

# DOCUMENTATION

## wM-Bus to TCP Gateway



INNOTAS ELEKTRONIK GMBH



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## 2 Revision directory

REVISION	DATE	MODIFICATION
1.0	April 07, 2016	First edition
1.01	April 22, 2016	Various extensions and corrections
1.02	March 15, 2017	Description of device password
4.3.0	September 08, 2017	Encryption / Filter ID / Removal WEB Interface
4.4.0	November 09, 2017	MASTER KEY

# DOCUMENTATION

## wM-Bus to TCP Gateway

### 3 Device description

The wM-Bus gateway receives wireless M-Bus protocols in T / C or S-Mode, filters them as required, stores them and sends them to a server via an IP connection. The gateway has no mobile data connection. It uses existing networks.

#### 3.1 Application areas

The gateway is particularly suitable for stationary data reception from wM-Bus protocols using existing networks or internet connections. The gateway is simply connected to an existing network. Power can be supplied via a USB port on the router or via a standard USB power supply unit. Normally, no further settings are necessary in the router.



## 4 Function description

The basic function of the gateway includes the receipt of wM-Bus protocols and their forwarding to a server. The gateway is connected to a USB supply and connected to the Internet via a network.

A PC USB port can be used to make configuration settings. All settings can be checked and changed using the terminal program via the UART registered in the PC. Status information is also output. The device is normally supplied via a USB port on the network router. In the standard setting, the gateway gets the network settings from the router via DHCP. The gateway in the local network can be reached via the IP address assigned to the device. With the help of a setup tool, all important settings can also be made from there. The gateway continuously receives all devices transmitting in the corresponding wM-Bus mode that are within its reception range. If necessary, the protocols run through some log filters and are stored in the memory with a time stamp. Up to 250 different devices can be saved. The latest protocol is always saved; older protocols from the same device are overwritten. No history is created! After the set interval has elapsed, the gateway connects to the server and sends all stored protocols to the server. If there is a connection error, it is redialed every 10 minutes up to 20 times. After a successful connection, the server can send a new setup to the gateway. The gateway saves this, then restarts and works with the new settings from this point on. A time server is regularly contacted for the current time (NTP server). Before each connection to the data server is established, its domain address is converted into a current IP via the chosen DNS server. For the signaling of individual states and events, 3 display LEDs are built into the device, 1x red, 1x yellow, 1x green. The LEDs can be controlled through the semi-transparent housing.

LED	ON	OFF	NUMBER	DESCRIPTION
RED	About 50ms	About 150ms	50	After RESET via watchdog or setup command.
RED	About 100ms	About 50ms	10	Network error was detected.
RED	About 100ms	About 3s	-	One of the following errors was detected: no connection to the NTP server, no IP received from the DHCP, no contact to the DHCP server, no contact to the DNS server, no connection to the data server.
YELLOW	About 100ms	About 100ms	1	A wM-Bus protocol has been received, has passed through the filter and is saved.
YELLOW	> 2s	-	1	Gateway is still being initialized and has no network settings or no cable is connected.
GREEN	-	-	-	Connection to the data server has been established.
GREEN	About 50ms	About 50ms	100	Resetting of all settings to the factory setting.

## 5 Security

The gateway communicates with the server via AES128 encrypted data. A public key is required for encryption.

The MASTER-KEY set at the factory is: 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

Direct access using the terminal program via the USB interface on the device is secured by a device password.

## 6 Setting options

The gateway can be configured in 3 ways:

- via a Windows setup tool program via the LAN port of the gateway
- via an optionally connected terminal program on the USB interface
- via the data server upon successful contact

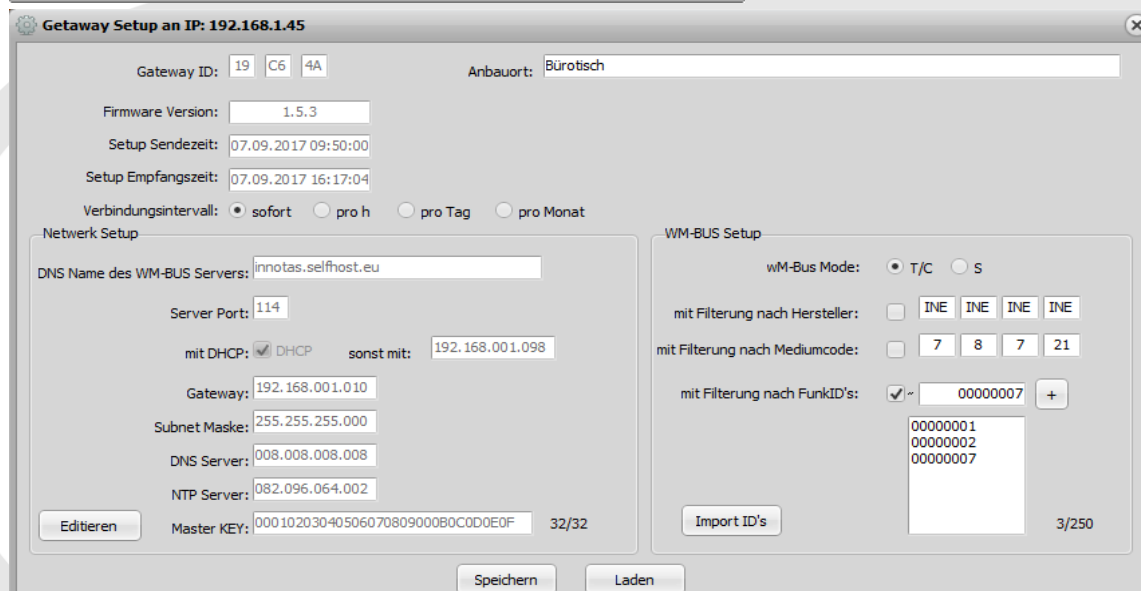
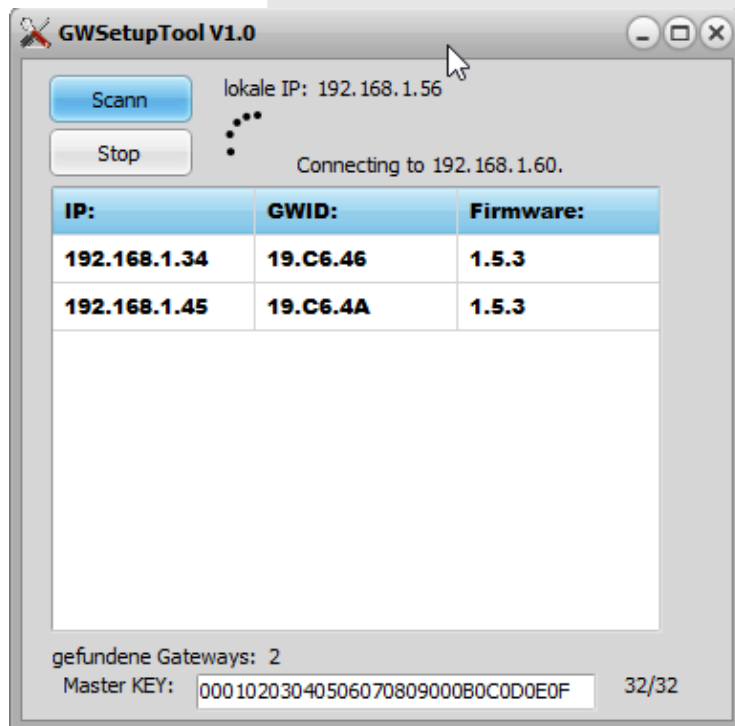
The network settings and the rules for wM-Bus reception can be set. The selection of the wM-Bus protocols to be received can be restricted by filter rules. The filters can be combined with one another.

- Up to 4 different medium codes,
- up to 4 manufacturer IDs and
- up to 250 different device IDs can be filtered.

The communication interval defines the point in time at which an attempt is made to send data to the data server. The setting "Immediately" means that an attempt is made to send a valid protocol to the server at the same time (approx. 7s) after receipt of a valid protocol.

## 6.1 Windows setup tool

If the gateway is connected to the router network via DHCP, the gateway can be reached via the assigned IP address. The user does not know the IP address. With the GWSetupTool the LAN can be scanned for all gateways in the network segment. In the list displayed, all gateways found are displayed with their ID and IP address. Since the data is sent in encrypted form, you need the correct master KEY. The MASTER-KEY must be entered correctly in the GWSetupTool before the scan. The MASTER-KEY must be the same as that used by the devices.



With a double click in the list on the respective gateway the setup menu opens and all device data can be changed except the MAC address. Please note that the individually changed network settings are valid.

Incorrect settings can lead to the gateway losing the network connection and no longer reachable or interfering with other devices in the network. In this case, the error must be corrected on site.

Please do not forget to save the new data after changing the settings!

After saving, the setting is saved in a file on the PC and sent to the gateway in encrypted form with the MASTER-KEY. If the reception is successful, the device reports and restarts. This can take a few seconds.

## 6.2 USB / UART terminal

If the gateway is operated on a USB interface, a UART is installed on the PC. The driver is from FTDI and is available in most Windows systems and should be installed automatically. Otherwise, download the driver from the FTDI website. Contact with the gateway can be established via the UART settings 8, n, 1, 115,200 baud. Communication takes place via AT commands followed by a CR. Entering the command line AT + HELP + CR displays the following help text. All commands are described here with their function and formatting.



```
HILFE
-----
AT+SETHWCFG=X      : Schaltet IP Vergabe über DHCP X=1 AN,X=0 AUS
AT+SETHWCFG=X      : Feste IP bei abgeschalteter DHCP Option mit Format X=192.168.001.012
AT+SETHWCFG=X      : Feste IP des Gateway bei abgeschalteter DHCP Option mit Format X=192.168.001.012
AT+SETHWCFG=X      : Feste Subnet mask bei abgeschalteter DHCP Option mit Format X=255.255.255.000
AT+SETHWCFG=X      : Feste IP des DNS Servers bei abgeschalteter DHCP Option mit Format X=008.008.008.008
AT+SETHWCFG=X      : Feste IP des NTP Servers bei abgeschalteter DHCP Option mit Format X=082.096.064.002
AT+SETHWCFG=X      : DNS Name oder IP des Gateway Servers mit Format X=082.096.064.002 oder X=innotas.selfhost.eu
AT+SETHWCFG=X      : Portnummer für Serverkontakt mit Format X=0023
AT+SETHWCFG=X      : Setzen der Uhrzeit mit hh,mm,ss
AT+SETHWCFG=X      : Setzen des Datums mit dd,mm,yy
AT+SETHWCFG=X      : Ausgabe von WM-BUS Setup Infos
AT+SETHWCFG=X      : Speichert alle Einstellungen und die Geraeteliste
AT+SETHWCFG=X      : Hinzufügen eine Filter ID mit Format X=00000008
AT+SETHWCFG=X      : DEBUG 1=AN, 0=AUS
AT+SETHWCFG=X      : Ausgabe von System INFOS
AT+SETHWCFG=X      : 32 Zeichen Master Key als HEX Zeichen zum verschlüsseln des Datenverkehrs mit dem Server
AT+SETHWCFG=X      : mit Format X=01233BAC1FFC00123B008898DD0CEF
AT+SETHWCFG=X      : WM-Bus Mode X=T/S , im T Mode wird auch C Mode empfangen
AT+SETHWCFG=X      : Setzen des Verbindungsintervall zum Server mit Format X=S/H/T/M.
AT+SETHWCFG=X      : mit S=sofort, H=stündlich ,T=täglich, M=monatlich
AT+SETHWCFG=X      : Schaltet Filterung nach Hersteller X=1 AN,X=0 AUS
AT+SETHWCFG=X      : Schaltet Filterung nach Medium X=1 AN,X=0 AUS
AT+SETHWCFG=X      : Schaltet Filterung nach ID's X=1 AN,X=0 AUS
AT+SETHWCFG=X      : Ausgabe aller Filter ID's
AT+SETHWCFG=X      : Löschen einer Filter ID im Format X=00000008
AT+SETHWCFG=X      : Löscht alle Filter ID's
AT+SETHWCFG=X      : Setzt alles auf Werkseinstellung.
AT+SETHWCFG=X      : Setzt fuer die Filterung 4 Mediumcodes mit Format X=007,008,021,007
AT+SETHWCFG=X      : Setzt fuer die Filterung 4 Herstellercodes mit Format X=INE,RMC,ENG,INE
GW>
```

## 7 Installation

Only a few steps are necessary to start up the gateway. On the one hand, the gateway is connected to the network with internet access using the supplied Ethernet cable and the power supply is established via the USB interface. The gateway starts up automatically. The gateway is secured through external access through a device password (see last page of the documentation).

```
'\n\n'\n'\n\n'LOGIN>'\n\n'A9M66722'\n\n'LOGIN-Ok'\n\n'GW>
```

The input is made either via USB and a terminal program

The device password is included with the gateway. After successful entry and unlocking, the gateway remains unlocked until midnight.

However, the gateway needs some changes to the settings for data communication with a data server. Either the setup tool or the AT command interface via USB can be used to change the settings. Upon delivery, the gateway is preset to DHCP. In most cases, this should ensure a smooth network connection, as this means that the gateway receives all the necessary network settings from the DHCP server, which normally runs on every Internet router. Now the domain address of the data server, the port on which communication is to take place, the communication interval and of course the wM-Bus settings such as radio mode T / C / S and the filters must be adapted to the respective needs. Are all settings set, the process is completed by pressing the "Save" button and the data record is saved. The gateway then restarts. The red LED must not flash if it is operating correctly!

The most important parameters that need to be adjusted:

$$AT + SETSRVDNS = mvserveraddress.de$$

*AT + SETSRVPORT = 0114*

then with

**AT + SAVESETUP** Save and the gateway restarts with these settings and sends its data to a server on myserveraddress.de on port 114.



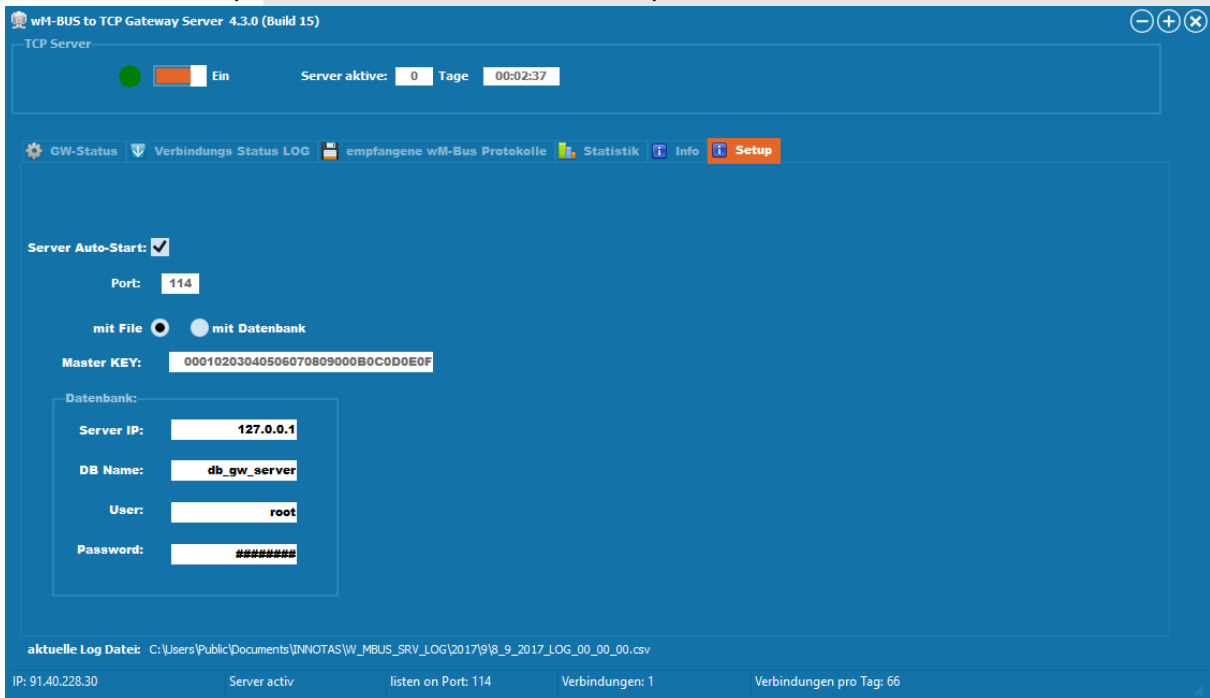
## 8 TCP server

A data server is required for the counterpart to the gateway, which receives the data from the gateway, decodes the data protocol and processes the individual wM-Bus data. Innotas Elektronik GmbH provides a small server for the demonstration. The server is operated in the network whose Internet access is entered in the gateway via the server domain. This can also be the same local network in which the gateway (s) are operated. It is important that the port forwarding is communicated to the internet router. It should also be noted that an exception rule for the port used is set in the firewall of the Windows PC, so that the data can also be passed through to the data server. The received data are displayed in the server and saved in a \*.csv data bank or in a MySQL data bank.

GWID:	IP:	Verb.zeit:	Kontakte:	letzte Daten:	Status:	Firmware:
19.C6.46	91.40.228.30	08.09.2017 09:34:26	219	WMBUS Daten	SETUP ok	1.5.3
19.C6.4A	91.40.228.30	08.09.2017 09:34:24	235	WMBUS Daten	SETUP ok	1.5.3

## 8.1 Settings

For the proper operation of the server, some settings are necessary: On the one hand, the TCP port on which the gateway data is expected must be named and the MASTER-KEY, which is used to decrypt the secure communication, must be entered. This must be the same as that of the gateways to be received! With the setting to write the data in a database, the database access point and its access data are required.



When saving in files, the program creates a folder structure in c: \ User \ Public \ Documents \ INNOTAS \ W\_MBUS\_SRV\_LOG \ year \ month \. A new file is created every day. The data received from various gateways are written to a file. The first column contains the time of receipt of the protocol in the gateway, the second the wM-Bus protocol wrapped in a start byte 0x68 and a stop byte 0x16 with an RSSI value (0x68, wM-Bus protocol, RSSI, 0x16). There is no decryption of the data with encrypted wM-Bus telegrams!

The \*.csv files can be read into the MDC program from Innotas Elektronik GmbH and decryption and data decoding can take place.

In the variant with storage in a MySQL database, a connection log is written in a log table with the name "log". The individual data are written in individual tables for each gateway, for example: "rx\_19\_c6\_4a". The setup data of each gateway are saved in the "setup\_data" table.

## 8.2 SETUP via the gateway server

In the current version of the data server it is possible to create a setup for individual gateways. This is then transmitted to the gateway at the time the respective gateway contacts the server. The identification takes place via the gateway ID, the last 3 bytes of the MAC address. Great care must be taken when changing the gateway setup data, as an incorrect network setup can result in the gateway no longer reaching the data server. In this case, on-site support is necessary to correct the settings via USB or via the local network in the gateway.

After a RESET and every hour at xx:15, the gateway sends its setup to the server.

The screenshot shows the 'Gateway Setups' web interface with the following fields and options:

- Gateway ID:** 19 C6 4A
- Anbauort:** [Empty text field]
- Firmware Version:** 1.5.3
- ☐ Firmware Update, senden bei nächsten Gateway Kontakt.
- Setup Sendezeit:** 08.09.2017 09:14:44
- ☐ Setup, senden bei nächsten Gateway Kontakt.
- Setup Empfangszeit:** 08.09.2017 09:14:44
- Verbindungsintervall:** ☒ sofort ☐ pro h ☐ pro Tag ☐ pro Monat
- Network Setup:**
  - DNS Name des WM-BUS Servers:** innotas.selfhost.eu
  - Server Port:** 114
  - mit DHCP:** ☒ DHCP **sonst mit:** 192.168.001.098
  - Gateway:** 192.168.001.010
  - Subnet Maske:** 255.255.255.000
  - DNS Server:** 008.008.008.008
  - NTP Server:** 082.096.064.002
  - Master KEY:** 00010203040506070809000B0C0D0E0F 32/32
- WM-BUS Setup:**
  - WM-Bus Mode:** ☒ T/C ☐ S
  - mit Filterung nach Hersteller:** ☐ INE INE INE INE
  - mit Filterung nach Mediumcode:** ☐ 7 8 7 21
  - mit Filterung nach FunkID's:** ☐ 00000001 +
  - Import ID's** button
  - 0/250** (ID count)

Buttons at the bottom: Editieren, Speichern, Laden.

### 8.3 Statistics / ID filtering

The "Statistics" tab lists the received data from the individual wM-Bus devices (number of protocols, reception quality) assigned to the individual gateways. In order to limit the data traffic to the relevant wM-BUS devices of interest, it makes sense to activate the filtering in the gateways. In addition to general filtering according to manufacturer ID and medium code, filtering according to individual IDs is also possible. In addition, it is possible to operate the devices for a short time without data filtering and then, after evaluating the data in terms of quantity and quality, use it to create a filter list.


Verzeichnis: C:\Users\Public\Documents\INNOTAS\W\_MBUS\_SRV\_LOG\2017\7\

Count	RadioID	Hersteller	Medium	GW: 16_F9_0E / 1	GW: 16_F9_B1 / 1	GW: 19_C6_42 / 0	GW: 19_C6_46 / 3	GW: 5D_83_2A / 1	GW: AA_BF_E6 / 0
0	88884444	INE	08	6 / -86 dbm	3 / -92 dbm		51 / -33 dbm	1 / -26 dbm	4 / -85 dbm
1	60606002	INE	08	3 / -95 dbm	1 / -97 dbm		70 / -52 dbm	4 / -48 dbm	5 / -96 dbm
2	43601399	INE	08			8 / -84 dbm	137 / -46 dbm	7 / -74 dbm	
3	30910025	INE	07	5 / -94 dbm	3 / -90 dbm		35 / -40 dbm	1 / -57 dbm	2 / -87 dbm
4	30910024	INE	07	3 / -92 dbm	2 / -91 dbm		35 / -39 dbm	1 / -37 dbm	3 / -90 dbm
5	22490008	INE	08	4 / -85 dbm			5 / -41 dbm	1 / -31 dbm	
6	00000126	INE	07	5 / -93 dbm	1 / -93 dbm		19 / -48 dbm	1 / -42 dbm	1 / -92 dbm
7	52270168	NAT	08				1 / -46 dbm		
8	30910020	INE	07				28 / -64 dbm	2 / -59 dbm	
9	31028802	TCH	80				4 / -62 dbm		
10	52370005	INE	07				22 / -61 dbm	1 / -57 dbm	
11	22859001	FFF	08				6 / -79 dbm		

aktuelle Log Datei: C:\Users\Public\Documents\INNOTAS\W\_MBUS\_SRV\_LOG\2017\9\8\_9\_2017\_LOG\_00\_00\_00.csv

IP: 91.40.235.236 Server aktiv listen on Port: 114 Verbindungen: 1 Verbindungen pro Tag: 260

In the "Statistics" tab, the user can select a day to be evaluated in the calendar and the program shows all received wM-Bus devices in the table. The number of telegrams received and the average received field strength are then displayed in the columns of the respective gateways. The user can mark the individual devices in the gateway columns by double-

clicking. Via the button  the user can now automatically generate filter settings for the respective gateways. These settings are transferred to the respective gateway the next time it contacts the server. If you choose to work with files, the respective csv files are evaluated, while the cooperation of the server with a database enables the data from the database to be analyzed.

## 9 MAC address, master key and device password

The MASTER-KEY set at the factory is: 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

