TECHDOCS

Manual

![WAGO logo]

WAGO-I/O-SYSTEM 758

758-918

Wireless ETHERNET Gateway
Wireless Transmission Link
for ETHERNET Protocols

Version 1.0.2

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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.

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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.

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1   Notes about this Documentation

> ## *Note*
>
> **Always retain this documentation!**
> This documentation is part of the product. Therefore, retain the documentation
> during the entire service life of the product. Pass on the documentation to any
> subsequent user. In addition, ensure that any supplement to this documentation
> is included, if necessary.

This documentation applies to the Wireless ETHERNET Gateway 758-918 listed
in the following table.

Table 1: Variants

Item No./Variant	Label
758-918	Wireless ETHERNET Gateway (internal antenna)
758-918/000-001	Wireless ETHERNET Gateway (external antenna)

The device shall only be operated according to the instructions in these operating
instructions.

1.1   Copyright

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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.

1.2   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).

1.3   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 (.)

1.4   Font Conventions

Table 3: Font Conventions

Font Type	Indicates
italic	Names of paths and data files are marked in italic-type. e.g.: *C:\Program Files\WAGO Software*
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. 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 Wireless ETHERNET Gateway 758-918, that also supports the applicable radio protocol.

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.

2.1.4   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. These modules contain no parts that can be serviced or repaired by the user. The following actions will result in the exclusion of liability on the part of WAGO Kontakttechnik GmbH & Co. KG:

- Repairs,
- Changes to the hardware or software that are not described in the operating instructions,
- Improper use of the components.

Further details are given in the contractual agreements. Please send your request for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

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   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.

2.4   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.

⚠ CAUTION

Radio frequency energy emission
This equipment emits RF energy in the ISM (Industrial, Scientific, Medical) band. Make sure that all medical devices used in proximity to this device meet appropriate susceptibility specifications for this type of RF energy.

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).

Note

Functional earth
This product is recommended for use in both industrial and domestic environments. For industrial environments it is mandatory to use the functional earth connection to comply with immunity requirements. For domestic environments the functional earth must be omitted if a shielded Ethernet cable is used, in order to meet emission requirements.

Note

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

Note

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

Note

Variants 758-918/000-001: Use the included antenna only!
The scope of delivery for Variant 758-918/000-001 includes the right external antenna. Connecting any other external antenna may result in the loss of transmission approval. Use the included antenna only.

3   Device Description

3.1   General Description

As a wireless ETHERNET gateway (WEG), the 758-918 device makes it possible to integrate conventional ETHERNET devices in a wireless network. For this purpose, the device has a wired ETHERNET interface and another interface for radio communication. The device uses the integrated radio technology to transmit the data received on the ETHERNET interface. Conversely, the device uses the ETHERNET interface to send data received on the radio 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 or PROFINET.

In combination with another function-related device, e.g., another WEG or Access Point (AP) of the same radio technology, the WEG can serve as a wireless replacement for ETHERNET cables. The WEG permits particularly robust, real-time radio connections over long distances. A suitable configuration can also prevent any degradation to other radio networks.
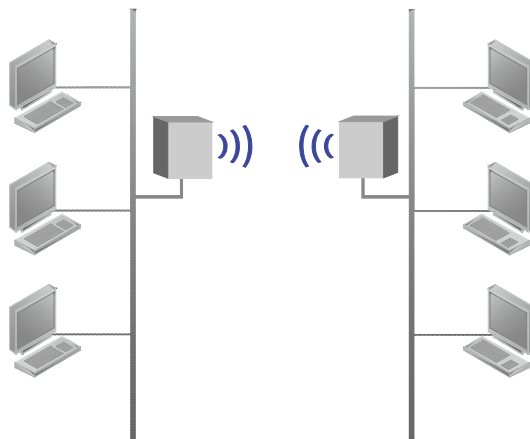
Figure 1: Wireless Transmission Between Two WEGs

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 8 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).

Depending on the application, the unit can be operated in various modes.

Note

Restrictions
- The *Bluetooth*® PAN (Personal Area Network) may not work with your own devices. The reason is the different implementation of *Bluetooth*® by various manufacturers.
- 5 GHz WLAN cannot be used with 2.5 GHz WLAN or *Bluetooth*® at the same time.

Note

WLAN or *Bluetooth*®?
Choose WLAN if data throughput and wireless roaming are required or if there are only a few other devices transmitting in the area.

Choose *Bluetooth*® if stability and low latency are important and there are several other devices transmitting in the area.

3.2   View
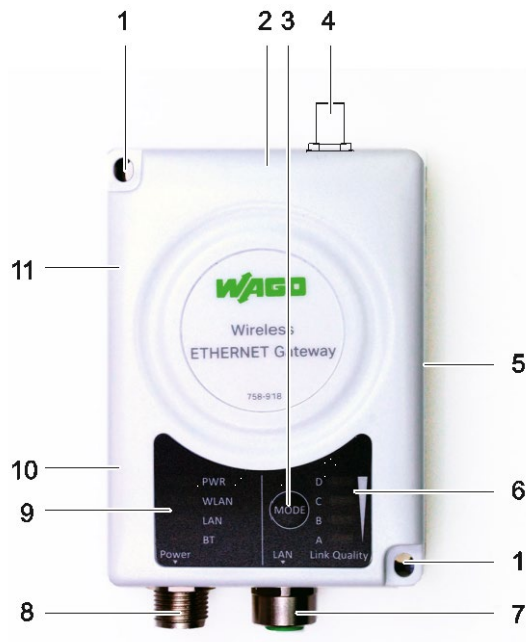
Figure 2: View

Table 4: Legend for Figure "View"

Pos.	Description	Details see Section
1	Fixing hole	"Mounting"
2	Internal MIMO antenna, 2.4 GHz	"Appendix" > "Internal Antenna Characteristics"
3	MODE membrane key for configuration	"Operating Elements"
4	Connector for external antenna (758-918/000-001 only)	--
5	Name plate	"Labeling"
6	LED indicators for • signal strength or link quality • status of configuration • modes	"Display Elements"
7	LAN connector, female M12	"Connectors"
8	Power connector, male M12	"Connectors"
9	LED indicators for • power status, • WLAN/LAN/*Bluetooth*® status and • diagnosis	"Display Elements"
10	Internal dual band antenna, 5 GHz	"Appendix" > "Internal Antenna Characteristics"
11	Internal dual band antenna, 2.4 GHz	"Appendix" > "Internal Antenna Characteristics"

3.3   Labeling

The device MAC address is included with other device data on the nameplate on the right side of the device:
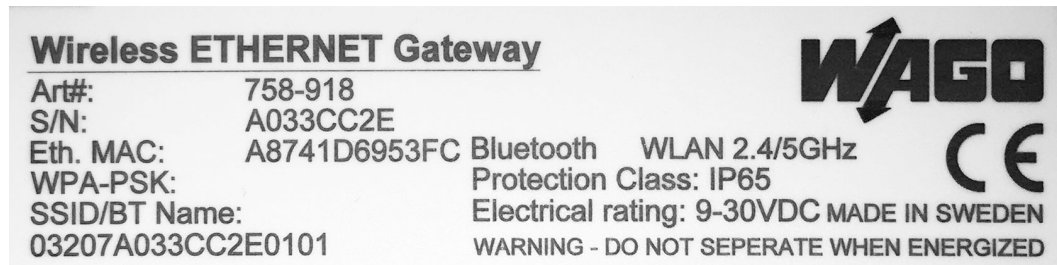

Figure 3: Marking on the Right Side – Type Plate (Example)

There may be information on approvals and contact details on the bottom side of the device:

Figure 4: Marking on Bottom Side – Approvals and Contact Details (Example)

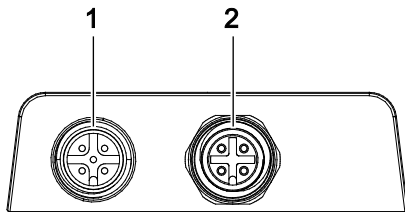## 3.4 Connectors

The device has two connections:

Figure 5: Connections

Table 5: Legend for Figure "Connections"

No.	Designation	Description
1	Power	Power supply and trigger input
2	LAN	Network connection

3.4.1 Power Supply Pin Assignment

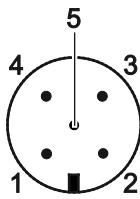Power is supplied to the device via a 5-pole, A-coded M12 connector.

Figure 6: Power Supply, M12 Connector on Device

Table 6: Legend for Figure "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	Functional ground

3.4.2   Network Connection Pin Assignment

The device can be connected to an ETHERNET network via a 4-pole, D-coded M12 socket.

Figure 7: Network Connection, M12 Socket on Device

Table 7: Legend for Figure "Network Connection, M12 Socket on Device"

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

3.5   Display Elements

The current device status is indicated by the 4 LEDs (PWR, WLAN, LAN and BT) on the left side of the WEG.

4 LEDs (A to D) on the right side of the device indicate the link quality, or the selected auto-configuration procedure.
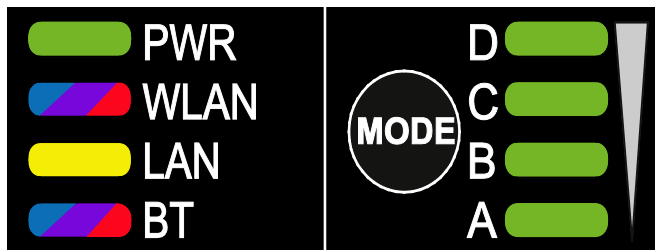
Figure 8: Display Elements

Table 8: Legend for Figure „Display Elements"

LED	Color/state	Meaning
PWR	OFF	No power
	Green	Normal operation
WLAN	OFF	WLAN disabled or no power
	Blue	Access point mode: Connected to at least one client Client mode: Connected to access point
	Blue flickering	WLAN data activity (when connected)
	Purple flickering	Client mode: Scanning for access points
	Purple	Client mode: Connecting to a detected access point
	Red	Unrecoverable error
LAN	OFF	No Ethernet connection
	Yellow	ETHERNET link present
	Yellow flickering	ETHERNET data activity (when connected)
BT	OFF	*Bluetooth*® disabled or no power
	Blue	NAP mode: Connected to at least one PANU client PANU mode: Connected to NAP
	Blue flickering	Bluetooth data activity (when connected)
	Purple	PANU mode: Trying to connect to NAP
	Red	Unrecoverable error
A+B+C+D	Green	RSSI/Link Quality > 75 %
A+B+C	Green	RSSI/Link Quality 50 % … 75 %
A+B	Green	RSSI/Link Quality 25 % … 50 %
A	Green	RSSI/Link Quality < 25 %
	OFF	No connection

In Recovery Mode the LEDs will indicate firmware update status:

Table 9: LED Indications – Recovery Mode

LED	Color/state	Meaning
PWR	Green	Firmware update in progress
	Green blinking	Waiting for valid firmware
WLAN, BT	Alternating red/blue	Firmware update in progress

Information

Firmware Update
Please contact our Support to perform a firmware update.

3.6   Operating Elements

The MODE membrane button is used to reset the service or to trigger certain autoconfiguration operations. LEDs A to D indicate which operation is active.
For more information, please refer to the Section "Configuration using the MODE Membrane Button".
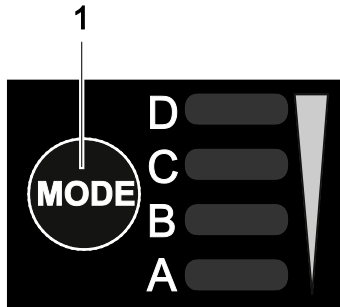
Figure 9: Control Element

Table 10: Legend for Figure "Control Element"

Pos.	Description
1	MODE membrane button

3.7   Technical Data

3.7.1   General Device Data

Table 11: Technical Data – General Device Data

Enclosure dimensions in mm depth × width × height	Approx. 92.7 × 67.8 × 33.2 (with no external antenna socket)
Weight	120 g
Ports	Power supply: M12 socket on device, 5-pole, male A-coded
	ETHERNET: M12 socket on device, 4-pole, female D-coded
Ambient temperature, operating	−30 °C ... + 65 °C
Ambient temperature, storage	−40 °C ... + 85 °C
Protection class	IP65
Humidity compatibility	EN 600068-2-78: +40 °C, 93 % for 4 days
Mounting position	On a flat mounting surface
Configuration	Via Web-based Management (WBM) or MODE membrane button or AT commands

3.7.2   Wireless Standards

Table 12: Technical Data – WLAN

Wireless standards	802.11a/b/g/d/e/i/h
Operation modes	Access point or client
2.4 GHz channels	1-11
5 GHz channels	Access point: 36-48 (U-NII-1) Client: 36-140 (U-NII-1, U-NII-2A, U-NII-2C)
RF output power	16 dBm
Maximum number of slaves	7 (for access point)
Power consumption	54 mA at 24 VDC (WLAN interface only)
Data rate	Data rate (gross): 54 Mbit/s Data rate (net): up to 20 Mbit/s
Authentication	WPA/WPA2-PSK, LEAP, PEAP
Encryption	WEP64/128, TKIP, AES/CCMP

Table 13: Technical Data – *Bluetooth*®

Standard version	4.0
Wireless standards (profiles)	PAN (PANU & NAP)
Operation modes	Access point or client
RF output power	10 dBm
Maximum number of slaves	7 (for access point)
Power consumption	36 mA at 24 VDC (*Bluetooth*® interface only)
Data rate (net), max.	1 Mbit/s
Security	NIST Compliant, FIPS Approved (authentication & authorization, encryption & data protection, privacy & confidentiality)

3.7.3   ETHERNET Interface

Table 14: Technical Data – ETHERNET Interface

No. of ETHERNET ports	1
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	192.168.0.99
Default subnet mask	255.255.255.0

3.7.4   Wireless Interface

Table 15: Technical Data – Wireless Interface

Internal antenna		
	2.4 GHz	Max. 2 dBi,
	5 GHz	Max. 0.5 dBi
Range		Up to approx. 400 m open area (WLAN and *Bluetooth*®)
Topology		Infrastructure, ad-hoc
Connection type		Subscriber

3.7.5   Power Supply

Table 16: Technical Data – Power Supply

Power supply connection	Via M12, max. wire cross-section max. 2.5 mm²
Nominal voltage	24 VDC (SELV)
Power supply	9 … 30 VDC (−5 % … +20 %) Cranking 12 V (ISO 7637-2:2011 pulse 4) Reverse polarity protection Consumption: 0.7 W (idle), 1.7 W (max)

3.8   Approvals

The following approvals have been grated for the Wireless ETHERNET Gateway
(758-918):

CE	Conformity Marking	
	IC "Industry Canada"	IC: 5325A-0965, for indoor use only (5GHz)
FCC	FCC "Federal Communications Commission" / CFR 47 Part 15, ETS 300328	FCC ID: PVH0965

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.

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.

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 17: 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   Mounting

> **Note**
>
> **Maintain a minimum distance of 50 cm between two WEGs!**
> 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, must not be located directly in front of metallic surfaces, as this can permanently degrade the radio capabilities of the antenna.

Use the mounting holes (see drawing below), for example, and the 2 M3 screws to attach the WAG to any flat, level surface.
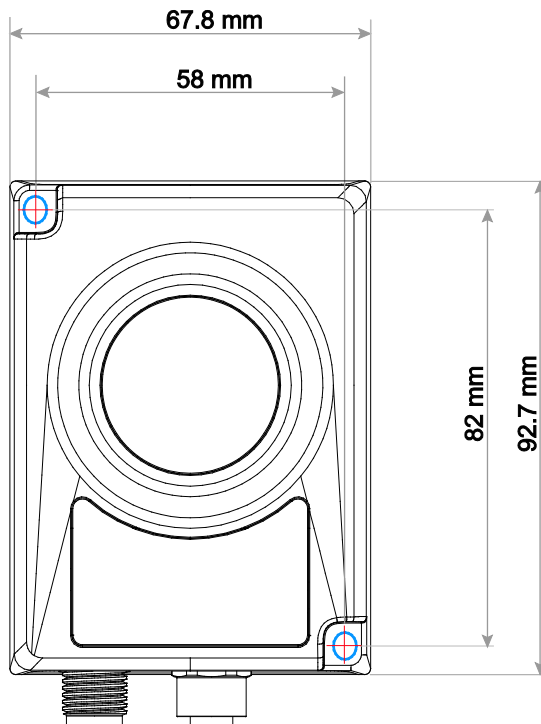
Figure 10: WEG Mounting Holes

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 11: Connecting the WEG

Note

Suppress the ground reference of the trigger input
For long cable lengths, electromagnetic disturbance variables can lead to
undesired signaling at the trigger input. Run the potential for the trigger input in
the same cable as the supply voltage and functional ground if the cable length
exceeds 3 m.

---

6   Commissioning

The device is <u>not</u> 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 SELV 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 3 ways:

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

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   Factory Settings

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

Table 18: Factory Settings

Group	Parameters	Default
Network	IP Assignment	Static
	IP Address	192.168.0.99
	Subnet Mask	255.255.255.0
	Default Gateway	192.168.0.99
WLAN	Operating Mode	Client
	Channel Bands	2.4 GHz & 5 GHz
	Authentication Mode	Open
	Channel	Auto
	Bridge Mode	Layer 3 IP forward
Bluetooth	Operating Mode	PANU (Client)
	Local Name	[*generated from MAC address*]
	Security Mode	Disabled
System	Password	[*Empty*]

Note

Set password
Make sure you set a secure password for the WEG!

You can restore the default settings at any time by holding down the MODE membrane button for > 10 seconds and then releasing it. This can be useful, for example, if you have forgotten the IP address or the WEG password.

You can also reset the WEG to the factory settings from the WBM or using AT commands. The process is explained in the sections below.

7.2   Operating Modes in "Easy Config"

The WEG has preconfigured operating modes ("Easy Config" setup) that are easy to use via the MODE membrane button or WBM.

Table 19: Operating Modes in "Easy Config"

Mode	2	3	4	5	6
Roll	--	--	Client	WLAN AP	Bluetooth NAP
Description	Reset to factory settings (complete)	Reset to factory settings (IP configuration)	Wait for automatic configuration	Find waiting clients and configure automatically	
LED-Anzeige	D⬜ C⬜ B🟩 A⬜	D⬜ C⬜ B🟩 A🟩	D⬜ C🟩 B⬜ A⬜	D⬜ C🟩 B⬜ A🟩	D⬜ C🟩 B🟩 A⬜

Modes 4, 5 and 6 are used in combination to automatically establish a WLAN or *Bluetooth*® network with WEGs of the same type (758-918).

Modes 5 and 6 scan for devices running in mode 4. Each WEG found is then reconfigured as a client and the scanning WEG is configured as an access point. The clients restart and connect to the access point.

> **Note**
>
> **Mode Timeout**
> The scan operation in modes 5 and 6 takes 120 seconds.
> These modes can be activated repeatedly to scan for other WEGs.
> Devices running in mode 4 wait 120 seconds or more until they receive a valid configuration from a WEG that scans in mode 5 or 6.

> **Note**
>
> **IP address**
> The configuration of the access point can change the IP address of a client.
> That may lead to termination of previously started browser sessions.

7.3   Configurations via 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 start the "Easy Config" autoconfiguration operation, navigate through modes 2 ... 6 and confirm the required mode.
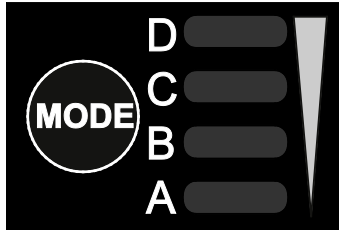
Figure 12: MODE Membrane Button and Status LEDs

7.3.1   Selecting the Mode

1.   Supply the device with power and wait until the connection status LEDs (A ... D) light up and go out again.

2.   Within 5 seconds of applying the power supply, press the MODE membrane button and release it again.

3.   Press the MODE membrane button again to navigate through the individual "Easy Config" modes. The respective LED (A ... C) indicates the current mode. Press the membrane button until you are in the required mode.

> **Note**
>
> **Start at mode 2**
> Mode 2 is the first available mode. To go to mode 6, you must press the MODE membrane button 5 times.

4.   To confirm the mode selected, hold down the MODE membrane button for 2 seconds and release it again.

The device is then restarted in the selected mode.

> **Note**
>
> **Confirm the selected mode within 20 seconds!**
> You must confirm the selected mode within 20 seconds by pressing the membrane button for 2 seconds. Otherwise, the device switches from "Easy Config Setup" to the previous operating mode.

7.3.2   Restoring Factoring Settings

1.   Supply the device with power and wait until the connection status LEDs
      (A ... D) light up and go out again.

2.   Press and hold the MODE membrane button for at least 10 seconds.

3.   Release the MODE membrane button again.

The WEG is reset to the factory settings.

7.3.3   "Recovery Mode"

If you are no longer able to access the WEG's WBM, "Recovery Mode" can be
used to install firmware via an external application. In such case, please contact
Support to obtain additional information.

1.   Press and hold the MODE membrane button **while** turning on the power
      supply to the WEG.

The WEG boots in "Recovery Mode".

7.4   Configurations via Web-Based Management (WBM)

The WBM is called up by entering the IP address of the WEG in a web browser.

The default IP address is 192.168.0.99. The computer used to access the WEG's WBM must be in the same subnet as the WEG.

→ **Note**

Web Browser
The WBM is compatible with the current versions of Internet Explorer, Chrome, Firefox and Safari. Other browsers may not support the full functionality of the WBM.

The navigation links in the WBM interface are used to access the following pages:
•   System Overview
•   Easy Config
•   Network Settings
•   WLAN Settings
•   Bluetooth$^{®}$ Settings
•   Firmware Update
•   AT Commands
•   System Settings
•   Help

7.4.1   WBM "System Overview" Page

Figure 13: WBM "System Overview" Page

> ![Note icon]
>
> ## Note
>
> **Grayed out buttons**
> The **[Save and Reboot]** and **[Cancel All Changes]** buttons are enabled once you make changes to the configuration.
> •   To save changes to a parameter setting and to reboot, click the yellow **[Save and Reboot]** button.
> •   To discard changes and to return to the previous configuration, click the red **[Cancel All Changes]** button.

7.4.2   WBM "Easy Config" Page

You can switch the WEG to a preconfigured mode from the "Easy Config" page:

1.   Connect to the WBM of your WEG.

2.   Go to the WBM "Easy Config" page.

3.   Select the required mode from the dropdown menu:
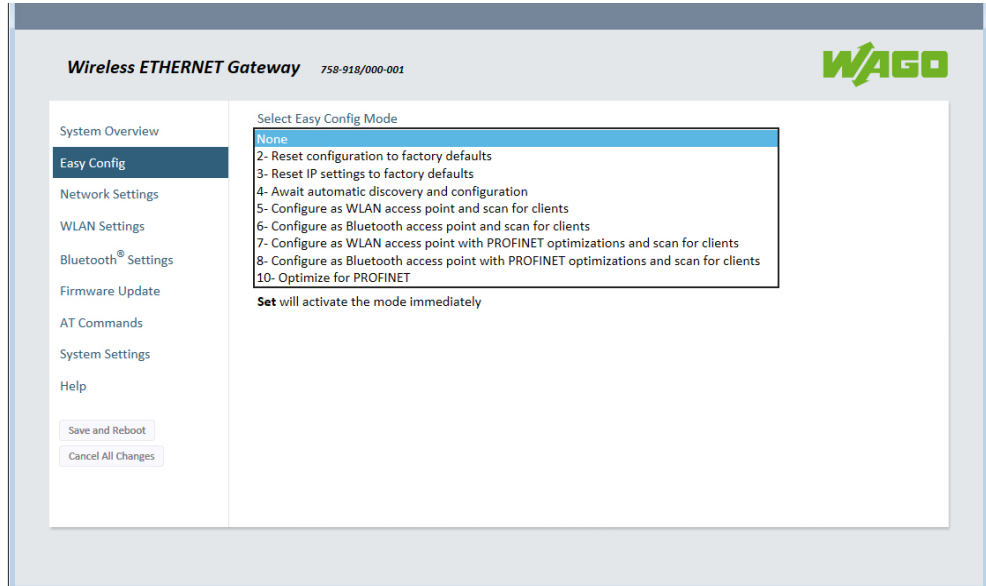
Figure 14: WBM "Easy Config" Page – Select Operating Mode

4.   Click **[Set]** to switch the WEG to the selected mode:
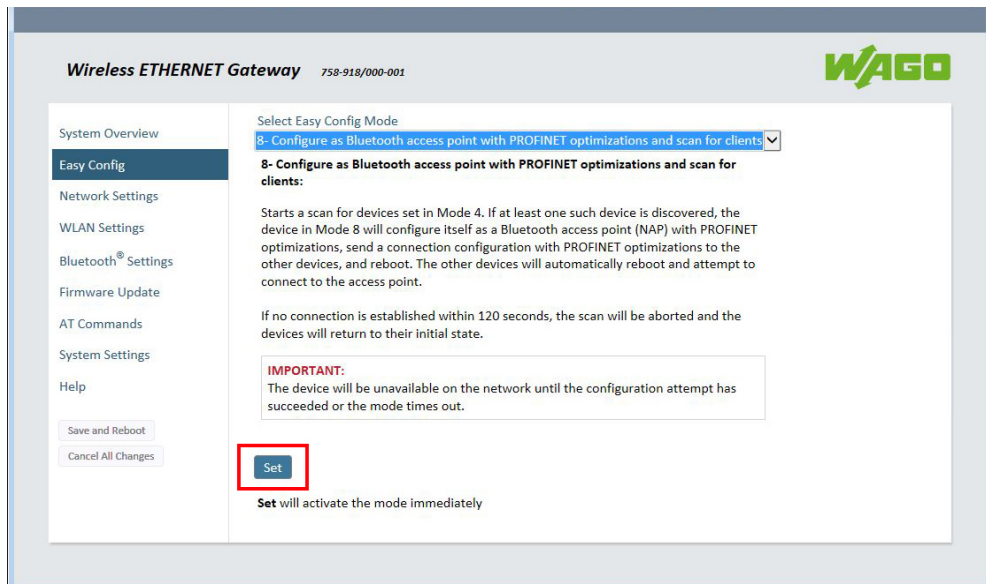
Figure 15: WBM "Easy Config" Page – Set New Operating Mode

5.   A window opens. Click **[OK]** to confirm the selection.
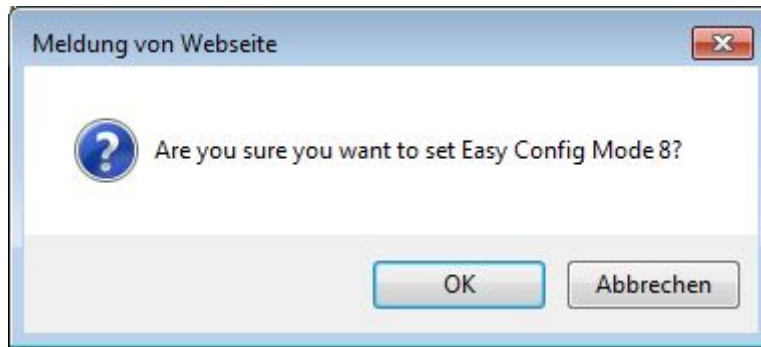
Figure 16: WBM "Easy Config" Page – Confirm Operating Mode Selection

The mode change goes into effect immediately.

> ## *Note*
>
> **Do not refresh or excite the browser window too quickly**
> When refreshing or closing the browser window, wait until the WEG has
> completed the change of mode.

Table 20: WBM "Easy Config" Page – Dropdown Menu

No.	Mode	Description
2	Reset configuration to factory defaults	Reset the configuration to the factory defaults and reboot the WEG. [*]
3	Reset IP settings to factory defaults	Resets the IP and DNS settings to the factory defaults. Deletes the entries in the table in which the IP addresses of connected WLAN/*Bluetooth*® clients are listed and reboots the device. [*]
4	Await automatic discovery and configuration	The WEG waits for the connection attempt of another device (running in mode 5 or 6) and automatically creates a WLAN or *Bluetooth*® network. If unable to establish a connection within 120 seconds, the device aborts the mode and returns to its previous settings. [**], [***]
5	Configure as WLAN access point and scan for clients	Scans for devices running in mode 4. If at least 1 such device is found, the WEG configures itself as a WLAN access point (AP), sends its connection configuration to the other device and reboots. The other device also reboots automatically and attempts to connect to the access point. If unable to establish a connection within 120 seconds, the scan operation is aborted and both devices return to their previous settings. [**]

Table 20: WBM "Easy Config" Page – Dropdown Menu

No.	Mode	Description
6	Configure as Bluetooth access point and scan for clients	Scans for devices running in mode 4. If at least 1 such device is found, the WEG configures itself as a *Bluetooth*® access point (NAP), sends its connection configuration to the other device(s) and reboots. The other device(s) also reboot(s) automatically and attempt(s) to connect to the access point. If unable to establish a connection within 120 seconds, the scan operation is aborted and the devices return to their previous settings. **)
7	Configure as WLAN access point with PROFINET optimizations and scan for clients	Scans for devices running in mode 4. If at least 1 such device is found, the WEG configures itself as a WLAN access point (AP) with PROFINET optimization, sends its connection configuration with PROFINET optimizations to the other device(s) and reboots. The other device(s) also reboot(s) automatically and attempt(s) to connect to the access point. If unable to establish a connection within 120 seconds, the scan operation is aborted and the devices return to their previous settings. **)
8	Configure as Bluetooth access point with PROFINET optimizations and scan for clients	Scans for devices running in mode 4. If at least 1 such device is found, the WEG configures itself as a *Bluetooth*® access point (NAP) with PROFINET optimization, sends its connection configuration with PROFINET optimizations to the other device(s) and reboots. The other device(s) also reboot(s) automatically and attempt(s) to connect to the access point. If unable to establish a connection within 120 seconds, the scan operation is aborted and the devices return to their previous settings. **)
10	Optimize for PROFINET	Adds optimization settings for PROFINET to the WEG and reboots.

*)   The IP address of the WEG is reset to the default address of 192.168.0.99.

**)   The WEG cannot be accessed in the network until the configuration attempt is successful or the time span within which a change in the mode has to take place has elapsed.

***) The IP address of the WEG is set by the access point and may differ from its previous IP address.

7.4.3   WBM "Network Settings" Page
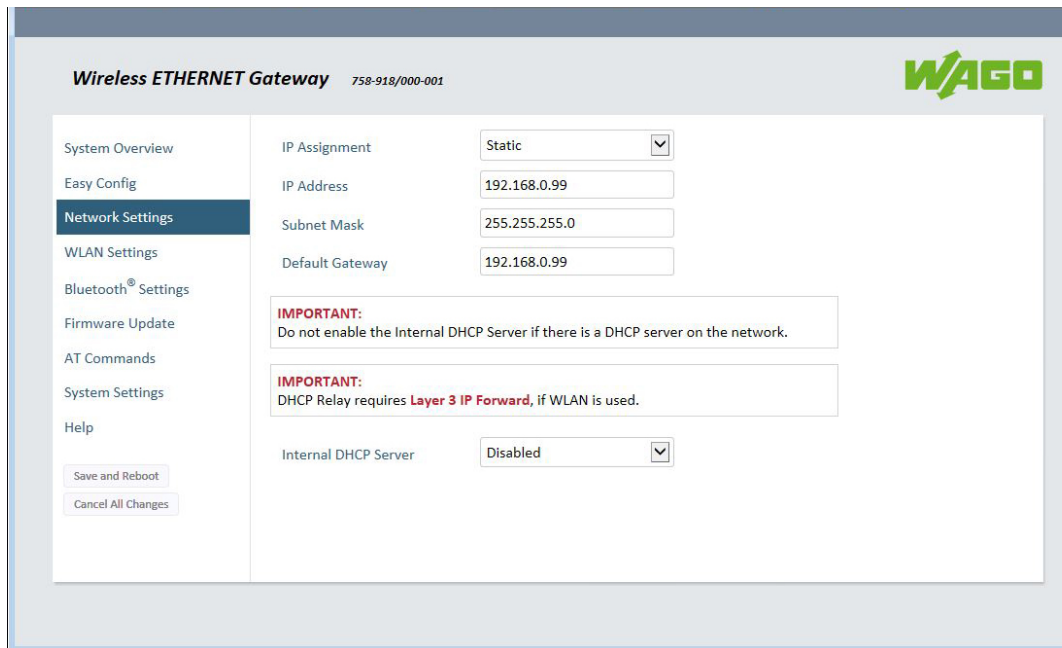
Figure 17: WBM "Network Settings" Page

Table 21: WBM "Network Settings" Page

Dropdown menu	Selection option	Notes
IP Assignment	Static [*)]	Selection between static or dynamic IP addresses.
	Dynamic (DHCP)	
Internal DHCP Server	Disabled [*)]	No internal DHCP functionality
	DHCP Server Enabled [**)]	Never select "DHCP Server Enabled" if there is already a DHCP server in the network! The address space is specified as X.X.X.Y where X is specified by the static IP address of the device. Y is the DHCP lease start address (between 1 and 247). Additional DHCP leases are automatically assigned as Y+n where n can be max. 7.
	DHCP Relay Enabled	If using a WLAN, "DHCP Relay Enabled" requires the "**Layer 3 IP forward**" setting. You can find this setting on the WBM "WLAN Settings" page > Advanced Settings > Bridge Mode.

[*)] Default setting
[**)] Selection only available if IP assignment is "Static"

1. Select the required network settings in the **IP Assignment** and **Internal DHCP Server** dropdown menus.

    If you make a new selection in the **IP Assignment** dropdown menu, the **[Save and Reboot]** and **[Cancel All Changes]** buttons are enabled.

2. Click the yellow **[Save and Reboot]** button to confirm your selection.
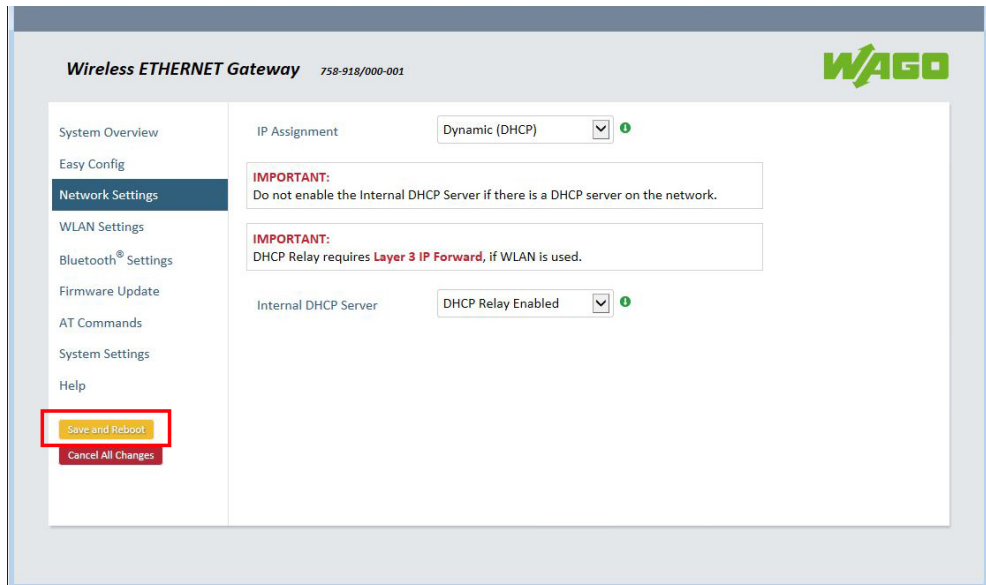
Figure 18: WBM "Network Settings" Page – Confirm Change

3. Abort the selection by clicking the red **[Cancel All Changes]** button. A window opens:

Figure 19: "Cancel All Changes" Note

4. Click **[OK]** to confirm that you want to cancel all changes.

7.4.4   WBM "WLAN Settings" Page

7.4.4.1   Client Mode

Figure 20: WBM "WLAN Settings" Page – "Client" Operating Mode

Table 22: WBM "WLAN Settings" Page – "Client" Operating Mode

Input/dropdown field	Options	Notes
Enable	☐	Disables the WLAN interface
	☑ [*)]	Enables the WLAN interface
Operating Mode	Client [*)]	--
	Access Point	--
Channel Bands	2.4 GHz	--
	5 GHz	--
	2.4 GHz & 5 GHz [*)]	The WEG can be configured to scan in both bandwidths, but it can only communication on one of the bandwidths (2.4 GHz **or** 5 GHz).
Connect to		
[Scan for Networks]	*Click Scan*	Click the button to generate a list of networks found.
Connect to SSID	*Free text*	To connect to a network manually, enter the network name here. This is useful, for example, if the required network does not make its SSID visible or scannable.

Table 22: WBM "WLAN Settings" Page – "Client" Operating Mode

Input/dropdown field	Options	Notes
Authentication Mode	Open	Without encryption or authentication
	WEP64/128	Input field for **Passkey** Password requirements: 5 or 13 characters; For hexadecimal: Begin with 0x
	WPA/WPA2-PSK[*)]	Input field for **Passkey** Password requirements: Between 8 and 63 characters; For hexadecimal: Begin with 0x
	LEAP	Input fields for • Username;
	PEAP	• Domain; • Pass phrase
Channel	Auto[*)]; 1 … 140	Selects a specific channel to be used when scanning for networks. What channels are available in this selection list depends on what bandwidth has been selected. Auto = All channels are scanned (default).
Advanced Settings		
Bridge Mode	Layer 2 tunnel	All step 2 data are transmitted via WLAN. This option should be used if different devices on both sides of an ETHERNET network should be able to communicate via WLAN ("many-to-many"). This mode only works between 2 WEGs.
	Layer 2 cloned MAC only	Step 2 data from just one MAC address is transmitted via WLAN ("many-to-one"). After selecting this option, the **Cloned MAC address** input field is enabled.
	Layer 3 IP forward [*)]	IP data from all devices is transmitted via WLAN.

[*)] Default setting

7.4.4.2   Access Point Mode

Figure 21: WBM "WLAN Settings" Page – Access Point Mode

Table 23: WBM "WLAN Settings" Page – "Access Point" Operating Mode

Input/dropdown field	Options	Notes
Enable	☐	Disables the WLAN interface
	☑ *)	Enables the WLAN interface
Operating Mode	Client *)	--
	Access Point	--
Network (SSID)	WEG_194249 *)	*Free text* for the network names of the WEG. If nothing is entered, the WEG generates an SSID from the last 6 characters of its MAC ID.
Authentication Mode	Open	Without encryption or authentication
	WPA2 *)	Input field for **WPA2 Passkey** is visible. Use the **[Show]** or **[Hide]** button to display or encrypt the password. Password requirements: Between 8 and 63 characters; For hexadecimal: Begin with 0x and consist of exactly 64 characters; all characters in the ASCII range are allowed with the exception of: • " (quotation marks) • , (comma) • \ (backslash)
Channel Bands	2.4 GHz	--
	5 GHz *)	--
Channel	1 *) … 11	(if "2.4 GHz" channel band is selected only)
	36 *), 40, 44, 48	(if "5 GHz" channel band is selected only)

*) Default setting

7.4.5   WBM "Bluetooth® Settings" Page

Figure 22: WBM "Bluetooth® Settings" Page

Table 24: WBM "Bluetooth® Settings" Page

Input/dropdown field	Options	Notes
Enable	☐	Disables the *Bluetooth*® interface
	☑*)	Enables the *Bluetooth*® interface
Operating Mode	PANU (Client) *)	The WEG is used as a *Bluetooth*® "Personal Area Network User" (PANU) client. It can connect to another Bluetooth® PANU client or a *Bluetooth*® access point.
	NAP (Access Point)	The WEG is used as a *Bluetooth*® network access point. It can be connected to up to 7 *Bluetooth*® PANU clients.
Local Name	WEG_194249 *)	*Free text* name to identify itself to other *Bluetooth*® devices. If nothing is entered, the WEG generates a name from the last 6 characters of its MAC ID.
Connectable	No*)	WEG accepts no connection requests from other *Bluetooth*® devices.
	Yes	WEG accepts connection requests initiated by other *Bluetooth*® devices.
Discoverable	No*)	WEG is not visible to other *Bluetooth*® devices.
	Yes	WEG is visible to other *Bluetooth*® devices.
Connect to		
Security Mode	Disabled	No encryption or authentication
	PIN*)	Encrypted connection with PIN query. Only works between 2 WEGs, not with external devices. Input field for **PIN** is enabled. The PIN must consist of at least 4 and maximum 6 digits.
	Just works	Encrypted connection with no PIN query.
Paired Devices		
List of *Bluetooth*® devices currently connected to this WEG		

*) Default setting

7.4.5.1   PANU (Client) Mode
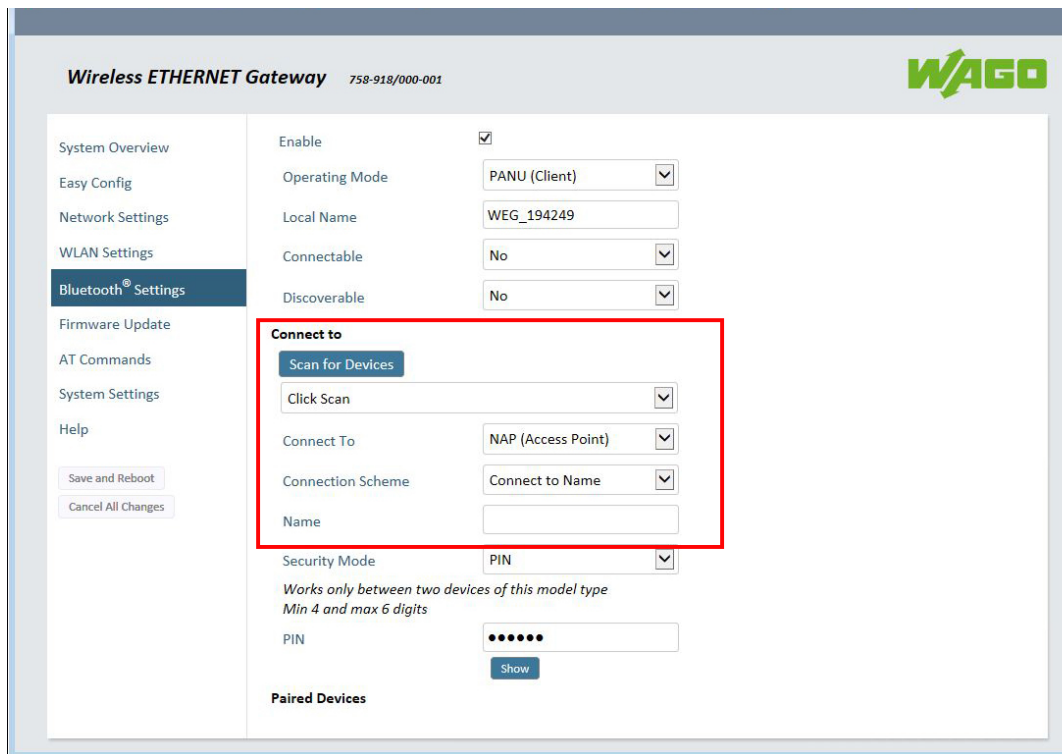
Figure 23: WBM "Bluetooth® Settings" Page– "PANU (Client)" Operating Mode

Table 25: WBM "Bluetooth® Settings" Page– "PANU (Client)" Operating Mode

Input/dropdown field	Options	Notes
Connect to		
[Scan for Devices]	*Click Scan*	Click the button to generate a list of devices found.
Connect to	NAP (Access Point)*)	For manually connecting to a NAP or PANU device.
	PANU (Client)	
Connection Scheme	Connect to MAC	Input field for **MAC Address** is visible.
	Connect to Name *)	Input field for **Name** is visible.
Name		*Free text* Name of the *Bluetooth*® device to which a connection is to be established.

*) Default setting

7.4.5.2   NAP (Access Point) Mode
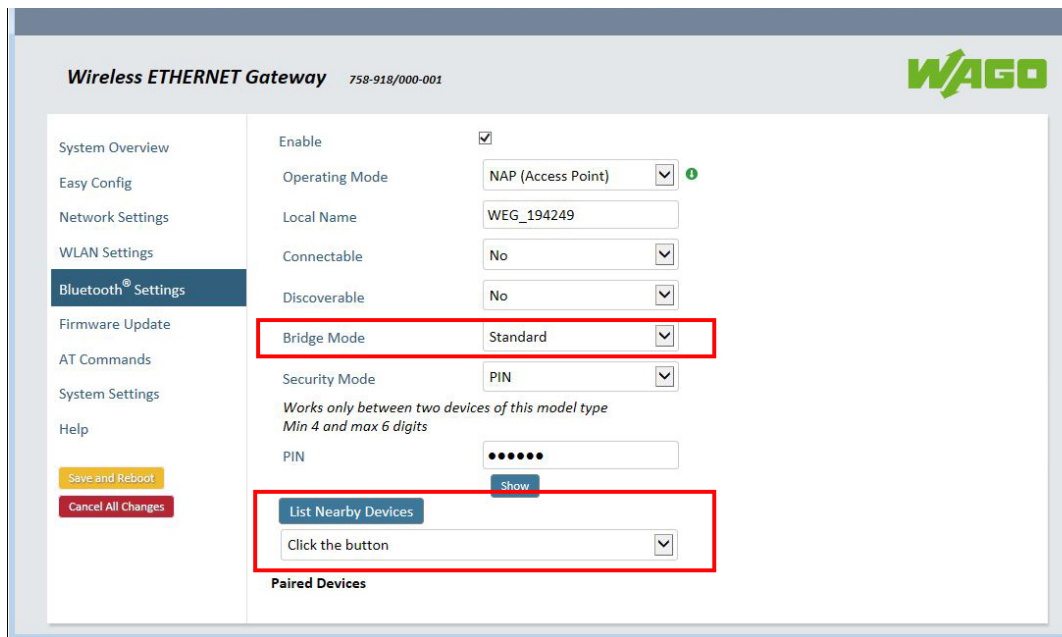
Figure 24: WBM "Bluetooth® Settings" Page – "NAP (Access Point) Mode"

Table 26: WBM "Bluetooth® Settings" Page – "NAP (Access Point) Mode"

Input/dropdown field	Selection option	Notes
Bridge Mode	Standard	Default Setting
	Layer 3 IP forward	IP data is transmitted via *Bluetooth®*. This mode must be selected to connect the WEG to an Android device. A DHCP server must be enabled in the network.
[List Nearby Devices]	*Click the button*	Click the button to generate a list of *Bluetooth®* devices within range. Coupling cannot be initiated in NAP mode.

7.4.6   WBM "Firmware Update" Page

i   *Information*

Firmware Update
Please contact our Support to perform a firmware update.
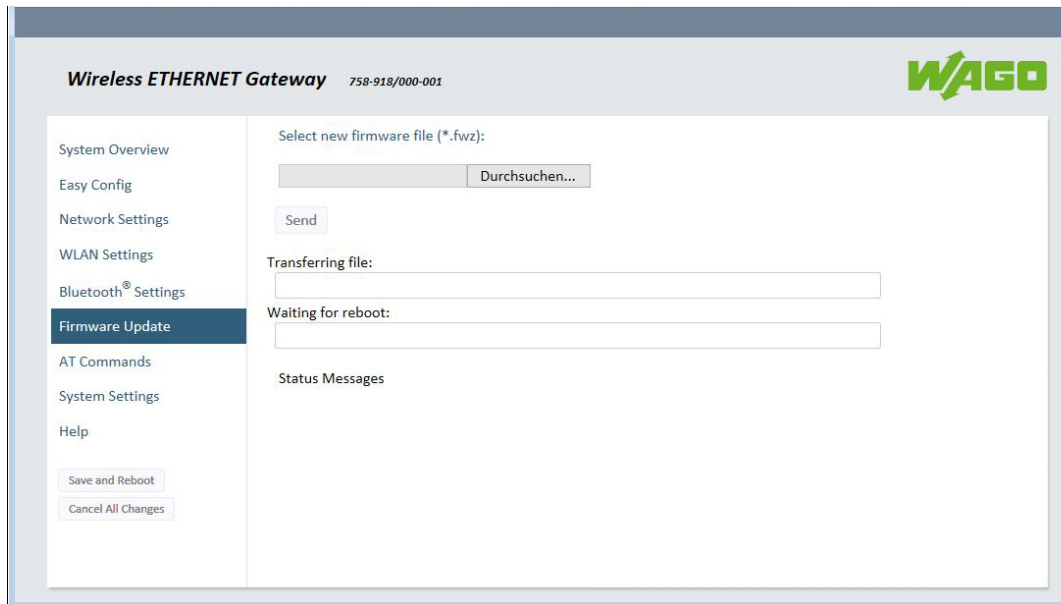
Figure 25: WBM "Firmware Update" Page

1.   Click the **[Browse…]** button to select a firmware version in the file system of your computer.

2.   Select the firmware file and click **[Open]**.

Progress bars in the WBM then displays the status of the update process ("Transferring file" and "Waiting for reboot"). The progress bars turn green when the update is finished. The WEG then automatically reboots.

7.4.7   WBM "AT Commands" Page
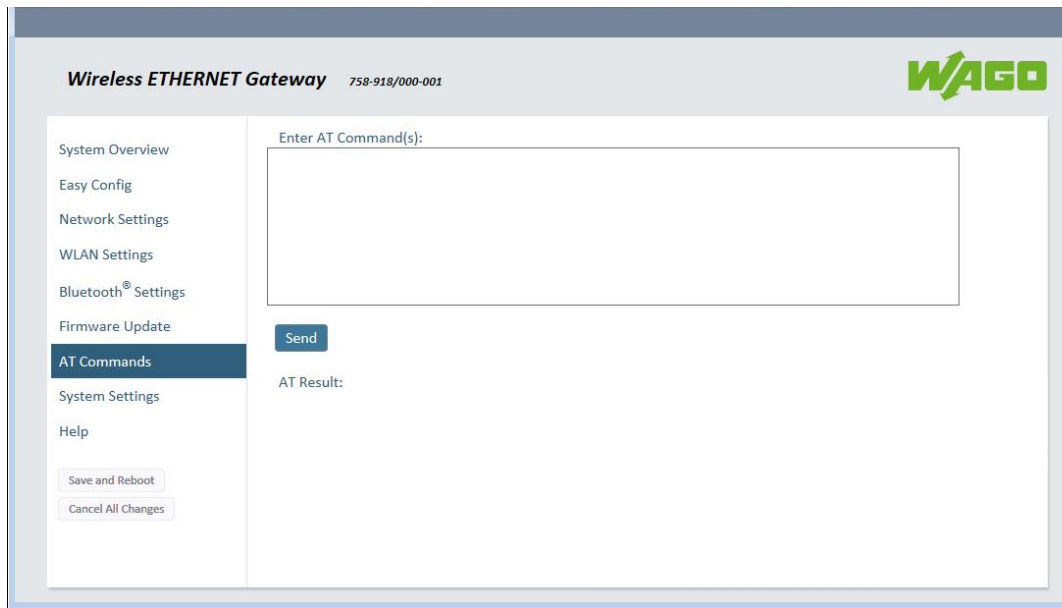
Figure 26: WBM "AT Commands" Page

On the "AT Commands" page, you have the option of sending AT commands to the device, e.g., to set parameters that cannot be addressed via the WBM or to read out parameters in text format.

1.   Enter the required command in the **Enter AT Command(s)** field.

2.   Send the command by clicking the **[Send]** button.

The results are displayed to you under **AT Result:**.
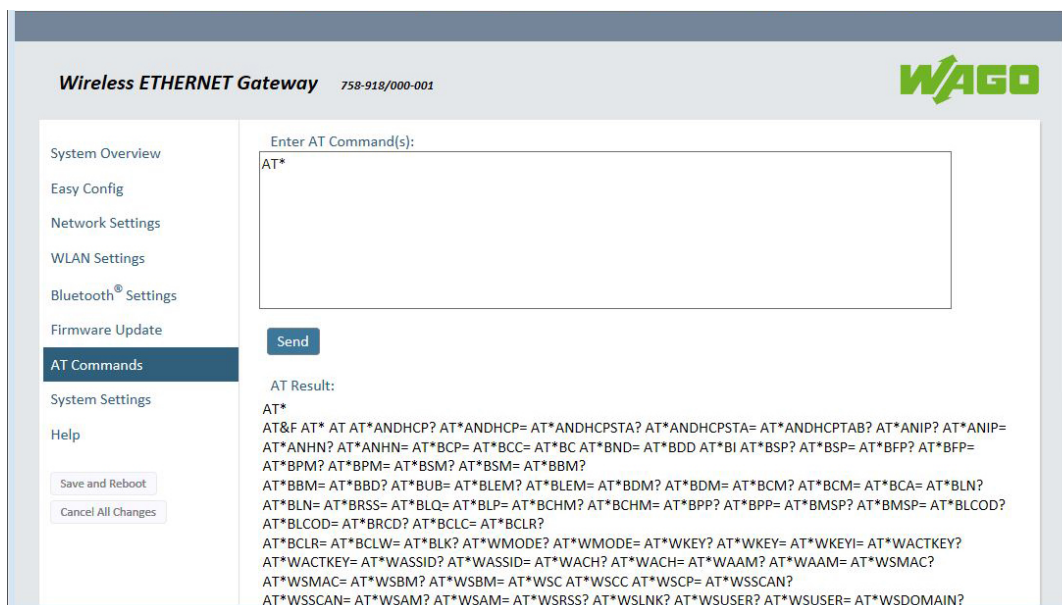
Figure 27: WBM "AT Commands" Page – Example: List of All Valid AT Commands by Sending the "AT*" Command

---

→	**Note**
	Overview of AT commands A list of all AT commands is also available on the "Help" page of the WBM. However, the list may also contain commands not supported by all device versions. For a list of valid commands for your device, use the "AT*" command.

7.4.8   WBM "System Settings" Page

Figure 28: WBM "System Settings" Page

On the "System Settings" page, you can:

• Give your WEG a descriptive name in the **Device Name** input field

• Click the blue **[Reboot System]** button to reboot your WEG
<u>without</u> saving any of the changes made;

• Click the **[Cancel All Changes]** button to discard any (unsaved) changes and to restore the currently enabled settings;

• Click the **[Factory Reset]** button to restore your WEG's default settings.

On this page, you also have the option of specifying a password to use the WBM:

1. Enter the required password in the **Password** input field. It can be up to 15 characters.

2. Enter the same password again in the **Confirm Password** field.

3. Click the **[Set Password]** button. A login window appears:
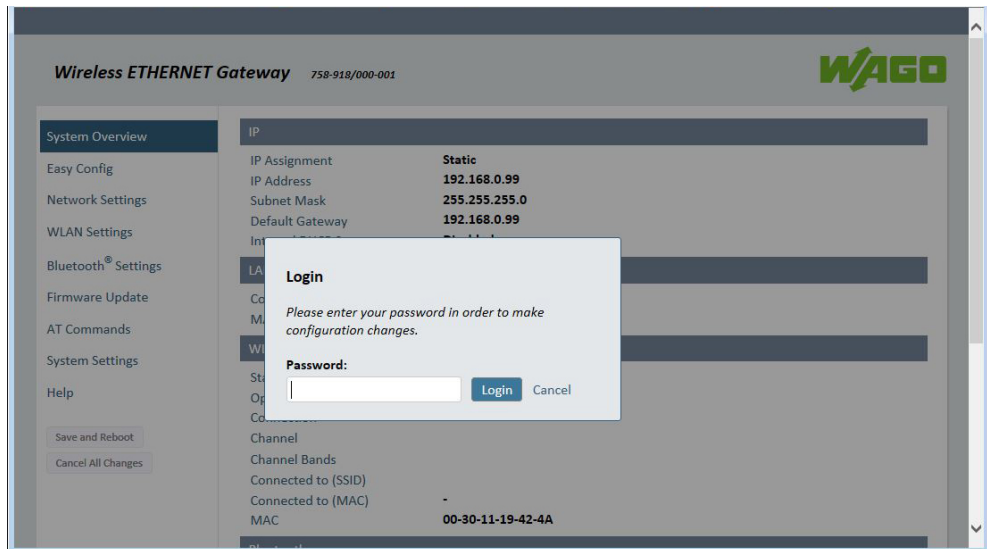
Figure 29: Password Query

4.   To make further configurations in the WBM, you now have to enter the password just set again.

5.   Click the **[Login]** button to return to the WBM pages.

7.4.9   WBM "Help" Page
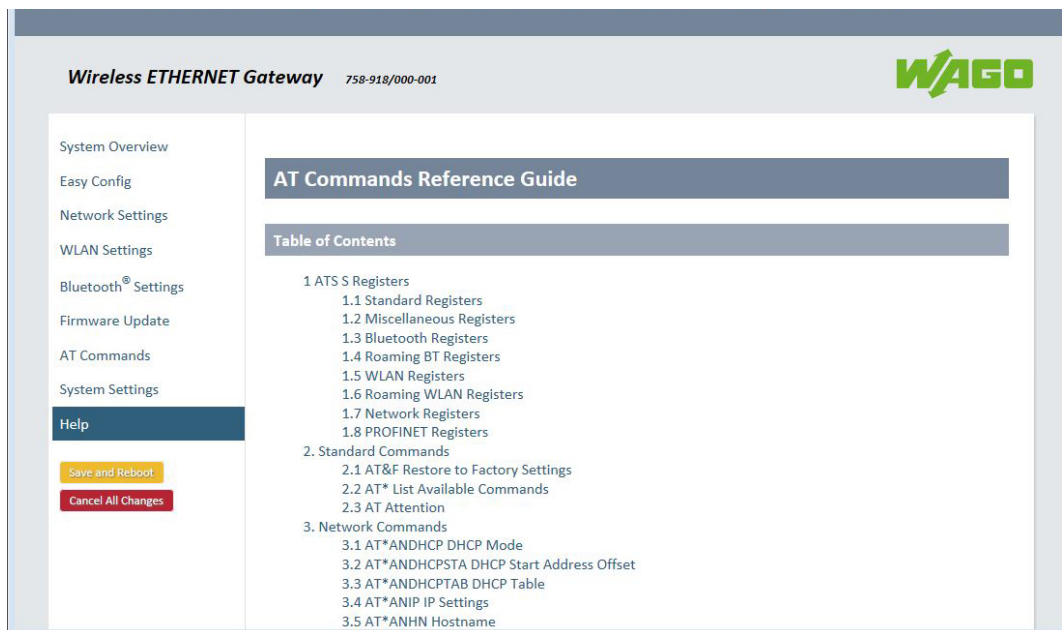
Figure 30: WBM "Help" Page – AT Commands Reference Guide

The WBM "Help" page contains a comprehensive reference guide with the list of AT commands.

7.5   Configurations via AT Commands

You can configure your WEG via AT commands.

6.   Connect to the WBM (see section "Configurations via Web-Based Management (WBM)".

7.   Go to the "AT Commands" page.

8.   Enter the required command in the "**Enter AT Command(s)**" field.

9.   Send the command by clicking the **[Send]** button.

The results are displayed to you under "**AT Result:**".

> *Note*
>
> **Overview of AT commands**
> A list of all AT commands is available on the "Help" page of the WBM. The list may also contain commands not supported by all device versions. For a list of valid commands for your device, use the "AT*" command.

7.6   External Trigger Input

It is the task of the digital input to trigger a roaming shift from one WEG to the other.

A list of configuration commands is available in the "AT Command Reference Guide" on the "Help" page of the WBM (see Section "Configurations via Web-Based Management (WBM)").

8   Appendix

8.1   Configuration Examples

The following examples require that you have installed the WEG and know how to connect to and use the WBM.

• All examples are based on the factory settings.

• The default values of settings not mentioned in the examples should not be changed.

• The computer used to access the WEG's WBM must be in the same subnet as the WEG.

8.1.1   Easy Config: ETHERNET Bridge via WLAN or *Bluetooth*®
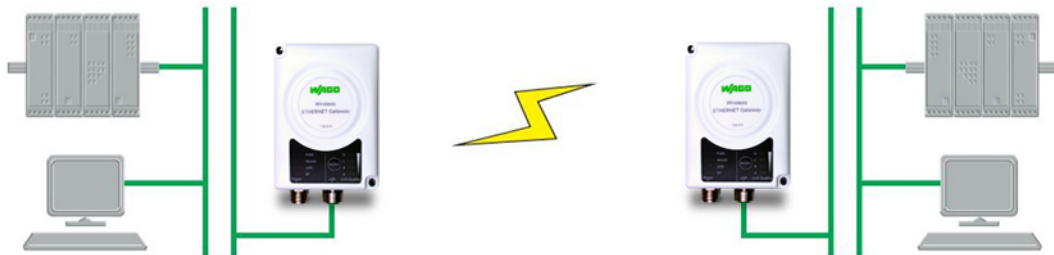
Figure 31: Couple Networks using Easy Config

This example describes how you couple 2 ETHERNET networks via WLAN or *Bluetooth*®. The WEGs are configured using their respective MODE membrane button exclusively.

1. Power on the **1st WEG** and wait for the LEDs to light up and go out again.

2. Briefly press on the MODE membrane button once.

3. Press on the MODE membrane button again until on LED C lights up ("Easy Config" mode 4):
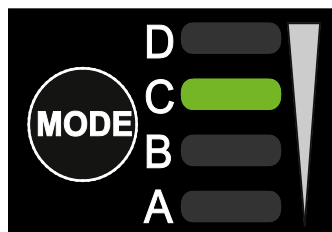
4. Confirm the selection by pressing and holding the MODE membrane button for 2 seconds.
   That WEG can now be found and is enabled for automatic configuration.

5.   Power on the **2nd WEG** and wait for the LEDs to light up and go out again.

6.   Briefly press on the MODE membrane button once.

7.   • For connection **via WLAN**:
      Press on the MODE membrane button repeatedly until on the LEDs
      A + C light up ("Easy Config" mode 5):
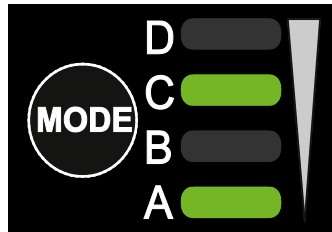
      • For connection **via *Bluetooth*®**:
      Press on the MODE membrane button repeatedly until on the LEDs
      B + C light up ("Easy Config" mode 6):
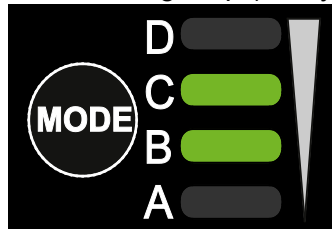
8.   Confirm the selection by pressing and holding the MODE membrane button
      for 2 seconds.
      The WEG should automatically find the first and configure it as a WLAN or
      Bluetooth® client. It configures itself as an access point.

The first WEG is automatically assigned the first available IP address within the
ETHERNET subnet where the second WEG is also located.

Add other WEGs
You can add up to 6 additional clients to the access point in this way. Each new
client is assigned the next available IP address within the current subnet.

8.1.2   Easy Config: PROFINET Network via *Bluetooth*®
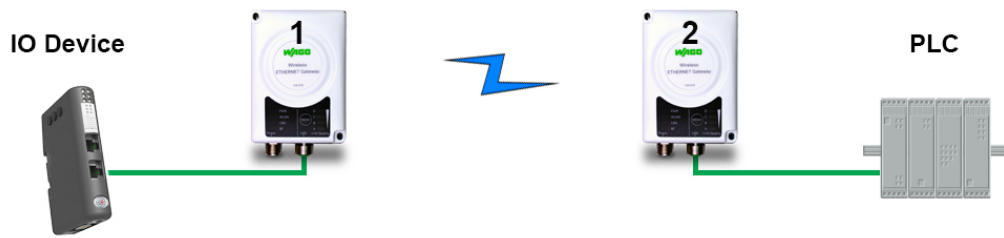
Figure 32: PROFINET Network

This example describes how to use 2 WEGs in "Easy Config" via *Bluetooth*® to connect a PROFINET device and a PROFINET PLC. You can select the relevant "Easy Config" mode using the respective MODE membrane button or via the WBM.

> ## *Note*
> **Observe the documentation!**
> Follow the instructions for configuring PROFINET communication in the documentation of the devices used!

1.   Reset **both WEGs** to their factory settings.

2.   Connect the **1st WEG** to the PROFINET device and the **2nd WEG** to the PROFINET PLC.

3.   Move the **1st WEG** to "Easy Config" mode 4.
      That WEG can now be found and is enabled for automatic configuration.

4.   Move the **2nd WEG** to "Easy Config" mode 6.
      This WEG should automatically find the first WEG and configure it as a *Bluetooth*® client – and configure itself as an access point.

5.   The I/O device should now be able to communication with the PLC.

Add other WEGs
You can add up to 6 additional clients to the access point in this way. Each new client is assigned the next available IP address within the current subnet.

> ## *Note*
> **Set the Cycle Update Time!**
> The "IO Cycle Update Time" for each I/O device must be set to ≥ 64 ms.

8.1.3   Easy Config: EtherNet/IP Network via *Bluetooth*®
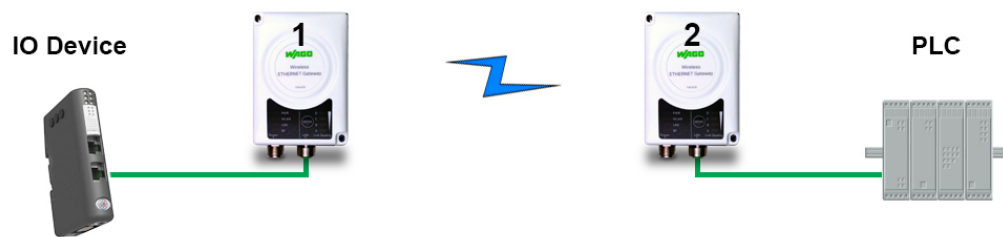
Figure 33: EtherNet/IP Network

This example describes how to use 2 WEGs in "Easy Config" via *Bluetooth*® to connect an EtherNet/IP device and an EtherNet/IP PLC. You can select the relevant "Easy Config" mode using the respective MODE membrane button or via the WBM.

> **Note**
>
> **Observe the documentation!**
> Follow the instructions for configuring EtherNet/IP communication in the documentation of the devices used!

1.   Reset **both WEGs** to their factory settings.

2.   Connect the **1st WEG** to the EtherNet/IP device and the **2nd WEG** to the EtherNet/IP PLC.

3.   Move the **1st WEG** to "Easy Config" mode 4.
      That WEG can now be found and is enabled for automatic configuration.

4.   Move the **2nd WEG** to "Easy Config" mode 6.
      This WEG should automatically find the first WEG and configure it as a *Bluetooth*® client – and configure itself as an access point.

5.   The I/O device should now be able to communication with the PLC.

Add other WEGs
You can add up to 6 additional clients to the access point in this way. Each new client is assigned the next available IP address within the current subnet.

> **Note**
>
> **Set RPI!**
> The "Requested Packet Interval (RPI)" for each I/O device must be set to ≥ 64 ms.

8.1.4   WBM: Connect an ETHERNET Network to an Existing WLAN
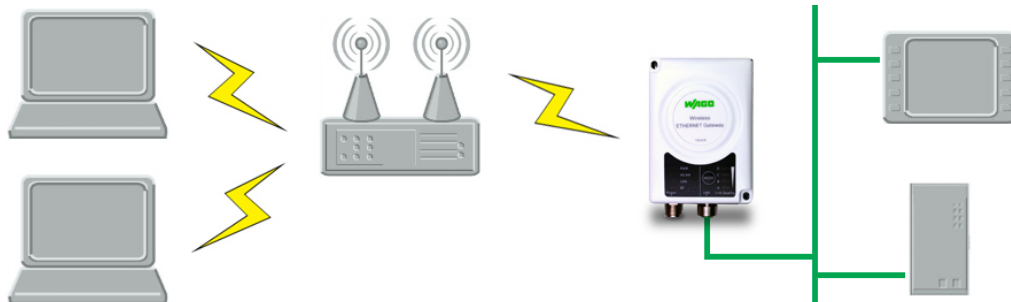
Figure 34: Connect to WLAN

This example describes how to connect a machine with internal ETHERNET network to an existing WLAN.

This configuration allows transfers to layer 3 ("Network Layer"), but not to layer 2 ("Data Link Layer"). In other words, WLAN can be used on TCP/IP-based protocols that start at layer 3, e.g., EtherNet/IP, MODBUS TCP and BACnet. Protocols such as PROFINET that start on layer 2 cannot be transferred via WLAN.

1.   First, resent the WEG to its factory settings.

2.   Configure the IP settings on the WBM "Network Settings" page based on the settings required for the existing network.

3.   If the network uses DHCP, select the "DHCP Relay Enabled" entry in the **Internal DHCP Server** selection list:

> **Note**
>
> **Do not enable the internal DHCP server!**
> Do not enable the internal DHCP server ("DHCP Server Enabled" entry from the **Internal DHCP Server** selection list) if there is already a DHCP server in the network!

4.   Go to the WBM "WLAN Settings" page.

5.   Click the **[Scan for Networks]** button.

6.   When the scan process is finished, select the required network from the associated selection list.

7.   If required, make a selection in the **Authentication Mode** selection list.

8.   Enter the respective password for the network in the **Passkey** input field.

9.   Make sure that the "Layer 3 IP forward" entry is selected in the **Bridge Mode** selection list (default setting):

Advanced Settings

Bridge Mode   Layer 3 IP forward   ⌄

10.   Click the yellow **[Save and Reboot]** button.

The ETHERNET network should now be connected to the WLAN access point.

8.1.5   Connecting ETHERNET Nodes to an Existing WLAN
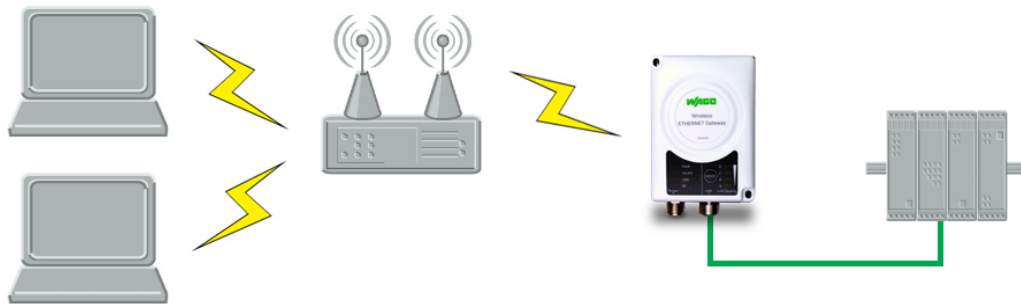
Figure 35: Add WLAN Connectivity

This example shows how to connect a PLC to an existing WLAN that supports layer 2 and layer 3 transfers. The WLAN interface of the WEG clones the MAC address of the ETHERNET interface of the PLC for this purpose.

In this configuration structure. only a single ETHERNET node is enabled to communicate with an external access point.

1.   First, resent the WEG to its factory settings.

2.   Configure the IP settings on the WBM "Network Settings" page based on the settings required for the existing network.

3.   Go to the WBM "WLAN Settings" page.

4.   Click the **[Scan for Networks]** button.

5.   When the scan process is finished, select the required network from the associated selection list.

6.   Click the yellow **[Save and Reboot]** button.

7.   Check on the WBM "System Overview" page if there is a WLAN connection before continuing.

Note

→ **Do not skip this control step!**
After completing the configuration process, you may have no access to the network via the WBM! The only way to get access to the WEG's WBM would be to then reset the WEG to its factory settings.

---

8.   Return to the WBM "WLAN Settings" page.

9.   Select the "Layer 2 cloned MAC only" entry in the **Bridge Mode** selection list:

Advanced Settings

Bridge Mode   Layer 2 cloned MAC only ▼ ⊕

Allows bridging of layer 2 data for one device

Cloned MAC Address   00-00-00-00-00-00

10.   Enter the MAC address of the PLC in the **Cloned MAC Address** input field.

11.   Click the yellow **[Save and Reboot]** button.

The WEG now works as a WLAN interface for the PLC by using the MAC address of the ETHERNET interface of the PLC.

8.1.6   Connecting a PLC to a Mobile Device via WLAN
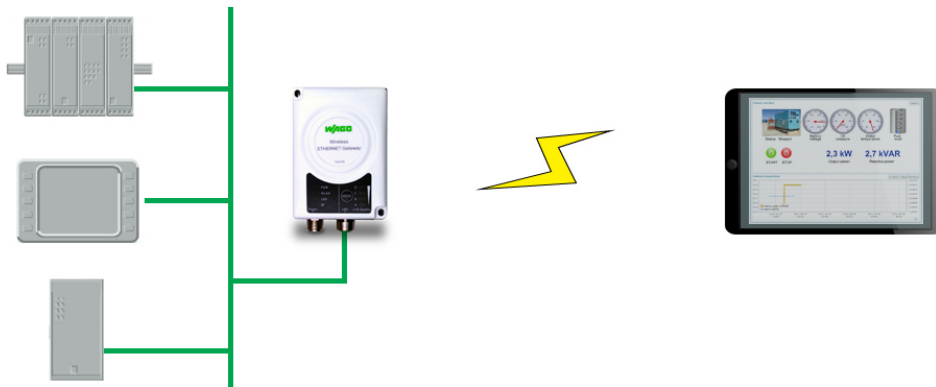
Figure 36: Connecting a PLC to a Tablet/Smartphone via WLAN

The example describes how you can use the WEG to access a tablet or smartphone on the Web interface of a PLC (or of another device within a wired network). The WEG functions as a WLAN access point.

> ### Note
>
> **Observe documentation**
> Follow the instructions for configuring the network settings in the documentation of the respective mobile device (e.g., tablets/smartphones)!

1.   First, resent the WEG to its factory settings.

2.   Configure the IP settings on the WBM "Network Settings" page based on the settings required for the existing network:

   •   If the network uses DHCP, select the "DHCP Relay Enabled" entry in the **Internal DHCP Server** selection list:

   Internal DHCP Server   DHCP Relay Enabled

   •   If the network uses a fixed IP address. select the "Static" entry in the **IP Assignment** selection list:

   IP Assignment   Static

   Then select the "DHCP Server Enabled" entry in the **Internal DHCP Server** selection list:

The WEG assumes the role of DHCP server in the network.

→ **Note**

Do not enable the internal DHCP server if there is already a DHCP server in the network!
Do not enable the internal DHCP server if there is already a DHCP server in the network! Doing so could lead to IP address problems.

3.   Go to the WBM "WLAN Settings" page.

4.   Select the "Access Point" entry in the **Operating Mode** selection list:

5.   Enter a new unique SSID for the network in the **Network (SSID)** input field.

6.   Select the "WAP2" entry in the **Authentication Mode** selection list.

7.   Specify a password in the **WAP2 Passkey** input field.

8.   Select the required bandwidth in the **Channel Bands** selection list.

9.   Select the required channel in the **Channel** selection list.

10.   Click the yellow **[Save and Reboot]** button.

You should now be able to connection to the WEG SSID by tablet/smartphone.
Enter the PLC IP address in the tablet/smartphone browser to access the Web
interface of the PLC.

8.2   Wireless Technology Basics

Wireless technology is based on the propagation and reception of electro-magnetic waves.

These waves respond in different ways in terms of propagation, dispersion, diffraction and reflection depending on their frequency and the medium in which they are travelling.

To enable communication there should optimally be an unobstructed line of sight between the antennas of the devices. However, the so called Fresnel Zones should also be kept clear from obstacles, as radio waves reflected from objects within these zones may reach the receiver out of phase, reducing the strength of the original signal (also known as phase cancelling).

Fresnel zones can be thought of as ellipsoid three-dimensional shapes between two wireless devices. The size and shape of the zones depend on the distance between the devices and on the signal wave length. As a rule of thumb, at least 60 % of the first (innermost) Fresnel zone must be free of obstacles to maintain good reception.
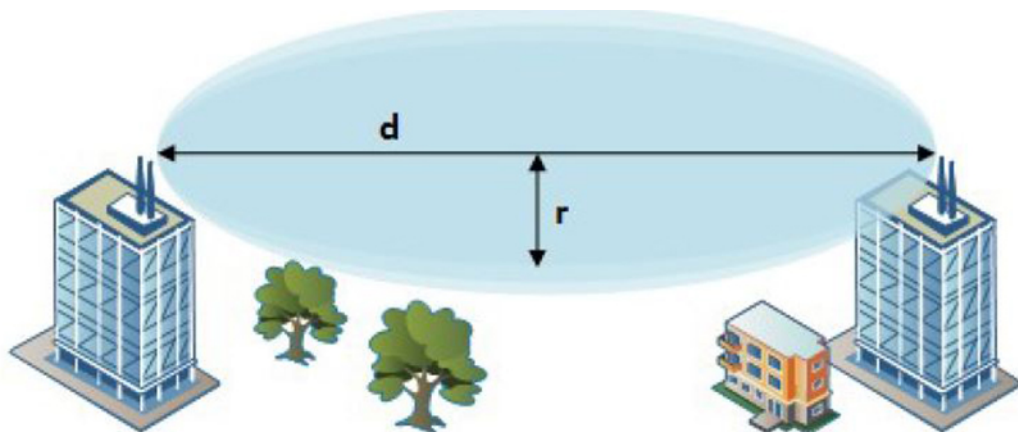
Figure 37: Fresnel Zones

Table 27: Area to Keep Clear of Obstacles (First Fresnel Zone)

Distance (d)	Fresnel Zone Radius (r)	
	2.4 GHz (WLAN or Bluetooth)	5 GHz (WLAN)
100 m	1.7 m	1.2 m
200 m	2.5 m	1.7 m
300 m	3.0 m	2.1 m
400 m	3.5 m	2.4 m

The wireless signal may be adequate even if there are obstacles within the Fresnel zones, as it always depends on the number and size of the obstacles and where they are located. This is especially true indoors, where reflections on metal objects may actually help the propagation of radio waves. To reduce interference and phase cancelling, the range may also need to be limited by

reducing the transmission power. For determining the optimal configuration and placement of wireless devices it is therefore recommended to use a wireless signal analysis tool.

8.3   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.

8.4   Internal Antenna Characteristics

The WEG has 3 independent quarter wave monopole antennas.

The following radiation diagrams and tables show the characteristics of the different antennas as measured under laboratory test conditions. The diagrams can be used as a general guide for finding the optimal placement and orientation of the WEGs.

The diagrams use a color spectrum from violet to red to indicate signal gain. The closer to the red end of the spectrum, the stronger the signal.

8.4.1   2.4 GHz Section of Dual Band Antenna
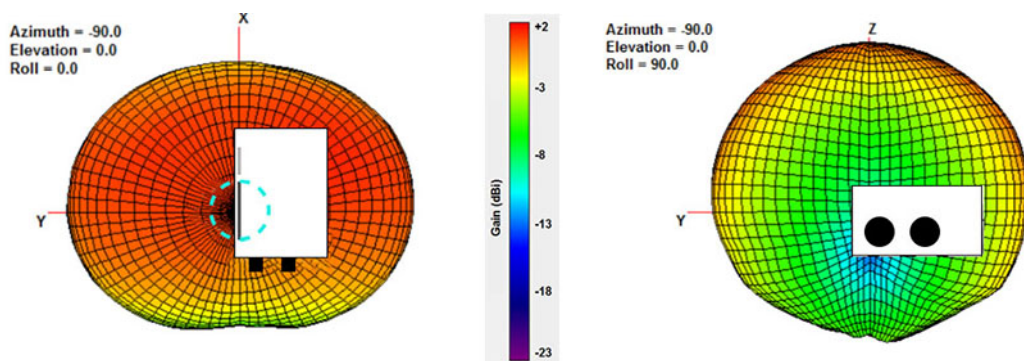
Figure 38: 2.4 GHz Antenna Gain and Directivity in Horizontal and Vertical Planes

Table 28: Dual Band Antenna 2.4 GHZ, in Plastic Box

Test	Frequency	Average Gain (%)	Peak Gain	Directivity
148	2400 MHz	−2.78 dBi (52.7 %)	+1.61 dBi	4.3 dB
149	2440 MHz	−2.24 dBi (60.5 %)	+1.80 dBi	3.9 dB
150	2485 MHz	−2.89 dBi (64.7 %)	+2.00 dBi	3.9 dB

8.4.2   5 GHz Section of Dual Band Antenna
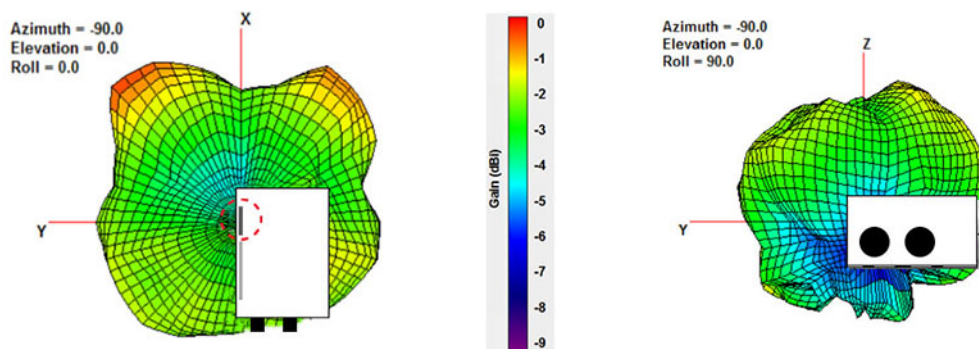
Figure 39: 5 GHz Antenna Gain and Directivity in Horizontal and Vertical Planes

Table 29: Dual Band Antenna 5 GHZ, in Plastic Box

Test	Frequency	Average Gain (%)	Peak Gain	Direktivity
151	5150 MHz	−4.80 dBi (33.1 %)	−2.49 dBi	2.3 dB
152	5250 MHz	−3.42 dBi (45.5 %)	−0.75 dBi	2.7 dB
153	5400 MHz	−3.13 dBi (48.6 %)	−0.14 dBi	3.0 dB
154	5600 MHz	−1.96 dBi (63.7 %)	+0.48 dBi	2.4 dB

8.4.3   2.4 GHz MIMO Antenna
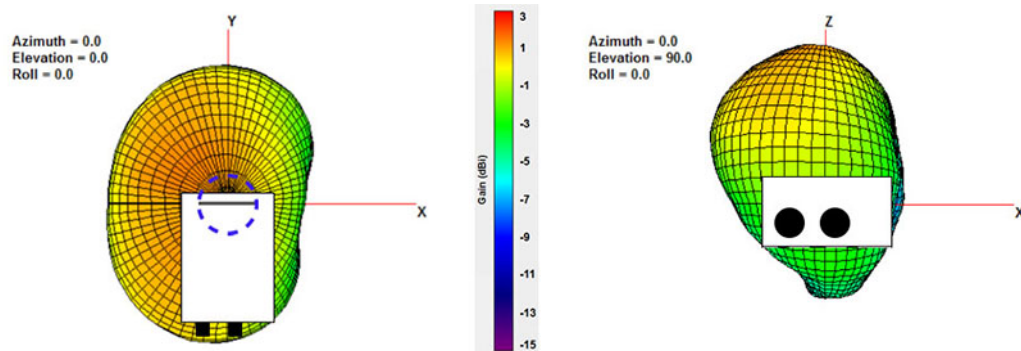
Figure 40: 2.4 GHz MIMO Antenna Gain and Directivity in Horizontal and Vertical Planes

Table 30: MIMO Antenna 2.4 GHZ, in Plastic Box

Test	Frequency	Average Gain (%)	Peak Gain	Directivity
168	2400 MHz	−1.95 dBi (63.8 %)	+2.66 dBi	4.6 dB
169	2440 MHz	−1.65 dBi (68.4 %)	+2.88 dBi	4.5 dB
170	2485 MHz	−1.42 dBi (72.1 %)	+2.76 dBi	4.2 dB

8.5   Properties of the External Antenna

The product variant (758-918/000-001) comes with a dual-band antenna. This has an antenna gain of max. 3 dBi in the relevant frequency range of 2.4 GHz or 5 GHz. The device complies with the corresponding radio guidelines with this antenna.

Table 31: Properties of the External Antenna

Polarization	Linear
Type	Monopole antenna
Point of nadir impedance	50 Ω
Antenna gain	Max. 3 dBi
Length	107 mm

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