Manual

AUTOMATION

WAGO-I/O-SYSTEM 758

Bluetooth® ETHERNET Gateway

758-915

Version 1.1.0, applicable from FW/HW Version 01/01

WAGO®

© 2014 by WAGO Kontakttechnik GmbH & Co. KG
All rights reserved.

WAGO Kontakttechnik GmbH & Co. KG

Hansastraße 27
D-32423 Minden

Phone: +49 (0) 571/8 87 – 0
Fax: +49 (0) 571/8 87 – 1 69

E-Mail: info@wago.com

Web: http://www.wago.com

Technical Support

Phone: +49 (0) 571/8 87 – 5 55
Fax: +49 (0) 571/8 87 – 85 55

E-Mail: support@wago.com

Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

E-Mail: documentation@wago.com

We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally protected by trademark or patent.

Table of Contents

1 Notes about this Documentation

Note

Keep this documentation!
The operating instructions are part of the product and shall be kept for the entire lifetime of the product. They shall be transferred to each subsequent user of the product. Care must also be taken to ensure that any supplement to these instructions are included, if applicable.

1.1 Validity of this Documentation

This documentation is only applicable to the 758-915 (*Bluetooth*® ETHERNET Gateway) of the WAGO-I/O-SYSTEM 758 series.

The *Bluetooth*® ETHERNET Gateway shall only be installed and operated according to the instructions in this manual.

1.2 Revision History

Table 1: Revision History

Document version	Device version		Revision
	Hardware	Firmware	
1.0.0	01	01	-
1.0.1	01	01	Editorial changes.
1.1.0	01	01	Section “Device Description” > … > “Pin Assignment for System Connection”: Figure corrected. Editorial changes.

1.3 Copyright

This Manual, including all figures and illustrations, is copyright-protected. Any further use of this Manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and phototechnical filing/archiving (e.g., photocopying) as well as any amendments require the written consent of WAGO Kontakttechnik GmbH & Co. KG, Minden, Germany. Non-observance will involve the right to assert damage claims.

1.4 Symbols

DANGER

Personal Injury!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

DANGER

Personal Injury Caused by Electric Current!
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Personal Injury!
Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Personal Injury!
Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Damage to Property!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

NOTICE

Damage to Property Caused by Electrostatic Discharge (ESD)!
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

Note

Important Note!
Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.

Information

Additional Information:
Refers to additional information which is not an integral part of this documentation (e.g., the Internet).

1.5 Number Notation

Table 2: Number notation

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.6 Font Conventions

Table 3: Font conventions

Font type	Indicates
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Programme\WAGO-I/O-CHECK*
Menu	Menu items are marked in bold letters. e.g.: **Save**
>	A greater-than sign between two names means the selection of a menu item from a menu. e.g.: **File** > **New**
Input	Designation of input or optional fields are marked in bold letters, e.g.: **Start of measurement range**
“Value”	Input or selective values are marked in inverted commas. e.g.: Enter the value “4 mA” under **Start of measurement range**.
[Button]	Pushbuttons in dialog boxes are marked with bold letters in square brackets. e.g.: **[Input]**
[Key]	Keys are marked with bold letters in square brackets. e.g.: **[F5]**

2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Bases

2.1.1 Subject to Changes

WAGO Kontakttechnik GmbH & Co. KG reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. WAGO Kontakttechnik GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

2.1.2 Personnel Qualification

All sequences implemented on the device may only be carried out by electrical specialists with sufficient knowledge in installation and handling of electrical equipment. The electrical specialists must also be familiar with the current standards and guidelines valid for the device.

2.1.3 Use in Compliance with Underlying Provisions

The device is used for wireless transmission of ETHERNET data packets per IEEE 802.3. A radio link must be set up for this to another device, for example a second 758-915, that also supports the *Bluetooth*® PAN profile.

The device has been developed for use in an environment that meets the IP65 protection class criteria. This specifies dust-tightness and protection against water jets (nozzle) from any angle. Operation in hazardous areas is prohibited.

2.2 Special Use Conditions for ETHERNET Devices

If not otherwise specified, ETHERNET devices are intended for use on local networks. Please note the following when using ETHERNET devices in your system:

- Do not connect control components and control networks to an open network such as the Internet or an office network. WAGO recommends putting control components and control networks behind a firewall.
- Limit physical and electronic access to all automation components to authorized personnel only.
- Change the default passwords before first use! This will reduce the risk of unauthorized access to your system.
- Regularly change the passwords used! This will reduce the risk of unauthorized access to your system.
- If remote access to control components and control networks is required, use a Virtual Private Network (VPN).
- Regularly perform threat analyses. You can check whether the measures taken meet your security requirements.
- Use “defense-in-depth” mechanisms in your system's security configuration to restrict the access to and control of individual products and networks.

2.3 Technical Condition of Specified Devices

The devices to be supplied ex works are equipped with hardware and software configurations, which meet the individual application requirements. WAGO Kontakttechnik GmbH & Co. KG will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of devices.

Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

2.4 Storage, Assembly and Transport

Whenever possible, the components are to be stored in their original packaging. Likewise, the original packaging provides optimal protection during transport.

When assembling or repacking the components, the contacts must not be soiled or damaged. The components must be stored and transported in appropriate containers/packaging. Thereby, the ESD information is to be regarded.

2.5 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions shall be observed:

DANGER

Always use voltage sources with current limitation/safety extra-low voltage!
Only use power supply sources based on IEC/EN60950 Section 2.5 “Power sources with limited output” with the device. The output of the external power supply must be short-circuit protected. The output voltage of the external power supply shall not exceed 30 VDC.

WARNING

Do not use device in hazardous environments!
The device is not designed for use in hazardous areas.

WARNING

Maintenance/Repair only by authorized specialists!
The device contains no parts that can be serviced by users. Always have all service, reconfiguration, maintenance or repair work performed by specialists authorized by WAGO.

DANGER

Do not work on components while energized!
All power sources to the device shall be switched off prior to performing any installation, repair or maintenance work.

CAUTION

Keep a distance of 20 cm to persons!
Install the device such that it is located at least 20 cm away from all persons during operation.

NOTICE

Replace defective or damaged devices!
Replace defective or damaged device (e.g., in the event of deformed contacts), since the long-term functionality of fieldbus station involved can no longer be ensured.

NOTICE

Protect the components against materials having seeping and insulating properties!
The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling devices/modules.

NOTICE

Cleaning only with permitted materials!
Clean soiled contacts using oil-free compressed air or with ethyl alcohol and leather cloths.

NOTICE

Avoid electrostatic discharge!
The devices are equipped with electronic components that you may destroy by electrostatic discharge when you touch. Pay attention while handling the devices to good grounding of the environment (persons, job and packing).

NOTICE

Device uses radio waves!
Never use the device in areas where operation of radio equipment is prohibited.

NOTICE

Do not open the enclosure!
Never open the enclosure. Opening of the enclosure will nullify the guarantee, legal warranty and authorization for use.

3 Device Description

The *Bluetooth*® ETHERNET gateway 758-915 (“WEG” – Wireless ETHERNET gateway) enables ETHERNET devices to be linked to a wireless *Bluetooth*® network, in which the data received via the ETHERNET interface is transmitted via *Bluetooth*®. In the other direction, data received at the *Bluetooth*® interface is transmitted via the ETHERNET interface. As data transmission of ETHERNET packets occurs with a transparent protocol on Layer 2 of the OSI reference model, this provides for easy integration of all Ethernet-based fieldbuses, such as MODBUS/TCP, ETHERNET/IP, PROFINET or PROFISAFE.

Together with a further *Bluetooth*® PAN profile compliant device with Ethernet capabilities, such as a further WEG or a *Bluetooth*® access point (AP), the WEG can also be used as a wireless substitute for ETHERNET cables. As a *Bluetooth*® Class 1 device with additional, special functions implemented which enhance coexistence, the WEG provides particularly robust, real-time-capable radio links over long distances without any adverse impact on other radio networks, such as WLAN (IEEE 802.11 b/g).

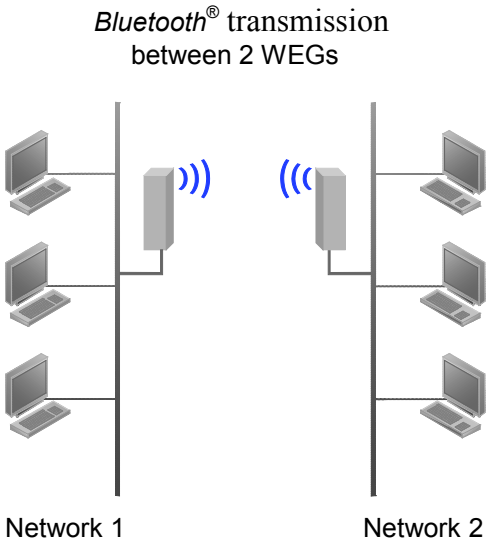


Figure 1: *Bluetooth*® transmission between 2 WEGs

An innovative operator control concept enables easy initiation of automatic configuration processes using a Mode membrane key on the device. This can be used to configure a substitute cable link between two WEGs in only a few seconds, without using additional aids or hardware / software.

In addition to operation using the Mode membrane key and the 7 LED status indicators, access to other status information and advanced device functions of the WEG is also possible via a Web-based management system (WBM).

The WEG supports the “Simple Network Management Protocol” (SNMP). Besides the object IDs (OIDs) for the RFC1213, the device also provides access to further device-specific parameters. A corresponding description file for the “Management Information Base” (MIB) is available from WAGO Support.

3.1 View

Figure 2: View

Table 4: Legend for the "View" figure

No.	Description	Details see Section:
1	Status and diagnosis LEDs (front)	"Display Elements"
2	Internal circular polarized directional antenna 5 dB	"Connectors"
3	Fixing hole 1	"Mounting"
4	LEDs for link quality indication (bottom), configuration and status indication	"Display Elements"
5	Mode membrane key for configuration	"Operating Elements"
6	Network connection, M12 socket on device	"Connectors"
7	Power supply, M12 connector on device	"Connectors"
8	Fixing hole 2	"Mounting"

3.2 Labeling

The status indicators for (POWER, ((•)), LAN) are marked on the front of the device.

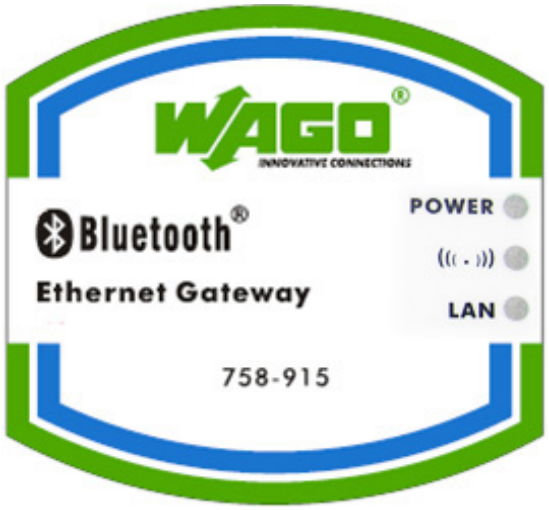


Figure 3: Marking on front of device

The connections (Power, LAN), link quality and configuration button (Mode) are marked on the bottom of the device.

Figure 4: Marking on bottom

The device MAC address is included with other device data on the nameplate on the back or side of the device.

Figure 5: Nameplate on back/side

3.3 Connectors

The device is equipped with two connections at the bottom:

Figure 6: Connections at bottom of device

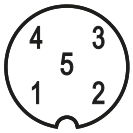
Table 5: Legend for the “Connections at bottom of device” figure

No.	Description
1	Power supply and trigger input (“Power”)
2	Network connection (“LAN”)

3.3.1 Pin Assignment for Power Supply

Power is supplied to the device via a 5-pole, A-coded M12 connector.

Table 6: Power supply, M12 Connector on Device



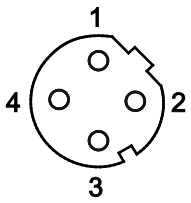
Pin	Pin assignment
1	V_{in} + (9 V … 30 VDC)
2	Trigger input ground
3	V_{in} Ground (0 V)
4	Trigger-input + (9 V … 30 VDC)
5	Not in use

The trigger input reacts to rising flanks and can be used for setting up and terminating radio links (see Section “Configuration using the Mode membrane button” / “Configuration via the Web-based Management System (WBM)”).

3.3.2 Pin Assignment for System Connection

The device is connected to the ETHERNET network via a 4-pole, D-coded socket and supports autonegotiation for 10/100 Mbit and the duplex mode.

Table 7: System connection, M12 Socket on Device



Pin	Pin assignment
1	Transmit +
2	Receive +
3	Transmit -
4	Receive -

3.3.3 Antenna

The device is equipped with an antenna. Good reception conditions exist when the front of the device is oriented centered to the remote device with which the radio link is to be established.

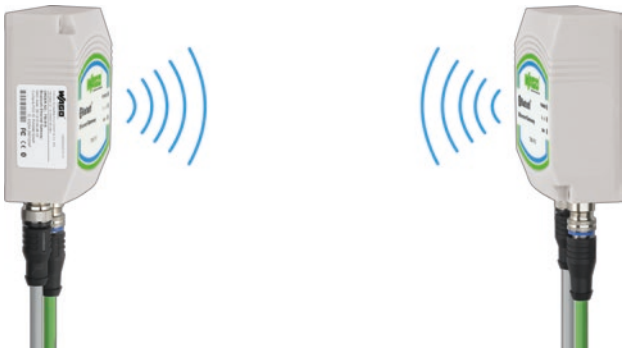


Figure 7: Aligning the device

As the device comes equipped with a circular polarized antenna, rotation of the device around the link axis between the local and remote device does not have any adverse impact on link quality.

The directional alignment (antenna) diagrams for the antenna are given in the following figures for a frequency of 2.450 GHz.

The horizontal diagram illustrates the two-dimensional top view of the electromagnetic field of the antenna, with the antenna being the center point. At a beam angle of around 60° the antenna provides excellent reception levels; reception continues to be good up to an angle of 90°, whereas reception markedly deteriorates at beam angles of 110° and greater.

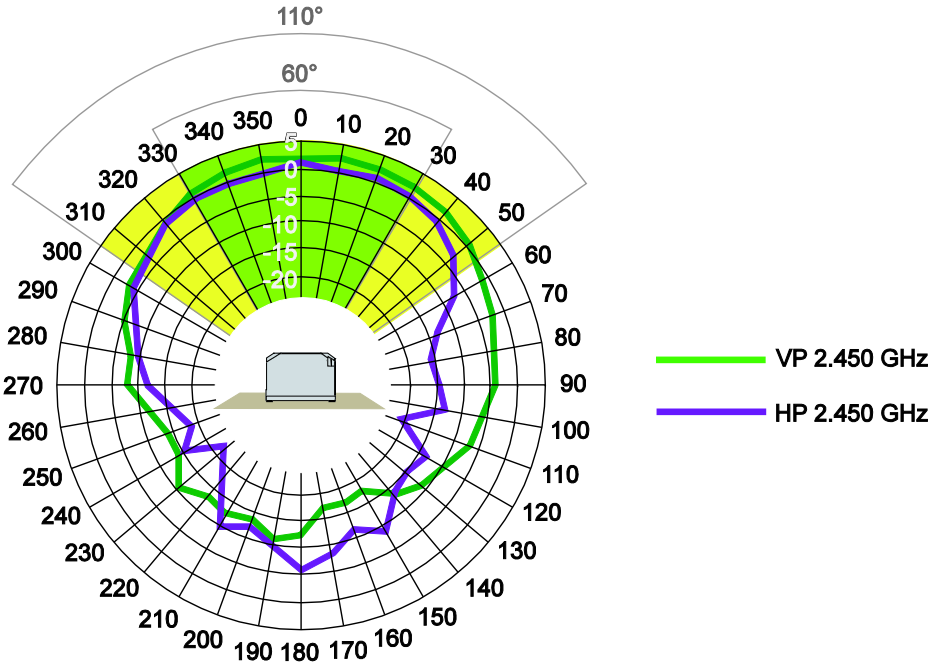


Figure 8: Antenna diagram – Horizontal 2.450GHz

The vertical antenna diagram shows the side view of the antenna's electromagnetic field.

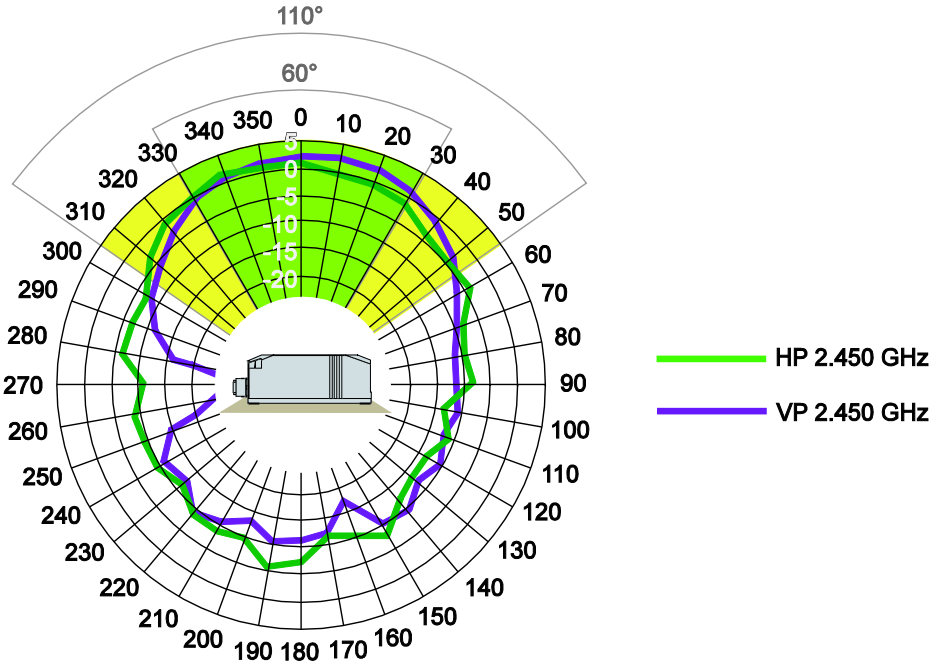


Figure 9: Antenna diagram – Vertical 2.450GHz

The alignment characteristic for the internal antenna is primarily relevant for links in the open field and over long distances. When operating the device at short distances, inside buildings or without line-of-sight links structural conditions are the decisive factor for good reception.

3.4 Display Elements

The current device status is indicated by the three LEDs on the front of the WEG.

Four other LEDs at the bottom of the device indicate the link quality, or the selected autoconfiguration procedure.

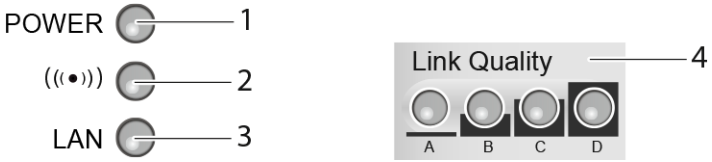


Figure 10: Display elements

Table 8: Legend for the “Display elements” figure

Nr.	Designation	Color	Status	Meaning
1	**Power**	green	On	Device ready for operation
			Off	Device not ready for operation
2	**(((.)))**	blue purple red	Blue	*Bluetooth*® link active
			Blue flashing	Data transmission
			Purple	Setting up link to other *Bluetooth*® device
			Red	Error
			Off	No *Bluetooth*® link available
3	**LAN**	yellow	On	ETHERNET link available
			Blinking	ETHERNET communication active
			Off	No ETHERNET link available
4	**Link Quality***	green	A on	Acceptable link quality
			A+B on	Good link quality
			A+B+C on	Optimal link quality
			A+B+C+D on	Excellent link quality
			Off	No *Bluetooth*® link available

* Status signals are also indicated via LEDs A to D during configuration. In this case, the indicators will differ from the status information given here, see Section “Configuration using the Mode membrane button”.

Note

Observe the operating mode!
The indicators for (((.))) and LAN are only valid when the power LED signals “Device ready for operation”. In special modes, such as device initialization or firmware update, the LEDs mentioned previously may respond differently than described above.

3.5 Operating Elements

The “Mode” membrane button is located at the bottom of the device. This button is used to initiate certain autoconfiguration procedures. LEDs A to D indicate which procedure is active. For more information about this refer to the Section “Configuration using the Mode membrane button”.

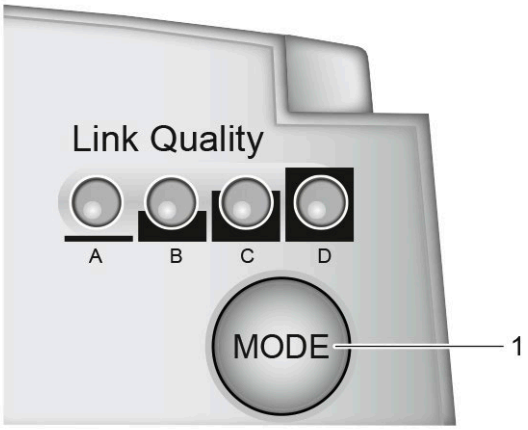


Figure 11: Operating element

Table 5: Legend for the “Operating element” figure

No.	Description
1	Mode membrane button

3.6 Technical Data

3.6.1 Device Data

Table 9: Technical Data – Device Data

Function	*Bluetooth*® ETHERNET Gateway
Dimensions (mm) W x H x D	66 x 91 x 36
Weight	120 g
Ports	Power connector: M12 plug, A-coded
	ETHERNET connector: M12 socket, D-coded
Operating temperature	-30 °C ... + 65 °C
Storage temperature	-40 °C ... + 85 °C
Degree of protection	IP65
Relative humidity (without condensation)	95 %
Connection to PE	not required
Fitting position	On a level mounting surface
Free from silicone	Yes
RoHS-compliant	Yes
Configuration	Via Web-based Management System or using the Mode membrane button
Immunity to interference	Static discharge based on EN 61000-4-2: Contact discharge ± 4 kV Air discharge ± 8 kV
	Electromagnetic fields based on IEC61000-4-3: 10 V/m, Criterion A
	Mains borne disturbance based on IEC 61000-4-6: 10 V RMS, Criterion A
	Rapid transients (burst) based on IEC 61000-4-4: Data interface: 1 kV Power supply: 2 kV
	Surge voltage based on IEC 61000-4-5: Data interface: ± 1 kV Power supply: ± 0.5 kV
Emission of interference	per EN 55022 Class B (residential areas)
Mechanical stability	Schock test based on IEC 60068-2-27 Operation 25 g, duration 11 ms Storage/Transport 50 g, duration 11 ms
	Vibration test based on IEC 60068-2-6 Operation 5 g, 10-150 Hz, Criterion 3
	Free fall based on IEC 60068-2-32 1 m

3.6.2 ETHERNET Interface

Table 10: Technical Data – ETHERNET Interface

Number of inputs	1 (trigger input)
Medium	Via M12, twisted pair wire, wire cross section 0.14 mm² … 0.22 mm²
Baud rate	10/100 MBit/s, Autonegotiation
Default IP address	192.168.1.99
Default subnet mask	255.255.255.0

3.6.3 *Bluetooth*® Interface

Table 11: Technical Data – *Bluetooth*® Interface

Bluetooth® version	*Bluetooth*® 2.0 based on IEEE 802.15.1; 2.4 GHz, max. 1 MBit/s
RF transmitting power	*Bluetooth*® Class 1
RF input sensitivity	-85 dBm at BER 0.1%
Wireless connections	1
Antenna	Internal directional antenna 5 dBi (non-exchangeable)
Transmission range	Up to 400 m (class 1)
Topology	Point-to-point
Bluetooth® Profile	PAN, PANU
Coexistence	FHSS with AFH and/or user-defined channel mask, adjustable transmitting power, Low Emission Mode™
Security	*Bluetooth*® security mode 3 supported, 128-bit encryption, authentication, PIN, non-discoverable mode

3.6.4 Supply

Table 12: Technical Data – Power Supply

Power supply connection	Via M12, max. wire cross section 2.5 mm²
Nominal Voltage	24 VDC (SELV)
Voltage range, permissible	9 V to 30 VDC
Current consumption, typical	65 mA at 24 VDC
Current consumption, maximum	200 mA at 24 V

3.7 Approvals

CE Conformity Marking

R&TTE Complaint with 1999/5/EG directive (per Article 3.2)

Bluetooth®

IC „Industry Canada“ IC: 5325A-090103AP

FCC "Federal Communications Commission" / CFR 47 Part 15, ETS 300328 FCC ID: PVH090103AP

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

With the exception of Andorra, Bulgaria, France and Latvia, the device may be used without restrictions in all European countries and in Switzerland, the USA and Canada.

The device may be used inside buildings in Bulgaria.
In France, the transmitting power must be limited to 10 dBm when used outside of buildings. In Norway the device may not be used with a radius of 20 km of the town center of Ny-Ålesund (Spitzbergen).

4 Mounting

4.1 Selecting the Installation Location

In order to use all the functions of the WEG, a radio link must be established to a device having similar functions, for example a second WEG of the same type. If the two devices are relatively close to one another, that is, if the distance between them is considerably less than the potential range, the installation location and device alignment will have comparatively little impact on the radio link. If you wish to set up and maintain a radio link over the longest distance possible, however, certain requirements regarding the installation of the device and the ambient conditions must be fulfilled.

The distance between devices may not be too great. The maximum range can only be effective under optimal conditions. A lack of line-of-sight link, or mis-alignment of the devices will result in reduced range.

For a line-of-sight link, install the devices such that the antennas are aligned toward one another, i.e., the marked front side of the devices face one another (see also the figure and the antenna diagrams in the section “Connectors” > “Antenna”).

If there is no line-of-sight link, but both devices have an unobstructed view of the same metallic or concrete surface (such as a building ceiling), a good radio link can be ensured through reflection.

If there is neither a line-of-sight link, nor a surface to use for reflection, for example between devices in different rooms, align the devices as for a line-of-sight link. The magnitude of the reduction in range for the devices in this case depends on the amount of material, e.g., brick walls, that the radio waves must pass through. In some circumstances, it may not be possible for the radio waves to penetrate certain obstacles, such as fire protection walls, at all.

Table 13: Selection of Installation Location

Ambient Conditions, Installation Location	**Radio link possible?**
Distance between devices is more than 400 m.	No
Line-of-sight link between devices that are about 200 m apart. Devices have been optimally installed and configured.	Yes
Two plaster or brick walls are located between the devices; distance between devices is around 30 m.	Yes. Links are also possible without line of sight, but the range is substantially reduced, depending on the obstacle (e.g., a wall).
A fire protection wall or a steel-reinforced concrete ceiling is located between the devices.	No. Reinforced concrete and other similar materials cannot be penetrated by radio waves when they are too thick.
The devices are located less than 50 m apart in a plant building, with the line of sight being obstructed by numerous machines or vehicles.	Possible. Building ceilings or other metallic or steel-reinforced large objects may permit an indirect link by reflecting the radio waves.

4.2 Fixing

Note

Always maintain a minimum distance of 50 cm between two WEGs!
Always maintain a distance of at least 50 cm between WEGs when installing them. Radio link quality can be degraded on failure to maintain this distance.

Note

Do not install antenna directly in front of metallic surfaces!
The front of the WEG, and hence the internal antenna, shall not be located directly in front of metallic surfaces, as this can permanently degrade the radio capabilities of the antenna.

Use the drilled holes (see drawing below), for example, and the two M3 screws to attach the WEG to any flat, level surface.

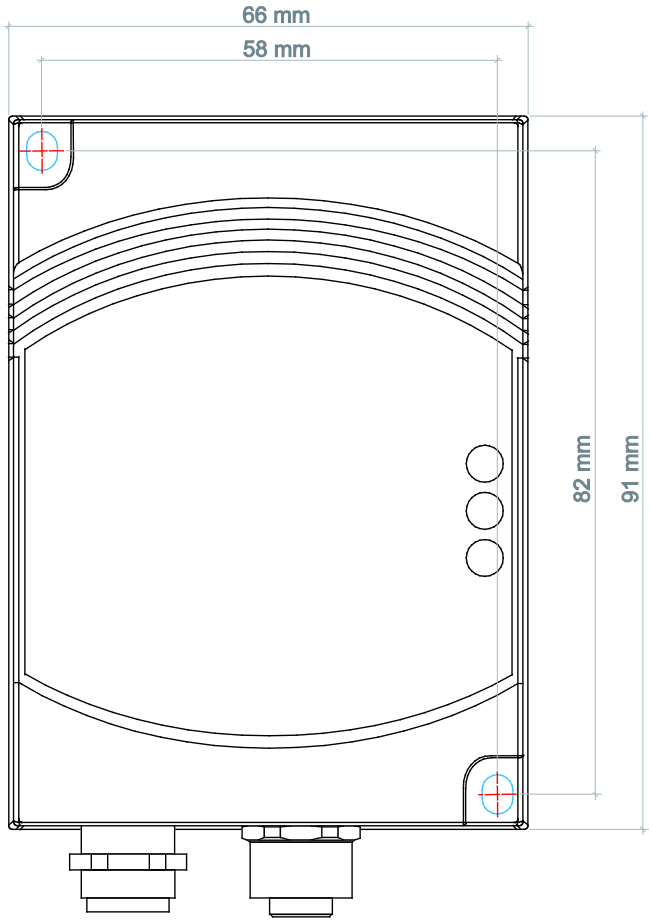


Figure 12: Drilled holes for attaching the WEG

5 Connect Devices

5.1 Connection

Before the device can be used, all cable connections must be established.

NOTICE

Ensure that wires are not live!
Power supply: Do not switch on the power supply until the device has been properly connected.
LAN: Improperly routed ETHERNET cables can carry dangerous overvoltage. Always ensure that these cables have been laid properly before connecting the device to the network.

1. Use a suitable cable, such as WAGO Item 756-1203/060-050, to connect the WEG to your network or ETHERNET terminal.

2. Use a suitable cable, such as WAGO Item 756-3101/040-020, to connect the WEG to the external power supply unit.

Figure 13: Connecting the WEG

6 Commissioning

The device is not equipped with a power switch, meaning it is put into operation simply by applying power.

Note

Use the correct supply voltage!
The output of the power supply unit must provide 24 VDC with a maximum current flow of 200 mA.

Switch on the external power supply unit to put the device into operation.

7 Configuration

After you have connected the WEG you can configure it in one of two ways:

- using the **Mode membrane button** and by activating certain modes
- by making settings via the **Web-based Management System (WBM)**

The various types of configuration are described in the following sections.

If the device has already been configured and you are not familiar with the current configuration, we recommend resetting the device to its factory default settings before making any further configuration settings. This can be done using the Mode membrane button.

7.1 Default settings

The following settings are active on initial startup of the WEG:

Table 14: Default Settings

Group	Subgroup	Parameter	Default value
Network	IP configuration	IP address	192.168.1.99
Network	IP configuration	Subnet mask	255.255.255.0
Network	IP configuration	Default gateway	192.168.1.99
Network	IP configuration	Receive IP via DHCP	No
Bluetooth	General	Operation mode	PANU
Bluetooth	General	Device name	“BTEG”
Bluetooth	Security	Passkey	“0000”
Bluetooth	Security	Security mode	On
Bluetooth	Security	Visible for other devices	Yes
Bluetooth	WLAN coexistence	Low emission mode	Off
Bluetooth	WLAN coexistence	Exclude WLAN channel	None
Bluetooth	Connection	Bluetooth address	(blank)
Bluetooth	Connection	Device name	(blank)
Bluetooth	Connection	Remote role	Panu
Bluetooth	Roaming	Link sensitivity	Medium
Bluetooth	Roaming	Connect to name scheme	Name
System	Security	Password	“wago”

You can always restore the factory default settings at any time using the Mode membrane button (see following section). This can be useful, for example, if you have forgotten the IP address or the device AT password.

7.2 Configuration Using the Mode Membrane Button

The quickest and easiest method for configuring the device is using the Mode membrane button located at the bottom of the device. LEDs A to D indicate the status during configuration, based on the active operating mode. By repeatedly pressing the Mode membrane button you can select and start an autoconfiguration procedure in the device that then automatically carries out the device configuration for the required scenario.

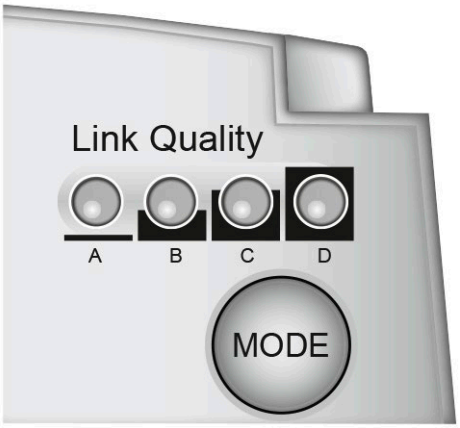


Figure 14: Mode membrane button and status LEDs

7.2.1 Overview of Autoconfiguration Procedures

The following autoconfiguration procedures can be selected in the order given:

Table 15: Autoconfiguration Procedures

Press button	Autoconfiguration Procedures	LED	A	B	C	D
1 x	**1 Exit configuration mode** Exit the configuration mode without saving changes made to the device configuration.	A	●	○	○	○
2 x	**1 Reset device to factory default settings** Restore all settings to the factory default settings.	B	○	●	○	○
3 x	**2 Reset IP parameters** Restore the IP parameters to the factory default settings. All other settings are retained.	A+B	●	●	○	○
4 x	**3 Wait for automatic configuration** The device will wait for configuration by a different WEG. Although the device is connectable, it will not initiate the setting up of a link.	C	○	○	●	○

Table 15: Autoconfiguration Procedures

Press button	Autoconfiguration Procedures	LED A B C D
5 x	**4 Initiate automatic configuration via *Bluetooth*®, WEG-WEG bridge** The WEG automatically sets up a link to a different WEG that is in the configuration mode “Wait for automatic configuration” (LED C) and then configures that WEG.	A+C 
6 x	**6 Initiate automatic configuration via *Bluetooth*®, WEG-WEG bridge with PROFINET-/PROFISAFE optimization** The WEG automatically sets up a link to a different WEG that is in the configuration mode “Wait for automatic configuration” (LED C) and then configures that WEG.	B+C 

On configuration using the Mode membrane button, only those parameters required for the particular autoconfiguration will be overwritten.

You can initially make changes via the Web-based Management System and then, for example, inhibit WLAN channels that are not to be used (“Channel skipping”). These changes also remain effective after one of the automatic configurations 3, 4, 5 or 6.

Autoconfiguration procedures 1 to 3 always become effective; procedures 2 and 3 change the device configuration immediately.
Autoconfiguration procedures 4 to 6 only change the device configuration when a radio link has been successfully established. If the WEG loses power before the autoconfiguration has been completed, or if no other WEG can be contacted via the radio link within 5 minutes for automatic configuration, the device will retain its previous configuration settings when it is restarted.

The following settings are overwritten in the course of the various autoconfiguration procedures:

Table 16: Overwriting of Configuration

Autoconfiguration procedure	Changes to Configuration on Successful Setup of Link
1	No changes made.
2	All settings are changed.
3	• Network > IP-Address: 192.168.1.99 • Network > Subnet Mask: 255.255.255.0 • Network > Gateway: 192.168.1.99
4	**Remote device using autoconfiguration procedure 5 or 6 (Initiate link setup):** • Network > IP-Address: 192.168.1.99 • Network > Subnet Mask: 255.255.255.0 • Network > Gateway: 192.168.1.99 • Bluetooth > Security > Passkey: (Random value, but identical to the partner device) • Bluetooth > Security > Security Mode: On • Bluetooth > Security > Visible: No • Bluetooth > Connection > Device Name: (blank) • Miscellaneous > Send AT command: > ATS1007=1250 > Send **Also effective when partner device is using autoconfiguration mode 6:** • De-activate the Web-based Management System • Activate PROFINET optimization
5, 6	**Autoconfiguration procedure 5 and 6:** • Network > IP-Address: 192.168.1.100 • Network > Subnet Mask: 255.255.255.0 • Network > Gateway: 192.168.1.99 • Bluetooth > Security > Passkey: (Random value, but identical to the partner device) • Bluetooth > Security > Security Mode: On • Bluetooth > Security > Visible: No • Bluetooth > WLAN coexistence > Low emission mode: On • Bluetooth > Connection > Device Name: (blank) • Bluetooth > Connection > Device Address: Device address of partner device • Miscellaneous > Send AT command: > ATS1007=1250 > Send **Also with autoconfiguration procedure 6:** • De-activate the Web-based Management System • Activate PROFINET optimization

Note

Enable de-activated WBM using the Mode membrane button!
If autoconfiguration is conducted with PROFINET optimization, the device de-activates the Web-based Management System to provide short cycle times. Consequently, configuration can only be changed using the Mode membrane button. Reset the device to the factory default settings to enable access to the Web-based Management System again.

7.2.2 Selection and Activation of an Autoconfiguration Procedure

General procedure:

1. Switch off the power supply to the WEG and then re-activate power supply to the device.

The Power LED lights up.

2. Within **the first 5 seconds** after applying power, press the Mode membrane button to switch to the operating mode “Configuration selection”.

LED A lights up and the operating mode “Configuration selection” is active.
If this is not the case, repeat steps 1 and 2.

3. Select the autoconfiguration procedure:
   Select the required autoconfiguration procedure by pressing the Mode membrane button until the appropriate combination of LEDs lights up (see previous section “Overview of Autoconfiguration Procedures”).
   If you have switched through all the operating modes in order, you can return to the first option in the order by pressing the button again.

Note

Configuration is halted if the Mode membrane button is not pressed for 20 s!
The mode “Configuration selection” is de-activated automatically if you do not press the Mode membrane button for selecting the autoconfiguration procedure. The WEG will then start up using the previous settings.

4. Activate autoconfiguration procedure:
   To execute the selected autoconfiguration procedure press the Mode membrane button again and hold it in for **at least 2 seconds** until the LED indicators A-D or the Power LED change.

Autoconfiguration procedure execution:
The device performs a restart as soon as the procedure has been completed successfully or canceled.

The behavior of the device up to this restart is based on the active autoconfiguration procedure:

Procedures 1, 4, 5, 6:	The LEDs A-D corresponding to the procedure will flash until the procedure is concluded. All of these procedures can also be manually terminated prematurely by pressing the Mode membrane button again, or by briefly disconnecting the power supply from the device. Procedures 4, 5, 6 also end automatically on successful configuration of a link, or after a timeout of 5 minutes.
Procedures 2, 3:	The device carries out the changes to the configuration and ends the procedure directly after this. This only takes a few seconds.

The LEDs return to their normal status on conclusion of the autoconfiguration procedure.

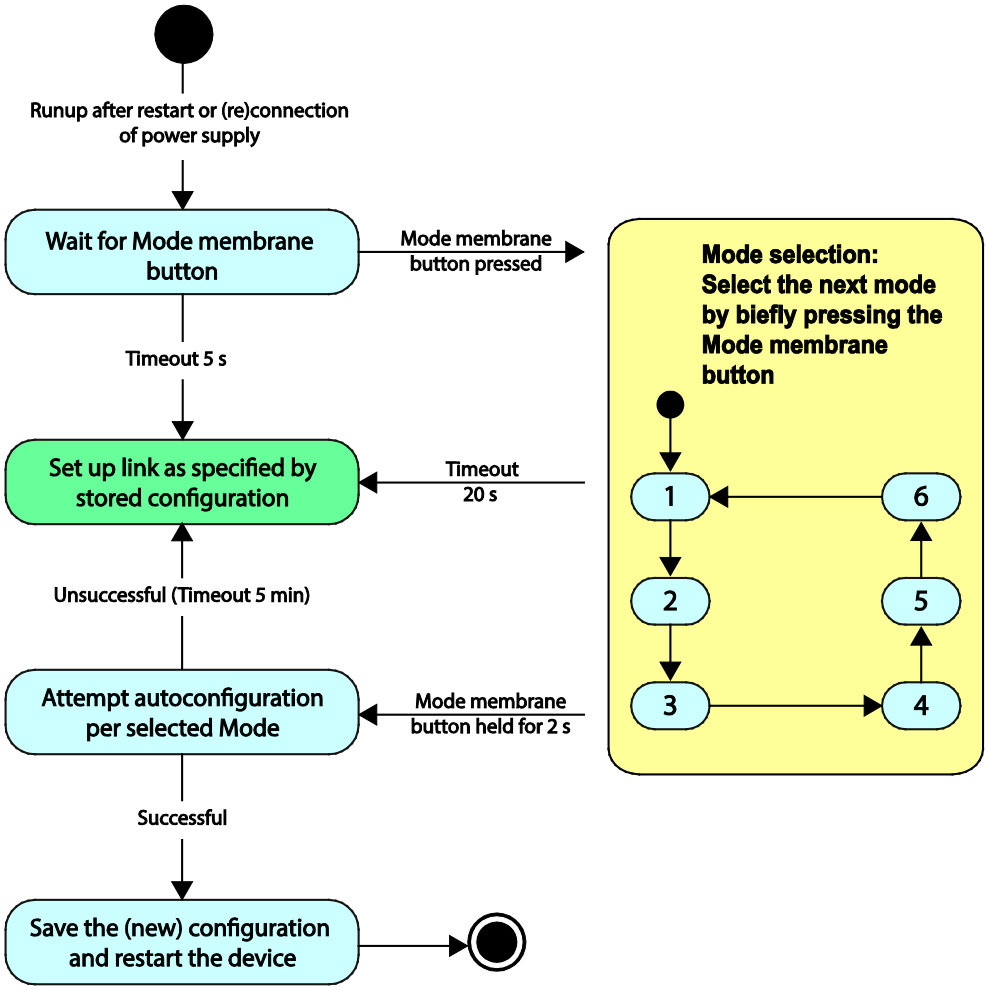


Figure 15: Flow chart

7.3 Configuration using the Web-based Management System (WBM)

A Web-based Management System (WBM) is available on an integrated Web server for configuring the WEG.

You can go the WBM by entering the IP address of the device in the browser URL line.

Device configuration is password protected. If you have forgotten the IP address or password you can reset the device to its factory default settings.

On initial commissioning, the device uses the static IP address and the default settings password (see Section “Default Settings”). You may have to modify the IP configuration of the PC from which you are accessing the WBM before a link can be set up.

7.3.1 Accessing the Web-based Management System

1. To open the WBM, launch a Web browser (e.g., Microsoft Internet Explorer or Mozilla Firefox).

2. Enter the IP address of the WEG on the URL line and confirm by pressing **[Enter]**.

Note

For WBM access; check the IP/firewall settings and the connection!
If you are not granted access to the WBM check the IP configuration for the PC from which you wish to access the WBM and the settings for the firewalls being used. Ensure that the WEG is properly connected and ready for operation and that the specified IP address is correct. Should you still not be able to set up a connection to the WBM after ruling out any error at the PC, or if you have forgotten the IP address of the WEG, reset the device to its factory default settings.

When access has been made to the WBM the WEG will display an overview page showing status information and operating elements for changing the device configuration (see figure below).

Before taking any further steps you should log on to the system using a valid password:

3. Enter your password in the field **System Overview > Password**.

4. Send the password by clicking on **[Login]**.

Note

Observe the proper processing sequence in the WBM!
When using the WBM, **always** enter your password **first**, then click **[Login]** and then click **[Read]**, to load the settings currently active in the device to the display. If you do not follow this sequence the device will display standard values (which cannot be changed) for password-protected settings instead of the actual values.

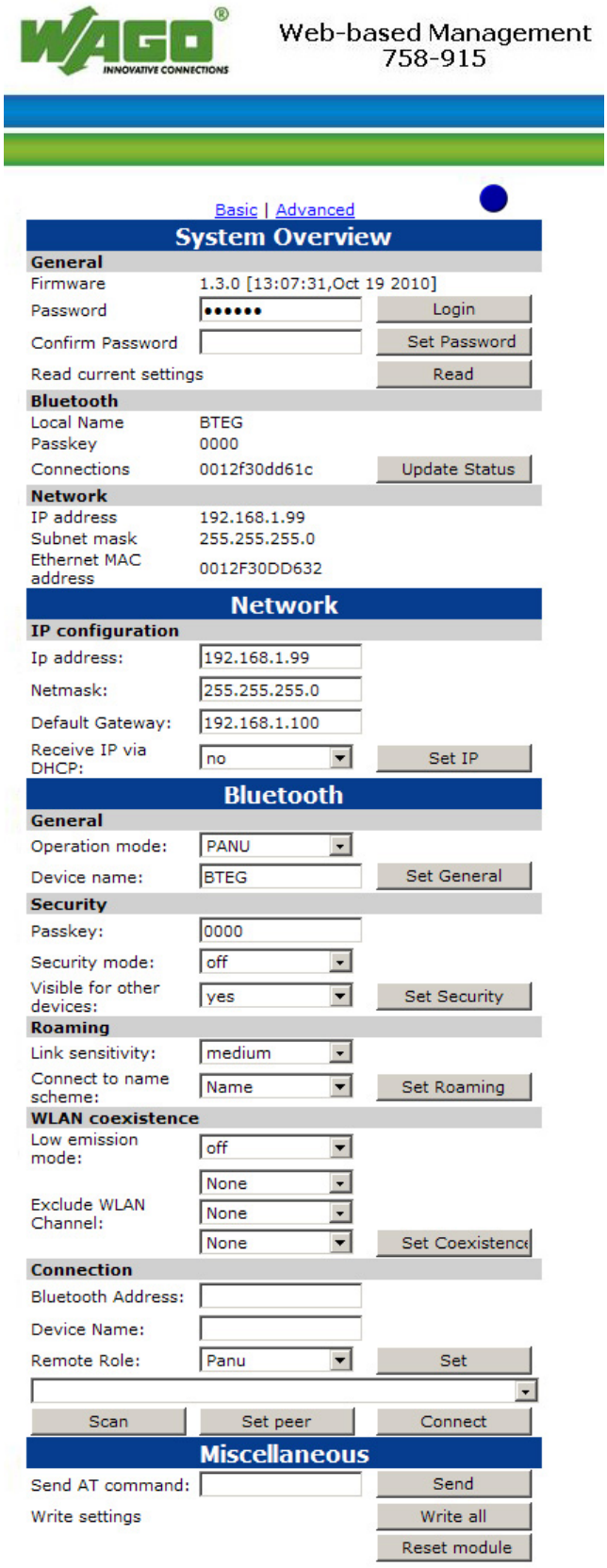


Figure 16: WBM Configuration page

7.3.2 "Basic" – "Advanced" Modes

Figure 17: "Basic" – "Advanced" modes

Reading or writing of parameters for the WBM is mapped internally by execution of AT commands.

When you click **[Advanced]** at the top of the WBM page a text dialog window "Output" is shown that displays the AT commands exchanged with the device. This display is only required when you wish to execute manual AT commands for an advanced configuration (see Section "Execution of AT Commands").

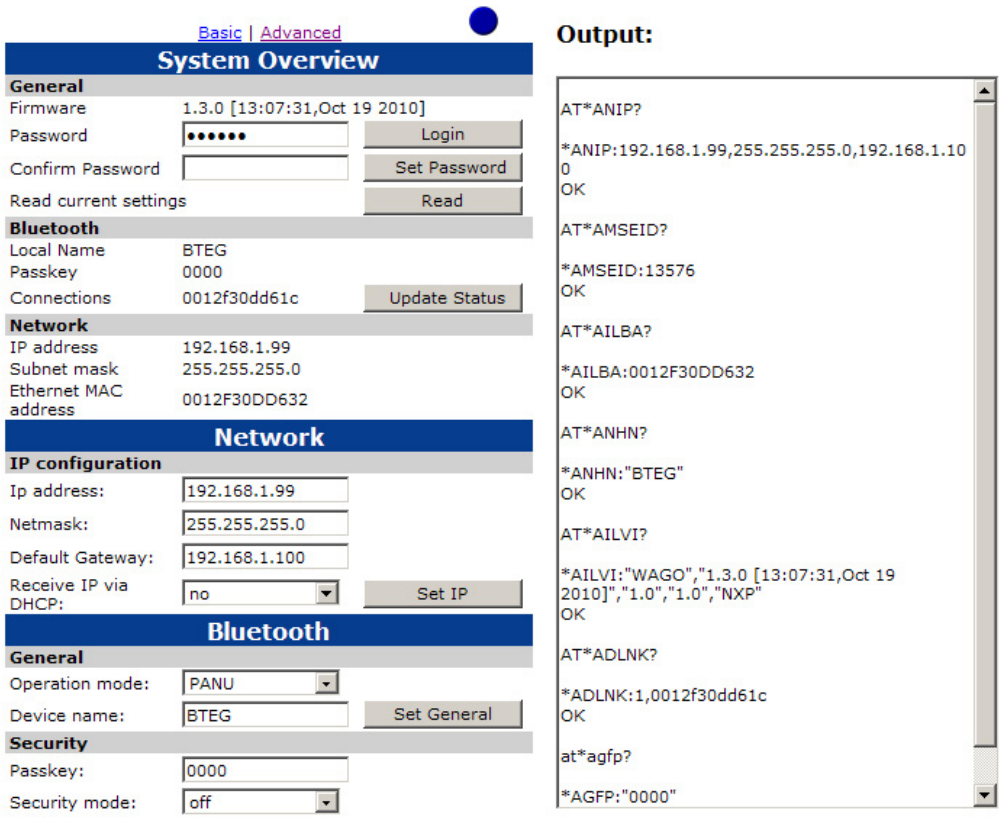


Figure 18: View of panel in the "Advanced" mode

This display is not required for configuration of the standard device settings. Click on **[Basic]** to hide this text dialog window again.

7.3.3 "System Overview" Section

The general device status is displayed in this section. You can also enter or change the access password here for protected device settings.

Change password

1. Enter the current password in the box **Password** (default: "wago").
2. Log in using this password by clicking **[Login]**.
3. Now enter your new password in the box **Password**.
4. Enter the password again in the box **Confirm Password**.
5. Save the new password by clicking on **[Set Password]**.

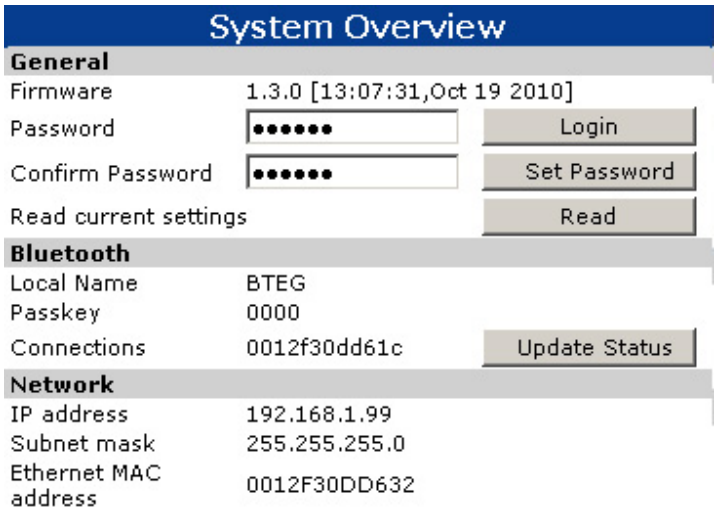


Figure 19: WBM configuration page – "System Overview" section

Table 17: WBM Configuration Page – “System Overview” Section

Entry	Input/Value/Button	Description
General		
Firmware	e.g. 1.3.0	Show the firmware version for the WEG
Password	_____	Input the access password for protected device settings
	[Login]	Send password
Confirm password	_____	Repeat/Confirm password
	[Set password]	Send new password
Read current settings	**[Read]**	Update display for all parameters presented in the WBM (read out current device settings)
Bluetooth		
Local name	BTEG	Display local device name
Passkey	0000 (default)	Display access code
Connections	Connected	*Bluetooth*® link established
	Not Connected	*Bluetooth*® link not established
	[Update status]	Read out and display all parameters for the section “System Overview” > “Bluetooth” from the device
Network		
IP address	162.168.1.99	Display IP address for WEG
Subnet mask	255.255.255.0	Display network mask
Ethernet MAC address	e.g. 00:12:f3:0d:d6:1c	Display the ETHERNET MAC address

7.3.4 “Network” Section

You can perform network configuration in this section.

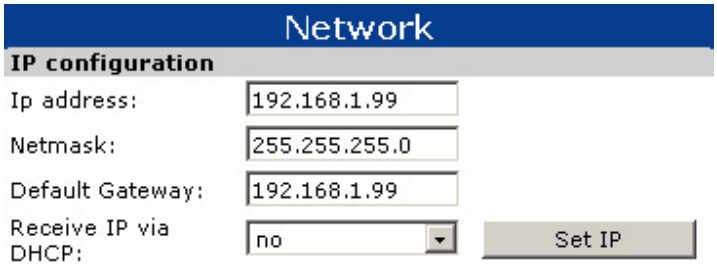


Figure 20: WBM configuration page – “Network” section

Table 18: WBM Configuration Page – “Network” section

Entry	Value	Description
IP configuration		
IP address	162.168.1.99	Input IP address for WEG
Netmask	255.255.255.0	Input the network mask
Default gateway	192.168.1.99	Input the standard gateway
Receive IP via DHCP	yes	Automatic allocation of IP address via DHCP If there is not active DHCP server in the network, the WEG will use the IP settings entered for “IP address”, “Netmask” and “Default gateway”.
	no	De-activate DHCP, manually set IP parameters The device will use the IP settings entered for “IP address”, “Netmask” and “Default gateway”.
	[Set IP]	Save selected settings in the section “IP configuration” in the WEG
		Note **Always restart the device after changing the IP settings!** Restart the WEG in the section “Miscellaneous” using **[Restart module]** if you have changed the IP settings. The WEG can be communicated with under the new IP configuration after restart.

Note

Use different IP addresses in PAN!
To rule out any IP address conflicts when linking the WEG to other PAN-compliant device, the devices must use different IP addresses.

Note

Reset IP parameters without changing settings!
If you no longer know the IP address for your WEG you can reset the IP address for the WEG using the Mode membrane button without having to change other settings (see Section “Configuration using the Mode Membrane Button” > “Overview of Autoconfiguration Procedures” > “3 – Resetting IP Parameters”).

7.3.5 "Bluetooth" Section

You can make changes in this section which affect the radio communications interface.

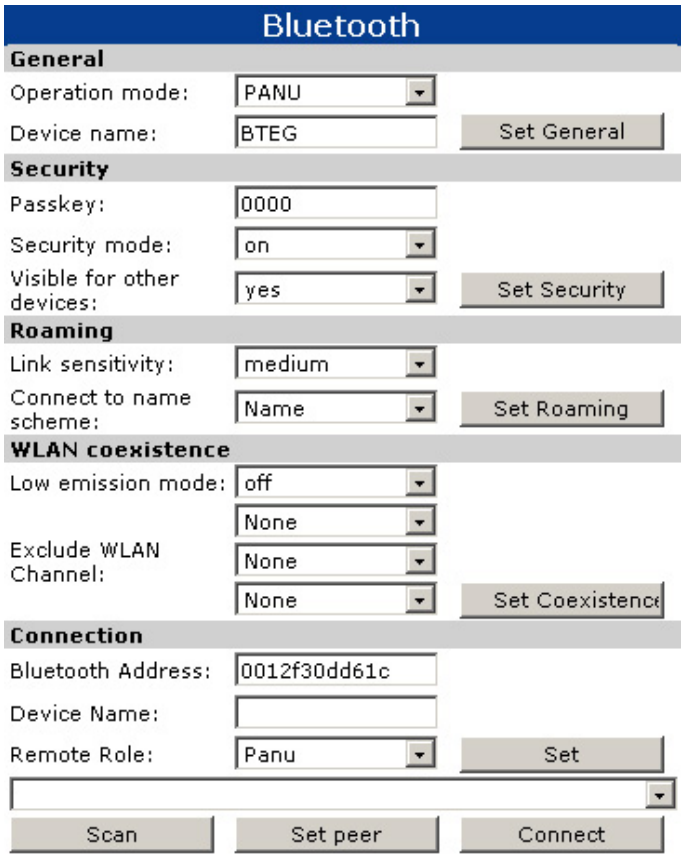


Figure 21: WBM configuration page – "Bluetooth" section

7.3.5.1 Bluetooth: General

Table 19: WBM Configuration Page – "Bluetooth" > "General"

Entry	Value	Description
General		
Operation mode	PANU NAP	The field "Operation mode" is reserved for future use. → Leave this setting at "PANU".
Device name	BTEG	Assign a device name (max. 248 characters) When inquiries are directed to the WEG the device identifies itself using this name.
		Note **Use unit device names!** Always use unique device names to facilitate identification of the devices.
	[Set General]	Save selected settings in the section "General" in the WEG

7.3.5.2 Bluetooth: Security

Table 20: WBM Configuration Page – "Bluetooth" > "Security"

Entry	Value	Description
Security		
Passkey	_____	Assign a passkey (max. 16 characters, no spaces, Standard passkey: "0000") The passkey (commonly referred to as the "*Bluetooth*® PIN") is used as the base value for calculating the actual link keys ("Link Keys"). The link keys, in turn, enable the use of secure authentication and encrypted data transfer.
Security mode	on	WEG requires a secure wireless link with other partner devices Both ends of the link must use the same passkey when a secure wireless link is set up.
	off	WEG does not require a secure wireless link with other partner devices The passkey is not evaluated
Visible for other devices	yes	WEG responds to inquiries from other devices The WEG replies only when not linked. The WEG does not usually reply to inquiries when it is actively linked to another device.
	no	WEG does not reply to inquiries from other devices Other devices may only set up a wireless link if they were previously linked to the WEG and their passkey has not changed since then.
	[Set Security]	Save selected settings in the section "Security" in the WEG

7.3.5.3 Bluetooth: Roaming

The WEG supports roaming between several other WEGs or PAN-compliant *Bluetooth*® network access points. The *Bluetooth*® device name of the other device is used in this process to identify as many link partners as possible.

If a device name has been given under "Bluetooth > Connection > Device name" and if a configuration has been saved using **[Set Roaming]**, the device will always attempt to establish a link based on the specified strategy ("Connect to name scheme").

In addition to restart and loss of link, the trigger input can also be used to initiate a new link setup. If a rising flank is recognized at the trigger input (see Section "Connections"), the WEG will terminate the existing wireless link and will set up a new link in line with the specified strategy.

Table 21: WBM Configuration Page – “Bluetooth” > “Roaming”

Entry	Value	Description
Roaming		
Link sensitivity	low medium high maximum	Sensitivity level at which the linked WEG reacts to disturbed radio link and attempts to switch to a partner device with a potentially strong signal. The higher this setting, the earlier the WEG attempts to change the link. → Select higher settings for scenarios in which fast roaming is required. → Select low settings for quasi-static links with adverse reception conditions.
Connect to name scheme		Strategy for searching for new link partners
		Note **Assign name or partial name of potential partner devices for evaluation of “Connect to name scheme”!** The settings defined here are only effective (or of significance) when the field **Device name** in the section “Bluetooth”> “Connection” is not blank.
	Name	• The WEG will search for exactly **one device**. • The device checks whether the device name contains the search string (see “Connection”). • The device establishes the link when this condition is fulfilled; otherwise it begins a new search (inquiry). → This setting is suitable for scenarios in which normally only the device to be linked is within range. If other active *Bluetooth*® devices are anticipated, use a different procedure.
	First name	• The WEG searches for a **list of devices** in the surrounding area. • The device checks each entry in the list to determine whether the specific device name contains the search string. • The WEG **establishes a link with the first device** to which this applies. As the order of the devices in the list of search results is random, the chosen device may not be the device with which the best link was able to be set up. → The initially detected device may be a device with low signal strength, which will ultimately result in increased roaming.
	Best name	• The WEG searches for a **list of devices** in the surrounding area. • The device **checks each entry in the list** to determine whether the device name contains the search string. • The **signal strength is determined** for each discovered device that meets this condition. • The WEG then establishes the link to an acceptable device with which a link can be set up. → Of the three strategies, “Best name” requires the longest time to set up a link, but does, however, usually provide the best results.
	[Set Roaming]	Save selected settings in the section “Roaming” in the WEG

7.3.5.4 Bluetooth: WLAN Coexistence

The adaptive frequency hopping technique (AFH) has always guaranteed excellent coexistence to other existing wireless networks. In this section you can define settings that enhance coexistence to WLAN systems in particular even more:

- In the "**Low Emission Mode™**" special coexistence measures are implemented to ensure that the WEG can also be operated in parallel with WLAN systems without any interference, including during a search (inquiry) for linkable devices.
- Using the option "**Exclude WLAN channel**" you can explicitly inhibit up to three WLAN channels. The frequency range for these WLAN channels will then not be utilized by the WEG.

Table 22: WBM Configuration Page – "Bluetooth" > "WLAN coexistence"

Entry	Value	Description
WLAN coexistence		
Low emission mode	on	When searching for linkable partners, the WEG employs the "Low Emission Mode™". This enables the frequency band to be commonly used more effectively. The WEG only evaluates this setting when it is the device that actively sets up the link. Links can be set up quickly to partner devices with the "Low Emission Mode™" activated. Linking to partner devices without, or with a de-activated "Low Emission Mode™" is only possible with restrictions. → With this mode activated, device inquiry and link setup require much more time. → With the "Low Emission Mode™" activated the WEG fulfills the requirements of the German automotive industry for secondary radio communications systems.
	off	No additional coexistence measures are implemented besides those set forth in the *Bluetooth*® standard.
Exclude WLAN channel	None 1 … 14	The WEG avoids the frequencies used by the specific WLAN channel when conducting its own wireless transmission. If required you can inhibit up to three WLAN channels using the three dropdown fields.
	[Set Coexistence]	Save selected settings in the section "WLAN Coexistence" in the WEG.

7.3.5.5 Bluetooth: Connection

In this section you can define under what preconditions a remote *Bluetooth*® device can be accepted as a link partner.

Note

Identification performed using either the device name or the device address!
Acceptable communications link partners are defined either by their device address or by their device name. As an OR option, one of these two fields must remain blank.

Note

Active link setup when device name / address has been entered!
If either the device name or device address field is not left blank the WEG will attempt to always actively set up a link on its own. This will prevent other devices from establishing a link to this WEG. When WEGs link up, only one of the devices may be active in setting up the link; the other one must remain passive. Therefore, the two fields for device name and device address must be blank for the passive WEG.

Table 23: WBM Configuration Page – “Bluetooth” > “Connection”

Entry	Value	Description
Connection		
Bluetooth address	_____	Enter the *Bluetooth*® address of the partner device → The communications link partner will be defined explicitly using this address. Links to other devices are not possible; for this reason the “Bluetooth address” setting is particularly well-suited for applications requiring stringent security precautions.
Device name	_____	Enter the device name for the link partner → The WEG identifies link partners on the basis of their device name entered here. Only those remote devices whose device names concur with the string entered in this field, or that contain this name as a substring, are considered to be acceptable devices (see Section “Sample Configuration” > “Roaming Among WEGs” in the appendix).
		 **Note** **Observe the proper spelling/case/structure of the device name!** In order for a remote device to be detected as an acceptable device, there must be 100% concurrence with the character string entered in the field **Device name** (for example, “weg” is not identical to “WEG”).
Remote role	Panu Nap Pan	Selecting the operating mode of the partner device • PANU (Personal Area Network User) for links to another WEG (standard setting) • NAP (Network Access Point) for links to access points • PAN (Personal Area Network) for links to either a PANU device or an NAP
	[Set]	Save selected settings in the section “Connection” in the WEG
	[Scan]	Search for compatible partner devices Discovered devices are displayed in the dropdown list above the **[Scan]** button. Select the preferred partner device from this list.
		 **Note** **Expand selection of partner devices!** To broaden the selection of discovered devices, de-activate the “Low Emission Mode™” in the section “WLAN Coexistence”. Save this setting using **[Write all].**
	[Set peer]	Automatically enter the data for the partner device (Bluetooth address) and establish the link
	[Connect]	Link up with partner device

7.3.6 "Miscellaneous" Section

You can define special settings in this section.

Figure 22: WBM configuration page – "Miscellaneous"

Table 24: WBM Configuration Page – "Miscellaneous" Section

Entry	Value	Description
Miscellaneous		
Send AT command	_____ **[Send]**	Input AT commands to use advanced device functions Send the AT command for execution to the WEG → To use this function you must already have clicked **[Advanced]** in the "System Overview" section to show the text dialog window with panel output.
Write settings	**[Write all]**	Save all of the settings currently shown in the WBM system in the device. → All settings will become effective immediately, except for the IP settings.
		Note **Check the parameters before saving!** Before storing the parameters, check to ensure that you actually wish to save all of the entered parameters.
		Note **Additional Information:** **[Write all]** includes all of the functions for the buttons **[Set IP]**, **[Set General]**, **[Set Security]**, **[Set Roaming]**, **[Set Coexistence]** and **[Set].**
	[Reset module]	Perform restart → Any changes to the configuration that have not been stored will be lost. If the IP configuration has been changed, the device can be communicated with under the new configuration after restart.

7.3.6.1 Execution of AT Commands

Both the AT commands transmitted via the WBM and the responses from the device are displayed in the text dialog window “Output”.

Output:

```
AT*AILVI?
*AILVI:"WAGO","1.3.1 [10:49:34,Nov 10
2010]","1.0","1.0","NXP"
OK

AT*AILBA?
*AILBA:0012F30DD61C
OK

AT*ADLNK?
*ADLNK:0,N/A
OK

AT*AMSEID?
*AMSEID:13576
OK
```

Figure 23: "Output" text dialog window for panel interface

Writing commands are concluded with "=<V>", with "<V>" indicating the value to be written. Read commands end with "?".

An example of write access could be "ATS1109=6", with "ATS1109?" as write access.

When the command has been executed, the WEG replies with "OK", followed by data (for read-only access). If the command fails, "ERROR" is signaled.

Table 25: AT Commands

AT Command	Description
AT&F	Reset the WEG to the factory default settings. There is no distinction drawn between read and write access for this command, nor does it possess any parameters.
ATS<n>? ATS<n>=<v>	Query or write the current value from the S register <n>. <n> = 1007: Poll interval: Defines the time intervals that the WEG checks whether new wireless communication messages have arrived from the partner device. Low values reduce latency, high values reduce current consumption. Recommended values: 1250: Optimization for minimal latency for linking with another WEG 25000: Optimization for best compatibility for linking to a generic *Bluetooth*® access point. <n> = 1109: Max inquiry output power: Upper limit for transmitting power (in dBm) for device search (inquiry) and link setup (paging). This value should never be selected so as to be greater than “Max output power”. <n> = 1211: SMART LED mode: Function of LEDs A..D for an active wireless link. 0x01: Only display RSSI at LEDs A..B 0x02: Only display link quality at LEDs A..D 0x03: Display RSSI at LEDs A..B and link quality at LEDs C..D
AT*AMGD? AT*AMGD=<data>	Up to 31 bytes of any user-specific data <data> can be stored in the WEG. This data is permanently stored and is also available after a restart.
(read access only) AT*AMRP?	Queries of the current transmitting power This query can determine any transmitting power margin that may be available. If this value is lower than 12, the link to the partner device is so strong that the WEG need not operate at the full transmitting power level.
AT*AMMP? AT*AMMP=<v>	Max output power: Read out/Set upper limit for the maximum transmitting power (in dBm). The WEG will never violate the limit specified here. If an unacceptably high value is used for write access, the WEG was use the next lower, valid value.
AT*AMSBN? AT*AMSBN=<v>, <s>	Read / Write SNMP name. If SNMP is to be used, this field should be assigned the value “WAGO_WEG_11:22:33:44:55:66”, with the MAC address of the WEG to be used in place of the digits shown here. The value <s> indicates whether the name is to be stored as a volatile (<s> = 0) or non-volatile (<s> = 1) value.

Information

Additional Information:
A complete list of the AT commands is available from WAGO Support.

8 Appendix

8.1 Sample Configurations

8.1.1 Preparation

Note

Reset the WEG prior to the sample configuration!
Always perform the following steps for the sample configuration **for all WEGs involved** to reset the WEGs to the factory default settings.

1. Connect the WEG to the power supply. If power is already applied, disconnect it briefly and then re-activate power supply to the device.

2. **Within 5 seconds after connecting power** pressure Mode membrane button.

The “A” LED lights up and the Configuration mode is active.

3. Press the Mode membrane button **1 x** to select autoconfiguration procedure 2 (“Reset to Factory Default Settings”).

LED “B” lights up.

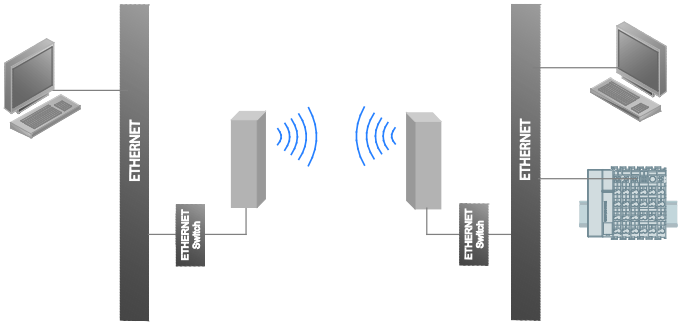
4. Press and hold the Mode membrane button for **at least 2 seconds** until LED “B” goes out.

The WEG has now been reset to the factory default settings.

8.1.2 WEG-WEG Bridge

Using two WEGs, a wireless link can be set up between spatially separated ETHERNET segments. This is useful, for example, when laying of a cable may not permitted or practical on account of structural conditions.

In this configuration example the WEGs fulfill the function of an ETHERNET bridge, i.e., they make network nodes of both ETHERNET segments accessible to one another by creating a transparent link on Layer 2 of the OSI reference model.



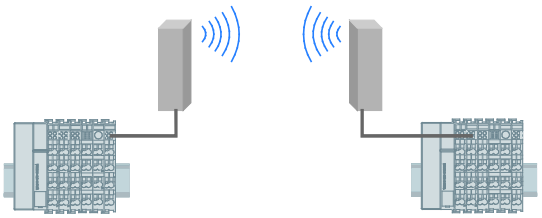


Figure 24: WEG-WEG bridge

The easiest way to conduct this configuration is to activate the associated autoconfiguration procedure using the Mode membrane button.

Note

Configuration changes the IP settings!
Please note that the configuration described below will also change the IP configuration of the devices (see Section “Configuration using the Mode Membrane Button”).
Upon conclusion of the autoconfiguration, the Web-based Management System can be accessed by every WEG under the new IP configuration.

8.1.2.1 Configuration of the 1st WEG Using the Mode Membrane Button

1. Activate the Configuration mode by pressing the Mode membrane button **1 x** within **5 s after restarting** the device.
   (If an extended period of time has passed since the last restart, disconnect the power from the device, reconnect it and then press the Mode membrane button.)

The “A” LED lights up and the Configuration mode is active.

2. Press the Mode membrane button **3 x**.

LED “C” lights up.

3. Press and hold the Mode membrane button for **at least 2 seconds** until LED “C” begins flashing.

This WEG is now in the operating mode “Wait for automatic configuration”, which remains active for about 5 minutes.

8.1.2.2 Configuration of the 2nd WEG Using the Mode Membrane Button

1. Activate the Configuration mode by pressing the Mode membrane button **1 x** within **5 s after restarting** the device.
   (If an extended period of time has passed since the last restart, disconnect the power from the device, reconnect it and then press the Mode membrane button.)

The “A” LED lights up and the Configuration mode is active.

2. In the Configuration mode press the Mode membrane button **4 x**.

The “A” and “C” LEDs light up.

3. Press and hold the Mode membrane button for **at least 2 seconds** until LED “A” and “C” begin flashing.

The WEG now attempts to set up a link to the 1st WEG.
Once this link has been established successfully, the 2nd WEG will configure the 1st WEG.
Both devices then carry out a restart and re-establish a wireless link automatically.
Successful autoconfiguration and establishing of a wireless link is indicated by the permanently lit blue link LED “**(((.)))**” on the top of both devices.

8.1.3 Roaming Among WEGs

When several WEGs are used, point-to-point links can be established consecutively between an ETHERNET segment and alternating other ETHERNET segments. This provides an ETHERNET device mounted on an independent transport system, for example, to always have access to a central network along long transport sections or in different rooms via a WEG with other suitably positioned WEGs.

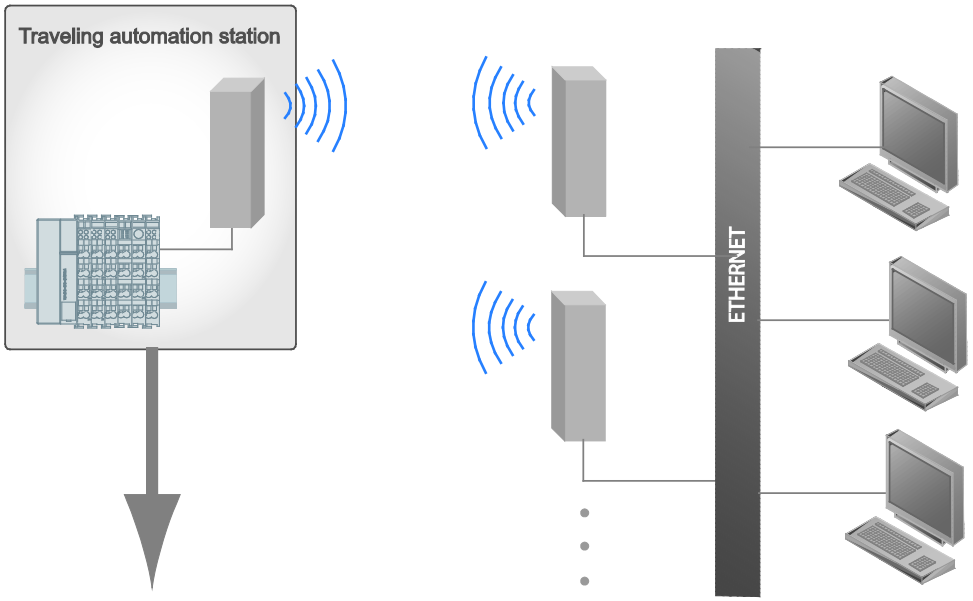


Figure 25: Traveling automation station

In scenarios with automatically changing links between several partner devices (“roaming”), each participating WEG must play one of two roles:

1. **Active Device**
   In this function the WEG initiates links to other WEGs automatically. Identification of suitable link partners is determined using the device names.

2. **Passive Device**
   In this function the device is ready to establish a link to any other WEGs but does not initiate setup of a link on its own.

In moving scenarios the passive devices involved in link setup are usually stationary (access points) and make up the majority of the devices, whereas the active device involved in link setup represents the mobile component and is only present as a single device or a low number of devices. Although the descriptions given below concur with this breakdown, it is not necessarily mandatory; a stationary device can also be the active device and a mobile device can be passive for link setup. The ration of active to passive devices, and vice versa, is also freely definable for roll assignment.

8.1.3.1 Common Configuration of WEGs

The following settings should be made via the Web-based Management System at all WEGs that are used, regardless of their role in this scenario.

Table 26: Common Configuration of WEGs

Group, Subgroup, Parameter	Value
Bluetooth, Security, Passkey	Must be identical for all WEGs.
Bluetooth, Security, Security Mode	Must be identical for all WEGs, recommended: On
Bluetooth, WLAN coexistence, Exclude WLAN channel	Should be identical at all WEGs.
Bluetooth, Connection, Bluetooth Address	(blank)
Bluetooth, Connection, Remote role	PAN

8.1.3.2 Configuration of Access Point WEGs

The following settings must be made via the Web-based Management System for each WEG that is to be used as an access point.

Table 27: Configuration of Access Point WEGs

Group, Subgroup, Parameter	Value
Bluetooth, General, Device name	Appropriate, device-specific name with a portion of the name that applies to all devices. For example, the following name can be selected when a total of three WEGs are used as access points: “WEG_myAP_X”, “WEG_myAP_Y”, “WEG_myAP_Z”.
Bluetooth, Security, Visible for other devices	Yes
Bluetooth, Connection, Device name	(blank)
Miscellaneous, AT commands, AT*AMMP (Maximum transmit power)	This setting limits the range of the specific WEG. Range is cut in half for each 6 dB. This is useful when a particular access point is to be linkable only within a relatively small radius to the device which is configured for changing link partners (roaming).

8.1.3.3 Configuration of a WEG with Changing Link Partners (Roaming)

You must make the following settings via the Web-based Management System for the WEG that is to be linked to alternating link partners.

Table 28: Configuration of the WEG with Changing Link Partners (Roaming)

Group, Subgroup, Parameter	Value
Bluetooth, Connection, Device name	Substring that is identical to the device names of all other WEGs to which a link is to be established. For example, this may be “WEG_myAP_” for links to devices having the name “WEG_myAP_X” and “WEG_myAP_Y”.
Bluetooth, Roaming, Link sensitivity	Based on the desired scenario – high setting when the device should switch access points at an early stage, low setting when existing links are to be maintained as long as possible.
Bluetooth, Roaming, Connect to name scheme	Recommended: “Connect to best name”
Miscellaneous, AT commands, AT*AMMP (Maximum transmit power)	Recommended: 20
Miscellaneous, AT commands, S register 1109 (Default transmit power)	This value determines at which range access points can be detected when searching for other devices. Accordingly, this value should be low for a dense network of access points and high for other cases. In any case the selected value must not exceed the setting for “Maximum transmit power” (AT*AMMP); it is better when this value is less than 6.

8.1.3.4 Roaming with Several Devices

Several devices, which can switch between link partners (roaming) can normally be used. If, however, several of these devices are located within the range of the same access point, only one device will be able to set up a point-to-point link. If enough WEGs are available, this problem can be resolved by each access point comprising several WEGs.

8.1.4 One or More WEGs at a Generic *Bluetooth*® NAP

A link can be set up to any *Bluetooth*® network access point (NAP) using a WEG to enable communication with devices in its ETHERNET segment. The following settings must be made for this in the Web-based Management System in the WEG:

Table 29: One or More WEGs at a Generic *Bluetooth*® NAP

Group, Subgroup, Parameter	Value
Bluetooth, Security, Passkey	Identical to the item selected at the access point.
Bluetooth, Security, Security Mode	Identical to the item selected at the access point.
Bluetooth, WLAN coexistence, Low emission mode	Off
Bluetooth, Connection, Bluetooth Address	MAC address of the access point, if known; otherwise leave blank.
Bluetooth, Connection, Device Name	If you do not know the MAC address for the access point enter the device name for the access point; otherwise leave blank.
Bluetooth, Connection, Remote role	NAP

The access point must normally be properly configured before a link can be established. Information necessary for this can be found in the documentation for the specific device.

8.2 Time Response

Optimal time response is achieved when a WEG is operated together with another WEG. Radio transmission then requires about 7 ms. The reply time for double transmission, such as for a ping, is about 14 ms.

On account of the limited bandwidth of the transmission path, a delay of around 8 ms must exist between transmissions of ETHERNET data packets. You must therefore set the cycle time appropriately for the bus master for transmission of cyclic fieldbus data.

8.2.1 Time response example: PROFINET

Recommendations for using a WEG-WEG bridge for transmitting data for a PROFINET network are given below.

In the event that outside data, such as from the IP protocol family, is present in addition to the PROFINET network data, PROFINET optimization should be activated, to ensure that the PROFINET data is handled with a higher priority. Failure to activate this option can result in the outside data occupying transmission bandwidth, making it unavailable for transmission of the PROFINET data.

The following minimum cycle times shall not be violated if the master is operated at one end of the wireless link and the smaller network with the slave nodes at the other end:

Table 30: Cycle Times between Master and Smaller Network Consisting of Slave Nodes

Number of slave nodes	Minimum cycle time [ms]
1	≥ 10
2	≥ 20
3	≥ 30
4	≥ 40

The data given in the table is based on typical applications, which tolerate sporadic packet loss or delays and which only signal an error after one or two repeated packet loss, for example.

When protocol or application data that must be in real-time is transported via the cyclic bus, the mandatory timeout must be at least four times the current cycle time, plus the one-way transfer time. Normally, a value less than that indicated in the table below should not be selected:

Table 31: Mandatory Timeout

Number of slave nodes	Minimum timeout value [ms]
1	≥ 60
2	≥ 100
3	≥ 150
4	≥ 200

Although linking of extensive PROFINET networks via wireless links is possible, this must be done using appropriately relaxed time limits.

8.3 Data Rate

The WEG offers a particularly robust substitute cable path with a long range thanks to the use of *Bluetooth*® technology. Transmission is only transparent, however, when the data to be transferred does not exceed the wireless link bandwidth. The maximum theoretically achievable data rate for bidirectional transmission via a WEG-WEG bridge is around 0.5 Mbit/s for each direction. Under actual conditions the maximum theoretical rate may not be fully achievable, depending on the type of ETHERNET packets to be transported. The device is not or is only conditionally suitable for applications such as streaming of multimedia content. The device is primarily used for wireless linking of automation systems, which transfer set volumes of process data in defined cycles.

8.4 Coexistence

A basic understanding of the significant influencing factors is required to optimize coexistence between different wireless technologies and/or devices. A brief description of the essential basics is therefore given below. These are followed by specific instructions for appropriate configuration of the WEG to conduct optimization of coexistence tailored to your particular application.

8.4.1 Basics

A significant advantage of *Bluetooth*® technology is that *Bluetooth*®-based products can carry out wireless communications license free. This is enabled using the ISM band at around 2.45 GHz, in which license-free data transmission is permitted throughout the world as long as specific provisions are adhered to.

However, as radio frequencies for data transmission are only available for a limited period, the range between 2.4 GHz and 2.5 GHz in particular is currently used by a number of standardized and proprietary technologies alike. Despite each technology having to support automatic coexistence mechanisms, these automatic mechanisms cannot always guarantee interference-free coexistence when the density of wireless users at a location exceeds certain limits. As nearly every technology will repeat transmission of data automatically in the event of interference, data loss or corrupt data can be ruled out, but the achievable transmission rate is reduced, thus increasing the transmission and reaction times.

Some companies have therefore begun having the use of wireless technologies organized by a central frequency utilization plan. The following basic multiplex techniques are employed to ensure interference-free coexistence:

1. **Time-Division Multiplex**
   Different devices must transmit simultaneously in order for a disturbance of two or more transmission signals to occur. At low traffic volumes, considerably more devices located near one another can be operated before a disturbance occurs.

2. **Code Multiplex**
   Even if radio signals are transmitted at the same time at the same location and in the same frequency range, the signals can be differentiated and sorted out at the receiving device on the basis of the codes (or frequency splitting techniques) that are used.

3. **Space-Division Multiplex**
   As wireless technologies may only operated with limited transmitting power in the ISM band, the transmitted signals become so weak at a certain distance that they no longer interfere with other devices.

4. **Frequency-Division Multiplex**
   Radio signals that use clearly isolated frequencies do not interfere with one another.

Availability of the multiplexing techniques presented here to the user does, however, vary to substantially different degrees.

1, for example, is essentially determined by the communicating applications. Although consideration can be given in the development of the application to ensuring that only important data is transmitted and that there is no steep increase in data traffic under critical conditions in particular, the stipulated process-based limits are nevertheless always tight.
The method explained under **2** is employed automatically by the wireless technologies involved; options for adaptation by the user are not given and would not be practical in any event.
The techniques described under **3** and **4** can, on the other hand, be easily integrated in a frequence utilization plan. Spatial distribution of devices taking part in wireless communication can easily be planned. Taking into consideration the structural conditions, in particular of fire protection walls or other “absorber” obstacles, mutual interference can be completely ruled out. Frequency-division multiplexing can be employed when clear, spatial separation is not possible. Some technologies even enable the user to specify set frequency ranges to allow them to be reserved exclusively for certain devices. Other technologies monitor the frequency band being used and automatically avoid ranges already experience intensive use.

Implementation of *Bluetooth*® technology in the form of the WEG 758-915 supports both approaches.

8.4.2 Space-Division Multiplex (Adaptation of Transmitting Power)

Bluetooth® technology implements automatic adaptation of transmitting power based on the signal quality. When the devices receive a very strong signal they reduce the transmitting power automatically; similarly, they also increase transmitting power when weak signals are received. This can be a problem to the extent that this mechanism does not recognize the cause for the poor signal. For example, when two devices equipped with different technologies are installed directly next to one another, this may degrade the reception quality on account of transmission by the other device. Now, when the transmitting power is increased due to poor reception, this may degrade reception even further. In cases like this and other similar scenarios, space-division multiplex should be provided as a better solution, based on proper installation and configuration.

It can usually be assumed that over a distance at which two devices with the same technology can no longer receive signals the devices also will not cause any interference.

By reducing the “Maximum transmit power” using the AT command AT*AMMP=<v> to the extent that reception is just possible at the planned installation location you can limit the radius covered by transmission to a minimum

The figure below illustrates the behavior for the maximum radius covered, depending on the optional device settings, (assuming unobstructed propagation of radio waves). A range difference of a factor of 10 exists between the highest and lowest limit that can be selected.

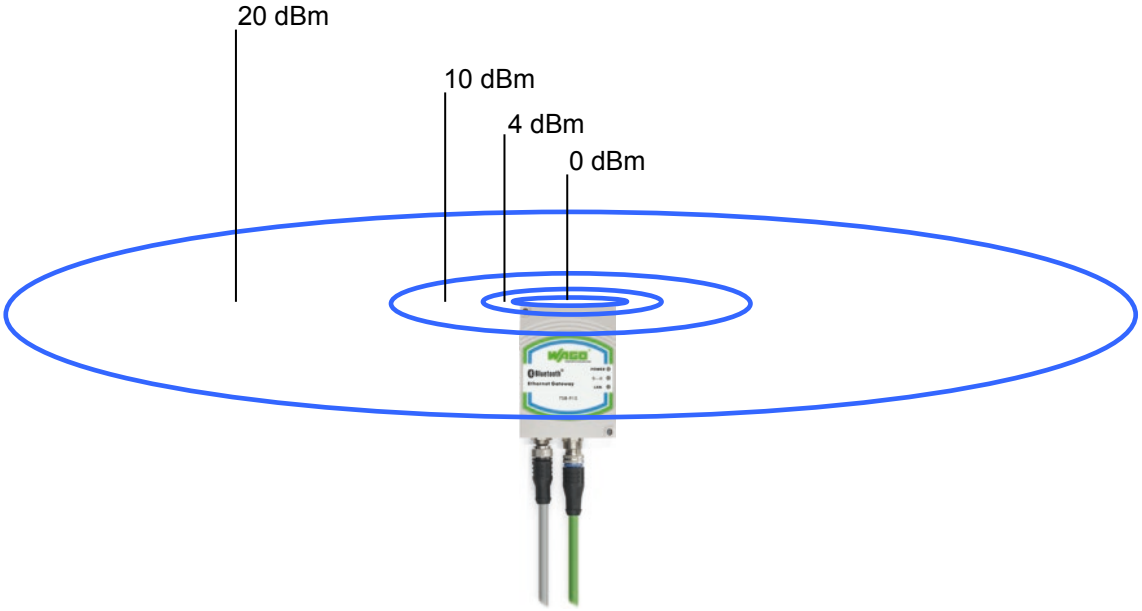


Figure 26: Range and limiting of transmitting power

8.4.3 Frequency Multiplexing (Switching of Channels with AFH and FHSS)

WLAN and *Bluetooth*® are the most common technology systems that utilize the license-free 2.45 GHz frequency band.

WLAN based on IEEE 802.11 b/g

- 11 channels for use worldwide
- 20 MHz bandwidth per channel
- Maximum of 3 channels can be used without any overlapping, e.g., channels 1, 6, 11

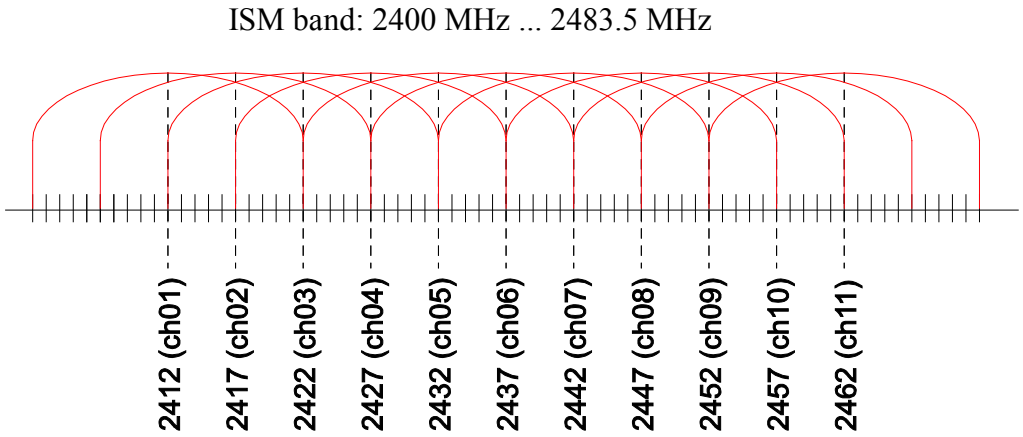


Figure 27: “Adaptive Frequency Hopping” (AFH) with WLAN example

***Bluetooth*® based on IEEE 802.15.1**

- 79 channels for use worldwide
- 1 MHz bandwidth per channel

Each connection can utilize all channels using the “Frequency Hopping Spread Spectrum” (FHSS). Only one channel is used at one time; this can be changed up to 1600 times per second.

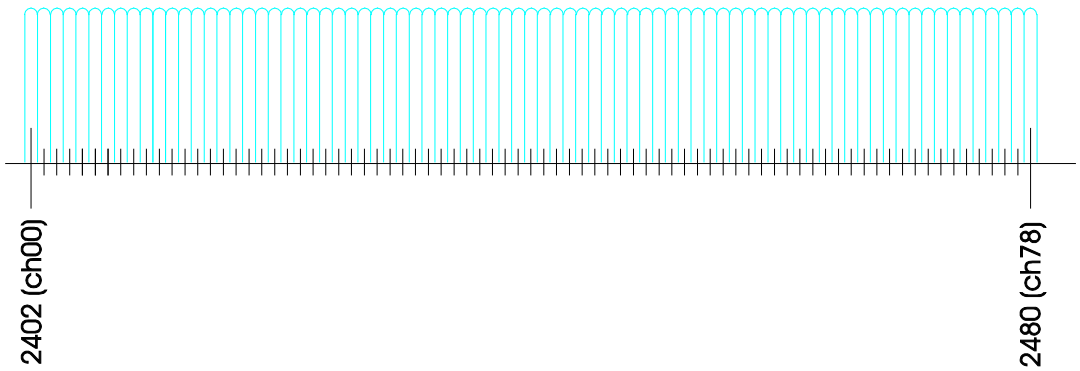


Figure 28: AFH with *Bluetooth*® example

Coexistence of *Bluetooth*® and WLAN

The *Bluetooth*® system (here: the WEG) employs “Adaptive Frequency Hopping” (AFH). The frequencies utilized in a WLAN system can be detected as being interfered with (see figure below).
In the example shown here, the *Bluetooth*® system does not use the affected channels 28-51, enabling WLAN and *Bluetooth*® to both have transmission without interference.

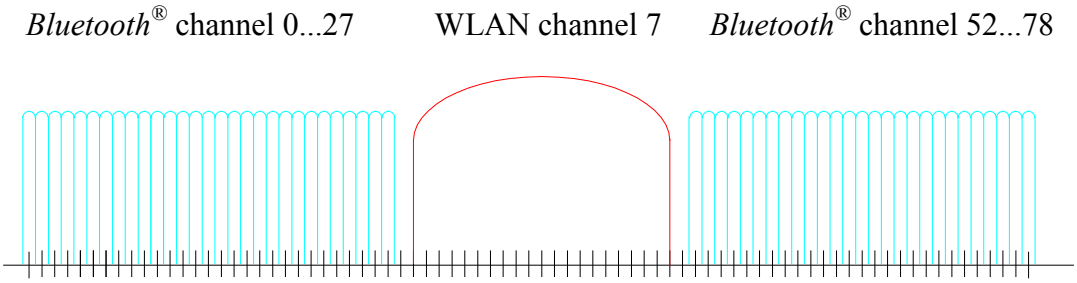


Figure 29: AFH with *Bluetooth*® and WLAN example

For AFH to be effective, transmission by the WLAN system must produce signals strong enough to interfere with *Bluetooth*® transmission. The figure below how *Bluetooth*® system transmission (blue/red) is repeatedly disturbed by an outside transmitter (purple). After a brief time AFH detects that the frequency involved is being interfered with and avoids this frequency in the future (transparent red). WLAN system transmission signals are also present (green/yellow) that do not disturb *Bluetooth*® transmission, but, due to its low signal strength, is likewise disturbed (yellow), making repetition necessary.

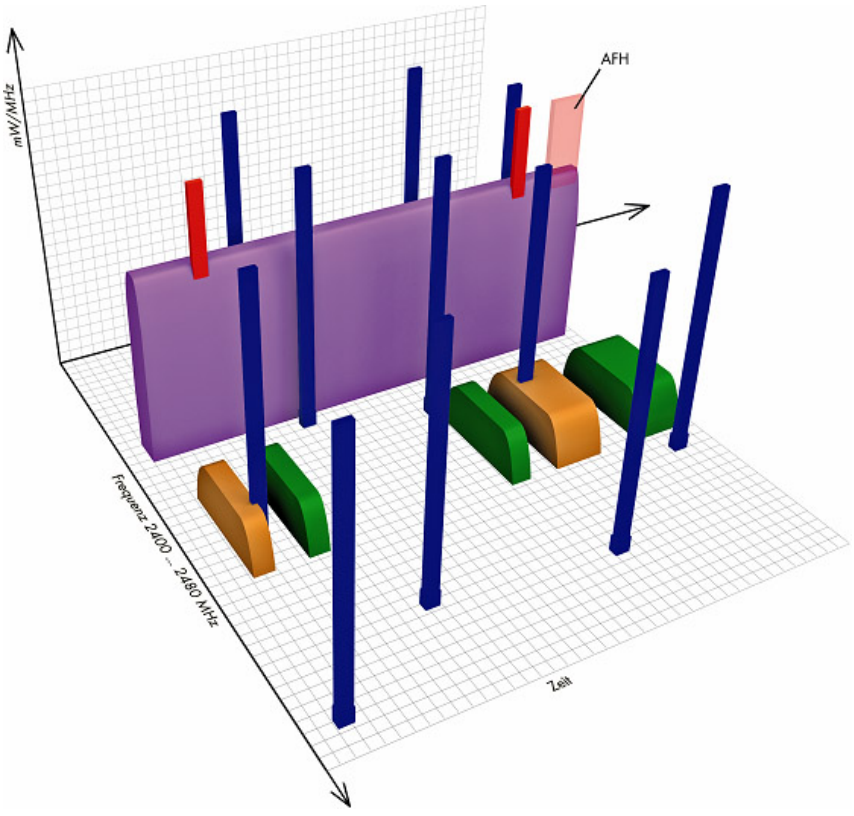


Figure 30: *Bluetooth*® with AFH, but without “Channel blacklisting”

The WEG also enables you to also “blacklist” (inhibit) frequency ranges in order to enhance coexistence between competing technologies:

→ In the Web-based Management System under “Bluetooth > WLAN coexistence > Exclude WLAN channel” enter the channel used by the WLAN; these frequencies will then be permanently blocked (highlighted in light blue).

After this, repeated transmission will no longer be required, as the transmission frequencies will not be disturbed (see figure below).

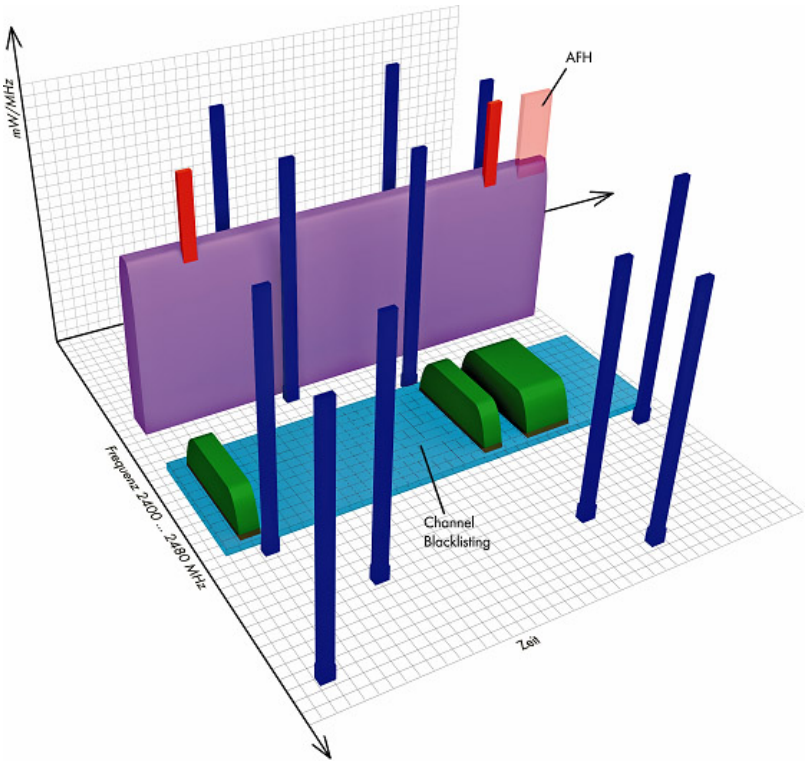


Figure 31: *Bluetooth*® with AFH and “Chanel blacklisting”

Optimum coexistence can be achieved using a combination of AFH and manual blocking of WLAN frequency ranges, guaranteeing undisturbed operation at a maximum transmission rate and minimum transmission and reaction times.

8.4.4 Low Emission Mode™

The properties of the *Bluetooth*® technology and setting options for the WEG described in the previous sections ensure that optimal coexistence is achieved when the device is in operation.

In addition to the properties during ongoing operation, frequency utilization for searching for connectable devices (Inquiry) must also be taken into account. During this inquiry phase, *Bluetooth*® devices transmit for up to 10 seconds, depending on device implementation, at set frequencies without utilizing the coexistence mechanisms available for ongoing operation. Therefore, if the use of the *Bluetooth*® device involves frequent inquiries, such as for roaming, this can represent a high interference potential for other wireless systems.

WEGs therefore implement the “Low Emission Mode™” to minimize the adverse effects of inquiry processes.

→ When you activate the setting “low emission mode” in the Web-based Management System for “Bluetooth > WLAN coexistence”, the WEG will reduce all device searches (Inquiry) to a minimum.

This ensures that disturbance of any WLAN transmission that is interfered with is limited only to a very short period.

Implementation of the “Low Emission Mode™” or similar mechanisms is a prerequisite for production facilities of the German automotive industry, among others, for authorization to operate a *Bluetooth*® system.

Note

Active “Low Emission Mode™” can slow down roaming!
Use of the “Low Emission Mode™” can result in not all detectable devices being discovered immediately on an inquiry. It must therefore be anticipated that switching to different access points will take more time than normal for roaming.

8.5 Range in Open Field

The maximum distance that can be overcome by a radio link is defined by the following factors:

1. **Input Sensitivity**
   This denotes the capability of the device hardware to detect the radio signal transmitted by the remote device. The greater the sensitivity, the more weaker signals that can be received.
   → This is a permanent device property.

2. **Transmitting Power**
   This denotes the signal strength which the device hardware outputs/can output for transmitting.
   → The maximum transmitting power for the WEG can be set as a parameter. Transmitting power should be set to the highest level for the maximum range.

3. **Antenna Gain**
   This factor denotes the focusing or bundling properties of the antenna. An antenna with high antenna gain exhibits a strong alignment characteristic, i.e., depending on the antenna alignment, only highly amplified or extremely attenuated signals can be received.
   → The internal antenna of the WEG possesses an antenna gain of 5 dBi, meaning that the reception properties can be greatly influenced by correct alignment. Best results are achieved when the antenna (front side of device) is facing exactly in the direction from which the radio signals are being received.

4. **Ambient Conditions**
   This factor deals with the physical environment/area around the wireless system. To achieve the maximum range a line-of-sight link should exist between the devices and there should be no objects present along the direct line-of-sight link within a specified radius (the so-called 1st Fresnel zone - see figure below). If this zone is even only partially blocked by any objects the achievable range can quickly be cut in half.

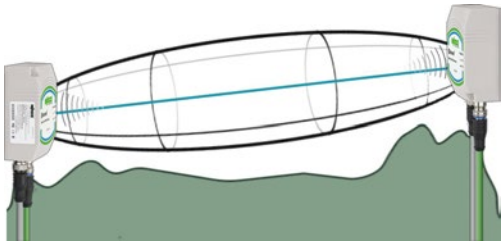


Figure 32: Fresnel zone

The shape of the 1st Fresnel zone is roughly an ellipse whose largest diameter (twice the radius of the 1st Fresnel zone) is at precisely half the distance.

The table below lists the radii that are to be kept clear:

Table 32: Radii to be kept clear

Distance	Radius for 1st Fresnel zone
100 m	1.7 m
200 m	2.5 m
300 m	3.0 m
400 m	3.5 m

Note

Range can be affected by other wireless systems!
Other range-influencing factors that are difficult to detect and rule out exist in the spurious irradiation from other wireless systems and/or in a temporal change of the radio channel, for example when the subscriber moves (swaying of the mast in strong wind), or other changes in ambient conditions (vehicles, movement of stored goods, pedestrians). These factors can make a precise prediction of the maximum range extremely difficult.

Note

Effective path of radio waves is more significant than the actual distance!
Overcoming of maximum distances for a line-of-sight link is a scenario completely different from use inside rooms or in the direct vicinity to competing wireless technologies. In these types of scenarios the decisive factor is frequently not the actual distance between the devices, but, rather, the effective path taken by the radio waves for multipath propagation, along with the actual interference present at the exact installation location. Under some circumstances, signal quality may even be enhanced by increasing the distance between the devices.

8.6 Data Security for Radio Transmission

It is often assumed that wireless communication systems are less secure than line-connected systems. When used and operated correctly, wireless systems offer at least an equivalent level of security.

The following conditions must apply before an unauthorized user can obtain access to data exchanged via wireless communication:

1. The attacker must be familiar with the communication system in use and be within the operating range of the system.

2. Radio transmission must take place without the use of any security mechanisms offered by this technology or the attacker must have adequate means to determine the security code.

A *Bluetooth*® network whose devices are set such that they do not reply to search requests by outside devices can only be detected using special instruments and only within the short radius around the transmitting devices. This is primarily due to the FHSS that is used which ensures that the frequency of the transmission channel is changed up to 1600 times per second. This not only improves coexistence, but also makes interception of the transmitted data extremely difficult.

→ To enjoy the benefits of this security mechanism, go to “Bluetooth > Security” and set the parameter “Visible for other devices” to “no”.

Note

The security mechanism is activated automatically when conducting configuration using the Mode membrane button!
If a link between WEGs is being configured using the Mode membrane button, the devices automatically activate this security setting (“Bluetooth > Security” > Parameter “Visible for other devices” = “no”).

Even when a *Bluetooth*® network is located at a location with public access and a potential attacker is aware of the network, data transfer can nevertheless only be intercepted using special equipment either when transmission is conducted without encryption, or when a non-secure code is used.

→ To achieve the best level of security go to “Bluetooth > Security > Passkey” and select a secure code consisting of up to 16 characters that is neither obvious, nor made up of a simple string of characters and, under “Bluetooth > Security”, set the parameter “Security Mode” to “on”.

Note

The secure mode is preset when conducting configuration using the Mode membrane button!
If a link between WEGs is being configured using the Mode membrane button, the devices will automatically activate the secure mode and select a random, secure code.

8.7 Health Considerations

The device emits microwave radiation. It is explained in the safety instructions that the device is not meant to be directly operated while in contact with the human body. As with any other type of radio waves, there is a certain degree of interaction between microwave radiation and human tissue. The intensity of this radiation in the frequency range used by the device is, however, the decisive factor in determining whether these effects can be measured or whether they may even be harmful.

Despite their related frequency ranges, communication devices are in no way comparable to microwave ovens, which operate at a considerably higher power level (600 W and higher) and concentrate their energy into a tightly enclosed compartment in order to achieve the best effect.

Radio communications devices, which are allowed to communicate license-free throughout the world in the ISM band at around 2.45 GHz are, on the other hand, subject to legal provisions restricting their transmitting power to 20 dBm EIRP (“equivalent isotropic radiated power”), which corresponds to an output of 100 mW = 0.1 W.

Commercially available cell phones, which are carried close to the body or held up to the ear, operate at frequencies up to 1.95 GHz and may only have a transmitting power of up to 2 W EIRP. In-car phones and other similar devices which are not carried on the body may even have a transmitting power of up to 8 W. These values exceed the maximum, permissible transmitting power for *Bluetooth*® technology in the ISM band by a factor of 20 or 80.

The distance to the antenna must also be taken into account here. At a distance of merely one meter the field strength already drops by 40 dB, which corresponds to a factor of 100.

Therefore, based on current knowledge the following can be said:

When used properly, the risk of hazards or injury to humans by radio waves used in *Bluetooth*® technology can be ruled out.

Glossary

A

Adaptive Frequency Hopping (AFH)
The adaptive frequency process “Adaptive Frequency Hopping” (AFH) is a refinement of the FHSS and is used to temporarily “jump over” defective or busy portions of the entire available frequency band and switch to other channels.
See also “FHSS”

Authentication
Authentication is a process for testing the identity transmitted by a communication partner.

B

Bit error rate (BER)
Generally: Frequency of bit errors in the data transmission.
Bluetooth® context: Information in percentage on recognized bit errors during baseband transmissions. As a rule, packets recognized as defective can be automatically repaired. If this is not possible, the defective data is automatically discarded.

C

Channel
See Transmission Channel

CoD (Class of Device)
The *Bluetooth*® Class-of-Device (CoD) is a 24-bit field indicating to which standard type of device (for example, mobile telephone or handsfree set) *Bluetooth*® devices belong. In addition to standard types, manufacturer specific types can also be used.

Cycle time
The cycle time is the rate at which a cyclic process is repeated or the time between two sequential starting points of a cyclic process, e.g. during the updating of cyclic process data between *Bluetooth*® devices connected wirelessly.

D

Data exchange
Transmission of data between communication partners.

Device Name
The *Bluetooth*® name of a device. This name can be queried by other *Bluetooth*® devices via a radio link.

DHCP (Dynamic Host Configuration Protocol)
This protocol permits automatic configuration of the network for a computer, and also assigns addresses or sets parameters centrally. The DHCP server uses a fixed IP address pool for automatically assigning random, temporary IP addresses to networked computers (Clients), thus saving considerable configuration work in large networks. The client also obtains other information, such as the gateway address (router) and the IP address of the name server (*DNS*).

Diagnostics
Diagnostic information provides information on the system status, particularly on disturbances or error conditions.

E

ETHERNET
Specifies a Local Area Network (*LAN*), which was developed by Xerox, Intel and DEC in the 70's. The bus access process takes place according to the CSMA/CD method.

F

Frequency Hopping Spread Spectrum (FHSS)
Generally: The frequency hopping process known as “Frequency Hopping Spread Spectrum” (FHSS) involves the division of a frequency range into sub-ranges, between which the data transmission then alternates. This improves co-existence with other networks and provides additional tapping protection and strength against narrow band disturbing influences.
Bluetooth® context: subdivision of the wireless channel into 79 subchannels. Each time, after transmission of a packet, the current sub-channel is changed. This may occur up to 1600 times per second.

G

Gateway
Device for connecting two different networks, performs the translation between differing protocols..

I

Inquiry
An “Inquiry” (request/information), in *Bluetooth*® technology, is a process in which *Bluetooth*® devices within range are sought.

ISM (Industrial, Scientific, and Medical Band)
ISM bands (“Industrial, Scientific, and Medical Band”) are frequency bands that can be used license-free with the observation of certain criteria. In addition to *Bluetooth*®, other wide-spread wireless technologies such as WLAN use the ISM band at 2.45 GHz according to IEEE 802.11.

L

Link Quality
The device indicates the current radio link quality level as a percentage. Link quality of 95 % denotes an excellent link; 75% and greater indicates a good link; 50 % and greater signals a mediocre link, while any value below 50% represents a poor link.

M

Media Access Control Identification (MAC ID)
The “Media Access Control Identification” (MAC ID) of a device is hardware address. *Bluetooth*® MAC addresses allow worldwide unique identification of a specific *Bluetooth*® wireless adapter.
The WEG uses the same MAC ID for identification at ETHERNET interface as it does for identification at the *Bluetooth*® interface.

P

Packet
For this module: A data/wireless packet consists of user data and header data that are transmitted together.

PAN (Personal Area Network)
The PAN (Personal Area Network) is a specific *Bluetooth*® profile.
A PAN of *Bluetooth*® devices is called a piconet.

Peer-to-Peer
Peer-to-peer denotes networks containing computers with equal authorization privileges, without any centralized access control. A server is not required here, as the subscribers exchange data directly with one another and can mutually access resources that are provided.

R

Roaming
Roaming denotes the capability of a radio communications network user to automatically dial into alternate radio networks for sending and receiving data.

Received Signal Strength Indication (RSSI)
The RSSI is an algorithm for determining the signal strength between wireless participants. RSSI values allow, for example, the diagnosis of distances between wirelessly connected devices that are too small or too large.
An RSSI value of 0 indicates that the reception signal is in the optimal range; a negative value indicates poor reception, while a positive value indicates that the devices are located very near to one another.

S

Signal strength
The signal strength is an indicator of reception quality. The higher the signal strength, the better the reception.

Subnet
A subnet is a logical division of a network.

Subnet mask
Subnet masks can be used to manipulate the address ranges in the IP address area in reference to the number of *sub nets* and hosts. A standard subnet mask is, for example 255.255.255.0.

Switch
Switches are comparable to *bridges*, but with several outputs. Each output uses the full ETHERNET bandwidth. Each output uses the full ETHERNET bandwidth. A switch activates a virtual link between an input and an output port for transmission of data. Switches learn which nodes are connected and filter the information transmitted over the network accordingly.

T

Transmission channel
A transmission channel is a mechanism or resource that enables data transmission over space or time.

W

WEG
Wireless ETHERNET gateway

List of Figures

List of Tables

WAGO Kontakttechnik GmbH & Co. KG
Postfach 2880 • D-32385 Minden
Hansastraße 27 • D-32423 Minden
Phone: +49/5 71/8 87 – 0
Fax: +49/5 71/8 87 – 1 69
E-Mail: info@wago.com

Internet: http://www.wago.com