C (short-time)
- Temperature range for transport and storage: -20..70 °C
- Air humidity: 0..95 % relH, non-condensing
- Degree of protection: IP67 (IEC 60529)

2.8.2 Electrical specifications

Power supply

The device has an internal power supply (pin assignment see Section 2.3):

⚠ Recommended backup fuse for circuit protection: circuit breaker 6 A or 10 A, tripping characteristic B

- Voltage: 90..260 VAC/50..60 Hz, 130..360 VDC, spring terminal ($\leq$1.5 mm^2), maximum cable length 25 m
- Power consumption: 1 W (idle state), max. 3 W
- Safety: reverse polarity protected M-Bus (only MUC.one M), overvoltage category II (IEC 60664-1), protection class II (IEC 61140), electronic resettable fuse (only MUC.one M)
- Peak inrush-current: <40 A
- Galvanic isolation between interfaces and mains: >3 kV

Meter interfaces

The device has one meter interface (pin assignment see Section 2.3):

- M-Bus (only MUC.one M): compliant to EN 13757-2/-3/-7, max. 3 unit loads (UL), Umark=30 V, Uspace=15 V, max. baud rate: 9600 bps, spring terminal ($\leq$1.5 mm^2)
- wM-Bus (only MUC.one W): compliant to EN 13757-4/-3/-7, 169/433/868 MHz, S-, T-, C- or C/T mode, internal antenna, only in receive mode

Communication interfaces

The device has a WLAN (WIFI) communication interface (internal antenna). Additionally, a modem is integrated (internal antenna):

- WLAN (WIFI): compliant to IEEE 802.11 b/g/n, centre frequency depending on channel: 2412-2472 MHz, internal antenna, function as access point (only for configuration). The median power output is dependent on the specification of the IEEE 802.11 and the data rate (in Mbps) or the channel width and the MCS index according to the following tables for the transmission mode and the receive mode:

Specification and data rate or channel width and MCS	Power output*
802.11b, 1 Mbps	18.8 dBm
802.11b, 11 Mbps	18.8 dBm
802.11g, 6 Mbps	19.13 dBm
802.11g, 54 Mbps	19.13 dBm
802.11n, HT20, MCS0	18.92 dBm
802.11n, HT20, MCS7	18.92 dBm
802.11n, HT40, MCS0	19.07 dBm
802.11n, HT40, MCS7	19.07 dBm

* Output directly at modem without losses in electric lines, plugs and cables, or without antenna gain

Table 6: WLAN power output in transmission mode

Specification and data rate or channel width and MCS	Median Input power*	Specification and data rate or channel width and MCS	Median Input power*
802.11b, 1 Mbps	–97 dBm	802.11n, HT20, MCS2	–85 dBm
802.11b, 2 Mbps	–95 dBm	802.11n, HT20, MCS3	–82 dBm
802.11b, 5.5 Mbps	–93 dBm	802.11n, HT20, MCS4	–79 dBm
802.11b, 11 Mbps	–88 dBm	802.11n, HT20, MCS5	–75 dBm
802.11g, 6 Mbps	–92 dBm	802.11n, HT20, MCS6	–73 dBm
802.11g, 9 Mbps	–91 dBm	802.11n, HT20, MCS7	–72 dBm
802.11g, 12 Mbps	–89 dBm	802.11n, HT40, MCS0	–89 dBm
802.11g, 18 Mbps	–86 dBm	802.11n, HT40, MCS1	–85 dBm
802.11g, 24 Mbps	–83 dBm	802.11n, HT40, MCS2	–83 dBm
802.11g, 36 Mbps	–80 dBm	802.11n, HT40, MCS3	–79 dBm
802.11g, 48 Mbps	–76 dBm	802.11n, HT40, MCS4	–76 dBm
802.11g, 54 Mbps	–74 dBm	802.11n, HT40, MCS5	–72 dBm
802.11n, HT20, MCS0	–92 dBm	802.11n, HT40, MCS6	–70 dBm
802.11n, HT20, MCS1	–88 dBm	802.11n, HT40, MCS7	–68 dBm

* Output directly at modem without losses in electric lines, plugs and cables, or without antenna gain

Table 7: WLAN input power in receive mode

- Mobile radio: NB-IoT modem, LTE Cat-NB, internal antenna, card holder for micro SIM card, supported bands:

RF band	Transmit band (Tx, in MHz)	Receive band (Rx, in MHz)	Maximum power output*
LTE B1	1920 to 1980	2110 to 2170	23 dBm
LTE B3	1710 to 1785	1805 to 1880	23 dBm
LTE B5	824 to 849	869 to 894	23 dBm
LTE B8	880 to 915	925 to 960	23 dBm
LTE B20	832 to 862	791 to 821	23 dBm
LTE B28	703 to 748	758 to 803	23 dBm

* Output directly at modem without losses in electric lines, plugs and cables, or without antenna gain

Table 8: Supported bands NB-IoT

2.8.3 Further specifications

Galvanic isolation

The meter interfaces are galvanically isolated from the supply voltage:

- Galvanic isolation: >3000 V

Processing unit

The central unit is a microprocessor system:

- CPU: 32-Bit LX7, up to 240 MHz clock frequency
- Memory: 320 kB RAM, 4 MB Flash
- Operating system: FreeRTOS

3 Tool Netdiscover

3.1 General information

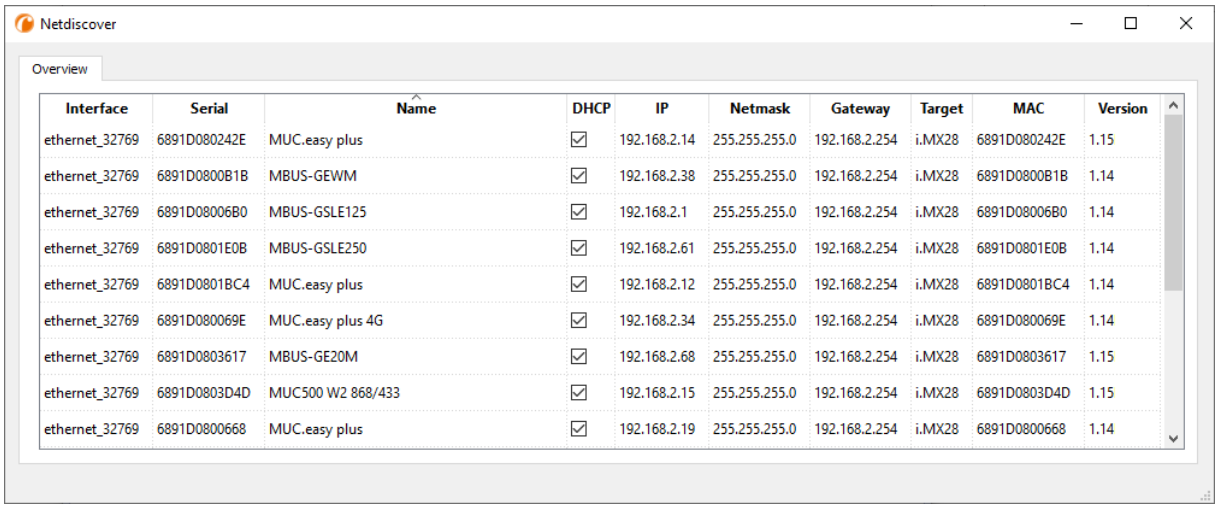
The solvimus GmbH provides its customers with the tool Netdiscover for easier management of products in the customer network. This tool, available for Windows and Linux, allows you to find devices of solvimus GmbH in the local network and to manage them.

- Depending on the product and thus on the hardware and/or the software installed on your device, not all the functions and parameters referred to in the text, in tables and figures are available. The screenshots are intended to show examples. A gateway for instance does not have a report interface for data push or a cellular modem.
- The file system of the MUC.one does not contain the file system levels *app/* and *ext/*.
- The MUC.one does not process **.tar.gz* files, but **.tar* .
- The MUC.one does not provide access to the file system via FTP.
- The MUC.one does not provide access to the command line via SSH.

The installation comes with two additional programmes. The applications *Putty* and *WinSCP* are utilities for SSH and (S)FTP access. The integration into the tool Netdiscover enables the easy access to the devices from a central location.

3.2 Discovering and accessing devices

After the tool is started, it uses UDP broadcast via UDP port 8001 to discover all devices from solvimus GmbH accessible in the local network and displays them in the main window.



Interface	Serial	Name	DHCP	IP	Netmask	Gateway	Target	MAC	Version
ethernet_32769	6891D080242E	MUC.easy plus	☑	192.168.2.14	255.255.255.0	192.168.2.254	i.MX28	6891D080242E	1.15
ethernet_32769	6891D0800B1B	MBUS-GEWM	☑	192.168.2.38	255.255.255.0	192.168.2.254	i.MX28	6891D0800B1B	1.14
ethernet_32769	6891D08006B0	MBUS-GSLE125	☑	192.168.2.1	255.255.255.0	192.168.2.254	i.MX28	6891D08006B0	1.14
ethernet_32769	6891D0801E0B	MBUS-GSLE250	☑	192.168.2.61	255.255.255.0	192.168.2.254	i.MX28	6891D0801E0B	1.14
ethernet_32769	6891D0801BC4	MUC.easy plus	☑	192.168.2.12	255.255.255.0	192.168.2.254	i.MX28	6891D0801BC4	1.14
ethernet_32769	6891D080069E	MUC.easy plus 4G	☑	192.168.2.34	255.255.255.0	192.168.2.254	i.MX28	6891D080069E	1.14
ethernet_32769	6891D0803617	MBUS-GE20M	☑	192.168.2.68	255.255.255.0	192.168.2.254	i.MX28	6891D0803617	1.15
ethernet_32769	6891D0803D4D	MUC500 W2 868/433	☑	192.168.2.15	255.255.255.0	192.168.2.254	i.MX28	6891D0803D4D	1.15
ethernet_32769	6891D0800668	MUC.easy plus	☑	192.168.2.19	255.255.255.0	192.168.2.254	i.MX28	6891D0800668	1.14

Figure 4: Main window of the tool Netdiscover

- The UDP broadcast finds all devices in the local network, regardless of IP settings and subnet masks. Therefore, this function is initially recommended.
- The UDP broadcast is usually not forwarded by routers. Therefore, this tool will only find all devices in the local network, in front of the router.

In addition to the MAC address of the devices and their network configuration, the names of the devices and also the version of the operating system are shown. Thus, all devices to be managed can be clearly identified and matched.

- The name of the devices corresponds to the **Device name** in ***General*** tab (see Section 4.2).

Various functions can be called using the context menu that appears by right-clicking on one of the devices:

- ***Ping***: starts the ping via ICMP to the device in a separate tab. So, testing of connectivity via TCP is possible.
- ***Web***: opens the default browser with the IP of the device. The web-based front end should open (see Chapter 4).
- ***FTP***: starts *WinSCP* with the IP of the device or blank. The login data or also the IP must be entered before connecting to the FTP/SFTP server of the device.
- ***SSH***: startet *Putty* with the IP of the device. The login data must be entered to connect to the SSH console.
- ***Deploy***: starts the mass deployment for devices in a separate tab.
- ***Import device list***: imports a device list into the main window.
- ***Net configuration***: starts a separate tab for changing the network configuration of the device via UDP broadcast.
- ***Version***: information about the version of the tool Netdiscover (displayed only if no device is selected).

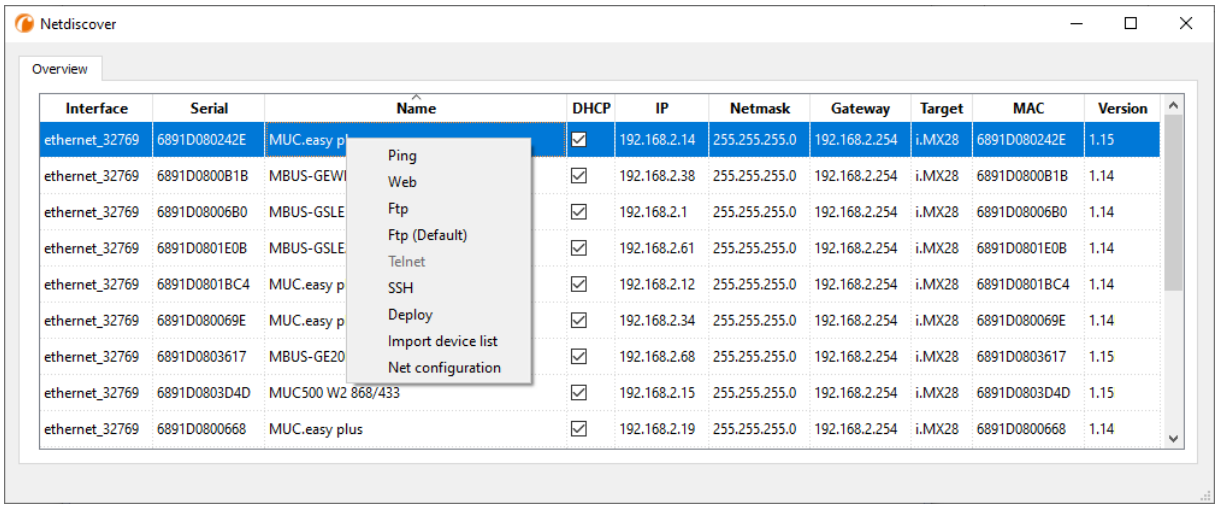


Figure 5: Context menu in the tool Netdiscover

- Depending on the network settings of your PC or your general network infrastructure, the UDP port 8001 may be blocked. Then calls of the tool are blocked and the main window remains empty.
- If a firewall is used in your network (also directly on the PC), there has to be an appropriate firewall rule. This rule should unblock this port to be able to list the devices.
- Ask your administrator about the firewall and network configuration.
- If access via UDP broadcast is denied, a list can be imported with the ***Import device list*** function in order to still be able to use all other functions via TCP.

Some important functions are described more in detail in the following subsections.

3.3 Network configuration

It is often necessary to adjust the network settings of the devices for further work, especially when commissioning devices.

The command ***Net configuration*** from the context menu in the tool Netdiscover opens another tab for the network configuration. Thus, IP address, subnet mask or gateway address can be changed to static or DHCP can be activated for obtaining these settings automatically from a DHCP server.

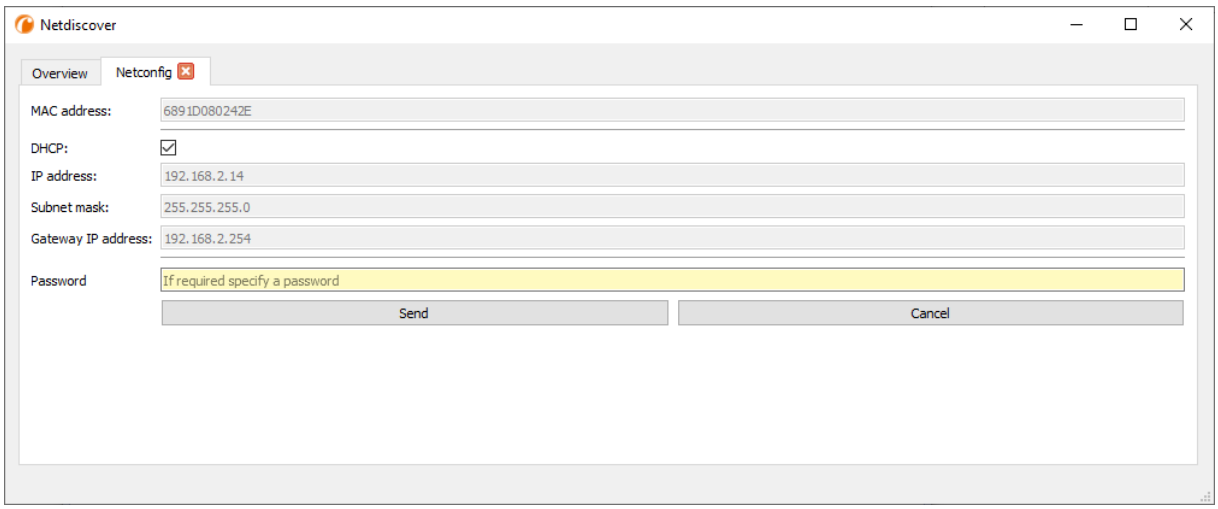


Figure 6: Network configuration via the tool Netdiscover

Modified configurations can be committed pressing the button **Send**. Modifications are only accepted with the password of the user *admin*, the admin password must be inserted in the field **Password**.

If automatic network configuration (DHCP) is selected, all parameters (**IP address**, **Subnet mask** and **Gateway IP address**) will be read from a DHCP server. The respective fields are deactivated then.

The assigned IP address can be identified at the DHCP server from the unique MAC address of the MUC.one. This address is displayed in the field **MAC address** in the main window of the tool Netdiscover as well as in the tab ***General*** (see Section 4.2) in the field **Serial number**.

Is the automatic configuration not possible in your network (no DHCP server available), the device will pick a standard address (169.254.xxx.xxx) according to RFC3927.

- The standard password in the default factory setting is described in the tab ***User*** (see Section 4.8).
- Changing the network parameters of the device can affect the accessibility. If the network parameters have already been set correctly by an administrator, they should not be changed.

3.4 Access to the web-based front end via HTTP

A web server is integrated on the devices from solvimus GmbH. This enables the configuration of the devices via an integrated, web-based front end (see Chapter 4).

Use the command ***Web*** from the context menu in the tool Netdiscover to quickly and easily call it in the default browser.

- If the web-based front end does not open, please follow the instructions in Section 4.12.

The front end supports only http, but not https. The encryption is assured by the WIFI interface with which the device is configured.

3.5 Access to the file system via FTP

The devices from solvimus GmbH can be accessed via FTP to work directly on the file system level. This enables updates, special configurations and extended functionality (see Chapter 8). The integrated FTP server of the devices supports both FTP and SFTP.

- If access via FTP or SFTP is not possible, check especially the IP settings and the opened port 22 for SFTP.
- In case of access issues, ask your administrator.

The command ***FTP*** from the context menu in the tool Netdiscover starts the *WinSCP* programme and uses the IP address of the selected device. Calling the command with a selected device, *WinSCP* always accesses the device via SFTP.

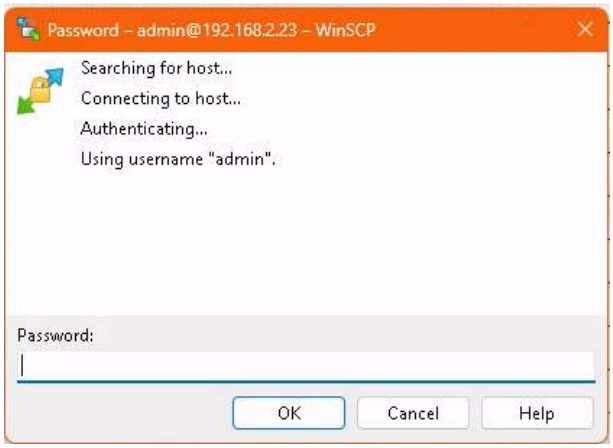


Figure 7: Entering user name when logging in via SFTP

WinSCP now establishes an SFTP or unsecure/secured FTP connection. When a connection is established to a specific device with SFTP, its authenticity is checked using stored certificates. Normally, the devices from solvimus GmbH are coming with an individual, self-signed certificate upon delivery. This certificate is usually classified as untrusted by your PC. Therefore, a security prompt with information about the device's certificate is displayed. The user must verify the validity of the certificate and then approve it to establish a secure connection. The confirmed certificate is stored in the PC for future connections.

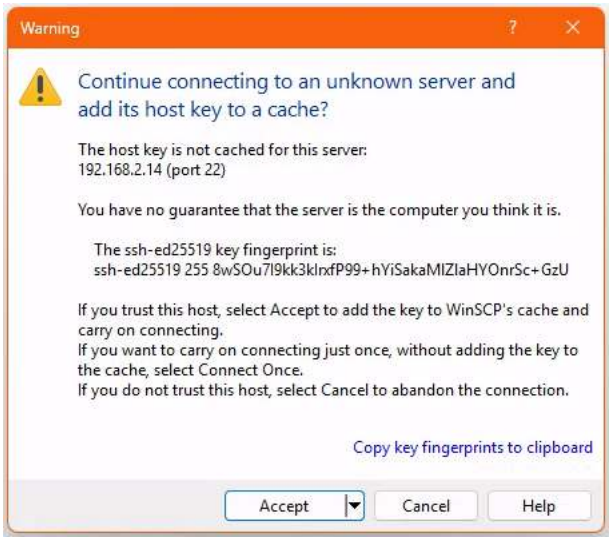


Figure 8: Security prompt for the certificate of the device for FTP access

WinSCP offers a dual-pane file manager after logging in successfully. This allows files to be uploaded to or downloaded from the device. File commands can be executed via a context menu, e. g. copying, renaming or editing. Drag&Drop for uploading and downloading is also supported.

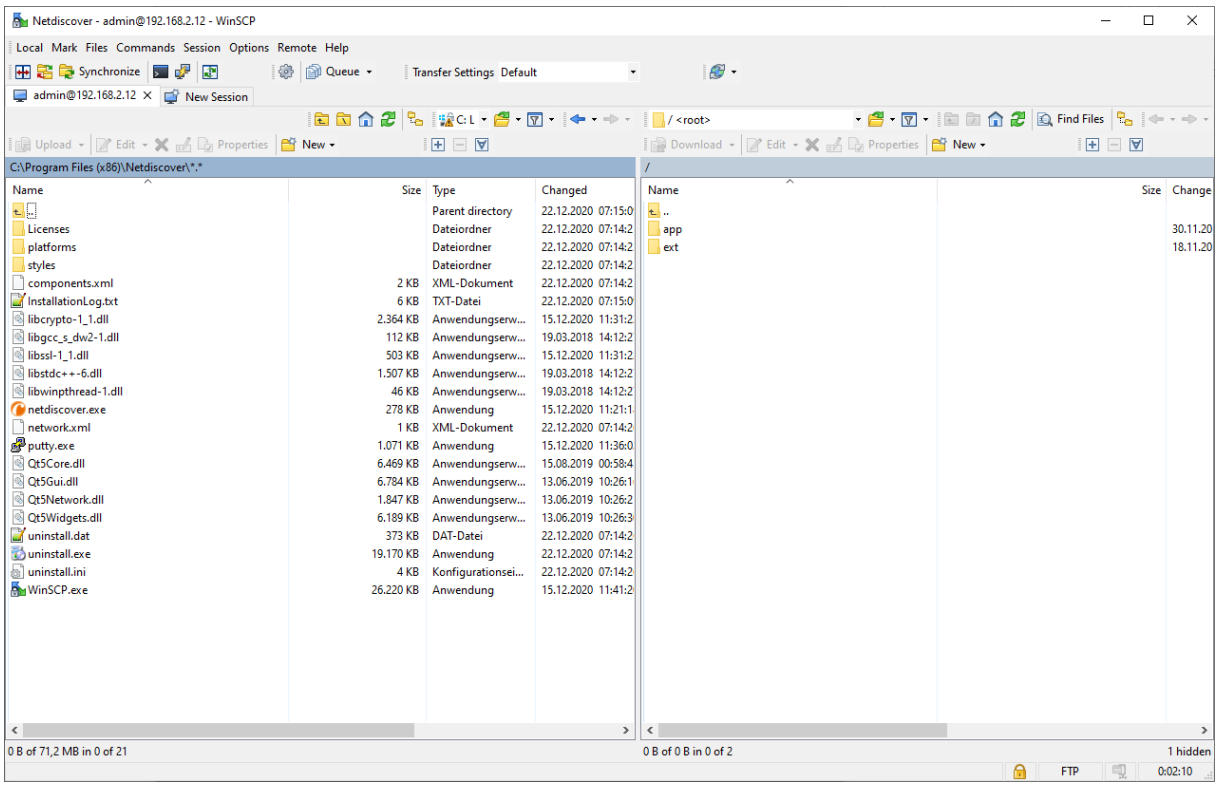


Figure 9: File manager view in *WinSCP*

- Changing files or the file system can affect the functionality of the system.
- The default login information, as delivered, is contained in Section 4.8.

3.6 Mass deployment

This function allows performing certain device configurations or firmware updates in parallel for all devices displayed in Netdiscover. For example, is is possible to import an previosly exported device configuration to multiple other devices at the same time. Another example would be importing certificate files needed on multiple devices to export meter data. A third and final example would be updating the application software on multiple devices in parallel.

- The configuration or update should explicitly only be deployed on similar devices.

In this case mark the devices in the tool Netdiscover on which you want to perform a configuration or firmware update in parallel.

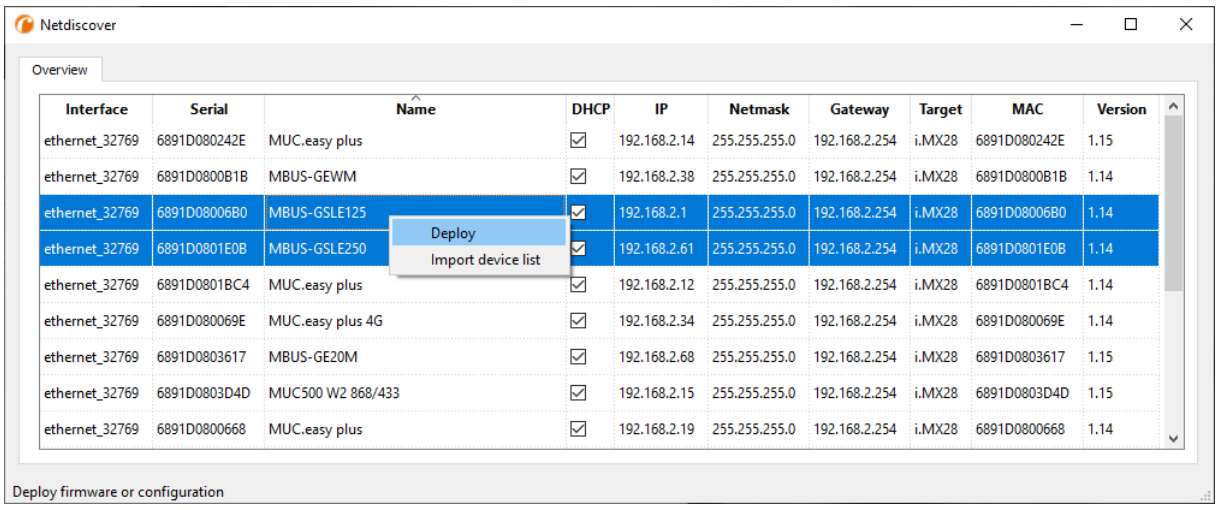


Figure 10: Selection of devices and initiation of the mass deployment

The command ***Deploy*** from the context menu in the tool Netdiscover opens another tab for mass deployment.

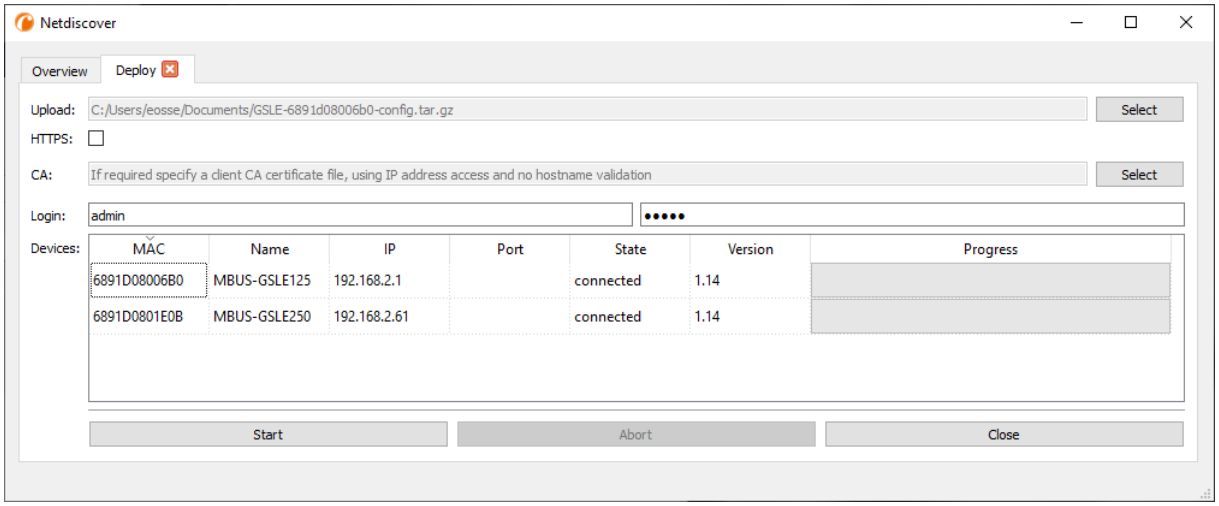


Figure 11: Mass deployment via the tool Netdiscover

The following input fields and buttons are available here:

- **Upload**: the configuration or update to be uploaded.
- **HTTPS**: selection field whether HTTP or HTTPS should be used.
- **CA**: the CA certificate to verify the client certificate of the devices for HTTPS-based work.
- **Login**: user name and password for the user *admin*.
- **Start**: starts the process.
- **Abort**: aborts the process.
- **Close**: closes the mass deployment tab.

In the central part, there is a list view with information about the devices and the status/progress of the process.

- Exclusively **. tar* archives are intended for the import of a device configuration or a certificate file.
- The generation of a **. tar* file with the device configuration is described in Section 4.10.2.
- Exclusively **. enc* files are intended for the update of the firmware.
- An update of the firmware is also possible via the website as described in Section 4.10.3.

The file is processed on the device after the upload. The device is then restarted.

3.7 Import of a device list

Devices cannot always be discovered automatically. Firewalls, routing settings or even the deactivation of the function **Network discovery active** in the ***Security*** tab (see Section 4.7) are possible reasons.

Therefore, a device list can be imported. This enables managing devices via the tool Netdiscover even without automatic dicovery.

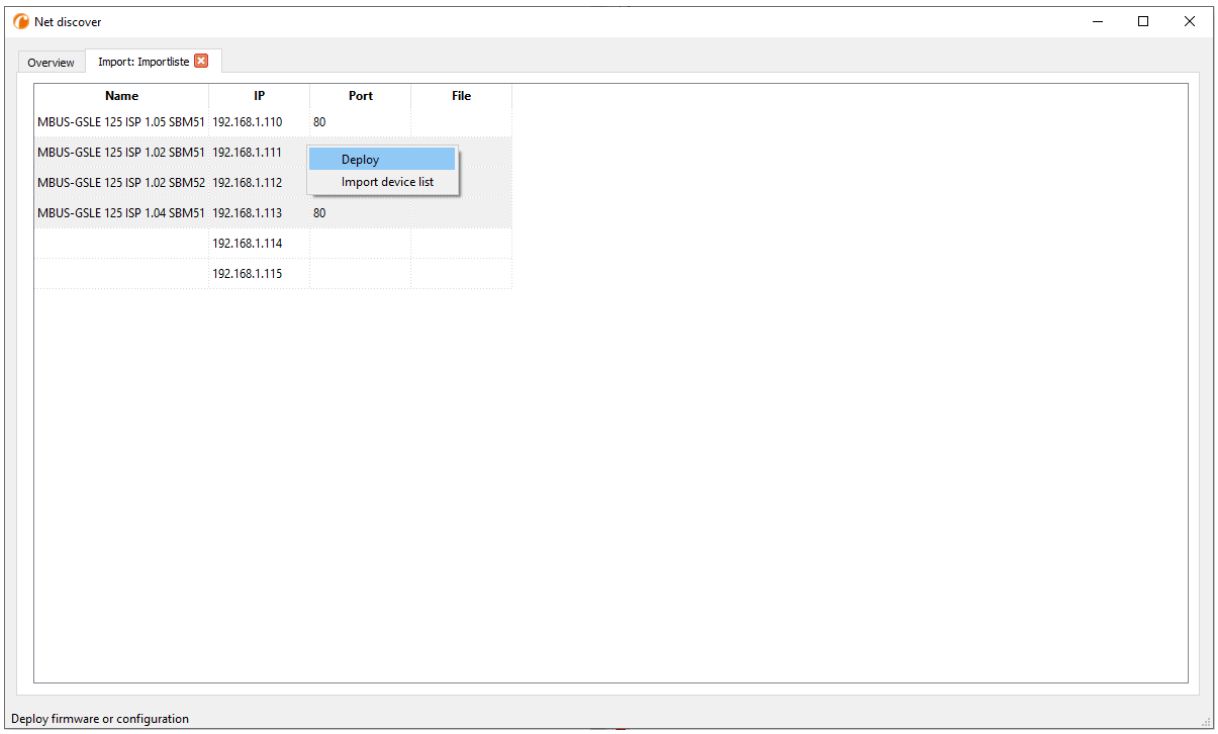


Figure 12: Viewing and using an imported list in the tool Netdiscover tool

First, a suitable CSV file has to be created before the actual import. In the CSV file, a comma or a semicolon can be used as a separator. The device data is entered here according to the following example to obtain the above list in the tool Netdiscover:

```
Port;Name;Password;Username;IP;File
80;MBUS-GSLE 125 ISP 1.05 SBM51;admin;admin;192.168.1.110;
80;MBUS-GSLE 125 ISP 1.02 SBM51;admin;admin;192.168.1.111;
80;MBUS-GSLE 125 ISP 1.02 SBM52;admin;admin;192.168.1.112;
80;MBUS-GSLE 125 ISP 1.04 SBM51;admin;admin;192.168.1.113;
;;admin;;192.168.1.114;
;;;;192.168.1.115;
```

- The header of the CSV file has to be identical to the one above.
- Only the *IP* column is mandatory. The other columns can be left empty and are set to default for special functions (*Port*: 80, *Password*: admin, *Username*: admin).

3.8 Troubleshooting network

3.8.1 No network connection

If no network connection to the device can be established, make a Ping connectivity test first (see Section 3.2).

If a Ping response is not detected, test the device via a direct network connection with a PC, provided the device is connected via a bigger network. Depending on the functions, a cross-over cable may need to be employed in case of a direct connection between PC and device.

Check the physical network connection between the device and the PC, if the cable is correctly joined and inserted.

- The network connection must be inserted in the connector for Ethernet.

At the network connection the *hyperlink-LED* must be lit yellow and the *Active-LED* must flash green from time to time. Check also the corresponding LEDs at the remote station (PC, hub etc.). If need be, repeat the connectivity test with switched cables.

If all LEDs are lit correctly, check if the device is detected in the tool Netdiscover (see Section 3.2). A prerequisite is that the device is connected to the PC via a local area network.

If the device being searched is not contained in the list (allocation via serial number), ensure that the communication is not prevented by a firewall.

If the device is in the list, configure it with a unique IP address available in the local network (see Section 3.3). Ask your administrator about this.

For a direct connection between PC and network, the following example configuration can be employed, provided no other participant is connected to the network with these addresses:

PC	
IP	192.168.1.10
Network mask	255.255.255.0
Device	
IP	192.168.1.101
Network mask	255.255.255.0

Table 9: Example IP addresses

If errors could not be eliminated, please contact our customer support (see Chapter 9).

3.8.2 The device can not be accessed via website or FTP(S)

If the device can not be accessed via a browser, make a Ping connectivity test first (see Section 3.2) or log on tentatively via FTPS (see Section 3.5). If a network communication with the device is not possible in general, follow the instructions in section Section 3.8.1. If a single service is not available, check the passwords and the firewall configuration at the PC or in the network.

Is the web page displayed whereas a login is not possible, check if you can log on with the *admin* account. Clear the cache in the browser and reload the website (e. g. key ⟨**F5**⟩ or ⟨**CTRL+F5**⟩).

If errors could not be eliminated, please contact our customer support (see Chapter 9).

4 Web-based front end

4.1 General information

Many products from solvimus GmbH, especially data concentrators and gateways for smart metering, are coming with an integrated web server and provide a website for the configuration. The devices can be configured easily and in a user-friendly manner via this website. Device parameters, meter configuration as well as services can be displayed or changed on this website.

This chapter gives an overview on how to use the web-based front end.

- Depending on the product and thus on the hardware and/or the software installed on your device, not all the functions and parameters referred to in the text, in tables and figures are available. The screenshots are intended to show examples. A gateway for instance does not have a report interface for data push or a cellular modem.
- The file system of the MUC.one does not contain the file system levels *app/* and *ext/*.
- The MUC.one does not process **.tar.gz* files, but **.tar* .
- The MUC.one does not provide access to the file system via FTP.
- The MUC.one does not provide access to the command line via SSH.

The web-based front end can easily be opened in the browser by entering the device's IP address. Alternatively, right-click on the device in our tool Netdiscover (see Chapter 3) and select the command ***Web*** in the context menu to launch the browser.

- We are testing the web-based front end in different browsers. We recommend using Chrome™ and Firefox browsers for optimal user experience. For the legally secure and data protection compliant setting of your browser, please ask your administrator.

The browser automatically displays the login window (see Figure 13). The administrator must log on with the login „admin“ and the password „admin", and is then prompted to modify the password. A password consisting of at least ten characters, of which at least one uppercase letter, at least one lowercase letter, at least one digit and at least one other character (special character) must be defined. Please confirm the provided certificate in the browser or „trust“ the website and its certificate if you are sure to access the correct device. The administrator has full access to the website. The browser offers to save the login and the password.

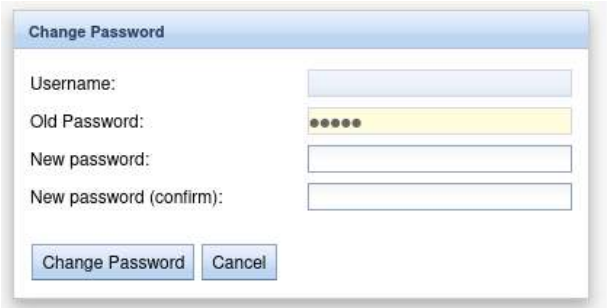


Figure 13: Login dialogue

- All interfaces remain deactivated until the password of the administrator is modified.
- For switching to another user (e. g. from the default user), the **Logout** button at the top right of the web-based front end can be clicked.

If the logged-in user has write access, the user has to log out after the configuration is finished. If the connection remains active, no other write access to the web-based front end is available. Only one session with write access is possible at a time.

- When a session is terminated without logging out previously, e. g. by closing the browser window, it remains active for approx. 1 min. Afterwards it is automatically closed and write access is possible again.

On the website of the device (see Figure 14), the functions are grouped into different tabs. So, the clarity can be maintained despite the large number of parameters. All modifications in one of the tabs must be saved before changing tabs, otherwise the modifications will be lost. The functions and parameters of the individual tabs are described below.

The **Print** button (see Figure 14, bottom right) can be used for getting an entire overview of the configuration or for exporting it via the clipboard. Details are given in Section 4.11.

The solvimus GmbH provides a manual in PDF format on the homepage. The link can be accessed by clicking the button **Help** (see Figure 14, bottom right).

4.2 Tab General

The ***General*** tab displays general properties of the device and its network configuration.

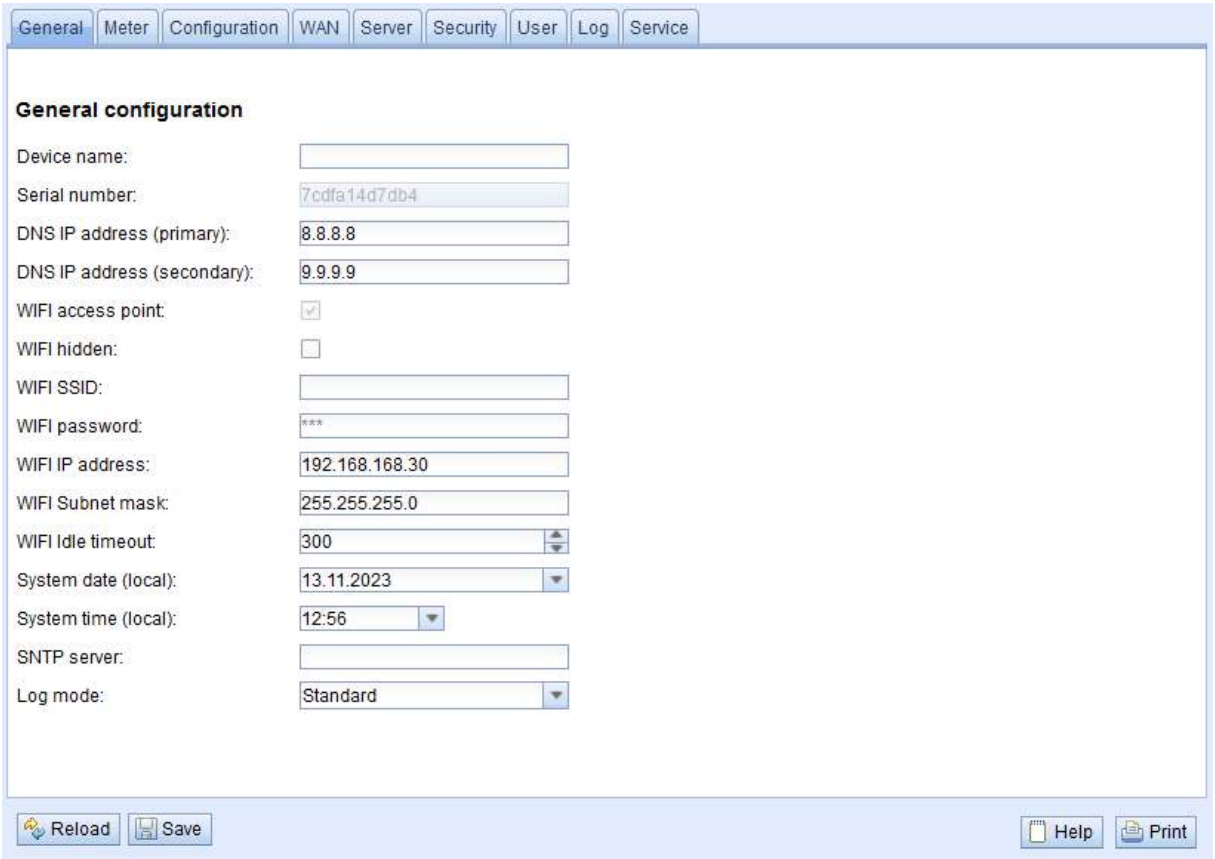


Figure 14: Tab General

The following parameters are shown and can be changed here:

Column name	Description
Device name	Name of the device (as assigned in the tool Netdiscover, max. 50 characters)
Serial number	Serial number of the device (MAC address), not editable
DNS IP address (primary)	Primary DNS server for the name resolution (see explanation underneath table)
DNS IP address (secondary)	Secondary DNS server for the name resolution (see explanation underneath table)
WIFI access point	Indicates activity of the WIFI access point. A deactivation is not possible.
WIFI hidden	Option whether the WIFI is visible or hidden and the SSID must be provided to connect to the MUC.one.
WIFI SSID	Name of the WIFI network. By default, this name is undefined and the network is automatically labelled mucone<serial number> (e. g. mucone806c4).
WIFI password	Password for the WIFI network, at least 8 characters long.

Continued on next page

Table 10 – *Continued from previous page*

Column name	Description
WIFI IP address	IP address of the MUC.one in the WIFI network. This defines also the network address and which IP addresses are assigned to clients that want to connect to the network.
WIFI Subnet Mask	Subnet make for the WIFI network
WIFI Idle timeout	Defines how long the WIFI access point remains active when no client is connected. A timeout of 0 means that the access point is always active and is also activated automatically when the device is started without having to trigger the magnetic switch.
System date (local)	Current, localized system date
System time (local)	Current, localized system time
SNTP Server	Address of the time server
Log mode	Level of detail of the log entries of the application ▪ *None*: The application does not generate any log entries. ▪ *Standard*: The application generates log entries for errors and warnings. ▪ *All*: The application generates log entries for all events.

Table 10: Fields in the General tab

- DNS IP address (primary, secondary): These are used if the network provider does not configure another DNS derver when connecting the WAN. The DNS server being used is visible in the tab ***WAN*** after connection. Should both be 0.0.0.0, then the network provider does not provide a DNS server and at least one DNS server must be configured here. Publicly available DNS servers are offered, e. g., by Google (8.8.8.8) or Quad9 (9.9.9.9). See also Table 13.

The **Save** button is used to save the configuration. The **Reload** command loads the last saved parameters and resets current changes.

If the network configuration is changed, the device will be available under the new IP right after processing the changes. All active sessions will be closed and users will be logged out automatically then.

- Changing the network parameters of the device can affect the accessibility. If the network parameters have already been set correctly by an administrator, they should not be changed.
- The device is automatically reinitialized by accepting the parameters via the **Save** button.
- Date and time are always processed as UTC time (without time zone shift). When shown on the website, the browser converts it according to the time zone of the respective computer. In Central Europe, for example, this is Central European Time or Central European Summer Time. If a different time zone is used here, the time shown on the website will be displayed accordingly.

4.3 Tab Meter

The ***Meter*** tab displays an overview of the connected meters. It offers further possibilities to the user: searching meters automatically, adding meters manually and configuring meters that are already present.

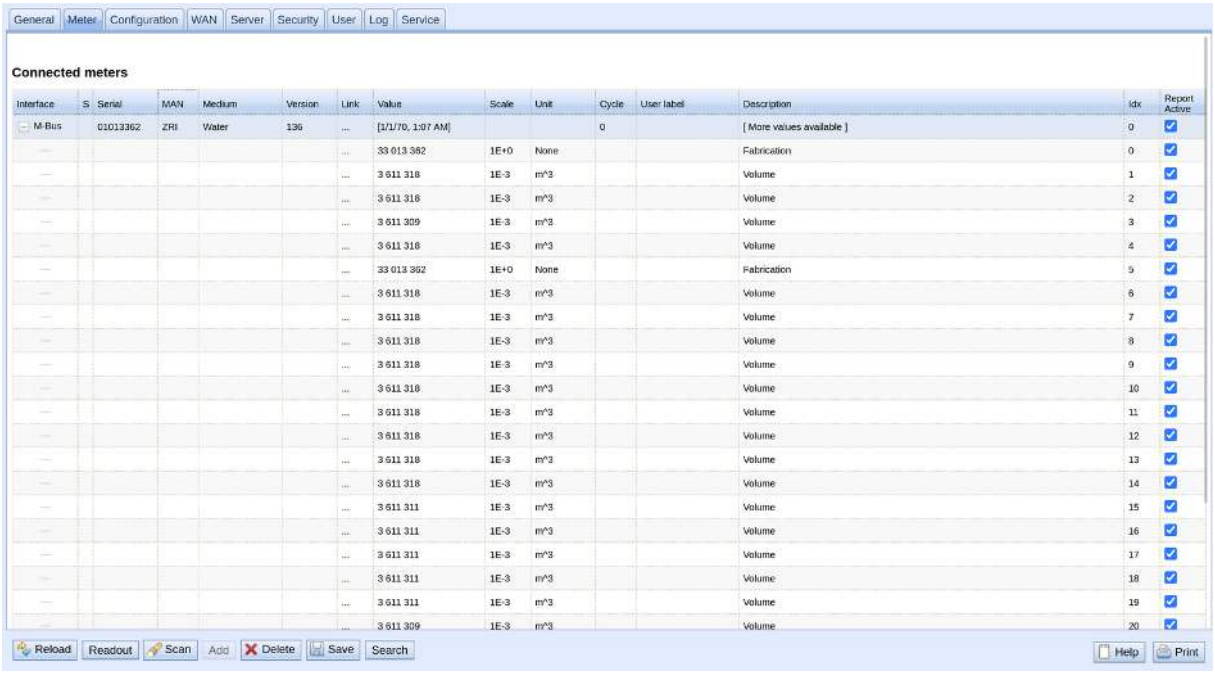


Figure 15: Tab Meter

The meter list is displayed in tabular format. Meter entries and the corresponding meter value entries are displayed one below the other. The individual columns have the following meaning:

Column name	Description
Interface	Interface to the meter ▪ *M-Bus*: wired M-Bus according to EN 13757-2/-3/-7 and OMS; only MUC.one M ▪ *wM-Bus*: wireless M-Bus according to EN 13757-4/-3/-7 and OMS; only MUC.one W ▪ *System*: Monitoring of internally measured values from the device
S (Status)	Shows the status of the meter or the meter value ▪ *!*: meter or meter values cannot be read, meter values are not up-to-date. ▪ *E*: meter/meter value edited ▪ *A*: meter/meter value added ▪ ***: Meter value list of that meter is limited (see *Maximum value count* parameter in ***Configuration*** tab)
Serial	Serial number of the meter (meter number, secondary ID)
MAN	Manufacturer of the meter (abbreviation), DLMS Flag-ID
Medium	Meter medium, see second column in Table 29
Version	Version number of the meter
Link	Primary address of a meter (M-Bus) or received signal strength indicator (RSSI) in case of wM-Bus
Value	Meter reading or measured value (unscaled)
Scale	Scaling factor (scientific notation). The value is defined by $Value \rightarrow Value \cdot Scale$
User Scale	Scaling factor (scientific notation). It complements the *Scale* provided or set by the meter, but does not replace it. It is suitable if an additional scaling is necessary. The value is defined by $Value \rightarrow Value \cdot Scale \cdot User\ Scale$ A column for *User Scale* is displayed only if *User Scale* deviates from the default value of *1e+0* (see Table 28).
Value (scaled)	Meter reading or measured value (scaled)
Unit	Unit, see second column in Table 31
OBIS-ID	OBIS code in the format X-X:X.X.X*X (X=0..255)
Encryption key	Key for encrypted wM-Bus meters. Supported modes: 5 and 7
Cycle	Readout interval in seconds (with 0, the general readout cycle is used, see ***Configuration*** tab)
User label	User-defined description of the meter value, this allows an application-specific mapping. Allowed characters are: A-Z, a-z, 0-9, !, §, $, %, &, /, (,), =, ?, + and *. A comma is also allowed. Illegal characters are: ⟨, ⟩ and ".

Continued on next page

Table 11 – *Continued from previous page*

Column name	Description
	If using the CSV format, the semicolon (or the corresponding separator) should not be used.
Description	Description of the meter value according to the second column in Table 30. The display of storage number, tariff, value type and raw data can be configured via the *Description mode* parameter in the ***Configuration*** tab.
Idx	Index/position of meter/meter value in the meter list
Active	Activates a meter or meter value for reporting to a server or logging.

Table 11: Columns in Meter tab

The meter configuration can be changed with the buttons at the bottom or via the context menu. According to the limitations of the interface used (M-Bus, wM-Bus etc.), individual meters or meter values can be automatically scanned or manually created, deleted or changed.

The meters or meter values in the list can be selected by a simple mouse click. A range can be selected with the ⟨**SHIFT**⟩ key held down, or multiple meters can be selected (individually) with the ⟨**CTRL**⟩ key held down.

Duplicates of the serial number are marked yellow for easier checking of the meter list. Using the **Search** button, the complete meter list can be searched for a text. The search comprises as well meter values hidden by closing the symbol in front of the interface type.

Reload loads the last saved parameters, resets current changes, and correspondingly updates the meter values.

Upon delivery, the device has an empty meter list. If meters are connected via the external interfaces of the device, the **Scan** button can be used to start an M-Bus scan. The scan mode *M-Bus mode* is configured in the ***Configuration*** tab. More information on this can be found in Section 4.4.

- Depending on the mode and the number of connected meters, this may take a very long time.

The process can be interrupted using the **Cancel** button, whereby the meters already found are saved in the meter configuration. After the scan, the meter configuration is immediately applied, and only needs to be saved again after further changes. The scan procedure is only adding meters to the existing list, it is not deleting or changing already configured meters. Newly found M-Bus meters and their values are automatically activated after the scan and are assigned to a Modbus address or a BACnet number. The scan also permanently adds newly received wM-Bus meters to the configuration, provided that the parameter *wM-Bus listen* in the ***Configuration*** tab is activated. Since wM-Bus meters are not necessarily your own, they are not automatically activated, unlike M-Bus meters. The listen mode initially only lists all received meters without permanently saving them to the list.

- The meter values of M-Bus and wM-Bus meters are arranged in the same order as the data is present in the protocol. So, the meaning of the values can be directly compared with the data sheet of the relevant meter. Alternatively, the raw data of the meter values (see parameter *Description mode* in the ***Configuration*** tab, see Section 4.4) can be used for mapping the values.
- The timestamps transmitted in the M-Bus or wM-Bus protocol are automatically assigned to the individual measured values, and therefore not listed in the meter list by default. The configuration parameter *MUC_SHOWTIMESTAMPENTRIES* in the configuration file *app/chip.ini* allows to manually activate the explicit representation of all timestamps (see Section 8.2).
- Newly received wM-Bus meters are deactivated by default, and have to be manually activated and saved in order to be integrated into the reports and log data. Unsaved wM-Bus meters are lost after a restart.

Meters which cannot be found as well as meters connected to interfaces which do not enable automated scanning can be added manually using the **Add** button or using the ***Add meter*** item in the context menu. The number of meters is limited. The button **Add** and ***Add meter*** in the context menu are automatically deactivated once the maximum number of meters is attained.

For configuring individual meters or meter values, double click an entry or call the editing dialogue with the ***Edit*** context menu item. The naming of the input fields corresponds to the columns of the meter list (see Table 11). Individual fields are activated or deactivated according to the interface.

Among other things, a *User label* can be assigned to all entries here, so the meter or meter value can be mapped to a specific application. The individual readout interval of the meters can be set via the parameter

Cycle as well. The key required for decoding can also be set for wM-Bus meters in the Meter editing dialogue.

The configuration can be finished with the **Ok** button or cancelled with the **Cancel** button.

For reporting and logging, individual meters and meter values can be directly activated or deactivated with the checkbox in the *Active* column. The meter values are automatically activated or deactivated by the configuration of a meter corresponding to the hierarchy. In the same way, an inactive meter is automatically activated if one of its meter values is activated. Multiple selected meters or meter values can be set with the context menu items ***Activate*** and ***Deactivate***.

All selected meters and meter values can be deleted by using the **Delete** button or the context menu item with the same name. Deleted wM-Bus meters are then created again if the parameter *wM-Bus listen* in the ***Configuration*** tab is activated.

- Individual meter values of an M-Bus or wM-Bus meter cannot be deleted.

The meter list is saved by using the **Save** button.

- Saving a meter configuration creates a new internal database file for logging the meter values aligned to this updated configuration.

4.4 Tab Configuration

The ***Configuration*** tab allows the parametrization of the meter interfaces of the device.

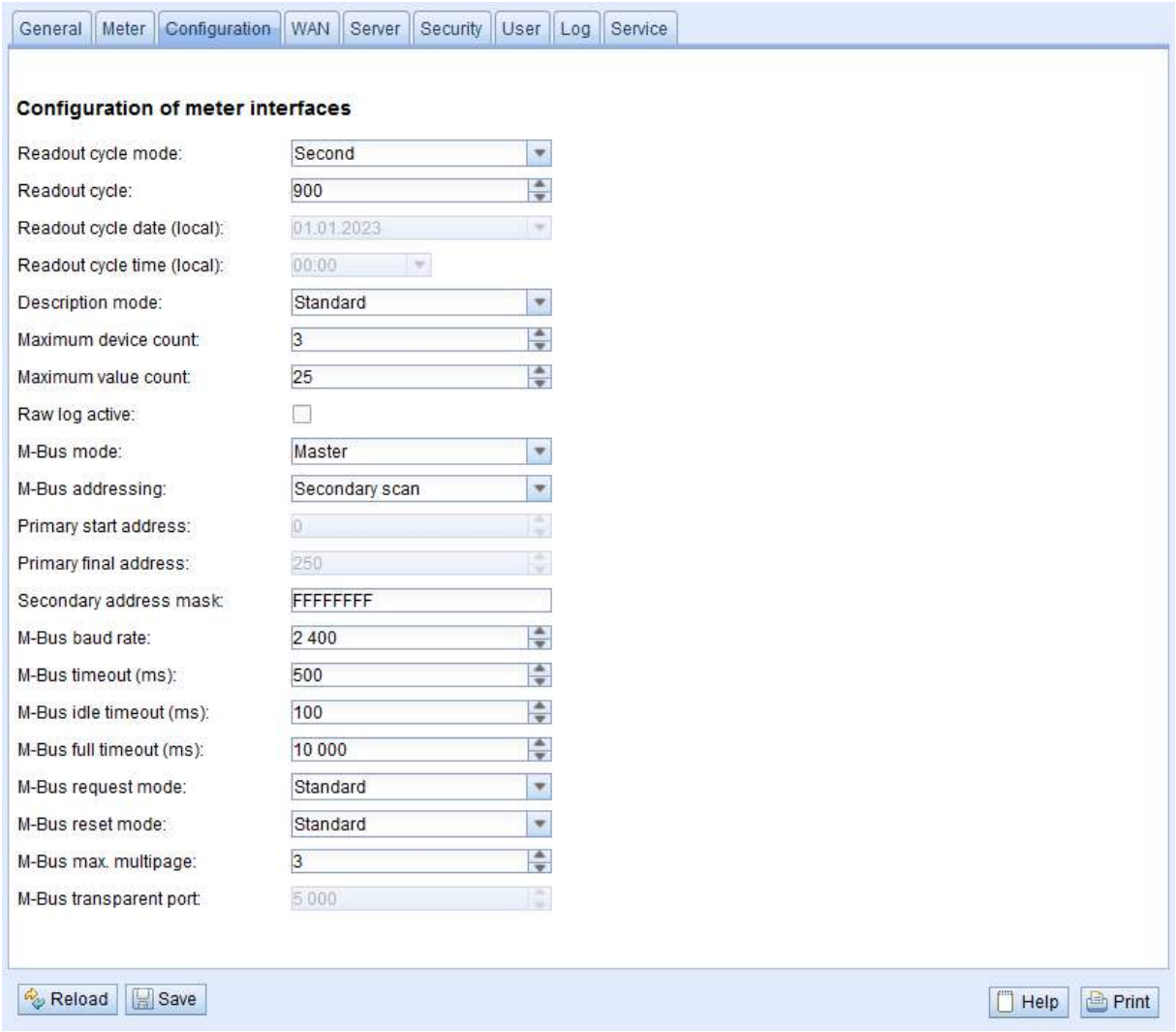


Figure 16: Tab Configuration

The following parameters are available:

Column name	Description
General readout and display parameters	
Readout cycle mode	Format for specifying the standard readout cycle (for all meters, unless otherwise specified for individual meters in the ***Meter*** tab via the parameter *Cycle*). ▪ *Second*: Readout cycle is specified in seconds ▪ *Minute*: Readout cycle is specified in minutes ▪ *Hour*: Readout cycle is specified in hours ▪ *Daily*: daily readout at the specified time ▪ *Weekly*: weekly readout on the specified weekday and at the specified time ▪ *Monthly*: monthly readout on the specified day of the month and at the specified time ▪ *Quarterly*: quarterly readout on the specified day and month of the quarter and at the specified time (month 1..3 per quarter) ▪ *Yearly*: yearly readout on the specified day and month and at the specified time
Readout cycle	Standard readout cycle of the meters (unit according to *Readout cycle mode* in seconds, minutes or hours; only for *Readout cycle mode* in *Second*, *Minute*, *Hour*)
Readout cycle date (local)	First readout day in case of daily to yearly specification of the standard readout cycle, depending on the interval format the entered month is used, the year is not relevant
Readout cycle time (local)	Readout time for daily to annual specification of the standard readout cycle
Description mode	Mode for displaying the meter value description on the website: ▪ *None*: empty meter value description ▪ *Standard*: simple meter value description (see Table 30) ▪ *Extended*: extended meter value description (parameters are only shown if not zero): Notation: description [storage number] ⟨tariff⟩ {value type} Example: Energy [2] ⟨1⟩ {max} ▪ *Extended with DIF/VIF*: extended meter value description added by raw DIF/VIF data: Notation: description [storage number] ⟨tariff⟩ {value type} # XX XX XX ... Example: Energy [2] ⟨1⟩ # 8C 11 04 ▪ *Extended with raw data*: extended meter value description added by complete raw data for this entry. Notation corresponds to *Extended with DIF/VIF*: Example: Energy [2] ⟨1⟩ # 8C 11 04 96 47 06 00 ▪ *DIF/VIF*: raw DIF/VIF data in description field ▪ *Raw data*: complete raw data for this entry in description field
Maximum device count	Limits the number of meters being added upon scanning (0: no limit). Already configured meters are included by this parameter.
Maximum value count	Limits the number of meter values for a meter during a readout process (0: no limit). Already configured meters keep their original configuration after initial scan or saving.
Raw log active	Activating the logging of raw data from the interfaces
Specific parameters of the M-Bus-Master*	
M-Bus mode	Konfiguration der transparenten Kommunikation. The following modes are available: ▪ *Disabled*: The M-Bus interface is deactivated. ▪ *Master*: The device is M-Bus master and can read out meters. ▪ *Transparent/TCP*: The M-Bus interface is available for a transparent communication via TCP. ▪ *Transparent/UDP*: The M-Bus interface is available for a transparent communication via UDP. ▪ *Master & Transparent/TCP*: The device is M-Bus master and can read out meters. The interface is at the same time available for a transparent communication via TCP.
M-Bus addressing	Configuration how the device searches meters during an M-Bus scan and how these meters are addressed (details see Section 5.3.2). The following modes are available: ▪ *Primary Scan*: Search for primary address ▪ *Secondary scan*: Search for secondary address ▪ *Secondary scan reverse*: Search for secondary address in inverted order
Primary start address	Sets the start address for the primary search.
Primary final address	Sets the final address for the primary search.
Secondary address mask	Sets the address mask for the secondary search, 8 digits; wildcards are indicated by the letter "F"; missing characters are filled up with leading 0 from the left.
M-Bus baud rate	M-Bus communication baud rate
M-Bus timeout	M-Bus timeout until first data is received (in ms)
M-Bus idle timeout	M-Bus timeout for detecting the end of communication (in ms)
M-Bus full timeout	M-Bus timeout (total) for the reception of a data telegram (in ms)

Continued on next page

Table 12 – *Continued from previous page*

Column name	Description
M-Bus request mode	Mode of the M-Bus readout process (REQ_UD2): ▪ *Standard*: Readout process using REQ_UD2 ▪ *Extended 1*: Readout process using Get-All-Data (DIF/VIF 0x7F 0x7E) and REQ_UD2 ▪ *Extended 2*: Readout process using Get-All-Data (DIF 0x7F) and REQ_UD2
M-Bus reset mode	Mode of the M-Bus reset (before scan and readout process): ▪ *None*: No reset ▪ *Standard*: SND_NKE to the primary address of the meter or to the broadcast address 0xFF in case of secondary addressing ▪ *Extended 1*: SND_NKE to the primary address 0xFD, followed by a SND_NKE to the primary address of the meter or to the broadcast address 0xFF in case of secondary addressing ▪ *Extended 2*: SND_NKE to the primary address 0xFD, followed by an application reset to the broadcast address 0xFF, followed by a SND_NKE to the primary address of the meter or to the broadcast address 0xFF in case of secondary addressing
M-Bus max. multipage	Limits the number of multipage requests
M-Bus transparent port	Network port of the transparent M-Bus mode
Specific parameters of the wM-Bus*	
wM-Bus frequency	Frequency band for the communication with the wM-Bus meters
wM-Bus mode	Sets the wM-Bus communication mode of the OMS interface (T, S, C or C/T-Mode) or deactivates the interface.
wM-Bus transparent mode	Activates and sets the transparent mode of the wM-Bus communication (Transparent/TCP or Transparent/UDP or Disabled).
wM-Bus transparent port	Network port of the transparent wM-Bus mode
wM-Bus listen	Activates the processing and listing of unconfigured and newly received wM-Bus devices
Show encryption keys	Displays the keys in plain text after saving the list.

*if device is equipped with this interface/function

Table 12: Fields in the Configuration tab

The **Save** button is used to save the configuration. The **Reload** command loads the last saved parameters and resets current changes.

The device is automatically reinitialized by accepting the parameters via the **Save** button.

4.5 Tab WAN

The ***WAN*** tab allows the parametrization of the WAN connection for devices with integrated cellular modem. This is permanently set up when the device is restarted and is kept permanently active.

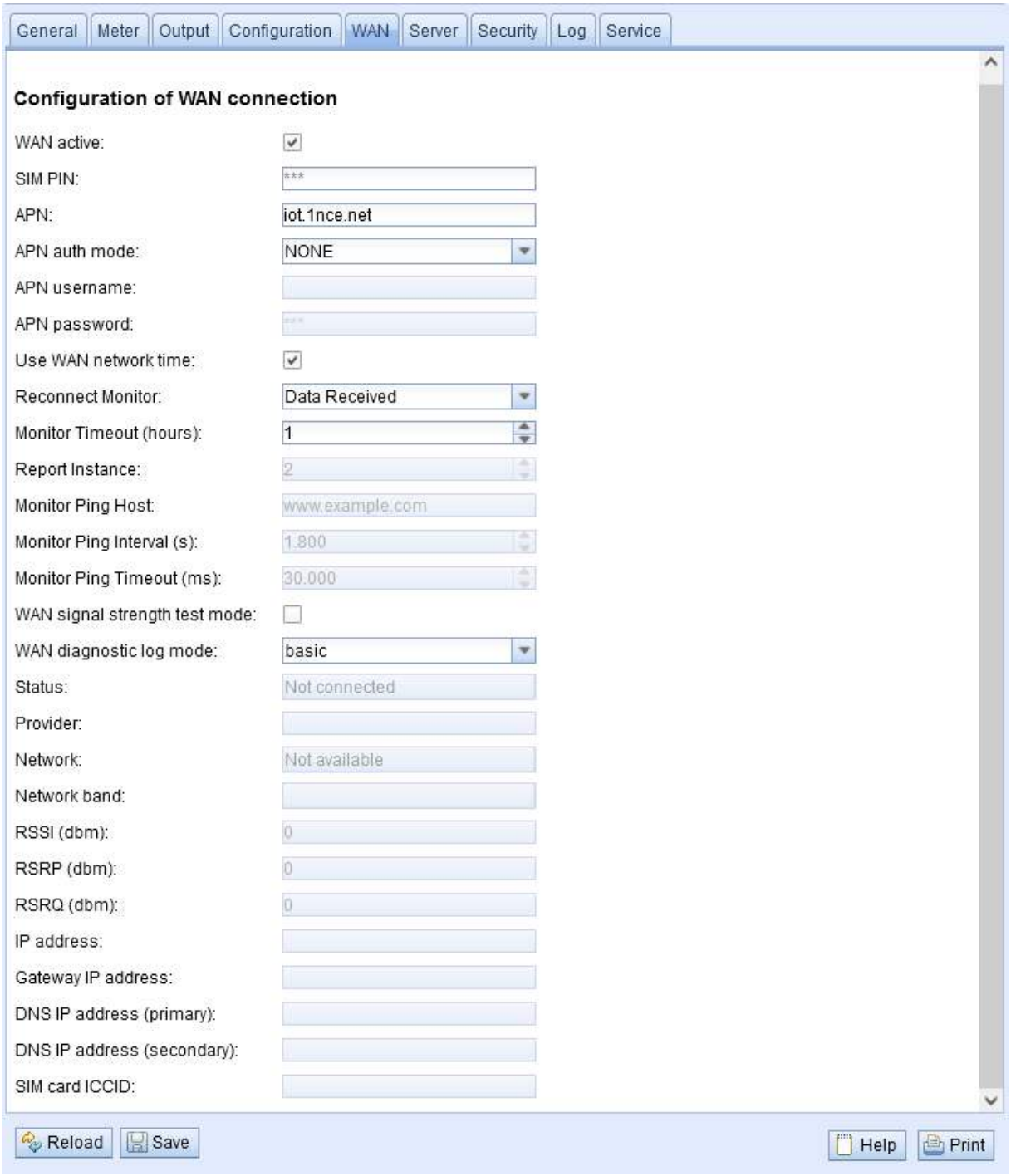


Figure 17: Tab WAN

The following parameters are available:

Column name	Description
WAN active	Activation of the WAN module
SIM PIN	PIN of the SIM card
APN	Name of the access point (APN)
APN auth mode	Authentication mode of the APN
APN username	User name for authentication at the APN
APN password	Password for authentication at the APN
Use WAN network time	Updates the system time when connecting with the radio network. This time is not updated regularly. SNTP (see Table 10) can be used for regular updating.

Continued on next page

Table 13 – *Continued from previous page*

Column name	Description
Reconnect Monitor	Additional monitoring of the radio connection and forced disconnection as well as renewal of the radio connection if the condition is not met. The following modes are available: ▪ *off*: no additional monitoring ▪ *Data Received*: data were received by radio in the indicated time frame ▪ *Any report successful*: an arbitrary report was at least once successful in the indicated time frame ▪ *All reports successful*: all reports were at least once successful in the indicated time frame ▪ *Selected report successful*: the selected report was at least once successful in the indicated time frame ▪ *Test Ping*: the ping host was reached at least once in the indicated time frame. Mind that: – A single echo request is sent. – *Monitor Ping Timeout* can block a readout. Therefore, *Test Ping* should not be used at very high readout frequencies. – The echo requests are sent with a payload of 0 bytes, the function requires 28 bytes data volume each for in and out per interval. – The pings are logged in the tab ***General*** if the Log Mode *All* is selected; as successful or as warning if failed due to timeout.
Monitor Timeout (hours)	Interval in hours which is monitored. If the condition of the Reconnect Monitor is not met within this time frame, the WAN connection will be reinitialised. Rationale numbers are also valid here, e. g.: *0.25*.
Report Instance	Report Instance which is monitored if the mode *Selected report successful* is used (otherwise greyed out).
Monitor Ping Host	Host/IP-address to be monitored. An IP address should be configured for the test, not a DNS name. If a DNS name is given, it will be resolved to an IP address during startup and after modifications in the tab ***Configuration*** and, if successful, will only be resolved again after 24 hours. This avoids the consumption of additional data volume by repeated resolution of the DNS name.
Monitor Ping Interval (s)	Interval in which a ping is sent (in s).
Monitor Ping Timeout (ms)	Timeout for the reception of a response (in ms).
WAN signal strength test mode	Sets the WAN interface in a mode to monitor the signal strength to optimize the antenna positions. In this mode, the parameters Provider, Network and the signal indicators (RSSI, RSSQ, RSRQ) are updated at high frequency for all devices. In devices with just one modem channel (see note underneath this table), no data connection exists via the WAN interface in this mode.
WAN diagnostic log mode	Activation of raw data output for the WAN communication in the system log
Status	Status of the WAN connection (connected / not connected)
Provider	Diplays, with WAN connected, the PLMN code or the name of the provider with whom the device is connected. See note underneath this table.
Network	Network technology of the radio connection. See note underneath this table.
Network band	Displays the mobile radio band (frequency band) in use. See note underneath this table.
RSSI (dbm)	Field strength of the cellular network in dBm (-113 to -51 dBm, -114 corresponds to be not connected). See note underneath this table.
RSRP (dbm)	Reference Signal Received Power. See note underneath this table.
RSRQ (dbm)	Reference Signal Received Quality. See note underneath this table.
IP address	IP address in the WAN
Gateway IP address	Remote station in the WAN
DNS IP address (primary)	Primary DNS server for the name resolution
DNS IP address (secondary)	Secondary DNS server for the name resolution
SIM card ICCID	Displays the number/ICCID of the inserted SIM card with active WAN connection

Table 13: Fields in the WAN tab

- Hint with respect to *WAN signal strength test mode*:
  - Updates of the fields Provider, Network, Network band, RSSI, RSSP, RSSQ depend on the device hardware. They are regularly updated in devices with several channels to the modem (MUC.easy^{plus} 4G/NB-IoT). In devices with just one channel to the modem, the values are read only when establishing the connection (MUC.easy^{plus} 2G/3G, MUC.one). For these devices, the test mode can be used to benefit from regular values when the antenna position is to be optimized. This mode should only be activated in case of local connection as there is no data connection in these devices for this mode.
  - Only RSSI, RSSP and RSSQ are updated automatically in the web-based front end. The button **Reload** can be used for updating the remaining parameters.

The necessary parameters for the WAN connection should be provided by the cellular network provider of your SIM card.

- Please check whether the cellular network contract includes the expected quantity of data, otherwise increased costs or a blocking of the SIM card may follow.
- Please check whether the parameters are correct. Incorrect parameters can lead to increased costs or blocking of the SIM card.
- If an invalid PIN is entered, it will be used only once per software startup. Thus, the remaining attempts for entering the PIN are not depleted and a new PIN can be entered via the website.
- Changing the WAN configuration via an active cellular network connection is not recommended, as the device may no longer be accessible after a changed or invalid configuration.

The **Save** button is used to save the configuration. The **Reload** command loads the last saved parameters and resets current changes.

- The device is automatically reinitialized by accepting the parameters via the **Save** button. An existing WAN connection is terminated and re-established.

4.6 Tab Server

The ***Server*** tab allows the parametrization of the data reports to third-party systems.

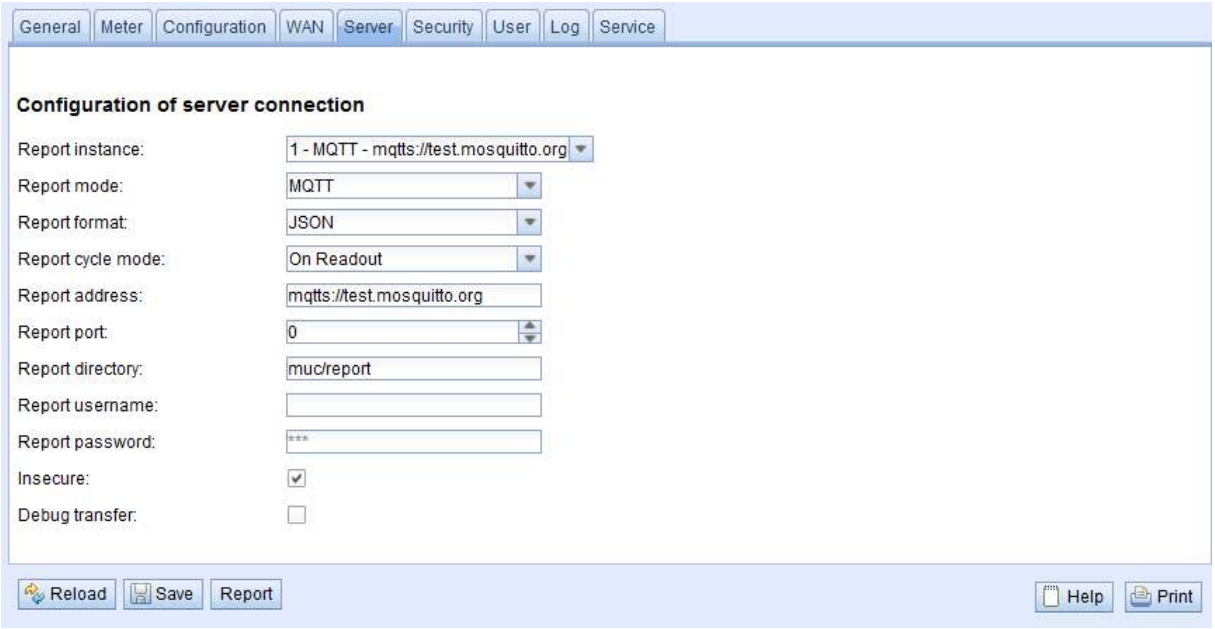


Figure 18: Tab Server

The following parameters are available:

Column name	Description
Parameters for data concentrators with Report functionality	
Report instance	Selection of the respective instance
Report mode	Sets the operating mode of the respective instance or deactivates it. The following modes are available: ▪ *TLS*: active data push via encrypted TCP channel to the specified server ▪ *TCP*: active data push via unencrypted TCP channel to the specified server ▪ *MQTT*: active data push via MQTT client to the specified server/broker (encrypted or unencrypted)
Report format	Sets the data format used for the transmission of the respective instance. Several predefined formats are available.
Report cycle mode	Set to „On Readout“ and sends the report directly after the readout. The report interval is identical to the readout interval.
Report address	Host address of the remote station or mail server (outgoing mail server)
Report port	Network port of the remote station to connect to
Report directory	Path on the remote station
Report username	User name for server access
Report password	Password for server access

Continued on next page

Table 14 – *Continued from previous page*

Column name	Description
Insecure	Allow insecure encrypted communication by disabling certificate and hostname verification

Table 14: Fields in the Server tab

Depending on the operating mode of the server interface, individual parameters required for the configuration are enabled.

When using PKI-based connections (TLS, MQTTS, SMTPS, FTPS), the server certificate or the Root CA certificate for the server must be saved on the device. This is achieved by **Config Import** of the certificates in PEM format in the tab ***Service***.

The **Save** button is used to save the configuration. The **Reload** command loads the last saved parameters and resets current changes. The **Report** button allows immediate transmission of the data previously read out.

Setting the parameters via the button **Save** causes a reinitialization of the device.

4.7 Tab Security

The ***Security*** tab allows the parametrization of the network services by the device.

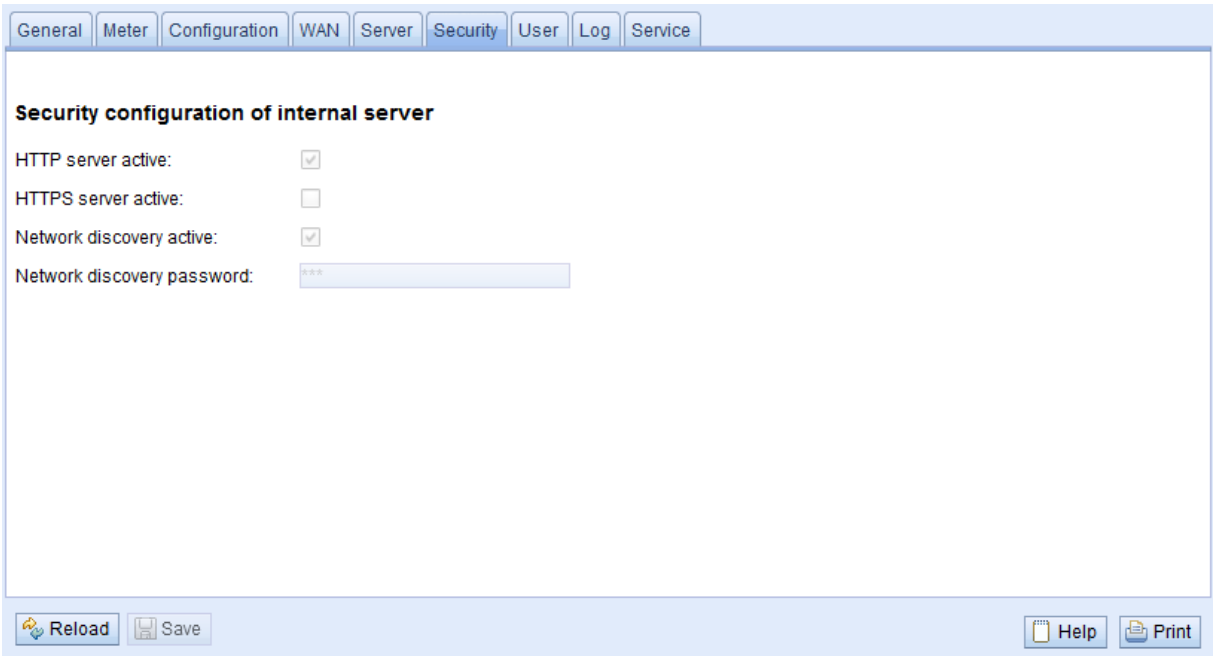


Figure 19: Tab Security

The following parameters are available:

Column name	Description
HTTP server active	Activation of the internal HTTP server of the device
HTTPS server active *	Activation of the internal HTTPS server of the device
Network discovery active	Activates the internal discovery server of the device. If deactivated, the device is no longer displayed in the Netdiscover tool (see Chapter 3)
Network discovery password	Password for setting the network parameters via the Netdiscover tool

*Not supported at present

Table 15: Fields in the Security tab

The **Save** button is used to save the configuration. The **Reload** command loads the last saved parameters and resets current changes.

The device is automatically reinitialized by accepting the parameters via the **Save** button. An existing WAN connection is terminated and re-established.

4.8 Tab User

The ***User*** tab allows the parametrization of different users and their permissions for the website.

Figure 20: Tab User

The following user is preconfigured upon delivery:

User name	Password	Comments
admin	admin	Administrative user with full access to all services of the device (HTTP, FTP, SSH, IP configuration).

Table 16: User account upon delivery

The administrator can create other users. When creating other users, the password directive applies as it did for the administrator (see Section 4.1).

On the website, the existing configuration is shown in a table and can be modified:

Column name	Description
Name	User name
Overwrite password	It is set if a (new) password has been set for the user in the editing dialogue.
Change Password	Setting whether the user is allowed to change his password
Require change Password	Setting whether the user has to change his password at the next login
Sessions	Number of currently active sessions of this user
Maximum sessions	Setting how often the user may be logged in at the same time in parallel (-1=unlimited)
Read General	Read permission to the General tab
Write General	Write permission to the General tab
Read Meter	Read permission to the Meter tab
Write Meter	Write permission to the Meter tab
Read Output	Read permission to the Output tab
Write Output	Write permission to the Output tab
Read Config	Read permission to the Configuration tab
Write Config	Write permission to the Configuration tab
Read WAN	Read permission to the WAN tab
Write WAN	Write permission to the WAN tab
Read Server	Read permission to the Server tab
Write Server	Write permission to the Server tab
Read Security	Read permission to the Security tab
Write Security	Write permission to the Security tab
Read Log	Read permission to the Log tab
Read Service	Read permission to the Service tab
Write Service	Write permission to the Service tab
Admin	Read and write permission to the User tab, and rights for **Config export** and **Config import**.
FTP	Permission of the user to log in via FTP (maximum 2 users)

Table 17: Fields in the User tab

The user configuration can be changed with the buttons at the bottom or via the context menu. Except from the *admin* user, other users can be created, deleted or changed.

The users in the list can be selected by a simple mouse click. A range can be selected with the ⟨**SHIFT**⟩ key held down, or multiple users can be selected (individually) with the ⟨**CTRL**⟩ key held down.

The **Reload** command loads the last saved parameters and resets current changes.

When write permission to a tab is granted, read permission is also granted automatically.

⚠ The *admin* user cannot be changed or deleted in the user configuration. The administrator password can only be changed by using the **Change password** button when the *admin* user is logged in.

⚠ If the administrator password is lost, the device can only be reset to factory defaults by solvimus GmbH as file access on the device is limited for safety reasons. When resetting, all configuration data and meter data are lost.

New users can be added via the **Add** button or via the context menu item with the same name. The following dialogue will open:

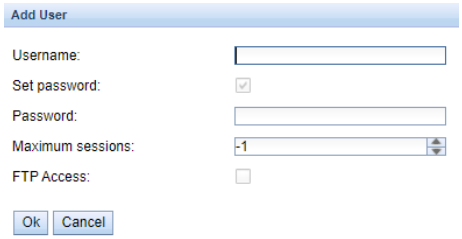


Figure 21: Input dialogue for adding new users

In addition to the user name and password, you can specify how often a user may log in at the same time (-1=unlimited).

For reconfiguring an already existing user, the editing dialogue can be opened by double clicking its entry or via the context menu item ***Edit***. This dialogue has the same structure as the dialogue for adding a user. For resetting the password of an existing user, the **Set Password** checkbox has to be set. If the **Set Password** checkbox is not set, the user password is not changed or reset during this configuration process. A user password cannot be read.

The configuration can be finished with the **Ok** button or cancelled with the **Cancel** button.

The permissions of a user are directly set in the user list. If a user has write permission to a tab, the user automatically gets the permission to see the tab (read access).

Using the button **Delete** or the context menu item with the same name, all selected users (with the exception of the *admin* user) can be deleted.

The **Save** button is used to save the user configuration.

4.9 Tab Log

The ***Log*** tab allows accessing log information and status outputs. That facilitates the analysis of the behaviour and troubleshooting.

- The extent of the log entries depends largely on the settings in the **Log mode** field in the ***General*** tab (see Section 4.2).
- For viewing the raw data logs of the meter interfaces, the **Raw data log** field in the ***Configuration*** tab must be activated (see Section 4.4).

Figure 22: Tab Log

The following parameters are available:

Field name	Description
Log source	Selects the source of the log entries ▪ *System log*: Show the log entries of the system (Linux) and the application ▪ *Application*: Show the log entries of the application ▪ *M-Bus*: Show the raw data of the M-Bus interface (if **Raw data log** is active in the ***Configuration*** tab) ▪ *wM-Bus*: Show the raw data of the wM-Bus interface (if **Raw data log** is active in the ***Configuration*** tab)
Filter active	Enables filtering by string expression
Filter	String expression used for filtering the log (search for keyword or regular expression in the **Message** column)

Table 18: Fields in the Log tab

The **Reload** button updates the log entries according to **Log source** and the filter settings.

- ✔ Using the keyword *serial=* allows filtering for one meter's secondary ID in the raw data log, e. g. *serial=12345678*. Only telegrams from this meter are shown then.
- ✔ Depending of the extent of the log entries, it may take some time to generate the table.
- ✔ The filter settings are kept when changing between tabs. So, coming back to this tab, the old filter is still active. This will ease the troubleshooting but may cause increased load times for extensive logs.
- ℹ The logging is done in the RAM, putting constraints on the log history. In normal mode, it is recommended to set Log Mode in the ***General*** tab to *Normal* and opt for *All* only for analysing problems.
- ℹ As the bus log and the system log share the log memory, **Raw log active** (see ***Configuration*** tab) should be activated exclusively for analysing bus problems, and then be deactivated again. Otherwise, a readout might prevent recording a system log message and problems can go unnoticed.
- ℹ If no log entries are shown, inspect the filter settings. Initialize the filter or deactivate it.
- ℹ The number of log entries shown is limited to 500. Use the filter to reduce the entries.

The **Export** button generates a CSV file containing all log entries matching the filter and time range for downloading it. This download may take some time depending on the size of the log.

4.10 Tab Service

The tab ***Service*** lists the available versions and licences, and provides the functionality for an update of the firmware as well as for the export and the import of the configuration.

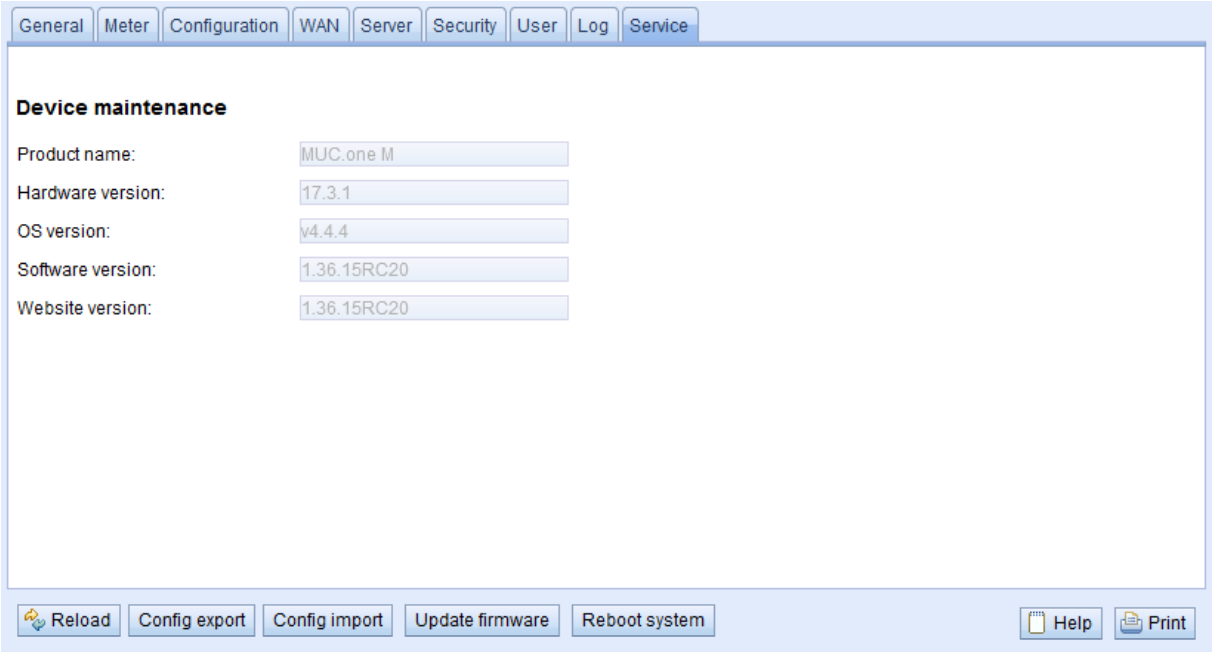


Figure 23: Tab Service

4.10.1 Device maintenance

The following parameters are available:

Column name	Description
Product name	Product name
Hardware version	Version of the hardware
OS version	Version of the operating system
Software version	Version of the software
Website version	Version of the website
M-Bus load profile	If available and ticked: licence for load profile active
Modbus server	If available and ticked: licence for Modbus server active
BACnet server	If available and ticked: licence for BACnet server active
M-Bus slave	If available and ticked: licence for M-Bus slave active

Table 19: Fields in the Service tab

The values are updated using the **Reload** button.

4.10.2 Export and import of the configuration

Users with *Admin* rights can click the buttons **Config export** and **Config import** to download the configuration from the device or upload the configuration to the device. These buttons are greyed out to all other users.

When exporting the configuration, a selection dialogue permits choosing which data is downloaded from the device:

- Certificates
- Device configuration
- Network configuration
- Device name
- Meter configuration

✔ The network configuration and the device name are part of the device configuration. If the device configuration is to be transferred to another device, it is recommended not to export the network configuration and the device name. Usually these should not be transferred to other devices.

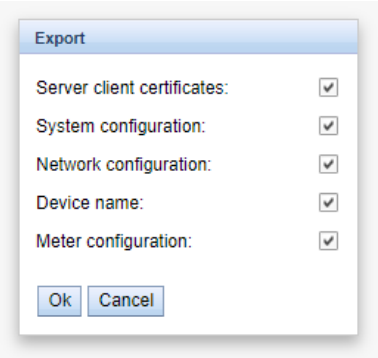


Figure 24: Options for exporting the configuration

The configuration is downloaded as a **. tar* file. This archive is an excerpt from the file system of the device. It can be stored as a backup or modified for uploading it later to the same or another device. It is useful for transferring a valid configuration to a replacement device or for commissioning many similar devices (see Section 3.6).

Mind that the device configuration file contains passwords. These can be modified to preserve data security (see Section 4.8).

When importing the configuration, a file selection dialogue comes up for selecting the corresponding **. tar* file.

4.10.3 Update of the firmware

Manual update of the firmware

Using the **Update firmware** button opens a file selection dialogue as well. An update file can be selected here. The solvimus GmbH provides updates as **. enc* files on a regular basis. These files can then be uploaded to the device. After successfully uploading them, the update process is started automatically and the device is then restarted. An alternative procedure for updating the firmware is described in Section 3.6.

Semiautomatic update of the firmware

If an update is available, a pop-up window is displayed to users with *Admin* rights, drawing attention to the update. The settings for the update are given in the follwing table.

Column name	Description
Auto update mode	Mode for the update function: *Download Update Info* or *Off* (deactivated).
Update check time	Time at which the update information is downloaded (in seconds since begin of the day, UTC).
Update Check Timespan	Time span in seconds after *Update check time* in which the download of the update information is randomly distributed.
Update check URL	URL of the update server including path to the main directory of the update information and protocol.
Download Update Info	Download of the update information.
Update version	Newest version available for the device.
Update warnings	Warnings to the update. This should be read carefully prior to installing the update.
Update Changelog	Differences in the firmware versions
Download and install update	Initiates the download and the installation.

Table 20: Fields for the semiautomatic update of the firmware

A reboot follows. All users with *Read Service* rights can see the information related to the update, the new version, the warnings and the changelog of the update.

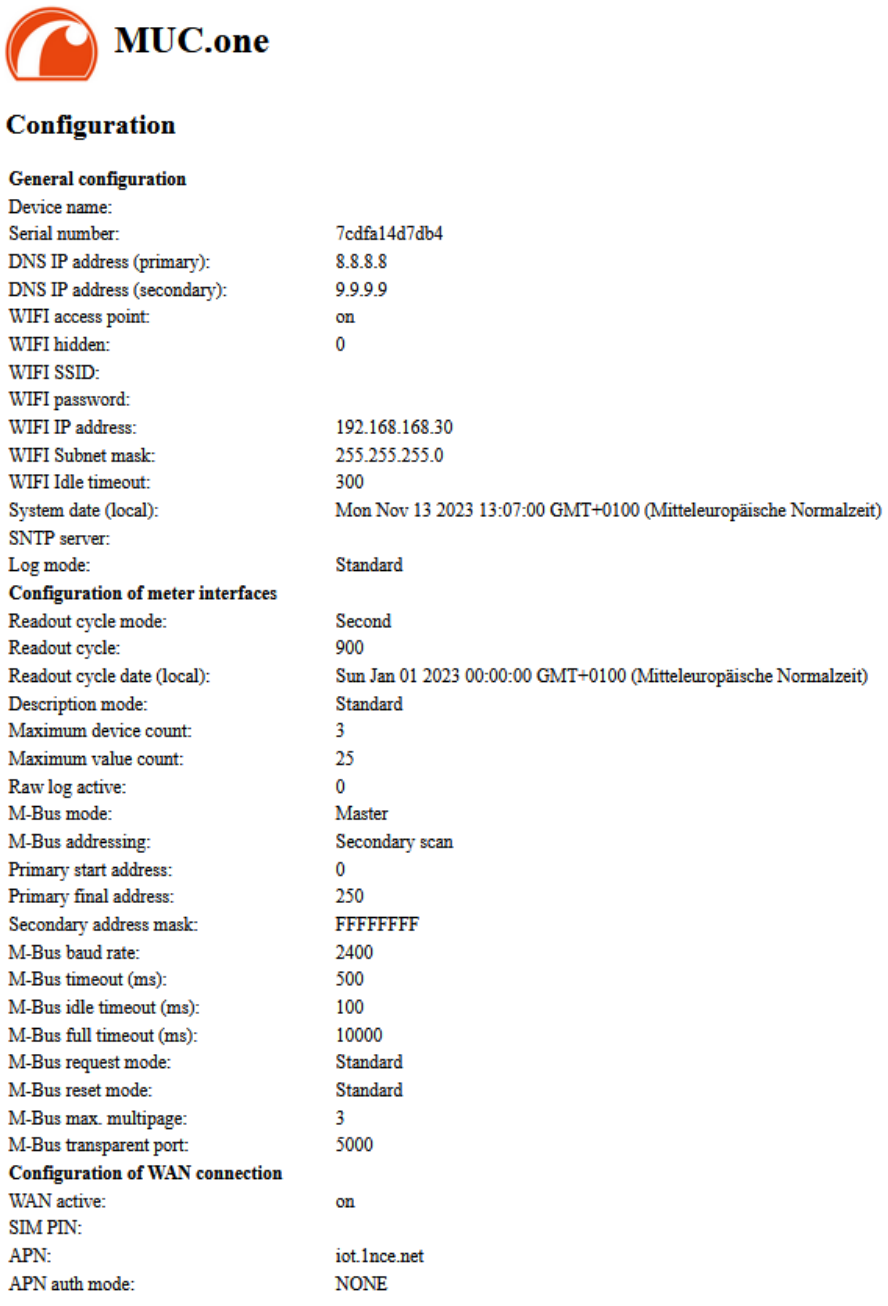
4.10.4 Reboot system

The device can be restarted using the **Reboot system** button. All internal processes are shut down and re-initialized after the restart. Meter data pending to be sent via the WAN interface is transferred after a restart. Use this button if you intend to manually modify the configuration via FTP(S) or after a manual update.

4.11 Print page

The **Print** button (see Figure 14, bottom right) can be used for getting an entire overview of the configuration or for exporting it via the clipboard. The website generates an additional browser window containing all available configured parameters and meters according to the access rights. The print page is automatically closed after a user has logged out from the website (at the top right of the web-based front end, if not already closed).

- The meter list displayed is also suitable for inserting it into a spreadsheet.



MUC.one

Configuration

General configuration	
Device name:	
Serial number:	7cdfa14d7db4
DNS IP address (primary):	8.8.8.8
DNS IP address (secondary):	9.9.9.9
WIFI access point:	on
WIFI hidden:	0
WIFI SSID:	
WIFI password:	
WIFI IP address:	192.168.168.30
WIFI Subnet mask:	255.255.255.0
WIFI Idle timeout:	300
System date (local):	Mon Nov 13 2023 13:07:00 GMT+0100 (Mitteleuropäische Normalzeit)
SNTP server:	
Log mode:	Standard
Configuration of meter interfaces	
Readout cycle mode:	Second
Readout cycle:	900
Readout cycle date (local):	Sun Jan 01 2023 00:00:00 GMT+0100 (Mitteleuropäische Normalzeit)
Description mode:	Standard
Maximum device count:	3
Maximum value count:	25
Raw log active:	0
M-Bus mode:	Master
M-Bus addressing:	Secondary scan
Primary start address:	0
Primary final address:	250
Secondary address mask:	FFFFFFFF
M-Bus baud rate:	2400
M-Bus timeout (ms):	500
M-Bus idle timeout (ms):	100
M-Bus full timeout (ms):	10000
M-Bus request mode:	Standard
M-Bus reset mode:	Standard
M-Bus max. multipage:	3
M-Bus transparent port:	5000
Configuration of WAN connection	
WAN active:	on
SIM PIN:	
APN:	iot.1nce.net
APN auth mode:	NONE

Figure 25: Print page of the device (excerpt)

4.12 Troubleshooting the front end

Using a standard web browser for accessing the web server running on the device is an easy and intuitive way to manage the device. Nevertheless, impairments or unwanted behaviour may occur.

- One potential error source is the browser cache, especially if several devices are operated with the same IP address or after an update has been applied. To eliminate this error source, first terminate the web

session by using the **Logout** button and then completely reload the website. Depending on the browser, this is initiated using a shortcut, e. g. ⟨**CTRL+F5**⟩ or ⟨**CTRL+R**⟩.

4.12.1 Website or front end cannot be accessed

The website cannot be loaded or the error message „webservice not available“ appears.

Please check whether the device is listed in the Netdiscover tool (see Chapter 3). Please check the connectivity in general via a ping test integrated in the Netdiscover tool.

Please check whether a firewall is blocking the data transmission or whether the routing is configured accordingly. Please ask your administrator.

In the case of an HTTPS connection, the browser may block the access under certain circumstances. Please confirm the provided certificate in the browser or „trust“ the website and its certificate if you are sure to access the correct device.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

4.12.2 Login to website is refused

Please check the user settings and permissions for the website as well as the user credentials.

There may be another user already logged in while the number of active sessions is limited. Then the login is denied. Please check the user credentials and the number of active sessions in the ***User*** tab.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

4.12.3 All input fields or buttons are greyed out

Buttons greyed out are indicating that write permission is not granted. Please note that only one logged in user gets write access.

Please check whether another session is already active. This can also occur if a browser window is just closed without logging out first. The session is then still active for a short time. Please log out again and wait about one minute. Please check the user's permissions and the number of active sessions in the ***User*** tab.

Please check whether the user has write permissions.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

4.12.4 Not all tabs are visible

Please check the user's read permissions. Only those tabs are available with granted read permission to the user. Please check the user's permissions in the ***User*** tab.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

5 Reading meters via M-Bus

5.1 General information

A widely used interface for the automated meter reading is the wired M-Bus (Meter-Bus). This was originally specified in EN 1434-3. It was then moved to a separate standard EN 13757:

- EN 13757-2 Communication systems for meters - Part 2: Wired M-Bus communication
- EN 13757-3 Communication systems for meters - Part 3: Application protocols
- EN 13757-7 Communication systems for meters - Part 7: Transport and security services

Originally developed for heat meters, the M-Bus is now available for all types of consumption meters as well as sensors and actuators. Thus, it is very important for reading out consumption data.

Fundamental features and advantages of the M-Bus are:

- The M-Bus is a digital interface for the electronic meter reading.
- All consumption meters in a building/property can be operated and read via a single cable.
- All consumption meters are individually addressable.
- The readout is protected against transmission errors and is very robust.
- The data is machine-readable and therefore easy to process.
- The data is self-describing.
- High readout rates are possible.
- The M-Bus is manufacturer independent, there is a wide range of devices.

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.

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):

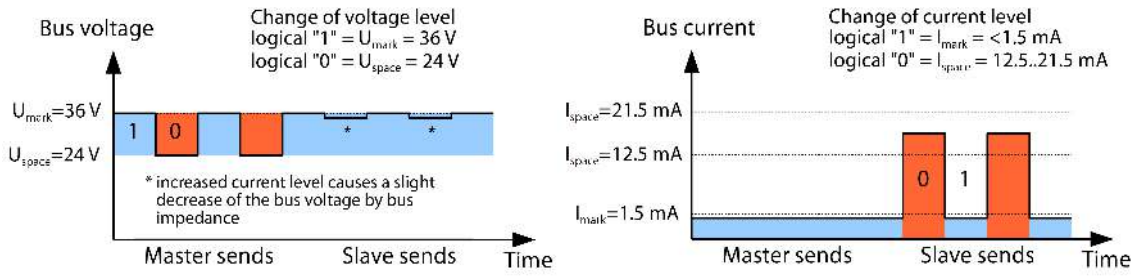


Figure 26: Signalling on the M-Bus

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
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 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 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 range 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.
Unit 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 unit load (see above)

Table 21: M-Bus specific terms

5.3 Configuration of the interface on the web-based front end

5.3.1 M-Bus mode

The parameter **M-Bus mode** in the ***Configuration*** tab activates the M-Bus interface and defines the fundamental functionality. The following modes are available:

- *Disabled*
- *Master*
- *Transparent/TCP*
- *Transparent/UDP*
- *Master & Transparent/TCP*

The *Transparent* modes allow the access to the physics of the M-Bus interface via a TCP or UDP port. The data stream is forwarded from the M-Bus interface to an IP interface (network (LAN) or cellular radio (WAN)).

The device then works in a way similar to an Ethernet-M-Bus converter or even to a cellular router with an M-Bus interface. The network port to be used is defined in the parameter **M-Bus transparent port**.

- The transparent mode allows direct communication with meters via the M-Bus interface. This requires appropriate M-Bus software on the control system (host system). The device provides the physical connection. This allows to transfer any kind of data with the meter and to use manufacturer specific protocols.

The mode *Master & Transparent/TCP* allows a combination of the transparent transmission and the Master capability of the device. In the absence of a client to a transparent TCP port, the M-Bus master uses the interface and reads out the meters according to the configuration in the mode *Master*. Once a client connects to the TCP port, it gets exclusive access to the interface as in the mode *Transparent/TCP*. A readout of meters or a scan of the M-Bus by the device is not possible as long as a client is connected. A readout fails if configured in this time. Once the client disrupts the connection, the interface is once again run by the M-Bus master, and meters are read out. An inactive connection to the transparent port is closed after 60 seconds in order to rule out a jamming of the M-Bus by open connections. In this mode, a client should assure that the connection is unblocked after usage. As an initiated readout of a meter is first completed upon connection by a client, a larger timeout is recommended for the first communication by the client when establishing the connection ($\geq$5 seconds).

5.3.2 Addressing, scanning and scan range

The M-Bus differentiates between primary addressing and secondary addressing. The M-Bus interface allows also mixed addressing. Meters can be searched first using primary addressing, and a subsequent scan can detect meters using secondary addressing.

The primary address is used for access control on link layer level. It is the basis of communication between master and slaves on the M-Bus and is used for communication in every telegram except the single character frame. The secondary address is an extension of the addressing and additionally controls the access on application layer level.

The valid address range for the primary addresses is 0-250, whereby the address *0* is a special case. According to the standard, only unconfigured meters (ex works) are allowed to have it. The address *253* is a special address used for the secondary addressing, the addresses *254* and *255* are used for the broadcast with and without response. The addresses *251* and *252* are reserved.

The secondary address consists of 4 parts. These are the *secondary ID* (an 8-digit decimal number), the *manufacturer ID* (value of 0-65535), the *medium ID* (value of 0-255), and the *version number* (value of 0-255). Thus, the address space includes theoretically $115.19*10^{15}$ unique values.

- The *manufacturer ID* can be converted to a manufacturer code maintained by the *DLMS User Association*. An overview can be found here: www.dlms.com/flag-id/flag-id-list

In case of primary addressing, this slave responds whose primary address matches the address in the request. This allows a simple and quick communication.

- If the primary address is not unique, primary addressing will cause collisions and communication may be disturbed. Several slaves are then responding at the same time.

Secondary addressing, on the other hand, uses a so-called selection (slave select) on the basis of the secondary address. This selection allows addressing of a meter with a matching secondary via the primary address *253*. The non-matching meters are deselected in the same step. Therefore, the process is more complex since a selection with confirmation is required additonally. Communication takes a longer time. However, the address space is much larger. Collisions do not occur, and more than 250 meters can be addressed on one bus system. In addition, commissioning is faster because not every meter has to be configured to a unique primary address.

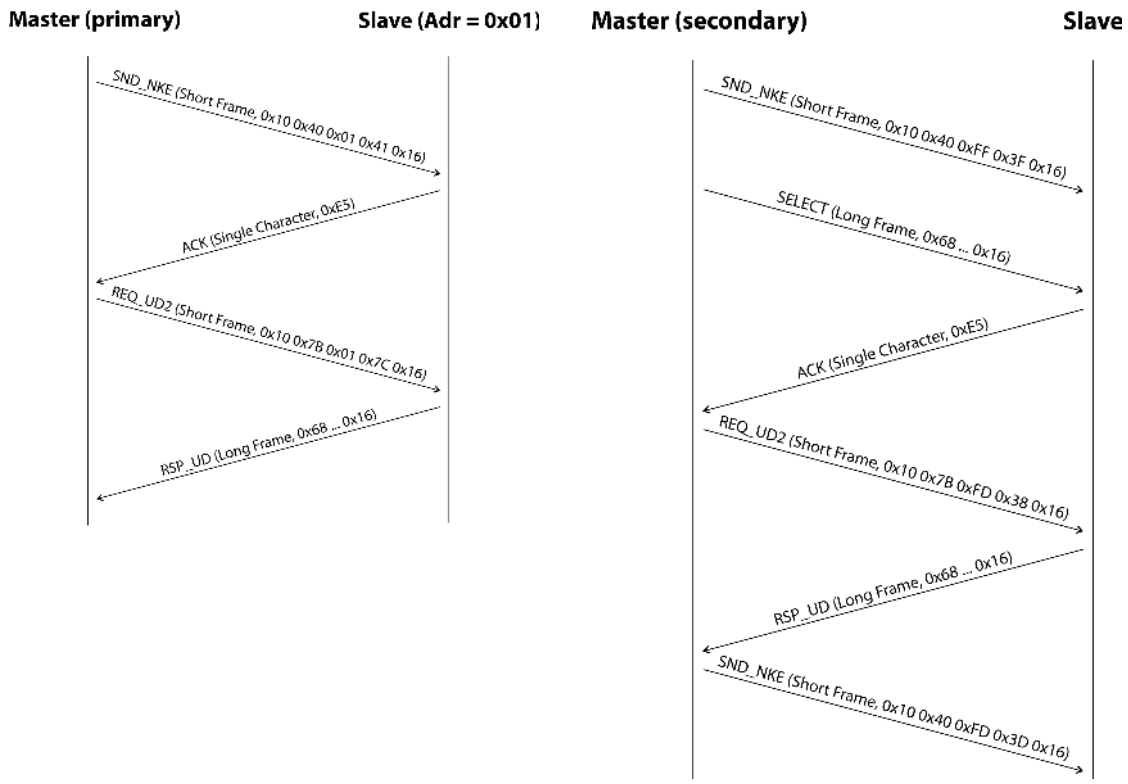


Figure 27: Example of primary and secondary addressing in comparison

Secondary addressing is supporting wildcards. For example, this allows using the 8-digit *secondary ID* for selection only. The other parts are masked with the placeholder 0xFF (255) or 0xFFFF (65535). Individual digits of the *secondary ID* can be masked with 0xF (16) as well.

- The M-Bus uses the BCD notation for the *secondary ID*. The 8-digit decimal number is encoded by an 8-digit hexadecimal number. Per each digit the characters A-F can be mapped to special features, but only the *F* is used as a placeholder at the respective digit.

The placeholders are the basis of the secondary scan. This divides the secondary address space piece by piece using the placeholders and checks whether there are meters in the respective part. If so, this part is further subdivided until there is at most only one meter per part or further subdivision is not possible. The common procedure here is to mask the *manufacturer ID*, *medium ID* and *version number* and to scan the 8-digit number range of the *secondary ID* only.

The range 00000000-99999999 is divided by sending the selection to *0FFFFFFF*, i. e. selecting all meters with a *0* at the first digit of the *secondary ID*. A request is then sent to the selected meters using the primary address *253*. If no response is received, no meter is in this range. So, the least significant, unmasked digit can then be incremented and the process continues with *1FFFFFFF*. If you get an undisturbed response, there is only one meter in this range. This meter is found here and could be registered. The process will then continue with the next step by incrementing the least significant, unmasked digit. If a disturbed response or collision is received, the process switches to the next, still masked digit and runs it from *0* to *9*. It is difficult to estimate what time a secondary scan will take in advance. There is a variability of the process depending on the meters and the distribution of the *secondary ID* in the address space.

Primary scan, in contrast, is very direct and determinate. Every primary address is requested and depending on a valid answer a meter is then registered or not. Thus, 250 requests are always necessary for a complete scan.

The parameter **Primary start address** and **Primary final address** in the ***Configuration*** tab limit the primary scan by specifying the start and end. The parameter **Secondary address mask** is used to mask the *secondary ID* for limiting the scan to a certain address range. For example, a mask *33FFFFFF* limits the scan to all meters having a *secondary ID* starting with *33*.

5.3.3 M-Bus baud rate

The parameter **M-Bus baud rate** in the ***Configuration*** tab is used to configure the bit presentation on the M-Bus interface. The baud rate essentially determines the speed of the data transmission.

- M-Bus usually uses 2400 bps. Other common baud rates are 300 bps and 9600 bps. Many meters detect the baud rate automatically.
- The other parameters for the bit presentation on the M-Bus interface are fixed to 8 data bits, even parity and 1 stop bit (8-E-1).

5.3.4 M-Bus timeouts

The M-Bus interface comes with three different timeouts: **M-Bus timeout**, **M-Bus idle timeout** as well as **M-Bus full timeout** (in transparent mode **M-Bus idle timeout** only). These can be parameterized in the ***Configuration*** tab.

The **M-Bus idle timeout** specifies how long the M-Bus interface must be „idle“, i. e. no data is sent/received, for detecting the end of a telegram (end of communication). It is mainly used for framing the packets of the M-Bus data stream, i. e. the assignment of incoming data to a logical unit (data packet).

The **M-Bus timeout** specifies how long the device is waiting for a response from the meter. If no data is received within this time after the request, the readout attempt is aborted.

The **M-Bus full timeout** specifies how long the device will accept incoming data. The reception is then aborted and the data is processed. This parameter also terminates reception if the **M-Bus idle timeout** is not reached because data is continuously received (without idle state, e. g. in case of faults).

5.3.5 M-Bus request mode

By default, the command REQ_UD2 is send from the master to the meter for reding it out. This is answered by the meter with the RSP_UD, which usually contains the meter data (consumption data).

In addition, the parameter **M-Bus request mode** in the ***Configuration*** tab can be used to explicitly define the requested data before the actual readout. Devices from solvimus GmbH can send a so-called global readout request to the meter before the actual request. A SND_UD is sent to the meter for this purpose. The user data then consists of only one or two characters. There are two implementations with the same functionality, depending on the manufacturer one or the other is supported:

- User data consisting of 2 Byte: DIF=0x7F, VIF=0x7E → **M-Bus request mode** *Extended 1*
- User data consisting of 1 Byte: DIF=0x7F → **M-Bus request mode** *Extended 2*

- This command is usually not necessary, because all meter values are transmitted by default using the normal request.
- Using this functionality may cause a change in the structure of the meter data.

5.3.6 M-Bus reset mode

The M-Bus there uses different variants and applications of a reset. A distinction is made between:

- Link layer reset → SND_NKE
- Application layer reset → Application reset using SND_UD

According to EN 13757, the link layer reset is only used for initializing the communication sequence on the link layer. Therefore, it resets the selection based on the secondary address, deselects the meter, and also resets the FCB mechanism (see Section 5.3.7).

The application layer reset, on the other hand, resets the application in the meter (or its communication application).

The parameter **M-Bus reset mode** in the ***Configuration*** tab can be used to select the variants and addressing of the resets. The resets are then sent at the beginning of a scan procedure and before each readout of a meter:

- *None*: Neither a link layer reset nor an application layer reset is sent.
- *Standard*: A link layer reset is sent to the broadcast address 0xFF and, in the case of primary addressing, also to the respective primary address.

- *Extended 1*: A link layer reset is explicitly sent to the selection address 0xFD before the link layer resets of the *Standard* mode.
- *Extended 2*: After the link layer reset to the selection address 0xFD, an application layer reset is sent to the broadcast address 0xFF. This is followed by the link layer resets of the *Standard* mode.

5.3.7 M-Bus multipaging

If the data of a meter do not fit into a single telegram (maximum 255 bytes user data), there is the possibility to split these data into several logically related, consecutive telegrams. The FCB mechanism according to IEC 60870-5-2 is used by the readout sequence. The solvimus GmbH calls this process „multipaging“.

In order to request possibly existing telegrams from the meter, the master has to toggle the FCB with each new request REQ_UD2. The meter then replies with the next telegram. If the master does not toggle the FCB, the meter will always respond with the same telegram again. The REQ_UD2 then alternately have a C field of 0x5B or 0x7B.

The parameter **M-Bus max. multipage** in the ***Configuration*** tab restricts the maximum number of consecutively requested telegrams. Especially in the case of meters having a lot of data (e. g. load profiles, due date records), the readout time can be shortened, and less relevant values are not read out at all.

- For most applications, it is sufficient to use the first telegram of the telegram sequence.
- The M-Bus does not provide a mandatory mechanism to directly access certain telegrams of the sequence. As a rule, the procedure always starts from the first telegram. At least all relevant telegrams have to be requested then.
- An „Application reset“ send to the meter reset the sequence to the first telegram.

5.4 Troubleshooting the M-Bus

5.4.1 Physical troubleshooting

In order to determine why meters on the M-Bus do not respond or are not found during the scan, it is recommended to check the M-Bus network physically. It is relatively easy to determine fundamental parameters, e. g. whether the M-Bus is at least correctly wired.

A standard multimeter is sufficient for simple measurements. The most important measurement is the voltage measurement between both M-Bus wires. The voltage measurement shows that:

- the M-Bus-Master correctly supplies the Bus: approx. 30-40 V are present
- the meter is correctly connected to the M-Bus: approx. 30-40 V are present
- the voltage drop is not too high: the voltage at the master is only slightly higher than at the meter
- the telegrams of the master are received at the meter: when master is sending, the value in the display of the multimeter „wobbles“

Another important measurement is the current measurement on the two M-Bus wires. The current measurement shows that:

- the load on the M-Bus is in a valid range: approx. (number of meters)*1.5 mA are flowing
- no external currents are present: current through both lines is identical
- the telegrams of the meter are received at the master: when meter is responding, the value in the display of the multimeter „wobbles“

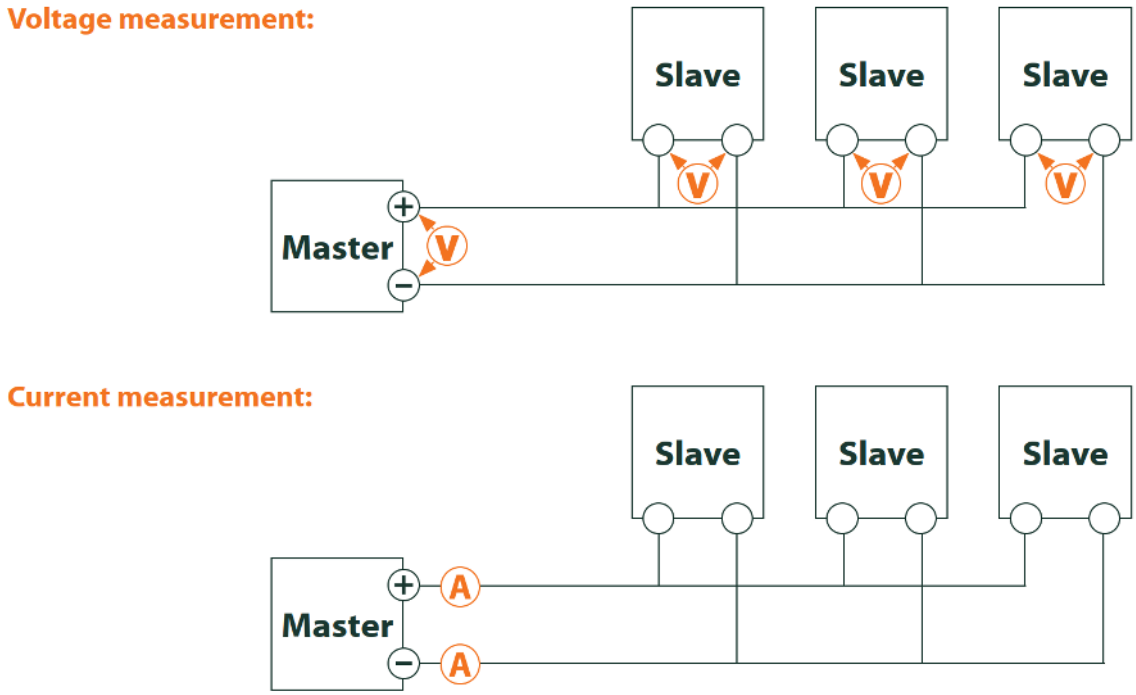


Figure 28: Troubleshooting the M-Bus by measurements with a multimeter

5.4.2 M-Bus meters are not found

Check the cables between the device and the meter, and replace faulty cables if necessary. While the device is switched on, please measure the M-Bus voltage (approx. 30-40 V) between the two M-Bus contacts at the device and also at the meter.

Ensure that the M-Bus interface is activated via the parameter **M-Bus mode** on the the web-based front end in the ***Configuration*** tab and that the scan mode configured therein (secondary or primary) is supported by the meter(s).

Please use an address mask or restrict the range for scanning the M-Bus step by step (e. g. **Primary start address**, **Secondary address mask**).

Additionally, the M-Bus requests can be adapted using the following parameters:

- **M-Bus request mode**
- **M-Bus reset mode**

Please scan again with different M-Bus baud rates (300, 2400 or 9600) or increase the timeouts.

Please remove other meters (if any) to eliminate a possible source of failure.

If another M-Bus meter (possibly of the same type) is available, you can perform another communication test with the other meter to localize the source of failure.

The number of attempts for an M-Bus request can also be increased. The extended configuration of the device in the file *app/chip.ini* (see Section 8.2) offers the parameter **MBUS_MAXRETRY**. This helps to find meters that do not answer every request. The default value here is 3. Please start the scan again.

If the same primary or secondary addresses are present more than once during the scan procedure, collisions can occur. Duplicated addresses are common when using primary addressing, especially in new installations. Therefore we are recommending secondary addressing. In this case collisions can occur as well, but are very unlikely. Due to the default value of the parameter **MBUS_SELECTMASK**=*14* (see Section 8.2), only the 8-digit serial number is searched for during the scan. It can be extened to the manufacturer, medium and version of the meter using other values for **MBUS_SELECTMASK**.

Please activate the raw data log by using **Raw data log** in the ***Configuration*** tab (see Section 4.4). The communication process can be analyzed very well using this raw data log.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

5.4.3 M-Bus meters are found, but do not show any data

Some meters are sending incorrect secondary address or encryption information in the data telegram. As a result, they may not be addressable for readout or may be processed incorrectly.

The parameter **MBUS_SELECTMASK** (see Section 8.2) can be used for masking the invalid parts of the secondary address. The parameter **MBUS_DISABLEDECRYPTION**=*1* (see Section 8.2) can be used to disable the uncommon decryption of M-Bus telegrams if they pretend to be encrypted.

Please restart the scan or start a readout.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

5.4.4 The scan takes a long time

The scanning for M-Bus meters can take a long time under certain circumstances. A duration of more than 1 hour is possible, especially when scanning for secondary addresses of meters with consecutive serial numbers.

Use an address mask or restrict the range for scanning the M-Bus step by step (e. g. **Primary start address**, **Secondary address mask**).

Decrease the value of the parameter **MBUS_MAXRETRY** in the device configuration file *app/chip.ini* (see Section 8.2) or decrease the timeouts.

Use a different scan mode in the ***Configuration*** tab (see Section 4.4). In particular, the reverse secondary scan *Secondary scan reverse* may help in this case. Please start the scan again.

In the event of interference on the M-Bus, long scan times may also occur. Interference may be processed as a received packet and thus a meter is assumed to be present in each single step.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

5.4.5 Device restarts during scan

For safety reasons, the device uses an internal watchdog, which is intended to prevent the device from becoming unreachable. If the scan takes a very long time, this watchdog may cause the device to restart. If the scan takes a long time, it is recommended to increase the value of the parameter **WATCHDOG_SCAN** in the file *app/chip.ini* (see Section 8.2). Please start the scan again.

There may also be heavy collisions on the bus under certain circumstances, e. g. if all meters are responding at the same time. In exceptional cases, these heavy collisions and the associated large increase in current may cause the device to restart. Please use an address mask or restrict the range for scanning the M-Bus step by step (e. g. **Primary start address**, **Secondary address mask**). If necessary, split the M-bus into physical parts and scan the sections one after another.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

6 Reading meters via wM-Bus

6.1 General information

A widely used interface for the automated meter reading is the wireless M-Bus (wM-Bus, wireless M-Bus, wireless Meter-Bus). Like the wired M-Bus, it is specified in EN 13757 series:

- EN 13757-4 Communication systems for meters - Part 2: Wireless M-Bus communication
- EN 13757-3 Communication systems for meters - Part 3: Application protocols
- EN 13757-7 Communication systems for meters - Part 7: Transport and security services

The wM-Bus is the extension of the M-Bus for using a radio system. Protocol and mechanisms are therefore very similar, deviations are coming from the specialities of radio. Thus, it is very important for reading out consumption data.

Fundamental features and advantages of the wM-Bus are:

- The wM-Bus is a digital interface for the electronic meter reading.
- All consumption meters are having a unique identifier.
- The readout is protected against transmission errors and is very robust.
- The data is machine-readable and therefore easy to process.
- The data is self-describing.
- High readout rates are possible.
- The wM-Bus is manufacturer independent, there is a wide range of devices.
- The data can be encrypted and is protected against replay attacks.
- The used frequency of 868 MHz offers sufficient coverage in the building at low transmission power.
- Repeaters can be used to extend the radio network.

6.2 Signalling of the wM-Bus

The wM-Bus is a radio system that operates mainly in the SRD band at 868 MHz. Other frequencies, such as 433 MHz or 169 MHz are also defined. The used and allowed frequency differs between continents and countries.

Technically, the wM-bus uses frequency modulation (FSK). The physical parameters and the modulation type depend on the mode of the wM-bus. There are different modes:

- *S-Mode*: Stationary mode: Mode originally intended for fixed installations, declining importance
- *T-Mode*: Frequent transmit mode: Mode originally intended for walk-by application, frequently used
- *R-Mode*: Frequent receive mode: Special mode for receiving on multiple radio channels simultaneously
- *C-Mode*: Compact mode: Energy-optimized variant similar to T-mode, growing importance
- *N-Mode*: Narrowband VHF: Special mode for the using 169 MHz
- *F-Mode*: Frequent receive and transmit mode: Special mode for using 433 MHz

The modes S, T, C and N are defined as unidirectional (e. g. S1 or T1) as well as bidirectional (e. g. S2 or T2). The R and F modes are always bidirectional. In the context of the meter interface, unidirectional means that the meter only transmits and does not receive data. Therefore, no data can be sent to the meter. In case of bidirectional communication and for saving the battery, the meter's time slot for receiving data is open only for a very short time after it has sent a telegram. The other side hase then to respond within this very short time to keep the receiver active, otherwise it will be switched off again.

The devices of solvimus GmbH are intended for unidirectional operation and are therefore only used to receive meter data.

6.3 Configuration of the interface on the web-based front end

The parameter **wM-Bus mode** in the ***Configuration*** tab activates the wM-Bus interface and defines the fundamental functionality:

- *Disabled*
- *T-Mode*
- *S-Mode*
- *C-Mode*
- *C/T-Mode*

The parameter **wM-Bus transparent mode** in the ***Configuration*** tab activates the *Transparent* modes of the wM-Bus interface:

- *Disabled*
- *Transparent/TCP*
- *Transparent/UDP*

After configuration of the mode, the transmission will be transparent. These *Transparent* modes allow the access to the physics of the wM-Bus interface via a TCP or UDP port. The data stream is forwarded from the wM-Bus interface to an IP interface (network (LAN) or cellular radio (WAN)). The device then works in a way similar to an Ethernet-wM-Bus converter or even to a cellular router with a wM-Bus interface. The network port to be used is defined in the parameter **wM-Bus transparent port**.

✔ The transparent mode allows direct communication with meters via the wM-Bus interface. This requires appropriate wM-Bus software on the control system (host system). The device provides the physical connection. This allows to transfer any kind of data with the meter and to use manufacturer specific protocols.

This also holds for a second wM-Bus interface if the device offers this interface.

6.4 Troubleshooting the wM-Bus

6.4.1 wM-Bus meters are not found

Please make sure that the wM-Bus interface is configured for T-, C-, C/T- or S-Mode according to the configuration of the meter. Set it correctly by using the parameter **wM-Bus mode** on the web-based front end in the ***Configuration*** tab (see Section 4.4).

Test the connectivity at a short distance. Position the meter at a distance of about 1 m from the device for a conenctivity test.

Check the internal configuration of the meter (e. g. transmission mode, transmission interval). Check the antenna connection and the position of the antenna.

Check whether the parameter **wM-Bus listen** in the ***Configuration*** tab is active. If not, no new meters are added to the list.

If another wM-Bus meter is available, you can use this meter for the communication test, possibly with a different communication mode. This helps to identify the source of failure.

Please activate the raw data log using the parameter **Raw data log** in the ***Configuration*** tab. The communication process can be analyzed very well using this raw data log.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

6.4.2 wM-Bus meters are found, but do not show any data

In most cases, this happens when the transmitted meter data is encrypted. Please check whether encryption is active in the meter and whether the entered key is correct. For entering the key, navigate to the ***Meter*** tab and enter the correct key there (column *Encryption key*, see Section 4.3).

If errors could not be eliminated, please contact our customer support (see Chapter 9).

7 Reporting of metering data

7.1 General information

Regarding the transmission of metering data to third-party systems such as meter data management, energy management or monitoring systems, a fundamental distinction is made between actively sending data, the data push, and data is getting fetched, the data pull.

Using the client-server model, in the case of data push the device from solvimus GmbH is the client and the third-party system is the server. In the case of the data pull, the device from solvimus GmbH is the server and the third-party system is the client. The client always establishes the connection and controls the data transmission. The server answers the requests and executes the commands of the client.

This chapter describes the data push, which can be configured on the data concentrators of solvimus GmbH in the ***Server*** tab.

The data pull is described separately in Section 2.7.

7.2 Saving meter data for reporting

The tab ***Server*** (see Section 4.6) permits the parameterization of the provision of data to third-party systems. The parameters such as cycle time, data format, mode and others can be set for this report in the ***Server*** tab (see Section 4.6).

- The data is transferred to the internal data structures immediately after readout. An internal storage (e. g. for later forwarding) is not available.
- Only activated values (column *Active* in the ***Meter*** tab) are written to the database. Other values are not available later.

7.3 General settings

Each instance has a parameter set. This can be configured on the web-based front end in the ***Server*** tab. Some parameters are always to be configured, others depend on the set mode.

The following parameters are available and have to be configured for each instance:

- **Report mode**: Sets the operating mode of the respective instance or deactivates it (see also Section 4.6).
- **Report format**: Sets the data format used for the transmission of the respective instance (see also Section 4.6).
- **Report cycle mode**: Format for specifying the report cycle of the respective instance (see also Section 4.6)
- **Report cycle**: Report cycle of the respective instance (see also Section 4.6)
- **Report cycle date (local)**: First report day of the respective instance in case of daily to yearly specification of the report cycle, depending on the interval format the entered month is used, the year is not relevant (see also Section 4.6)
- **Report cycle time (local)**: Report time of the respective instance for daily to annual specification of the report cycle (see also Section 4.6)

7.4 Defined data and file formats

The devices from solvimus GmbH are offering some defined data formats.

7.4.1 XML format

XML is a data stream using so-called tags or markups (entries/elements and attributes) for presenting hierarchically structured data. This data is usually in plain text and therefore readable by both humans and machines.

The XML format is specified as follows:

Entry	Attribute	Description
interface		Contains a complete packet with one or more muc entries.
	MESSAGE_TYPE	Specifies the type/version of the packet: e. g. 1
muc		Contains the data for one respective device with corresponding meter entries.
	MUC_ID	Hexadecimal notation of the serial number of the device (corresponds to the serial number/MAC address on the web-based front end in the ***General*** tab).
	VERSION	Protocol version
	TIMESTAMP	UNIX time (UTC) at time of report
meter		Contains the data for one respective meter with corresponding data entries.
	INTERFACE	Interface of the meter, as number (up to XML-8) or as text (XML-9) 1: S0 2: M-Bus 5: wM-Bus 6: DLDERS 10: System 11: Modbus
	METER_ID	Serial number of the meter
	USER	User-specific description of the meter (column **User label** in ***Meter*** tab)
	MAN	Manufacturer code of the meter
	VER	Version number of the meter
	MED	Medium of the meter, see second column in Table 29
	MED_ID	Medium ID of the meter, see first column in Table 29
data		Contains one or more meter values of the same type in the respective entry items. The values are specified via the attributes.
	OBIS_ID	OBIS code according to OBIS specification, configured via the web-based front end (column **OBIS-ID** in ***Meter*** tab). In version XML-8 the raw DIF/DIFE/VIF/VIFE fields coming from M-Bus/wM-Bus for that meter value are reported here.
	DESCRIPTION	See second column in Table 30
	MEDIUM	Medium of the meter, see second column in Table 29
	UNIT	See second column in Table 31, energy values in Wh are converted to kWh
	SCALE	Signed scaling factor (scientific notation): (scale of the meter) · (User Scale)
	DIF	DIF/DIFE fields from the M-Bus/wM-Bus raw data, in hexadecimal byte notation
	VIF	VIF/VIFE fields from the M-Bus/wM-Bus raw data, in hexadecimal byte notation
	USER	User-specific description of the meter value (column **User label** in ***Meter*** tab)
entry		Data entry consisting of a parameter timestamp (T) and a parameter value (VAL)
param		Contains a parameter item.
	NAME="T"	The associated parameter item represents the UNIX time (UTC) at the time of the measurement, if transmitted by the meter together with the measured value.
	NAME="T_MUC"	The associated parameter item represents the system time of the device at the time of data reception as UNIX time (UTC).
	NAME="VAL"	The associated parameter item represents the received value of the meter value specified in data.

Table 22: Format of XML data

The following table illustrates the protocol version:

Entry	Attribute	XML-8
interface		x
	MESSAGE_TYPE	x
muc		x
	MUC_ID	x
	VERSION	1F9
	TIMESTAMP	x
meter		x
	INTERFACE	Numerisch
	METER_ID	x
	USER	x
	MAN	x
	VER	x
	MED	x
	MED_ID	
data		x
	OBIS_ID	Rohdaten
	DESCRIPTION	x
	MEDIUM	x
	UNIT	x

Continued from previous page

Table 23 – *Continued from previous page*

Entry	Attribute	XML-8
	SCALE	x
	VIF	
	DIF	
	USER	x
entry		x
param		x
	NAME="T"	x
	NAME="T_MUC"	x
	NAME="VAL"	x

Table 23: Data in XML-8

A sample XML packet in version XML-8 looks like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<interface MESSAGE_TYPE="1">
 <muc MUC_ID="6891d0806c4c" VERSION="1F9" TIMESTAMP="592">
 <meter METER_ID="01013362" INTERFACE="2" MAN="ZRI" VER="136" MED="Water">
 <data DESCRIPTION="Fabrication" UNIT="None" SCALE="1" MEDIUM="Water"  OBIS_ID="0C 78">
 <entry>
 <param NAME="T_MUC">586</param>
 <param NAME="VAL">33013362</param>
 </entry>
 </data>
 <data DESCRIPTION="Volume" UNIT="m^3" SCALE="0.001" MEDIUM="Water"  OBIS_ID="04 13">
 <entry>
 <param NAME="T_MUC">586</param>
 <param NAME="VAL">3611318</param>
 </entry>
 </data>
...
 </meter>
...
 </muc>
</interface>
```

7.4.2 CSV format

Several CSV formats are available for transmission of raw frames. CSV is a table-like file format which uses a character, solvimus GmbH uses a semicolon „;“ (in **CSV-10** a comma), for separating numerical values and texts (columns) from each other. This allows easy processing or viewing e. g. in Excel.

The first line in the file (in all protocol versions except **CSV-0** and **CSV-1**) specifies the column heading. The following lines contain the data of the meters and its meter values at a particular readout time.

The CSV data has the following format:

Column heading	Description
Information related to meters	
Index	Indexes the different meters within a CSV file
Timestamp	System time of the device at the time of data reception as UNIX time (UTC) or in readable format
DeviceId	ID of the meter, consisting of manufacturer code, serial number, version number and medium ID
Link	Primary address of the meter for M-Bus or reception quality (RSSI, in steps of -0.5 dBm) for wM-Bus
User	User-specific description of the meter (column **User label** in ***Meter*** tab)
METER_ADDRESS	ID of the meter, composed of manufacturer code, serial number, version number and media type
READING_DATE	Unix timestamp (UTC) or readable time of the device at the instant of the readout
RAW_TELEGRAM	Telegram
Information related to meter values	
IndexX	Indexes the different meter values of a meter
ValueX	Meter value

Continued on next page

Table 24 – *Continued from previous page*

Column heading	Description
ScaleX	Signed scaling factor (scientific notation): (scale of the meter) · (User Scale)
UnitX	See second column in Table 31
DescriptionX	See second column in Table 30
UserX	User-specific description of the meter value (column **User label** in ***Meter*** tab)
TimestampX	The timestamp transmitted by the meter (UNIX time (UTC) or in readable format), or 0 if not available
ObisidX	OBIS-ID (column **OBIS-ID** in ***Meter*** tab)

Table 24: CSV format

The first columns of each line contain data of the meter, including the meter identification (address) and the time at which the data was read out. The other columns are added dynamically according to the configured meters and number of meter values, whereby the meter values are inserted by counting from 0 (e. g. Value0).

The following table illustrates the different protocol versions:

Column	CSV-0	CSV-1	CSV-3	CSV-4	CSV-5	CSV-6	CSV-9	CSV-10
Index						x	x	
Timestamp	Unix	Unix	Unix	Unix	Unix	Unix	Klartext	
DeviceId	x	x	x	x	x	x	x	
Link				x	x	x	x	
User					x	x	x	
METER_ADDRESS								x
READING_DATE								x
RAW_TELEGRAM								x
IndexX						x	x	
ValueX	x	x	x	x	x	x	x*	
ScaleX	x	x	x	x	x	x		
UnitX	x	x	x	x	x	x	x	
DescriptionX	x	x	x	x	x	x	x	
UserX			x	x	x	x	x	
TimestampX			Unix	Unix	Unix	Unix	Klartext	
ObisIdX		x	x	x	x	x	x	

* (meter value) · (scale of the meter) · (User Scale)

Table 25: Data in different CSV versions

A sample CSV file in version **CSV-3** is shown in the following figure:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Timestamp	DeviceId	Value0	Scale0	Unit0	Description0	User0	Timestamp0	ObisId0	Value1	Scale1	Unit1	Description1
2	1370135021	EMU-000238	987	1,00E+00	Wh	Energy		0					
3	1370135025	EMH-003898	18354	1,00E+00	h	On Time		1339357800		24214	1,00E+01	Wh	Energy
4	1370135028	ZRM-314040	90	1,00E-03	m^3	Volume	label5	1369836720		1943	1,00E-02	Grad C	Flow Tempe
5	1370135030	LUG-6666020	436	1,00E+03	Wh	Energy	label 1	1370141940	1-0:0.0.0*0	650	1,00E-03	m^3/h	Volume Flov
6	1370135031		245	1,00E-03	m^3			0	0-2:2.0.0*0				
7	1370200016	EMU-000238	987	1,00E+00	Wh	Energy		0					
8	1370200020	EMH-003898	18373	1,00E+00	h	On Time		1339422780		24228	1,00E+01	Wh	Energy
9	1370200022	ZRM-314040	90	1,00E-03	m^3	Volume	label5	1369901700		1945	1,00E-02	Grad C	Flow Tempe
10	1370200025	LUG-6666020	436	1,00E+03	Wh	Energy	label 1	1370206920	1-0:0.0.0*0	650	1,00E-03	m^3/h	Volume Flov
11	1370200026		245	1,00E-03	m^3			0	0-2:2.0.0*0				
12													
13													

Figure 29: Excerpt of a CSV file

The transmission of data in the **CSV-10** format requires setting in the device configuration file *app/chip.ini* (see Section 8.2) that the frames of the meters are joined to the data by defining the configuration parameter *MUC_SHOWDATAFRAME=1*. If the meters had been created before, the values of the frames must be activated subsequently. A sample data set in **CSV-10** format is given here (long lines are wrapped):

METER_ADDRESS, READING_DATE, RAW_TELEGRAM
15686402,13:45:56 23/07/2021,4544B4090264681509077A3D2000000C13420100000F1B2C16870111201623
07210E00000E00000E00000E00000E00000E00000E00000E00000E00000E00000E000000
00000048,13:46:54 23/07/2021,1E44B05C48000000011B7AA20000002F2F0A66310202FD971D00002F2F2F2F

7.4.3 JSON format

One JSON format is available for the reports. JSON is a compact, serialized data stream for representing structured data. This data is usually readable by both humans and machines and separated by delimiters.

Object	Property	Data type	Description
muc		Object	Contains the data for one respective device with corresponding meter entries.
	MUC_ID	String	Hexadecimal notation of the serial number of the device (corresponds to the serial number/MAC address on the web-based front end in the ***General*** tab).
	VERSION	String	Protocol version
	TIMESTAMP	Integer	UNIX time (UTC) at time of report
	meter	Array	Array of meter objects
meter		Object	Contains the data for one respective meter with corresponding data entries.
	METER_ID	String	Serial number of the meter
	INTERFACE	String	Interface of the meter S0 MBus wMBus DLDERS System Modbus
	MAN	String	Manufacturer code of the meter
	VER	String	Version number of the meter
	MED	String	Medium of the meter, see second column in Table 29
	MED_ID	String	Medium ID of the meter, see first column in Table 29
	USER	String	User-specific description of the meter (column **User label** in ***Meter*** tab)
	data	Array	Array of data objects
data		Object	Contains the data for one respective meter value with the corresponding entries.
	DESCRIPTION	String	See second column in Table 30
	UNIT	String	See second column in Table 31, energy values in Wh are converted to kWh
	SCALE	String	Signed scaling factor (in decimal form): (scale of the meter) · (User Scale)
	OBIS_ID	String	OBIS code according to OBIS specification, configured via the web-based front end (column **OBIS-ID** in ***Meter*** tab).
	USER	String	User-specific description of the meter value (column **User label** in ***Meter*** tab)
	DIF	String	DIF/DIFE fields from the M-Bus/wM-Bus raw data, in hexadecimal byte notation
	VIF	String	VIF/VIFE fields from the M-Bus/wM-Bus raw data, in hexadecimal byte notation
	entry	Array	Array of entry objects
entry		Object	Data entry consisting of a parameter timestamp (T) and a parameter value (VAL)
	T_MUC	Integer	System time of the device at the time of data reception as UNIX time (UTC)
	T	Integer	UNIX time (UTC) at the time of the measurement, if transmitted by the meter together with the measured value
	VAL	String	Value of the meter value specified in data

Table 26: Format of the JSON data

A sample JSON packet looks like this (line feeds are inserted for better illustration):


```
{"muc":{ "MUC_ID":"6891d0800e62","VERSION":"1","TIMESTAMP":1601297784,"meter":[
{"METER_ID":"00000001","INTERFACE":"MBus","MAN":"SIE","VER":21,"MED":"Electricity",
"MED_ID":2,"USER":"metering1","data":[
{"DESCRIPTION":"Energy","UNIT":"kWh","SCALE":0.001,"OBIS_ID":"1-0:1.8.0*255",
"USER":"energy3","DIF":"04","VIF":"03","entry":[
{"T_MUC":1601297679,"VAL":"537980"},{"T_MUC":1601297761,"VAL":"537980"},
{"T_MUC":1601297765,"VAL":"537980"},{"T_MUC":1601297770,"VAL":"537980"}]}]},
{"METER_ID":"00094824","INTERFACE":"MBus","MAN":"BEC","VER":32,"MED":"Electricity",
"MED_ID":2,"data":[
{"DESCRIPTION":"Energy","UNIT":"kWh","SCALE":0.01,"DIF":"0E","VIF":"84 00","entry":[
{"T_MUC":1601297679,"VAL":"2887897"},{"T_MUC":1601297761,"VAL":"2887897"},
{"T_MUC":1601297765,"VAL":"2887897"},{"T_MUC":1601297770,"VAL":"2887897"}]},
{"DESCRIPTION":"Power","UNIT":"W","SCALE":0.01,"DIF":"04","VIF":"A9 00","entry":[
{"T_MUC":1601297679,"VAL":"382207"},{"T_MUC":1601297761,"VAL":"382207"},
{"T_MUC":1601297765,"VAL":"382207"},{"T_MUC":1601297770,"VAL":"382207"}]}]}]}}
```

7.5 Reporting data via TCP

A common communication method for transferring data is using TCP packets and their data container. The data is thus sent as a data stream to the remote station, where it is gathered and processed.

Using TCP, the data is transmitted unencrypted. If encryption is necessary, the data should be sent via TLS (see Section 7.6).

Since the systems for the data processing are usually using databases or similar things, data formats which can be processed automatically, such as XML or JSON, are preferred here. But any data format can be transferred.

According to the destination the parameters **Report address**, **Report port** and **Report directory** have to be set. An empty path specified in **Report directory** generates a TCP data stream, a non-empty path generates an HTTP data stream (e. g. /", /upload").

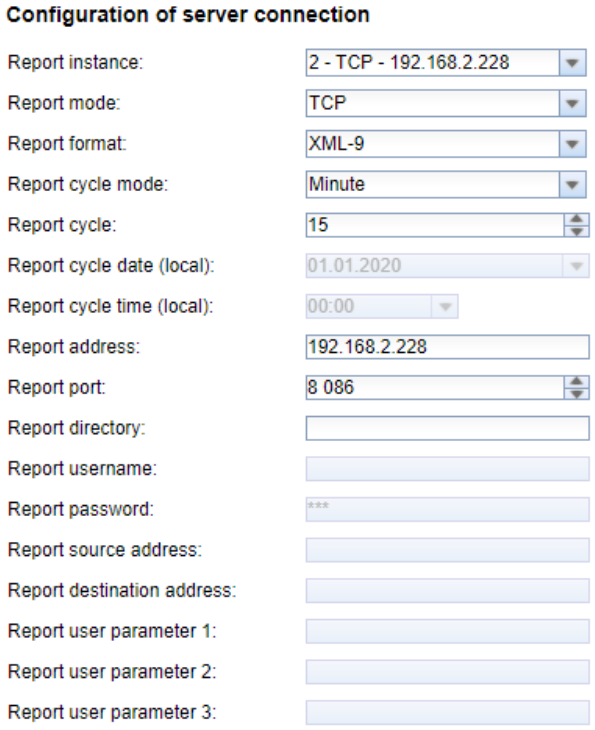


Figure 30: Sample configuration for reporting XML data via TCP every 15 minutes

7.6 Reporting data via TLS

As a rule, transmitting data via an unencrypted TCP connection (see Section 7.5) is not recommended for commercial or industrial applications. Encryption is common here.

Using TLS, the TCP data stream is asymmetrically encrypted. Each participant has both a private key known only to him and a public key known to everyone. Data that is exchanged gets encrypted with the public key of the other participant. The decryption is then performed using the secret private key on the recipient side.

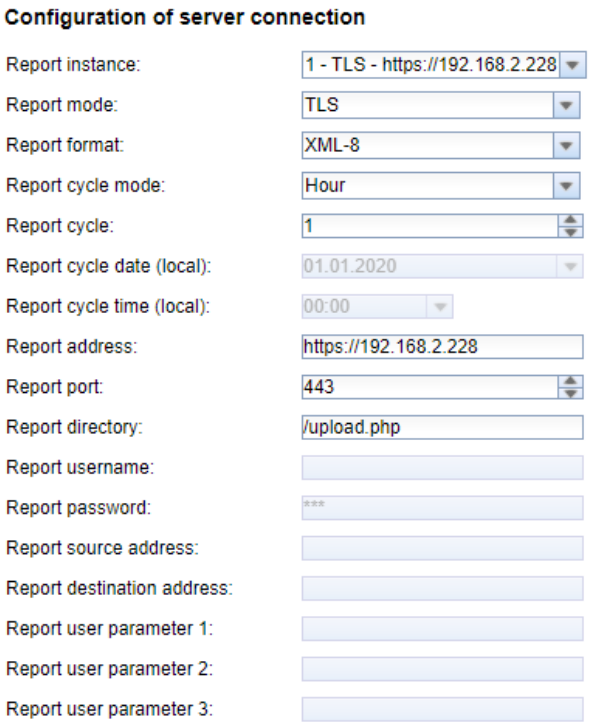


Figure 31: Sample configuration for reporting XML data via TLS every hour

TLS also offers mutual authenticity checks of client and server by means of signed certificates. This provides a very high level of security. A distinction is made between server-side authentication and client-side authentication, depending on which side is authenticating. The products from solvimus GmbH are supporting both variants, also in combination.

- The devices from solvimus GmbH are using certificates in the *PEM* format (RFC 7468).

In the case of server-side authentication, the device from solvimus GmbH checks if the server is trustworthy. This requires an installed certificate (public key) issued by the certification authority to be relied upon, and who has signed the certificate of the server.

- Unless otherwise specified and available, the devices are using *app/cacert.pem* for checking the authenticity of the server (RFC 4945).

In the case of client-side authentication, the client has to authenticate itself. In the case of data concentrators and gateways this means the device itself. This requires an issued certificate and a secret private key.

- Unless otherwise specified and available, the devices are using *app/clicert.pem* as the certificate of the device (RFC 5280).
- Unless otherwise specified and available, the devices are using *app/clikey.pem* as the private key of the device (RFC 5958).

The certificates can be uploaded manually via SFTP (see also Section 3.5). However, it is also possible to import them via the ***Service*** tab (see Section 4.10.2). The files have to be archived into a **.tar.gz* file in this case.

- The free, open source software *7-Zip* can be used for creating a **.tar.gz* archive. As an example, the file *cacert.pem* can first be packed into a **.tar* ball without sub-directory and packed into a **.gz* archive afterwards.

For using individual certificates for each server instance or if the naming or path has to be different, the file app/chip.ini allows to enter other file names and paths manually (see also Section 8.2).

In section *[REPORT_x]* in the file *app/chip.ini* the following parameters are used for assigning *PEM* files to the respective report:

- CA_FILE: the public key of the certification authority matching the server certificate, e. g.: `CA_FILE=app/srv_instance1.pem`
- CERT_FILE: the certificate of the device for the respective report, e. g.: `CERT_FILE=app/dcu.pem`
- KEY_FILE: the private key matching the certificate of the device, e. g.: `KEY_FILE=app/key.pem`

7.7 Reporting data via MQTT

MQTT is a very popular standard in cloud communication, especially for sending data to a cloud system. It is an open network protocol which can be used in M2M communication having potentially high delays and networks which are not continuously available. The TCP ports 1883 and 8883 are reserved for MQTT, the latter for encrypted communication using the TLS protocol.

MQTT differentiates between:

- Publisher: Device or service that sends the data, e. g. a sensor or a data concentrator.
- Subscriber: Device or service that processes the data, e. g. a visualization or a billing software.
- Broker: Central data hub for MQTT, it also manages the network and ensures robustness.

MQTT uses so-called topics to classify messages hierarchically. This can be compared to specifying a path on the file system. The publisher sends data of these topics to the Broker. This then distributes the data to the subscribers.

Certificates must be provided on the device for the encrypted connection via port 8883. Background information can be found in Section 7.6. Please ask your administrator in this case.

✔ Unencrypted MQTT requires the scheme mqtt:// at the beginning of the server address.

7.7.1 Example Azure cloud

For connecting to an Azure cloud, the parameters need to be set as follows:

- **Report address**: Internet address of the Azure cloud server
- **Report directory**: Device ID and topic for the Azure cloud
- **Report user name**: User name for the Azure cloud, usually consisting of internet address, device name and API version
- **Report password**: Password for the Azure cloud, usually a composition of access key, signature and expiration date

The following example should clarify the parameters:

- **Report address**: `SolvimusHub.azure-devices.net`
- **Report directory**: `devices/MUC063C/messages/events`
- **Report user name**: `SolvimusHub.azure-devices.net/MUC063C/?api-version=2018-06-30`
- **Report password**: `SharedAccessSignature sr=SolvimusHub.azure-devices.net%2fdevices%2fMUC063C&sig=rQXaVuN%2bjWqh0vVr9E6ybo7VbMBQ4QQNOidzMtoqI2g%3d&se=1639260907`

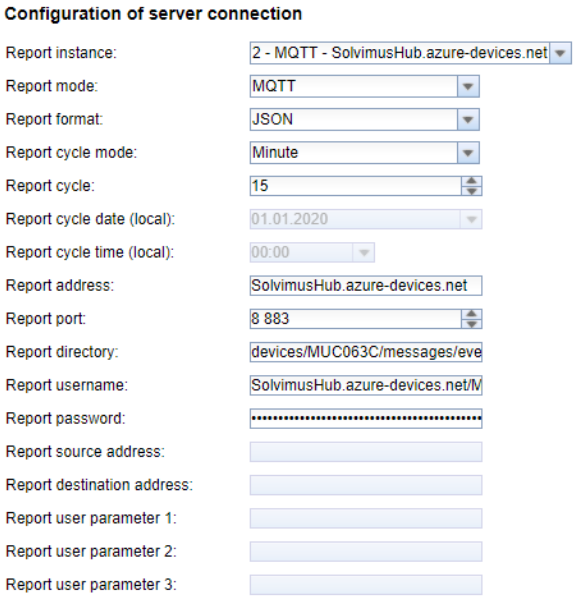


Figure 32: Sample configuration of a report to the Azure cloud

7.7.2 Example AWS cloud

For connecting to an AWS cloud, the parameters need to be set as follows:

- **Report address**: Internet address of the AWS cloud server
- **Report directory**: Device ID and topic for the AWS cloud
- **Report user name**: User name for the AWS cloud
- **Report password**: Password for the AWS cloud

The following example should clarify the parameters:

- **Report address**: `b-fbf31b71-1234-5678-a052-3b5a4fafabcd-1.mq.eu-central-1.amazonaws.com`
- **Report directory**: `demo201909/testing`
- **Report user name**: `demo201909`
- **Report password**: `YXcajMTbZ7WUBzrsst`

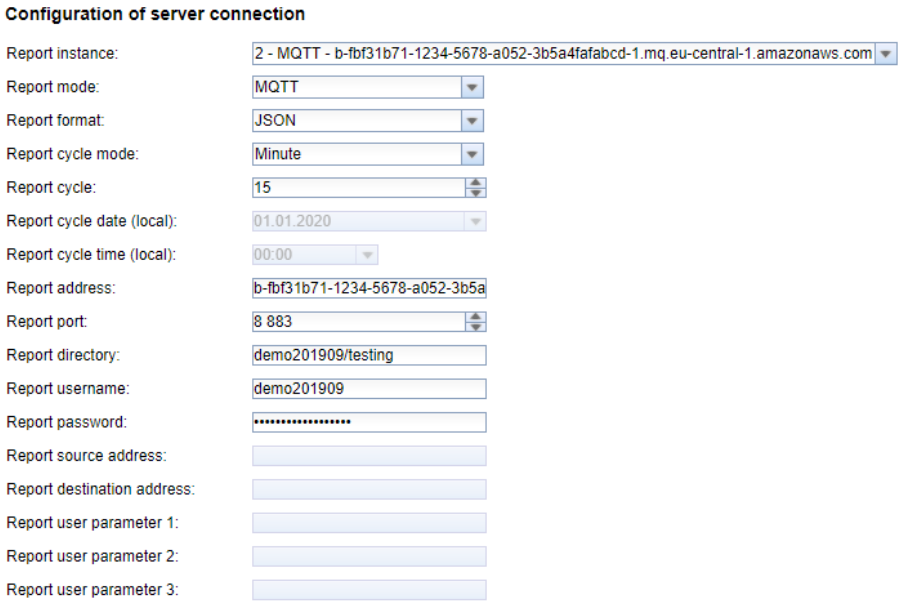


Figure 33: Sample configuration of a report to the AWS cloud

7.8 Troubleshooting the report

Troubleshooting the transfer of metering data is very complex. Typically, connectivity or authentication/encryption are the issues here. Indications of the reason or of the failure can be found in the ***Log*** tab.

Please check whether a firewall blocks the data transmission or whether the routing is configured accordingly. Please ask your administrator in this case.

In the case of TLS encryption, please check whether all necessary certificates are available, especially the CA certificate for the remote station.

Please check the correct setting of **Report username** and **Report password** as well as **Report address**, **Report port** and **Report directory** of the respective instance.

If errors could not be eliminated, please contact our customer support (see Chapter 9).

7.9 Retry of a readout

The default behaviour in case of a failed report is as follows:

- If a report fails, e. g. because there is no connection to internet, it will be resent after 1/10 of **Report cycle time (local)** (see Table 14) or at least 10 minutes. This is reiterated till the report is sent successfully.
- For reports with a time interval according to **Report cycle mode** (see Table 14): The time interval of the report is not modified for the retry. If the connection is perturbed for a longer period, so that another report would have to be sent, it will be queued. It will be transmitted as soon as the original report could be sent. Thus, several reports can be sent consecutively.
- For reports according to *On Readout* for **Report cycle mode** (see Table 14): If several readouts pile up during the pertubation, the time period of the report will be extended. For repeated transmission attempts, the data of the new reports will be contained in the report.

The parameters *RETRY_INTERVAL*, *MIN_SEND_INTERVAL* and *MAX_BACKLOG* in the device configuration file *chip. ini* (see Section 8.2) permit user-specific settings.

8 Advanced configuration options

8.1 Update

The firmware can be updated conveniently via the web interface (see Section 4.10.3).

8.2 Device configuration file chip.ini

The file *app/chip. ini* contains the general system parameters and is therefore the central device configuration file. The parameters are grouped into different sections. If the parameters are not configured in *chip. ini*, the default values are used.

- The device needs to be rebooted after changing the file *chip. ini* manually for taking effect. Reboot can be triggered via the web-based front end using the button **Reboot system** in the ***Service*** tab or via the command line.
- Manual changes are permanently stored on the flash not instantly, but after a few minutes. As a result, changes are possibly lost if the device is rebooted by switching the power supply off and on.
- A range „0, 1“ without further explication means: 0 = inactive/no, and 1 = active/yes.
- The file *chip. ini* can be transferred to other devices via FTPS. Some settings like the network configuration (e. g. different IP address) needs to be taken into account.

Parameter	Description	Range	Standard
Group [IP]			
ADDRESS	IP address of the device	0.0.0.0-255.255.255.255	192.168.1.101 (explicit)
DHCP	Activation of the DHCP client	0, 1	0 (explicit)
DHCP_HOSTNAME	Host name to log on to the DHCP server	Text, max. 255 characters, %SERIAL%: MAC address of the device	Name of the device from group [DEVICE]
GATEWAY	IP address of the gateway	0.0.0.0-255.255.255.255	192.168.1.254 (explicit)
NETMASK	Subnet mask of the device	0.0.0.0-255.255.255.255	255.255.255.0 (explicit)
Group [DEVICE]			
NAME	Name of the device in the tool Netdiscover	Text, max. 50 characters	*Product name* (explicit)
TIMEZONE	Time zone of the device	Text, max. 255 characters	Universal, corresponds to GMT
Group [DNS]			
NAME_SERVER1	IP address of the primary DNS server, IP or host name	Text, max. 255 characters	Not set
NAME_SERVER2	IP address of the secondary DNS server, IP or host name	Text, max. 255 characters	Not set
Group [VPN]			
CONFIGFILE	Path to the client configuration file for OpenVPN	Text, max. 255 characters	vpn/config.ovpn
ENABLE	Activation of the OpenVPN client	0, 1	0
Group [WEB]			
CERT_COMMON_NAME	The fully qualified domain name	Text, max. 255 characters	Not set
CERT_COUNTRY	Country code	Text, max. 255 characters	Not set
CERT_LOCATION	Location/city	Text, max. 255 characters	Not set
CERT_ORGANISATION	Legal name of the organisation	Text, max. 255 characters	Not set
CERT_ORGANISATION_UNIT	Unit/department	Text, max. 255 characters	Not set
CERT_STATE	State or region	Text, max. 255 characters	Not set
HTTP_ENABLE	Activation of the HTTP server	0, 1	0
HTTPS_ENABLE	Activation of the HTTPS server	0, 1	1

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
HTTP_PORT	Network port of the HTTP server	0-65535	80
HTTPS_PORT	Network port of the HTTPS server	0-65535	443
Group [FTP]			
CERT_COMMON_NAME	The fully qualified domain name	Text, max. 255 characters	Not set
CERT_COUNTRY	Country code	Text, max. 255 characters	Not set
CERT_LOCATION	Location/city	Text, max. 255 characters	Not set
CERT_ORGANISATION	Legal name of the organisation	Text, max. 255 characters	Not set
CERT_ORGANISATION_UNIT	Unit/department	Text, max. 255 characters	Not set
CERT_STATE	State or region	Text, max. 255 characters	Not set
ENABLE	Activation of the FTP server	0, 1	1
Group [SSH]			
ENABLE	Activation of the SSH server	0, 1	1
Group [UDPCFG]			
ENABLE	Activation of the UDP-based search and configuration protocol	0, 1	1
IPCFG_PASSWORD	Password for the modification of the IP address via the UDP configuration protocol	Text, max. 255 characters	Not set
Group [ICMP]			
ENABLE_ECHO	Activation of the ICMP/Ping echo service	0, 1	1
Group [SOLVIMUS]			
AUTOUPDATE_URL	URL of the update server including path to the main directory of the update information and protocol	Text, max. 255 characters	Standard update server
AUTOUPDATE_TIME	Time at which the update information is downloaded (in seconds since begin of the day, UTC)		10800
AUTOUPDATE_TIMESPAN	Time span in seconds after AUTOUPDATE_TIME in which the download of the update information is randomly distributed		7200
AUTOUPDATE_MODE	Mode for the update function: OFF: updates are not searched, DOWNLOAD_INFO: the update information is refreshed, the download and the installation of the update must be confirmed in the web interface	OFF, DOWNLOAD_INFO	DOWNLOAD_INFO
BACNET_BBMD	IP of the BACnet BBMD (BACnet Broadcast Management Device)	Text, max. 255 characters	Not set
BACNET_CONFIGURE NETWORK	Activation of a BACnet-specific network configuration (additional IP address)	0, 1	0
BACNET_DEVICEID	BACnet device ID	1-4294967295	1
BACNET_DEVICENAME	BACnet device name	Text, max. 255 characters	Not set
BACNET_ENABLE	Activation of the BACnet communication	0, 1	0
BACNET_IP	BACnet IP (system configuration will be used if not set)	Text, max. 255 characters	Not set
BACNET_LOCATION	BACnet location information	Text, max. 255 characters	metering
BACNET_NETMASK	BACnet Network mask (system configuration will be used if not set)	Text, max. 255 characters	Not set
BACNET_PORT	BACnet network port	0-65535	47808
DLDERS_ADDRESS DISABLE	DLDE request with meter serial number (=0) or wildcard request (=1). In the latter case only 1 meter is permitted.	0, 1	0

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
DLDERS_BAUDRATE	Baud rate for the serial DLDE communication	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	9600
DLDERS_DATABITS	Data bits for the serial DLDE communication	7, 8	7
DLDERS_DEVPATH	Linux path for the serial DLDE communication	Text, max. 255 characters	Not set
DLDERS_ENABLE	Activation of the serial DLDE interface	0, 1	0
DLDERS_FIRSTTIMEOUT	Request mode: timeout for initial reception of data from meter. Push mode: time without registration of data (Wait idle, in ms)	0-65535	3000
DLDERS_FIXEDLAYOUT		0, 1	0
DLDERS_ FLOWCONTROL	Handshake for the serial DLDE communication: 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0
DLDERS_FULLTIMEOUT	Maximum timeout for reading a meter (in ms)	0-65535	30000
DLDERS_IDLETIMEOUT	Idle time for detection of the end of communication (in ms)	0-65535	100
DLDERS_ LOADPROFILE_ MAXRDAYS		0-65535	366
DLDERS_ LOADPROFILE_ SKIPINVALIDENTRY		0, 1	0
DLDERS_MODE	Communication mode for the serial DLDE interface	REQUEST, REQUEST_ECHO, PUSH	REQUEST_ECHO
DLDERS_PARITY	DLDE parity: 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	2
DLDERS_RAWLOG ENABLE	Activation of the raw data logging to the directory *ext/*	0, 1	0
DLDERS_RS485ENABLE	Activation of the RS-485 interface for the DLDE communication	0, 1	1
DLDERS_SMLENABLE	Activation of processing SML protocol data	0, 1	0
DLDERS_STOPBITS	Stop bits for the serial DLDE interface	1, 2	1
DLDERS_TRANSPARENT	Activation of the transparent transmission of the serial DLDE interface to a network port: NONE: transmission deactivated, TCP: transmission of a TCP port, UDP: transmission to a UDP port	NONE, TCP, UDP	NONE
DLDERS_TRANSPARENT PORT	Network port for the transparent transmission via TCP or UDP	0-65535	0
FASTRESCAN_TIME	Cycle time for updating the temporary meter list of received wM-Bus meters (in s)	1-4294967295	60
I2C_DEBUGOUT	Activation of raw data output for the internal I2C communication in the system log	0, 1	0
MBMSTMETER_ BAUDRATE	Baud rate for the serial Modbus communication (Master RTU)	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	19200
MBMSTMETER_ DATABITS	Data bits for the serial Modbus communication (Master RTU)	7, 8	8
MBMSTMETER_ MAXRETRY	Number of retries for a Modbus request to the meter (Master RTU)	0-255	3

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MBMSTMETER_PARITY	Parity of the serial Modbus communication (Master RTU): 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	0
MBMSTMETER_ STOPBITS	Stop bits for the serial Modbus communication (Master RTU)	1, 2	1
MBMSTMETER_ SERIALENABLE	Activation of the serial Modbus (Master RTU)	0, 1	0
MBMSTMETER_ SILENTINTERVAL	Timeout between two bytes in a data packet / a response (Master RTU, in ms)	0-65535	20
MBMSTMETER_ TCPCONNECTTIMEOUT	Timeout for a connection to a Modbus TCP meter (in ms)	1-4294967295	5000
MBMSTMETER_ TIMEOUT	Timeout for the response of the meter (Master RTU, in ms)	0-65535	500
MBUS_ALLOWINSECURE	Deactivates the authentication check when decrypting	0, 1	0
MBUS_BAUDRATE	Baud rate for the M-Bus communication	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800; but only up to the upper maximum stated in Section 2.8.2, 'Meter interfaces'	2400
MBUS_DATABITS	Data bits for the M-Bus communication	7, 8	8
MBUS_DEVPATH	Linux path for the M-Bus interface	Text, max. 255 characters	Not set
MBUS_DISABLE DECRYPTION	Deactivation of decrypting the M-Bus packets (status field)	0, 1	0
MBUS_ENABLE	Activation of the M-Bus interface	0, 1	1
MBUS_FIRST FCBBIT_NEG	Begins reading the M-Bus meters with a specific FCB-bit value: 0: first FCB-bit set, 1: first FCB-bit not set	0, 1	0
MBUS_FIXEDLAYOUT		0, 1	0
MBUS_FLOWCONTROL	Handshake for the M-Bus communication: 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0
MBUS_FORCE	Compatibility mode for reading of faulty M-Bus meters, emulates correct ACK	0-2	0
MBUS_FREEZE STORAGENUM	Storage number for Freeze meter data	0-4294967295	0
MBUS_FULLTIMEOUT	Maximum timeout for reading a meter (in ms)	0-65535	10000
MBUS_IDLETIMEOUT	Idle time for detection of the end of communication (in ms)	0-65535	100
MBUS_IGNORECRCFIELD	Compatibility mode for reading faulty M-Bus meters, disregards the CRC field	0, 1	0
MBUS_IGNORELENGTH FIELD	Compatibility mode for reading faulty M-Bus meters, disregards the length field	0, 1	0
MBUS_LOADPROFILE MANUFACTURER	Manufacturer code for identification of load profile meters, according to M-Bus standard: „EMH“=(0x$A8$ 0x15) → 0x15A8=5544	0-65535	5544
MBUS_LOADPROFILE MAXCOUNT	Number of load profile entries initially requested by the meter	1-65535	65535
MBUS_LOADPROFILE MODE	Activation of load profile readings for electricity meters via M-Bus	DISABLED, DIZH, DIZG	DISABLED
MBUS_MAXMULTIPAGE	Limits the number of Multipage requests	0-255	3

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MBUS_MAXPRIMARY ADDRESS	Upper address for the M-Bus primary search	0-250	250
MBUS_MAXRETRY	Number of retries for an M-Bus or Multipage request	0-255	3
MBUS_MINPRIMARY ADDRESS	Lower address for the M-Bus primary search	0-250	0
MBUS_NOADDRESS VERIFY	Deactivation of the address verification in primary addressing	0, 1	0
MBUS_PARITY	Parity of the M-Bus communication: 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	2
MBUS_RAWLOGENABLE	Activation of the raw data logging to the directory *ext/*	0, 1	0
MBUS_REQUESTMODE	Request mode	ALL, EXT, ONLY, FREEZE	ONLY
MBUS_RESETMODE	Reset Modes: 0: NKE after Select, 1: NKE before Select 2: No NKE 3: NKE at 0xFD and NKE at 0xFF before the communication 4: NKE at 0xFD, application reset at 0xFF and NKE at 0xFF before the communication	0-4	0
MBUS_RS485ENABLE	Activation of the RS-485 interface for the M-Bus communication	0, 1	0
MBUS_SCANMODE	Search algorithm for the M-Bus	PRIMARYSCAN, SECONDARYSCAN, SECONDARYSCAN ALLOC, SECONDARYSCAN REVERSE, SECONDARYSCAN ALLOCREVERSE	SECONDARYSCAN
MBUS_SECMASK MANUFACTURER	Predefined manufacturer ID for the secondary search	Precisely 4 characters, each 0-9/A-F	0xFFFF
MBUS_SECMASK MEDIUM	Predefined medium ID for the secondary search	Precisely 2 characters, each 0-9/A-F	0xFF
MBUS_SECMASKSERIAL	Secondary search for the meter serial number	Precisely 8 characters, each 0-9/A-F	0xFFFFFFFF
MBUS_SECMASK VERSION	Predefined version number for the secondary search	Precisely 2 characters, each 0-9/A-F	0xFF
MBUS_SELECTMASK	Ignoring of selected ranges, for these placeholders are used (setting via bit mask): +1: serial number +2: manufacturer +4: version field +8: medium	0-15	14
MBUS_SMLENABLE	Activation of processing SML protocol data	0, 1	0
MBUS_SOCPAGESELECT ENABLE	Activates Pageing according to the specification of the company Socomec	0, 1	0
MBUS_SOC MANUFACTURER	Manufacturer code for identification of meters with Socomec pageing, according to M-Bus standard: „SOC“=(0xE3 0x4D) → 0x4DE3=19939	0-65535	19939
MBUS_SPXMETER CONVERT	Activation of manufacturer-specific decoding (manufacturer code SPX)	0, 1	0
MBUS_STOPBITS	Stop bits for the M-Bus communication	1, 2	1
MBUS_TIMEOUT	Timeout till first data are received from the meter (in ms)	0-65535	2000

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MBUS_TRANSPARENT	Activation of the transparent transmission of the M-Bus interface to a network port or an M-Bus slave interface: NONE: transmission deactivated, MBUS: Master TCP: transmission to a TCP port, UDP: transmission to a UDP port, TCP_ONDEMAND: Master & Transparent/TCP	NONE, MASTER, TCP, UDP, TCP_ONDEMAND	NONE
MBUS_TRANSPARENT PORT	Network port for the transparent transmission via TCP or UDP	0-65535	0
MBUS_WAKEUPENABLE	Activation of the specific wakeup requests	0, 1	0
MBUSSLV_BAUDRATE	Baud rate for the M-Bus slave communication	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	2400
MBUSSLV_DATABITS	Data bits for the M-Bus slave communication	7, 8	8
MBUSSLV_DEBUGOUT	Activation of the raw data output for the M-Bus slave communication in the system log	0, 1	0
MBUSSLV_DEVPATH	Linux path for the M-Bus slave interface	Text, max. 255 characters	Not set
MBUSSLV_ FLOWCONTROL	Handshake for the M-Bus slave communication: 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0
MBUSSLV_ FULLTIMEOUT	Maximum timeout for the request of a meter (in ms)	0-65535	10000
MBUSSLV_ IDLETIMEOUT	Idle time for detection of the end of communication (in ms)	0-65535	100
MBUSSLV_PARITY	Parity for the M-Bus slave communication: 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	2
MBUSSLV_RS485ENABLE	Activation of the RS-485 interface for the M-Bus slave communication	0, 1	0
MBUSSLV_STOPBITS	Stop bits for the M-Bus slave communication	1, 2	1
MBUSSLVMETER_MODE	Activation of the M-Bus slave interface: DEFAULT: product-specific activated, NONE: deactivated, TCP: activation via TCP port, UDP: activation via UDP port, MBUS: activation via the M-Bus slave interface	DEFAULT, NONE, TCP, UDP, MBUS	DEFAULT
MBUSSLVMETER_PORT	Network port for access to the M-Bus slave interface via TCP or UDP	0-65535	5040
MBUSSLVMETER_ WMBUSALLOW ENCRYPTED	Activation of the transfer of encrypted wM-Bus meters via the M-Bus slave interface	0, 1	0
MBUSSLVMETER_ WMBUSALLOW EXTENDEDHEADER	Activation of the transfer of specific wM-Bus header data (e. g. AFL/ELL) via the M-Bus slave interface	0, 1	0
MBUSSLVMETER_ WMBUSALLOWOTHER	Activation of the transfer in spite of unknown wM-Bus header data via the M-Bus slave interface	0, 1	0

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MBUSSLV2METER_ MODE	Activation of the second M-Bus slave interface: NONE: deactivated, TCP: activation via a TCP port, UDP: activation via a UDP port	NONE, TCP, UDP	NONE
MBUSSLV2METER_PORT	Network port for access to the second M-Bus slave interface via TCP or UDP	0-65535	5050
MBUSSLV2METER_ WMBUSALLOW ENCRYPTED	Activation of the transfer of encrypted wM-Bus meters via the second M-Bus slave interface	0, 1	0
MBUSSLV2METER_ WMBUSALLOW EXTENDEDHEADER	Activation of the transfer of specific wM-Bus header data (e. g. AFL/ELL) via the second M-Bus slave interface	0, 1	0
MBUSSLV2METER_ WMBUSALLOWOTHER	Activation of the transfer in spite of unknown wM-Bus header data via the second M-Bus slave interface	0, 1	0
METER_ADJUST TIMESTAMPS			0
METER_CYCLEMODE			SECOND
METER_CYCLE TIMESTAMP			Not set
METER_DELAY	Delay for reading of meter data according to the configured reading cycle (in s)	0-4294967295	0
METER_PRESENT VALUESONLY			0
METER_MAXALLVALUE COUNT	Limitation of total meter data (0: no limitation)	0-65535	0
METER_MAXDEVICE COUNT	Limitation of the number of meters (0: no limitation)	0-65535	500
METER_MAXVALUE COUNT	Limitation of meter values per meter (0: no limitation)	0-65535	25
METER_OBISGEN	Automatic generation of OBIS codes for meter values from DIF/VIF codes when creating M-Bus and wM-Bus meters 0: off, 1: on	0, 1	0
METER_RETRYDIVIDER	Reduces the quantity of values read and used for reporting. Only values every METER_ RETRYDIVIDER are retained for reporting. All read values are used for visualisation and for other interfaces (Modbus or BACnet).	0-65535	0
METER_STAT_CONFIG	Path to the meter configuration file	Text, max. 255 characters	app/device_handle.cfg
METER_TIME	Cycle time for reading meters (unit according to METER_ CYCLEMODE), caution: with small cycle times and a large quantity of meters, significant log files can be created	1-4294967295	900
METER_ VIFSTRINGMODE	Placement of the VIF string in the data flow: 0: VIF string after last VIFE, 1: VIF string immediately after VIF string identification	0, 1	1
METERSYSTEM_ ENABLE	Activation of the system meter function	0, 1	1
METERSYSTEM_SCRIPT TIMEOUT	Timeout after whose expiration the system meter scripts are aborted (in s)	0-65535	0
MODBUS_ADDRESS	Primary Modbus address or Unit identifier	0-255	0
MODBUS_APPLICATION	Application information within the device identification	Text, max. 255 characters	Modbus TCP Gateway

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MODBUS_BAUDRATE	Baud rate for the serial Modbus communication (RTU)	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	19200
MODBUS_CONNECTION TIMEOUT	Timeout of the Modbus TCP connection (in s)	0-65535	60
MODBUS_DATABITS	Data bits for the serial Modbus communication (RTU)	7, 8	8
MODBUS_DEBUGOUT	Activation of raw data output for the Modbus communication in the system log	0, 1	0
MODBUS_DEVPATH	Linux path for the serial Modbus interface	Text, max. 255 characters	Not set
MODBUS_DISCONNECT TIMEOUT	Timeout after whose expiration inactive Modbus TCP connections are aborted (in s)	0-1000	60
MODBUS_ENABLE	Activation of the Modbus slaves	0, 1	0
MODBUS_ FLOWCONTROL	Handshake for the serial Modbus communication: 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0
MODBUS_IP			Not set
MODBUS_ MAXCONNECTIONS	Maximum number of parallel Modbus TCP connections	0-80	5
MODBUS_MODE		Serial, TCP, UDP	TCP
MODBUS_MODEL	Device information within the device identification	Text, max. 255 characters	Standard
MODBUS_NWPORT	Network port of the Modbus TCP slaves	0-65535	502
MODBUS_PARITY	Parity of the serial Modbus communication: 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	0
MODBUS_PRODUCT CODE	Device code for the Modbus function „Read Device Identification“	Text	A code defined by solvimus GmbH and dependent on the device is returned.
MODBUS_RS485ENABLE	Activation of the RS-485 interface for the serial Modbus communication (RTU)	0, 1	0
MODBUS_SPAN			1
MODBUS_STOPBITS	Stop bits for the serial Modbus communication (RTU)	1, 2	1
MODBUS_VENDOR	Manufacturer information within the device identification	Text, max. 255 characters	[Branding]
MODBUS_VENDORURL	Website information on manufacturer within the device identification	Text, max. 255 characters	[Branding]
MODBUS_VERSION	Version of the firmware indicated by Modbus within the device identification. If not set explicitly, it corresponds to the software version on the configuration page.	Text, max. 255 characters	-
MODBUS_WRITEACCESS			READONLY
MODBUSMETER_ PROTOCOLVERSION	Protocol version of the Modbus meter data: Bit 0: 2 registers per value (only floating point value), Bit 1: Multislave activated, Bit 2: Word-Swapping of 32-Bit floating point values, Bit 3: Dummy mode activated	0-16	0
MUC_CONFIG_VER	Version of the configuration, corresponding to the firmware version that it had saved. Set exclusively by the application.	0-65535	-

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MUC_ FORCESTOREREADOUT	Database mode to „Store meter values“ (see Table 12) 0: automatic 1: on	0, 1	0
MUC_LOG	Sets the level of system output via system log	DEFAULT, NONE, ERRORONLY, ALL	DEFAULT
MUC_LOGCYCLE DIVIDER	This parameter enables that not all readouts are written to the database and transferred into the reports. For example, if this parameter equals 4 when fixing *Readout cycle* to 15 minutes, only every fourth value will be written to the database and the report lists only one value per hour. This allows smaller *Readout cycle*, e. g. for Modbus or BACnet or for display on the web page. A value of 0 deactivates this function.	0-65535	0
MUC_METER DESCRIPTION_ ENABLEFLAGS	Enable Flags for representing the description on the website: Bit 0: Description Bit 1: Storage number, tariff, value type Bit 2: DIF/VIF raw data Bit 3: All raw data of the data value entry	0 - 16	1
MUC_PASS_ENCMODE	Activation of the encryption of the passwords in the device configuration file: 0: no encryption, 1: encryption without MAC, 2: encryption with MAC	0, 1, 2	0
MUC_REPORT FATALREBOOTTIMEOUT			0
MUC_REPORT SCRIPTABORTTIMEOUT			30
MUC_SCALEVALUES	Scaled values within the CSV and XML log data	0, 1	0
MUC_SETDEVICES	Activation of setting the meter values. The setting of meter values must be supported by the meters. INTERNAL: S0 and digital outputs of the system meter, INTERNALORDIGITALOUT: S0 and digital outputs, ALL: all meter values, NONE: no meter values	INTERNAL, INTERNALORDIGITAL-OUT, ALL, NONE	INTERNAL
MUC_SETDEVICETIME			0
MUC_SHOWDATAFRAME	Explicit listing of the raw data frame as meter value, for Multi-page meters one entry is added per frame	0, 1	0
MUC_SHOWMETER STATUSBYTE	Explicit listing of the status byte of the meter (M-Bus and wM-Bus) as meter value	0, 1	0
MUC_SHOWTIMESTAMP ENTRIES	Explicit representation of the timestamps of a meter	0, 1	0
MUC_SHOWVALUE SCALEDWEB	Activation of the display of the column „Value (scaled)“	0, 1	1
MUC_SHOWVENDOR RAWDATA	Explicit listing of manufacturer-dependent data as meter value	0, 1	0
MUC_SHOWVENDOR RAWDATAWEB	Representation of binary data on the website (manufacturer-dependent or data container)	0, 1	0
MUC_SHOWWMBUS RSSIVALUE			0
MUC_TRIMVALUES			0

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
MUC_USE_FREEZE	Activation of the Freeze command for reading meters	0, 1	0
SHOW_KEYS	Show decrypted data on the website	0, 1	1
SNTP_ENABLE	Activation of the reference via SNTP server	0, 1	1
SNTP_REQTIMEOUT	Timeout for a SNTP request (in ms)	1-65535	15000
SNTP_RETRY	Number of retries for a SNTP request	0-255	2
SNTP_TIMEOUT	Timeout for a renewed SNTP time query (explicit, in s)	1-4294967295	86400
SNTPIP	Address of the time server (SNTP)	Text, max. 255 characters	pool.ntp.org
SNULL_ENABLE	Activation of the S0 interface	0, 1	0
SNULL_MODE	Counting mode for S0	RELATIVE, ABSOLUTE	RELATIVE
WAN_APN	Access point for WAN	Text, max. 255 characters	Not set
WAN_AUTH	Authentication procedure for accessing WAN	NONE, PAP, CHAP	CHAP
WAN_BAUDRATE	Baud rate for WAN communication	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	115200
WAN_DATABITS	Data bits for the WAN communication	7, 8	8
WAN_DEBUGOUT	Activation of raw data output for the WAN communication in the system log 0, none: off (default), 1, basic: display of the AT communication and of the power cycles, 2, extended: as 1 and additional state requests at the modem like e. g. SIM card settings for preferred providers, 3, all: as 2 and additional Raw binary communication data and parsed replies	0, 1, 2, 3	0
WAN_DEVPATH	Linux path for the WAN interface	Text, max. 255 characters	Not set
WAN_ENABLE	Activation of the WAN communication (mobile radio)	0, 1	0
WAN_FLOWCONTROL	Handshake for the WAN communication: 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
WAN_FREQUENCY BANDS	Comma-separated list of the bands to be activated. If void or if an unavailable setting is given, the default of the modem will be used (the value stored in the modem will be overwritten with the default). An error is logged for invalid entries or not supported bands, and the default of the modem will be used. It will not be verified if the bands match the WAN technology. Conflicting settings can prevent the modem from going online. The parameter is supported exclusively for the modem of the MUC.easy^{plus} 4G. For other modems, an error is logged if the parameters are set, and the WAN is started without restriction on the bands.	GSM,DCS, U1,U2,U5,U8, L1,L2,L3,L4,L5,L7,L8,L9, L10,L12,L13,L14,L17,L18, L19,L20,L21,L25,L26,L27, L28,L40,L41,L66	Default of the modem (the value stored in the modem will be overwritten with the default)
WAN_FULLTIMEOUT			0
WAN_IDLETIMEOUT			0
WAN_MAXRETRY	Number of retries for establishing the WAN connection (0: no limit)	0-255	0
WAN_OLDBAUDRATE	Baud rate for the WAN communication, affects only older devices (0: inactive)	0, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	0
WAN_PARITY	Parity of the WAN communication: 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	0
WAN_PASSWORD	Password to access WAN	Text, max. 255 characters	Not set
WAN_PIN	PIN for the SIM card	Text, max. 255 characters	Not set
WAN_PROVIDER			Not set
WAN_PUK	PUK for the SIM card	Text, max. 255 characters	Not set
WAN_RECONNECT MONITOR	Mode for the monitoring of the radio connection and forced disconnection as well as renewal of the radio connection	OFF, WAN_ACTIVITY, REPORT_ANY, REPORT_ALL, REPORT_SPECIFIC, PING	OFF
WAN_RECONNECT PINGHOST	Host/IP-address which is monitored	String	-
WAN_RECONNECT PINGINTERVAL	Interval in which a ping is sent (in s)		1800
WAN_RECONNECT PINGTIMEOUT	Timeout for the reception of a response (in ms)		30000
WAN_RECONNECT REPORTINSTANCE	Number of the report selected for monitoring. Only active if WAN_RECONNECTMONITOR = REPORT_SPECIFIC	1 to number of supported reports (integer)	1
WAN_RECONNECT TIMEOUT	Interval which is monitored (in seconds). If no response on a ping is received within this limit, another attempt to establish the connection will be undertaken.	1800-4294967295	86400
WAN_RS485ENABLE	Activation of the RS-485 interface for WAN communication	0, 1	0
WAN_RSSITEST			0
WAN_STOPBITS	Stop bits for the WAN communication	1, 2	1

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
WAN_TECHNOLOGY	Selected radio technology. The preset mode DEFAULT is interpreted as the intended or reasonable value according to the modem type. If the modem does not support that mode (e. g. LTE on NB-IoT), an error is logged and the modem remains in the prior state.	DEFAULT, LTE, GSM, UMTS, NBIOT, CATM, LTE_GSM, LTE_UMTS, UMTS_GSM, LTE_UMTS_GSM	DEFAULT
WAN_USER	Username for accessing WAN	Text, max. 255 characters	Not set
WATCHDOG_IDLE	Watchdog timeout for the idle state (in s)	1-4294967295	120
WATCHDOG_PROCESS	Watchdog timeout in the busy state (in s)	1-4294967295	900
WATCHDOG_READOUT	Watchdog timeout during readout (in s)	1-4294967295	Quadruple of the readout cycle, at least: WATCHDOG_PROCESS
WATCHDOG_SCAN	Watchdog timeout during scanning (in s)	1-4294967295	43200000
WEBCOM_PASSWORD PATTERN	Regular expression (regex) to enforce a defined password complexity. Standard: 10 characters; of which at least 1 uppercase letter, 1 lowercase letter, 1 digit, 1 special character	Text, without spaces and line feeds	`^(?=.*[A-Z]+) (?=.*[0-9]+) (?=.*[a-z]+) (?=.*[^A-Za-z0-9]+) .{10,}`
WEBCOM_PASSWORD PATTERNMSG	Message when trying to set a password of insufficient complexity	Text, max. 255 characters	Password requires at least: 10 characters, 1 uppercase and 1 lowercase letter, 1 digit and 1 character not included in previous groups (special character)!
WEBCOM_ ADMINLOGIN_ SWITCHREQ		0, 1	1
WEBCOM_USESWITCH			Not set
WEBCOM_TIMEOUT	Timeout for a web session after automatic logout of a user (in ms)	1-4294967295	60000
WMBUS_ALLOW INSECURE			0
WMBUS_BAUDRATE	Baud rate for the wM-Bus communication	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	19200
WMBUS_CACHESIZE	wM-Bus cache size for temporary storage of received meter data	1-500	500
WMBUS_CACHE TIMEOUT	Storage time of received wM-Bus packets in the cache list (in s, 0: no limit)	0-4294967295	0
WMBUS_DATABITS	Data bits for the wM-Bus communication	7, 8	8
WMBUS_DECRYPTUSE LINKLAYERID			0
WMBUS_DEVPATH	Linux path of the wM-Bus interface	Text, max. 255 characters	Not set
WMBUS_FIXEDLAYOUT		0, 1	0
WMBUS_FLOW CONTROL	Handshake for the wM-Bus communication: 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0
WMBUS_FULLTIMEOUT	Maximum time (in ms) for a „packet“ in the transparent mode of the wM-Bus which will be transmitted via TCP/UDP in a consolidated form. The Idle Timeout defined by WMBUUS_ IDLETIMEOUT is respected.	0-65535	1000

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
WMBUS_IDLETIMEOUT	Idle time (in ms) after which the „packet“ in the transparent mode of the wM-Bus, which will be transmitted via TCP/UDP in a consolidated form, is regarded as completed.	0-65535	20
WMBUS_MODE	Mode of the wM-Bus module	S, T, C, C_T	C_T
WMBUS_NETWORK_ ROLE	Function of the wM-Bus interface	DISABLED, MASTER, SLAVE	MASTER
WMBUS_PARITY	Parity of the wM-Bus communication: 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	0
WMBUS_ RAWDATAINCLUDERSSI		0, 1	0
WMBUS_RAWLOG ENABLE	Activation of the raw data logging to the directory *ext/*	0, 1	0
WMBUS_RS485ENABLE	Activation of the RS-485 interface for the wM-Bus communication	0, 1	0
WMBUS_SMLENABLE	Activation of processing SML protocol data	0, 1	0
WMBUS_STOPBITS	Stop bits for the wM-Bus communication	1, 2	1
WMBUS_TRANSPARENT	Activation of the transparent transmission of the wM-Bus interface to a network port: NONE: transmission deactivated, TCP: transmission of a TCP port, UDP: transmission to a UDP port	NONE, TCP, UDP	NONE
WMBUS_TRANSPARENT PORT	Network port for the transparent transmission via TCP or UDP	0-65535	0
WMBUS_TRANSPARENT RSSI	Activation of the integration of the RSSI value in transparent mode	0, 1	0
WMBUS_TRANSPARENT STARTSTOP	Activation of the integration of a start byte and stop byte in transparent mode	0, 1	0
WMBUS_USE LINKLAYERID	Compatibility mode for reading of faulty wM-Bus meters, uses link layer address instead of extended link layer address	0, 1	0
WMBUS2_BAUDRATE	Baud rate for the wM-Bus communication (channel 2)	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800	19200
WMBUS2_DATABITS	Data bits for the wM-Bus communication (channel 2)	7, 8	8
WMBUS2_DEVPATH	Linux path of the wM-Bus interface (channel 2)	Text, max. 255 characters	Not set
WMBUS2_FLOW CONTROL	Handshake for the wM-Bus communication (channel 2): 0: none, 1: XON/XOFF when sending, 2: RTS/CTS, 8: XON/XOFF when receiving, 9: XON/XOFF when sending and receiving	0, 1, 2, 8, 9	0
WMBUS2_MODE	Mode of the wM-Bus module (channel 2)	S, T, C, C_T	C_T
WMBUS2_PARITY	Parity of the wM-Bus communication (channel 2): 0: none, 1: odd, 2: even, 3: mark, 4: space	0-4	0
WMBUS2_RS485ENABLE	Activation of the RS-485 interface for the wM-Bus communication (channel 2)	0, 1	0

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
WMBUS2_STOPBITS	Stop bits for the wM-Bus communication (channel 2)	1, 2	1
WMBUS2_ TRANSPARENT	Activation of the transparent transmission of the wM-Bus interface (channel 2) to a network port: NONE: transmission deactivated, TCP: transmission of a TCP port, UDP: transmission to a UDP port	NONE, TCP, UDP	NONE
WMBUS2_ TRANSPARENTPORT	Network port for the transparent transfer of the wM-Bus interface (channel 2) via TCP or UDP	0-65535	0
WMBUS2_ TRANSPARENTRSSI	Activation of the integration of the RSSI value in transparent mode of the wM-Bus interface (channel 2)	0, 1	0
WMBUS2_ TRANSPARENT STARTSTOP	Activation of the integration of a start byte and stop byte in transparent mode of the wM-Bus interface (channel 2)	0, 1	0
MODBUS_TLSENABLE			0
MODBUS_CA_FILE			
MODBUS_CERT_FILE			
MODBUS_KEY_FILE			
MODBUS_INSECURE			0
MBUS_TRANSPARENT_ TLSENABLE			0
MBUS_TRANSPARENT_ CA_FILE			
MBUS_TRANSPARENT_ CERT_FILE			
MBUS_TRANSPARENT_ KEY_FILE			
MBUS_TRANSPARENT_ INSECURE			0
WMBUS_ TRANSPARENT_ TLSENABLE			0
WMBUS_ TRANSPARENT_CA_FILE			
WMBUS_ TRANSPARENT_CERT_ FILE			
WMBUS_ TRANSPARENT_KEY_ FILE			
WMBUS_ TRANSPARENT_ INSECURE			0
WMBUS2_ TRANSPARENT_ TLSENABLE			0
WMBUS2_ TRANSPARENT_CA_FILE			
WMBUS2_ TRANSPARENT_CERT_ FILE			
WMBUS2_ TRANSPARENT_KEY_ FILE			
WMBUS2_ TRANSPARENT_ INSECURE			0
DLDERS_ TRANSPARENT_ TLSENABLE			0
DLDERS_ TRANSPARENT_CA_FILE			
DLDERS_ TRANSPARENT_CERT_ FILE			

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
DLDERS_ TRANSPARENT_KEY_ FILE			
DLDERS_ TRANSPARENT_ INSECURE			0
MBUSSLVMETER_ TLSENABLE			0
MBUSSLVMETER_CA_ FILE			
MBUSSLVMETER_CERT_ FILE			
MBUSSLVMETER_KEY_ FILE			
MBUSSLVMETER_ INSECURE			0
MBUSSLV2METER_ TLSENABLE			0
MBUSSLV2METER_CA_ FILE			
MBUSSLV2METER_ CERT_FILE			
MBUSSLV2METER_KEY_ FILE			
MBUSSLV2METER_ INSECURE			0
Group [REPORT_x]*			
MODE	Mode of the report instance or deactivation		DISABLED
FORMAT	Format employed of the report instance		Not set
HOST	Remote station of the report instance		Not set
PORT	Network port of the remote station of the report instance		
PATH	Path for the remote station of the report instance		Not set
USER	Username for the remote station of the report instance		Not set
PASSWORD	Password for the remote station of the report instance		Not set
TOADDRESS	Receiver address of the report instance, particularly SMTP		Not set
FROMADDRESS	Sender address of the report instance, particularly SMTP		Not set
PARAM1	User-specific parameter (1) of the report instance, particularly user format or user mode		Not set
PARAM2	User-specific parameter (2) of the report instance, particularly user format or user mode		Not set
PARAM3	User-specific parameter (3) of the report instance, particularly user format or user mode		Not set
BASENAME	Basic file name for files to be transmitted (XML or CSV)		
CONTENTTYPE			
CONVERTARG			
EXTENSION			
INSECURE			0
CA_FILE	Path to the CA certificate for the report instance		
CERT_FILE	Path to the device certificate for the report instance		
KEY_FILE	Path to the device key for the report instance		
CYCLEMODE			MINUTE
CYCLE	Cycle time for meter reading (unit according to CYCLEMODE)		15
CYCLEDELAY			0
CYCLETIMESTAMP			Not set
RANDOMDELAY			

Continued on next page

Table 27 – *Continued from previous page*

Parameter	Description	Range	Standard
READOUT_FILTER	Selection if all values, or only the newest, or only the oldest value from a particular time span should to be transmitted in a cyclic report	ALL, NEWEST, OLDEST	ALL
RETRY_INTERVAL	Interval for the retry of failed reports: -1: no repetition, failed reports are not retransmitted, 0: automatic (for cyclic reports retry after 1/10 of the Report Cycle Time with minimum 10 minutes, for reports with „On Readout“ retry after 10 minutes), >0: time in seconds after which a failed report is retransmitted	-1, 0, arbitrary positive integer	0
MIN_SEND_INTERVAL	Minimum interval for sending the report. Assures that at least this delay (in seconds) is respected after the successful transmission of a report or the failure to send a report before transmitting the subsequent report. The parameter is not effective if reports are prompted by Readout or manually via the website.	0, arbitrary positive integer	0
MAX_BACKLOG	Maximum time into the past for which reports are sent (in seconds). See complement underneath this table.	arbitrary positive integer	0
VERIFY_STATUS	If this parameter is enabled, the report will be marked as failed and repeated in the report modes TCP and TLS, provided HTTP status codes 400 or higher are received.	0, 1	0

*x denotes the report instance 1-10

Table 27: chip.ini parameters

- Complement to MAX_BACKLOG:
  - For cyclic reports, only reports are transmitted whose data range is not entirely older than this period. If the beginning of the data range is older and the end newer than this time for a report, then the report will be transmitted with its entire data range.
  - For a report triggered „On Readout“, the begin of the data range is limited to the Backlog time.
  - The analysis occurs upon system start, reconfiguration or the generation of a report by due date, retry after failure or readout. If reports fail continually, no retry of reports older than the indicated time will occur.

8.3 Meter configuration file Device_Handle.cfg

The file *app/Device_Handle.cfg* contains the meter configuration. If this file does not exist, it can be created via the web-based front end using the ***Meter*** tab. All wM-Bus meters collected during operation are integrated permanently into the list after a scan process or by manually saving the configuration. Only those parameters need to be stored in that file which deviate from the defined default values (version entry excluded).

- The file has to be saved as UTF8 encoded XML file.
- If the file *Device_Handle.cfg* is changed manually, the parameter <*layoutversion*> stated therein has to be incremented.
- The device needs to be rebooted after changing the file *Device_Handle.cfg* manually for the change to take effect. The reboot can be triggered via the web-based front end using the button **Reboot system** in the ***Service*** tab or via the command line.
- Manual changes are permanently stored on the flash not instantly, but after a few minutes. As a result, changes are possibly lost if the device is rebooted by switching the power supply off and on.
- The file *Device_Handle.cfg* can be transferred to other devices via FTPS. The attached meters need to be taken into account.

The file is an XML file and has the following structure:

Parent	Element	Description	Standard	Example
	root	Root element	-	-
root	version	Version number of the XML specification	Not set	0x06
root	layoutversion	Layout number of the database	Not set	0x06
root	meter	Parent element for each meter	-	-
meter	interface	Interface of the meter: M-Bus, wM-Bus, DLDERS, S0, Modbus	Not set	M-Bus
meter	serial	Meter number (serial number), BCD notation, leading „0x“	0xFFFFFFFF	0x30101198
meter	manufacturer	Manufacturer code of the meter (wildcard 0xFFFF)	0xFFFF	0x3B52 (NZR)
meter	version	Version number of the meter	0xFF	0x01
meter	medium	Medium of the meter, see second column in Table 29 (wildcard 0xFF, if not set)	Not set	Electricity
meter	primaryaddress	Primary address of the meter (M-Bus, S0 or Modbus)	0	0x03
meter	addressmode	Addressing mode 0: secondary, 1: primary	0	0
meter	readoutcycle	Specific readout cycle (in s)	0	900
meter	maxvaluecount	Limitation of the number of meter values	0	12
meter	encryptionkey	Key for encrypted communication, e.g.: AES for wM-Bus	Not set, 0	0x82 0xB0 0x55 0x11 0x91 0xF5 0x1D 0x66 0xEF 0xCD 0xAB 0x89 0x67 0x45 0x23 0x01
meter	active	Activates the meter for logging or for reporting.	1	1
meter	rssi	RSSI value of the last reception (wM-Bus)	0	123
meter	register	Register assignment (e. g. Modbus slave)	0	250

Continued on next page

Table 28 – *Continued from previous page*

Parent	Element	Description	Standard	Example
meter	user	User-specific text (see **User label** column in the ***Meter*** tab)	Not set	Floor-1-Right
meter	dbid	Unique database key of the meter, if the meter is activated for reporting	Not set	1
meter	value	Parent element for each meter value of the meter	-	-
value	description	Description of the meter value, see second column in Table 30	None	Energy
value	unit	Unit of the meter value, see second column in Table 31	None	Wh
value	encodetype	Coding of the meter value	NODATA	INT32
value	scale	Scaling factor of the meter value (scientific notation)	1e0	1e-3
value	userscale	User-specific scaling factor of the meter value (scientific notation)	1e0	1e-1
value	valuetype	Type of meter values: INSTANTANEOUS, MAXIMUM, MINIMUM, ERRORSTATE	instantaneous	instantaneous
value	storagenum	Storage number of the meter value	0	2
value	tariff	Tariff information of the meter value	0	3
value	confdata	Generic data, OBIS code of the meter value (X-X:X.X.X*X; X=0-255; see **OBIS-ID** column in the ***Meter*** tab)	Not set	0x01 0x00 0x01 0x08 0x00 0xFF
value	rawdata	Raw data of the meter value for M-Bus and wM-Bus	Not set	07 FB 0D 00 00 00 00 00 00 00 00
value	dif	Data information fields of the meter value for M-Bus and wM-Bus	Not set	07
value	vif	Value information fields of the meter value for M-Bus and wM-Bus	Not set	FB 0D
value	active	Activates the meter value for logging or for reporting.	1	1
value	register	Register assignment (e. g. Modbus slave)	0	250
value	user	User-specific text (see **User label** column in the ***Meter*** tab)	Not set	Room 2
value	bacnetreg	Object number for BACnet	Not set	8

Table 28: Structure of the Device_Handle.cfg

8.4 Preconfiguration of the meter list

Manual editing of a meter list for large installations with many meters is demanding and time-consuming.

This can be automated with two approaches.

8.4.1 File meter-conf-import.csv

The first approach uses the *app/meter-conf-import.csv*. It is used to add meta information such as the **Encryption key** or the **User label** when scanning/listing a meter.

- ✔ If the meter is already listed or configured in the ***Meter*** tab, the data from the file will not be transferred. The meter has to be removed from the list first.

The file can be manually uploaded to the device via FTPS (see also Section 3.5). However, it is also possible to import it via the ***Service*** tab (see Section 4.10.2). The file has to be provided as packed **.tar.gz* file.

- ➔ For creating a **.tar.gz* archive, the free, open source software *7zip* can be used. First, the file *meter-conf-import.csv* needs to be packed without subdirectory into a **.tar* ball and afterwards into a **.gz* archive.

The following columns can be used in the CSV file:

- Interface: the interface via which the meter is read out (M-Bus, wM-Bus).
- Serial: 8-digit meter serial number
- Encryption key: Encryption key of the meter in hexadecimal byte notation (optional)

- User label: User-specific label of the meter (optional)
- Cycle: Readout interval of the meter (in seconds, optional)
- Max readout values: Limit to the quantity of meter values if the meter provides additional meter values (optional). If not set, the parameter „Maximum value count“ from the tab ***Configuration*** is used.

Here is an example:

```
Interface; Serial; Encryptionkey; user label; cycle; Max readout values
WMBUS;12345670;00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 01;;
WMBUS;12345671;01 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 02;;
WMBUS;12345672;02 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 03;;
WMBUS;12345673;03 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 04;;
WMBUS;12345674;04 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 05;;
WMBUS;12345675;05 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 06;;
WMBUS;12345676;06 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 07;;
WMBUS;12345677;07 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 08;;
WMBUS;12345678;08 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 09;;
WMBUS;12345679;09 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F;Apartment 10;;
```

8.4.2 File Device_Config.cfg

The second approach uses the file *app/Device_Config.cfg*.

8.5 Media types, measurement types and units

In the EN 13757-3 standard, media types, measurement types (measurement value descriptions) and units and are predefined. The devices from solvimus GmbH are using it for allowing a uniform data display.

The following table contains the predefined values for the medium:

Index	Description
0	Other
1	Oil
2	Electricity
3	Gas
4	Heat (outlet)
5	Steam
6	Warm water
7	Water
8	Heat cost allocator
9	Compressed air
10	Cooling (outlet)
11	Cooling (inlet)
12	Heat (inlet)
13	Combined heat / cooling
14	Bus / System component
15	Unknown medium
16-19	Reserved
20	Calorific value
21	Hot water
22	Cold water
23	Dual register (hot/cold) water
24	Pressure
25	A/D Converter
26	Smoke detector
27	Room sensor
28	Gas detector
29-31	Reserved
32	Breaker (electricity)
33	Valve (gas or water)
34-36	Reserved
37	Customer unit
38-39	Reserved
40	Waste water
41	Waste

Continued on next page

Table 29 – *Continued from previous page*

Index	Description
42	Carbon dioxide
43-48	Reserved
49	Communication controller
50	Unidirectional repeater
51	Bidirectional repeater
52-53	Reserved
54	Radio converter (system side)
55	Radio converter (meter side)
56-255	Reserved

Table 29: Media types

The following table contains the predefined measurement types (descriptions for the measured value). Depending on the meter's interface, user-specific text-based measurement types (indication by index 31) can also be configured.

Index	Description
0	None
1	Error flags (Device type specific)
2	Digital output
3	Special supplier information
4	Credit
5	Debit
6	Volts
7	Ampere
8	Reserved
9	Energy
10	Volume
11	Mass
12	Operating time
13	On time
14	Power
15	Volume flow
16	Volume flow ext
17	Mass flow
18	Return temperature
19	Flow temperature
20	Temperature difference
21	External temperature
22	Pressure
23	Timestamp
24	Time
25	Units for H. C. A.
26	Averaging duration
27	Actuality duration
28	Identification
29	Fabrication
30	Address
31	Meter specific description (text based)
32	Digital input
33	Software version
34	Access number
35	Device type
36	Manufacturer
37	Parameter set identification
38	Model / Version
39	Hardware version
40	Metrology (firmware) version
41	Customer location
42	Customer
43	Access code user
44	Access code operator
45	Access code system operator
46	Access code developer
47	Password
48	Error mask
49	Baud rate
50	Response delay time
51	Retry
52	Remote control (device specific)

Continued on next page

Table 30 – *Continued from previous page*

Index	Description
53	First storagenum. for cyclic storage
54	Last storagenum. for cyclic storage
55	Size of storage block
56	Storage interval
57	Vendor specific data
58	Time point
59	Duration since last readout
60	Start of tariff
61	Duration of tariff
62	Period of tariff
63	No VIF
64	wM-Bus data container
65	Data transmit interval
66	Reset counter
67	Cumulation counter
68	Control signal
69	Day of week
70	Week number
71	Time point of day change
72	State of parameter activation
73	Duration since last cumulation
74	Operating time battery
75	Battery change
76	RSSI
77	Day light saving
78	Listening window management
79	Remaining battery life time
80	Stop counter
81	Vendor specific data container
82	Reactive energy
83	Reactive power
84	Relative humidity
85	Phase voltage to voltage
86	Phase voltage to current
87	Frequency
88	Cold/Warm Temperature limit
89	Cumulative count max. power
90	Remaining readout requests
91	Meter status byte
92	Apparent energy
93	Apparent power
94	Security key
95	Data frame
96-255	Reserved

Table 30: Measurement types

The following table contains the predefined units. Depending on the meter's interface, user-specific units can also be configured.

Index	Unit	Symbol	Description
0	None		None
1	Bin		Binary
2	Cur		Local currency units
3	V	V	Volt
4	A	A	Ampere
5	Wh	Wh	Watt hour
6	J	J	Joule
7	m^3	m^3	Cubic meter
8	kg	kg	Kilogram
9	s	s	Second
10	min	min	Minute
11	h	h	Hour
12	d	d	Day
13	W	W	Watt
14	J/h	J/h	Joule per Hour
15	m^3/h	m^3/h	Cubic meter per hour
16	m^3/min	m^3/min	Cubic meter per minute
17	m^3/s	m^3/s	Cubic meter per second
18	kg/h	kg/h	Kilogram per hour

Continued on next page

Table 31 – *Continued from previous page*

Index	Unit	Symbol	Description
19	Degree C	°C	Degree Celsius
20	K	K	Kelvin
21	Bar	Bar	Bar
22			Dimensionless
23-24			Reserved
25	UTC		UTC
26	bd	bd	Baud
27	bt	bt	Bit time
28	mon	mon	Month
29	y	y	Year
30			Day of week
31	dBm	dBm	Decibel (1 mW)
32	Bin		Bin
33	Bin		Bin
34	kVARh	kVARh	Kilo voltampere reactive hour
35	kVAR	kVAR	Kilo voltampere reactive
36	cal	cal	Calorie
37	%	%	Percent
38	ft^3	ft^3	Cubic feet
39	Degree	°	Degree
40	Hz	Hz	Hertz
41	kBTU	kBTU	Kilo british thermal unit
42	mBTU/s	mBTU/s	Milli british thermal unit per second
43	US gal	US gal	US gallon
44	US gal/s	US gal/s	US gallon per second
45	US gal/min	US gal/min	US gallon per minute
46	US gal/h	US gal/h	US gallon per hour
47	Degree F	°F	Degree Fahrenheit
48-255			Reserved

Table 31: Units

9 User Support

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

E-Mail: support@solvimus.de
Phone: +49 3677 7613065

If you communicate your request by e-mail, please add

- a print page of the web page, including the „Meter Configuration“ (see Section 4.11) as a searchable PDF file in landscape format (if applicable for your device) and
- the device configuration file (see Section 4.10.2)

to permit a rapid and effective handling.

Mind that our customer support can read passwords from your device configuration file. Modify these immediately after the creation of the configuration file (see Section 4.8).

10 Simplified EU Declaration of Conformity

Hereby, solvimus GmbH declares that the radio equipment type MUC.one is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address:

https://www.solvimus.de/