



USER MANUAL

— Longo Bluetooth Products
LBT-1.GW1
Modbus RTU Bluetooth Gateway

Version 4



Written by SMARTEH d.o.o.
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User Manual

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STANDARDS AND PROVISIONS: Standards, recommendations, regulations and provisions of the country in which the devices will operate, must be considered while planning and setting up electrical devices. Work on 100 .. 240 V AC network is allowed for authorized personnel only.

DANGER WARNINGS: Devices or modules must be protected from moisture, dirt and damage during transport, storing and operation.

WARRANTY CONDITIONS: For all modules LBT-1 - if no modifications are performed upon and are correctly connected by authorized personnel - in consideration of maximum allowed connecting power, warranty of 24 months is valid from the date of sale to the end buyer, but not more than 36 months after delivery from Smarteh. In case of claims within warranty time, which are based on material malfunctions the producer offers free replacement. The method of return of malfunctioned module, together with description, can be arranged with our authorized representative. Warranty does not include damage due to transport or because of unconsidered corresponding regulations of the country, where the module is installed.

This device must be connected properly by the provided connection scheme in this manual. Misconnections may result in device damage, fire or personal injury.

Hazardous voltage in the device can cause electric shock and may result in personal injury or death.

NEVER SERVICE THIS PRODUCT YOURSELF!

This device must not be installed in the systems critical for life (e.g. medical devices, aircrafts, etc.).

If the device is used in a manner not specified by the manufacturer, the degree of protection provided by the equipment may be impaired.

Waste electrical and electronic equipment (WEEE) must be collected separately!

LBT-1 devices are developed considering the following standards:

- EMC: EN 303 446-1
- LVD: EN 60669-2-1

Smarteh d.o.o. operates a policy of continuous development. Therefore we reserve the right to make changes and improvements to any of the products described in this manual without any prior notice.

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1.ABBREVIATIONS

LED	Light Emitted Diode
PLC	Programmable Logic Controller
PC	Personal Computer
OpCode	Message Option Code
LBT-1.GWx	x means a different number of gateway type i.e. LBT-1.GW1 Modbus RTU Bluetooth Mesh gateway
LPN	Low Power Node





2. TERMINOLOGY

- **Mesh Network** A network topology where devices communicate with one another to create a reliable and scalable system, enabling devices to forward messages within the network.
- **Provisioning** The process of adding a new device to a mesh network by assigning it a unique unicast address and network keys, ensuring secure communication with other devices.
- **Mesh Proxy** A device that allows non-mesh devices to interact with a mesh network by forwarding messages between the mesh network and other devices that do not support mesh functionality.
- **Unicast Address** A unique identifier assigned to each device in the network, ensuring that messages are sent to a specific device rather than broadcasted to all devices.
- **Group Address** An address that represents a group of devices within the mesh network. Messages sent to a group address are received by all devices in that group.
- **Network Key** A shared key used by all devices in the mesh network to secure communication. It is essential for ensuring the confidentiality and integrity of data in the network.
- **Application Key** A key used for securing application-specific communication within the mesh network. Each device in the network can have one or more application keys assigned to it.
- **Composition Data** Data that describes the features, models, and capabilities of a device in the mesh network. This information is used to inform other devices in the network about the device's capabilities.
- **Subscription Address** A group address to which devices can subscribe in order to receive specific messages. This allows devices to act as receivers for broadcasted data within the mesh.
- **Friendship** A feature in BLE Mesh where one device stores data on behalf of a low-power device, allowing the low-power device to conserve energy by sleeping and receiving messages later.
- **Provisioned Device** A device that has been successfully added to the mesh network and has received its unique address, keys, and other configuration settings.
- **Provisioning Tool** The tool used to configure and provision devices into a mesh network, including device setup, network key management, and application key assignment.
- **Provisioning Success** A status indicating that a device has been successfully added to the network, with its keys and settings properly configured. Smarteh BLE Mesh Provisioning tool
- **Device Binding** The process of associating a device with an application key, publication address, or subscription address to enable specific communication within the mesh network.
- **Publication Address** An address used by devices to broadcast information to other devices in the network. It is typically a group address that all devices in the group can receive.
- **Opcode** A specific operation code used to define actions or commands within the mesh network, allowing devices to execute predefined functions.
- **Key Index** A reference number used to distinguish different keys used in the mesh network. It helps to identify the specific key used for security purposes during communication.
- **Security Credentials** A set of keys and authentication mechanisms used to secure communication between devices in the mesh network.
- **Key Refresh** A process of changing the network or application key periodically to enhance security by preventing unauthorized access to the mesh network.





- **Message Retransmit** A mechanism in the mesh network to retransmit messages to ensure reliability and prevent data loss, typically associated with network transmit settings like retransmit count.
- **Node:** Provisioned Device connected and talking to Bluetooth mesh network. The device can be simple node in the network or it can have one or more network features (LPN, Friend, Relay, Proxy).
- **Low-power node (LPN)** for nodes in the Bluetooth mesh network that are powered with battery and need to preserve power. They need friend node to receive messages when they are in low power mode.
- **Friend node** friend node in the Bluetooth mesh network receives and stores messages for LPN and delivers them when LPN asks for them
- **Relay node** relay nodes in the Bluetooth mesh network re-transmit messages of the same mesh network that are meant for other nodes so that message can travel longer distances across mesh network.
- **Proxy node:** proxy node in the Bluetooth mesh network act as bridge between Bluetooth mesh network and normal Bluetooth network. It is used to connect to Bluetooth mesh network.





3.DESCRPTION

LBT-1.GW1 Modbus RTU Bluetooth gateway is designed to operate with any PC or any PLC controller if they support Modbus RTU RS485 communication. Beside default 115.2kbps/8N1, also other communication settings are supported. If the PC cannot directly support RS485 communication, it's possible to use an appropriate USB → RS485 adapter, for example: Smarteh LSA-2 adapter.

For each Smarteh LBT-1 product such as LBT-1.BA1 BLT Mesh thermostatic valve actuator, LBT-1.B01 BLT Mesh window/door sensor, etc., there is a description of Modbus RTU commands in the corresponding user manual. Using these commands, communication with the nodes can be established after LBT-1 nodes are successfully provisioned/added to the Bluetooth Mesh network.

Example of Modbus RTU commands:

Table 1: 4xxxx, Holding registers

Reg.	Name	Description	Raw → Engineering data
10	Execute command	Execute command for Read and/or Write by toggling bit	Bit0 toggle → Write Bit1 toggle → Read
11	Destination address*	Destination node address. Can be a unicast, group or virtual address.	0 .. 65535 → 0 .. 65535
12	Element index*	Sending node model element index	0 .. 65535 → 0 .. 65535
13	Vendor ID*	Vendor ID of the sending node model	0 .. 65535 → 0 .. 65535
14	Model ID*	Model ID of the sending node model	0 .. 65535 → 0 .. 65535
16	Virtual address index*	Index of the destination Label UUID	0 .. 65535 → 0 .. 65535
17	Application key index*	The application key index used	0 .. 65535 → 0 .. 65535
18	Option code**	Refer to the option code table	0 .. 63 → 0 .. 63
19	Payload byte length**	Refer to the option code table	1 .. 10 → 1 .. 10 bytes
20	Payload word[0]**	Refer to the option code table	0 .. 65535 → 0 .. 65535

* Observed from network provisioning tool

** User defined parameters, refer to the option code table

In addition to Smarteh Bluetooth Mesh devices, other standard Bluetooth Mesh devices can also be integrated in the above mentioned Bluetooth Mesh network. More than a hundred Bluetooth Mesh devices can be provisioned and can operate in a single Bluetooth Mesh network.



4.FEATURES

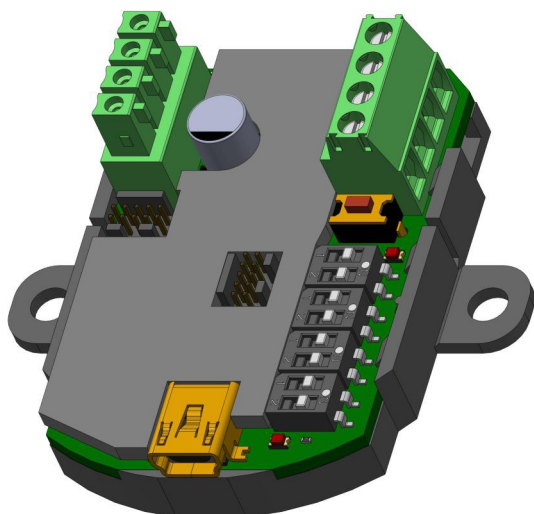


Figure 1: LBT-1.GW1

Table 2: Technical data

Communication standard: Bluetooth Mesh is a low power wireless mesh protocol and allows device to device communication and device to main control device communication

Radio frequency: 2.4 GHz

Radio range for direct connection: < 30 m, depending on application and building.
By using Bluetooth Mesh topology, much bigger distances can be achieved.

USB for power supply and Modbus RTU Slave for communication with the main device

RS485 Modbus RTU Slave for communication with main device

DIP switches for gateway and communication settings

Power supply: 5..30 V DC

Protection degree: IP20

Working temperature: 0 .. 50 °C

Storage temperature: -20 .. 60 °C

Type of casing: PA6

Status indicators: red and green LEDs





5. OPERATION

LBT-1.GW1 Modbus RTU Bluetooth gateway can operate with Smarteh LBT-1 products and with other vendors Bluetooth Mesh products while provisioned to the same Bluetooth Mesh network. Bluetooth Mesh vendor model of the individual product must be obtained from the vendor. At the same time, it must also be connected to the PLC controller or PC, supporting Modbus RTU RS485 communication.

For each Smarteh LBT-1 product e.g. radiator valve actuator, window/door sensor,..., there is a description of Modbus RTU commands in the corresponding Smarteh LBT-1 product user manual. Using these commands, communication with nodes can be established, after LBT-1 products are successfully provisioned to the same Bluetooth Mesh network. LBT-1.GW1 acts as a **Relay, Friend and Proxy node** in a Bluetooth mesh network.





Figure 2: Bluetooth Mesh system topology

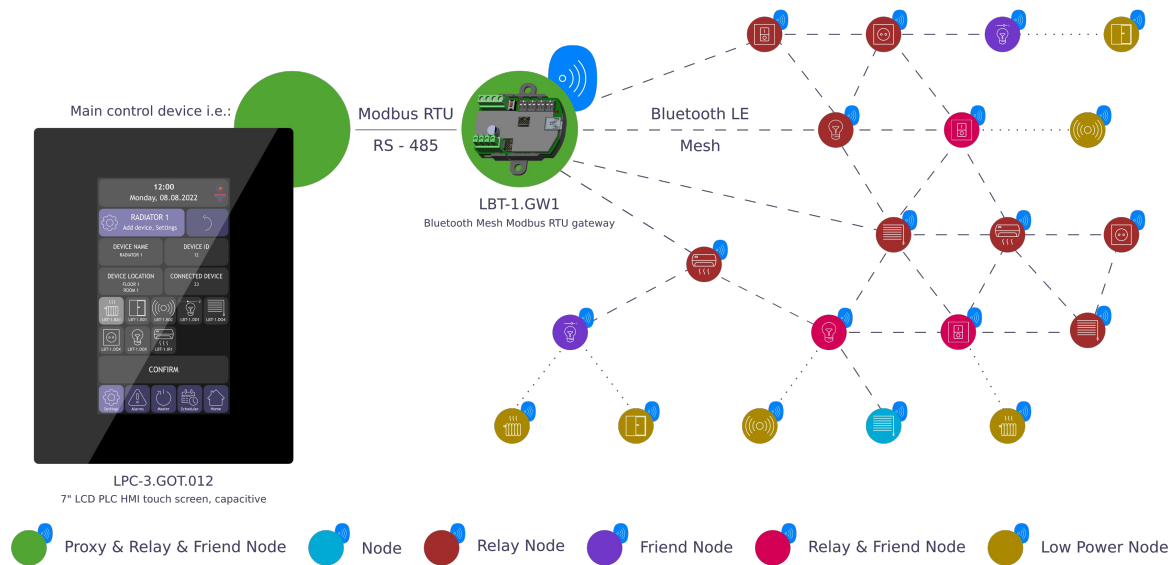
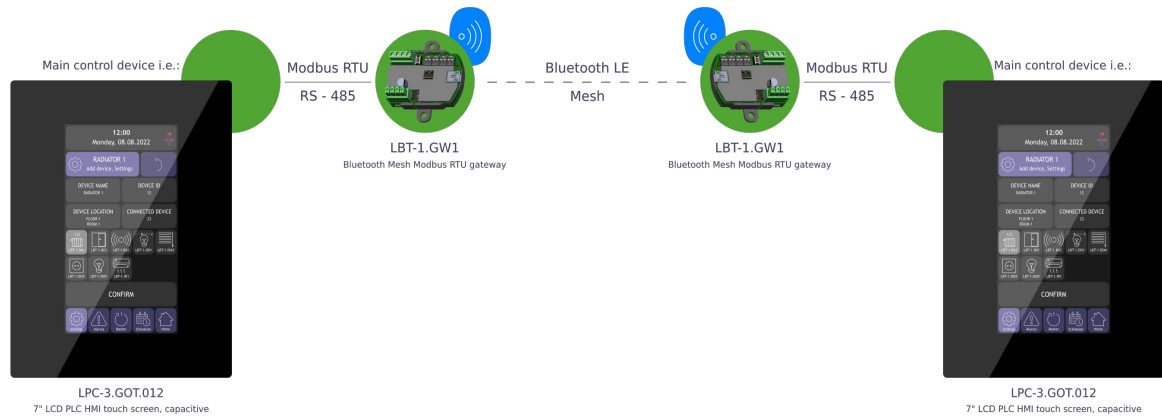


Figure 3: Bluetooth Mesh connection between two LBT-1.GW1





5.1. Other Modbus RTU Bluetooth gateway functions:

- **Factory reset:** This function will delete all Bluetooth Mesh network parameters stored on the LBT-1.GW1 gateway and will restore to the factory default condition. LBT-1.GW1 gateway will be ready for provisioning. See Table 7 for more information.

5.2. Operation parameters

LBT-1.GW1 Modbus RTU Bluetooth gateway connected to the main control device like Smarteh LPC-3.GOT.012 or similar, transmits and receives the following general operation codes listed in the table below. For operation codes related to the individual Smarteh LBT-1 Bluetooth product, please see the corresponding LBT-1 user manual. All communication between PLC based main control device as LPC-3.GOT.012 or similar is performed by using Modbus RTU communication. Individual Bluetooth Mesh node configuration data should be observed by using the Bluetooth network provisioning tool.

5.3. Modbus RTU settings:

Default Modbus RTU settings: Slave ID 234, Baudrate: 115200 bps, Parity: None, Stop bit: 1.

Slave ID is set by DIP switches S3 and S4.

Default Modbus settings are applied when DIP switches S3 and S4 are set to "0" position. When the DIP switches are set to another position, user defined Modbus RTU settings are applied.

Do not use smaller Modbus RTU poll times than 100 ms.

Table 3: 4xxxx, Holding registers, Modbus RTU settings

Reg. Name	Description	Raw → Engineering data
801 SlaveID	Modbus RTU save address, read only	0 → 234 (default) 1 .. 15 → 1 .. 15
802 Baudrate	Baudrate for Modbus RTU communication	0 → 115200 bps (default) 1 → 4800 bps 2 → 9600 bps 3 → 14400 bps 4 → 19200 bps 5 → 38400 bps 6 → 56000 bps 7 → 57600 bps 8 → 115200 bps
803 Parity	Parity for Modbus RTU communication	0 → None (default) 1 → Even 2 → Odd
804 StopBit	Stop bits for Modbus RTU	1 → 1 (default) 2 → 2



**Table 4: 4xxxx, Holding registers, Modbus RTU to Bluetooth Mesh gateway**

Reg.	Name	Description	Raw → Engineering data
10	Execute command	Execute command for Read and/or Write by toggling bit	Bit0 toggle → Write Bit1 toggle → Read
11	Destination address*	Destination node address. Can be a unicast, group or virtual address.	0 .. 65535 → 0 .. 65535
12	Element index*	Sending node model element index	0 .. 65535 → 0 .. 65535
13	Vendor ID*	Vendor ID of the sending node model	0 .. 65535 → 0 .. 65535
14	Model ID*	Model ID of the sending node model	0 .. 65535 → 0 .. 65535
16	Virtual address index*	Index of the destination Label UUID	0 .. 65535 → 0 .. 65535
17	Application key index*	The application key index used	0 .. 65535 → 0 .. 65535
18	Option code**	Refer to the option code table	0 .. 63 → 0 .. 63
19	Payload byte length**	Refer to the option code table	1 .. 10 → 1 .. 10 bytes
20	Payload word[0]**	Refer to the option code table	0 .. 65535 → 0 .. 65535
21	Payload word[1]**	Refer to the option code table	0 .. 65535 → 0 .. 65535
22	Payload word[2]**	Refer to the option code table	0 .. 65535 → 0 .. 65535
23	Payload word[3]**	Refer to the option code table	0 .. 65535 → 0 .. 65535
24	Payload word[4]**	Refer to the option code table	0 .. 65535 → 0 .. 65535

* Observed from network provisioning tool

** User defined parameters, refer to the option code table



**Table 5: 3xxxx, Input registers, Modbus RTU to Bluetooth Mesh gateway**

Reg.	Name	Description	Raw → Engineering data
10	Messages pending	Number of messages pending in receiving buffer	1 .. 10 → 1 .. 10
11	Destination address	Destination node address. Can be a unicast, group or virtual address	0 .. 65535 → 0 .. 65535
12	Element index	Sending node model element index	0 .. 65535 → 0 .. 65535
13	Vendor ID	Vendor ID of the sending node model	0 .. 65535 → 0 .. 65535
14	Model ID	Model ID of the sending node model	0 .. 65535 → 0 .. 65535
15	Source address	Unicast address of the node model which sent the message	0 .. 65535 → 0 .. 65535
16	Virtual address index	Index of the destination Label UUID	0 .. 65535 → 0 .. 65535
17	Application key index	The application key index used	0 .. 65535 → 0 .. 65535
18	Option code status	Refer to the option code table	0 .. 63 → 0 .. 63
19	Payload length	Refer to the option code table	1 .. 10 → 1 .. 10 bytes
20	Payload word[0]	Refer to the option code table	0 .. 65535 → 0 .. 65535
21	Payload word[1]	Refer to the option code table	0 .. 65535 → 0 .. 65535





Table 5: 3xxxx, Input registers, Modbus RTU to Bluetooth Mesh gateway

22	Payload word[2]	Refer to the option code table	0 .. 65535 → 0 .. 65535
23	Payload word[3]	Refer to the option code table	0 .. 65535 → 0 .. 65535
24	Payload word[4]	Refer to the option code table	0 .. 65535 → 0 .. 65535



6.INSTALLATION

6.1.Connection scheme

Figure 4: Connection scheme

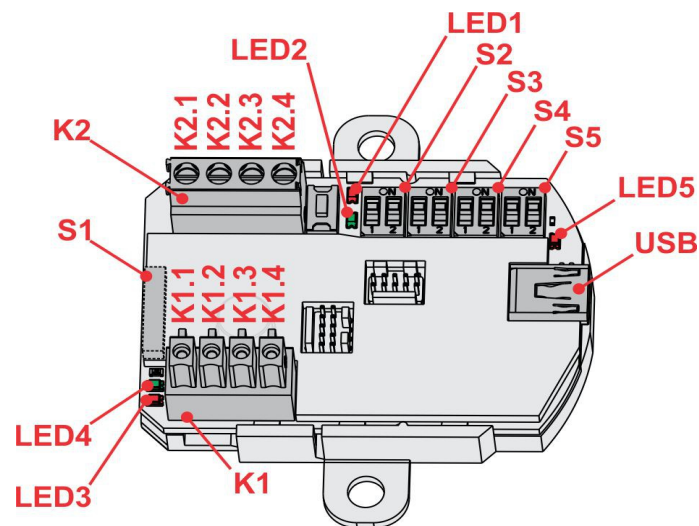


Table 6: K1, K2

K1.1	+	Power supply input 5 .. 30 V DC
K1.2	-	Ground
K1.3	A	RS485 A
K1.4	B	RS485 B
K2.1	+	Power supply input 5 .. 30 V DC
K2.2	-	Ground
K2.3	A	RS485 A
K2.4	B	RS485 B



**Table 7: LEDs**

LED1: red	Error	3x blinks inside 5 sec time period = unprovisioned node
LED2: green	Status	1x blink inside 10 sec time period = normal operation. It's also feedback for S1 reed contact when activated with magnet.
LED3: red	RS-485 Rx status	Blink: OK Off: no communication from Master On: A and/or B line in the shortcut
LED4: green	RS-485 Tx status	Blink: OK Off: no answer On: A and/or B line in the shortcut
LED5: red	Status	Generic status

Table 8: USB

USB	USB	Power supply and Modbus RTU communication
-----	-----	---



**Table 9: Inputs**

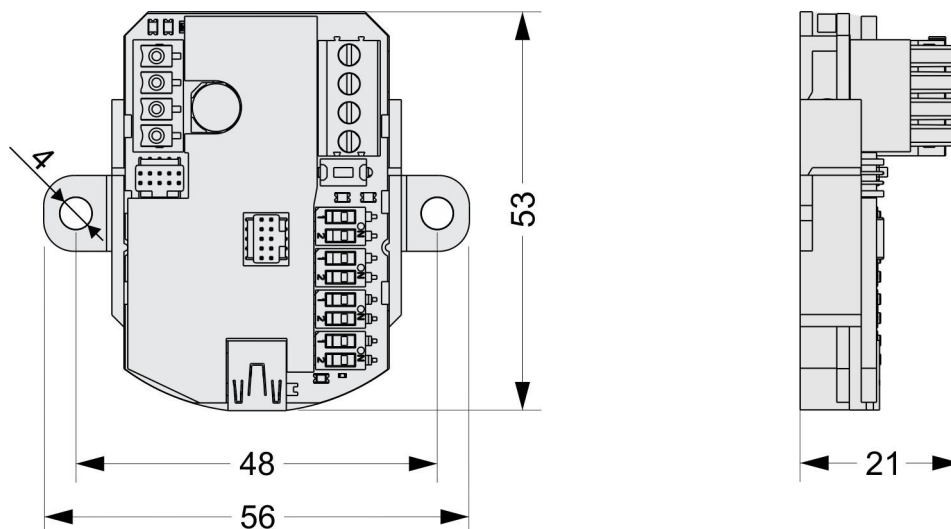
S1	Reed contact	<p>Inside the 5sec time window, perform number of swipes in a duration of not less than 200ms with a permanent magnet close to the gateway reed contact position. The following gateway action or mode will be set:</p> <table><tr><th><u>number of swipes</u></th><th><u>Action</u></th></tr><tr><td>4</td><td>Reset</td></tr><tr><td>5</td><td>Factory reset</td></tr></table> <p>A hardware reset is triggered if reed contact is continuously closed with a permanent magnet for more than 5 seconds.</p>	<u>number of swipes</u>	<u>Action</u>	4	Reset	5	Factory reset
<u>number of swipes</u>	<u>Action</u>							
4	Reset							
5	Factory reset							
S2.1	DIP Switch	Modbus RTU 0 → USB 1 → RS485, K1 and K2						
S2.2	DIP Switch	Spare						
S3.1	DIP Switch	Modbus RTU Slave ID						
S3.2	DIP Switch	0000 → default Modbus RTU settings, Slave ID: 234 0001 .. 1111 → 1 .. 15 Slave ID						
S4.1	DIP Switch	S3.1: MSB						
S4.2	DIP Switch	S4.2: LSB						
S5.1	DIP Switch	Spare						
S5.2	DIP Switch	Spare						

NOTE: If LBT-1.GW1 Modbus RTU Bluetooth Mesh gateway is not connected directly to the Smarteh LPC-3.GOT.012 main control or similar device using male-female connectors, twisted pair extension cable should be used. The LBT-1.GW1 gateway must be placed separately from other electrical appliances and cable must be installed separately from high power and high voltage wires in accordance with general industry electrical installation standards.



6.2.Mounting instructions

Figure 5: Housing dimensions



Dimensions in millimeters.



Gateway attachment to the LPC-3.GOT.012, other PLC controller or PC must be performed while main control device is not powered.



Figure 6: LBT-1.GW1 gateway directly connected to the main control device LPC-3.GOT.012 or similar

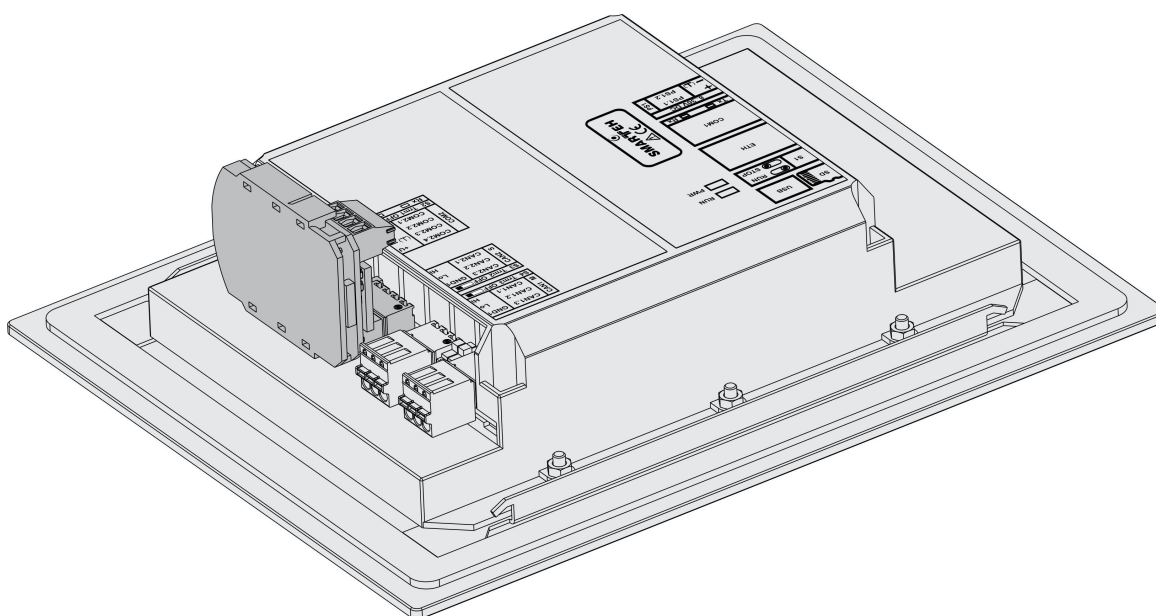
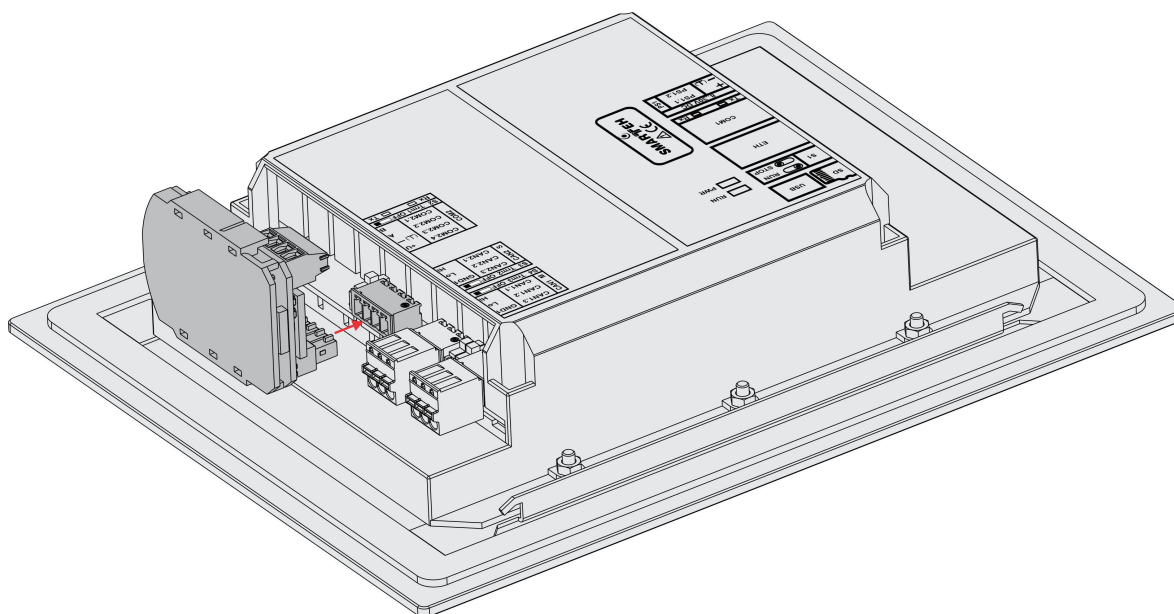
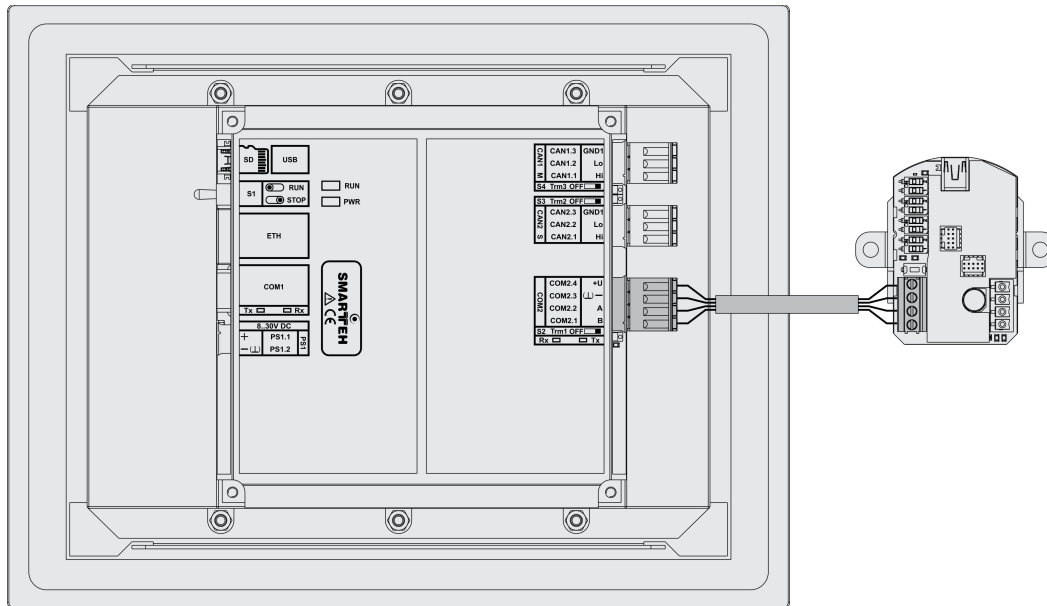
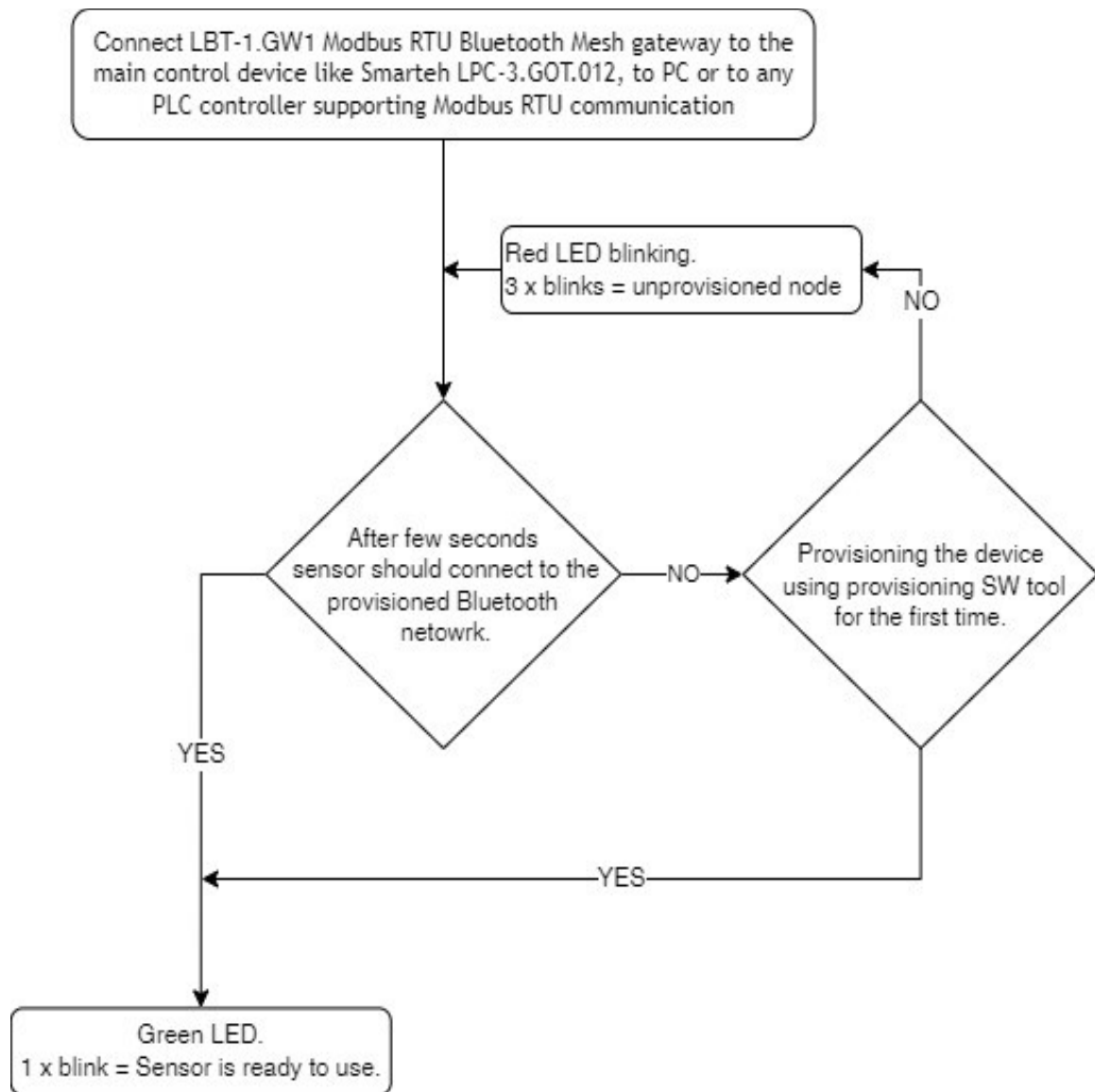


Figure 7: LBT-1.GW1 gateway connected to the main control device LPC-3.GOT.012 or similar using an extension cable





1. Check that main control device like Smarteh LPC-3.GOT.012 or similar is not powered.
2. Attach LBT-1.GW1 Modbus RTU Bluetooth gateway to the LPC-3.GOT.012 using integrated male-female connector or use extension cable for connection to other PC or PLC device.
3. Power up the main control device.
4. Once provisioning of LBT-1.GW1 Modbus RTU Bluetooth gateway is finished, gateway will continue with normal mode of operation and this will be indicated as Green LED blinking.

Dismount in reverse order.





6.3.Maintenance

The LBT-1.GW1 Modbus RTU Bluetooth gateway is a maintenance free.





7.SYSTEM OPERATION

7.1.Interference warnings

Common sources of unwanted interference are devices that generate high frequency signals. Those are typically computers, audio and video systems, electronic transformers, power supplies, various ballasts, frequency converters and similar. The clearance distance from the LBT-1.GW1 gateway to any of above mentioned devices should be at least 0.5 m or greater.

WARNING:

- To protect plants, systems, machines and network against cyber threats, it's necessary to implement and continuously implemented state of the art security concept.
- You are responsible for preventing unauthorized access to your plants, systems, machines and networks and they are allowed to be connected to the internet only, when security measures like firewalls, network segmentation, ... are in place.
- We strongly recommend the updates and usage of the latest version. Usage of the version that is no longer supported may increase the possibility of cyber threats.





7.2. Application examples based on Smarteh Bluetooth products

Figure 8: Smarteh Bluetooth Mesh application example

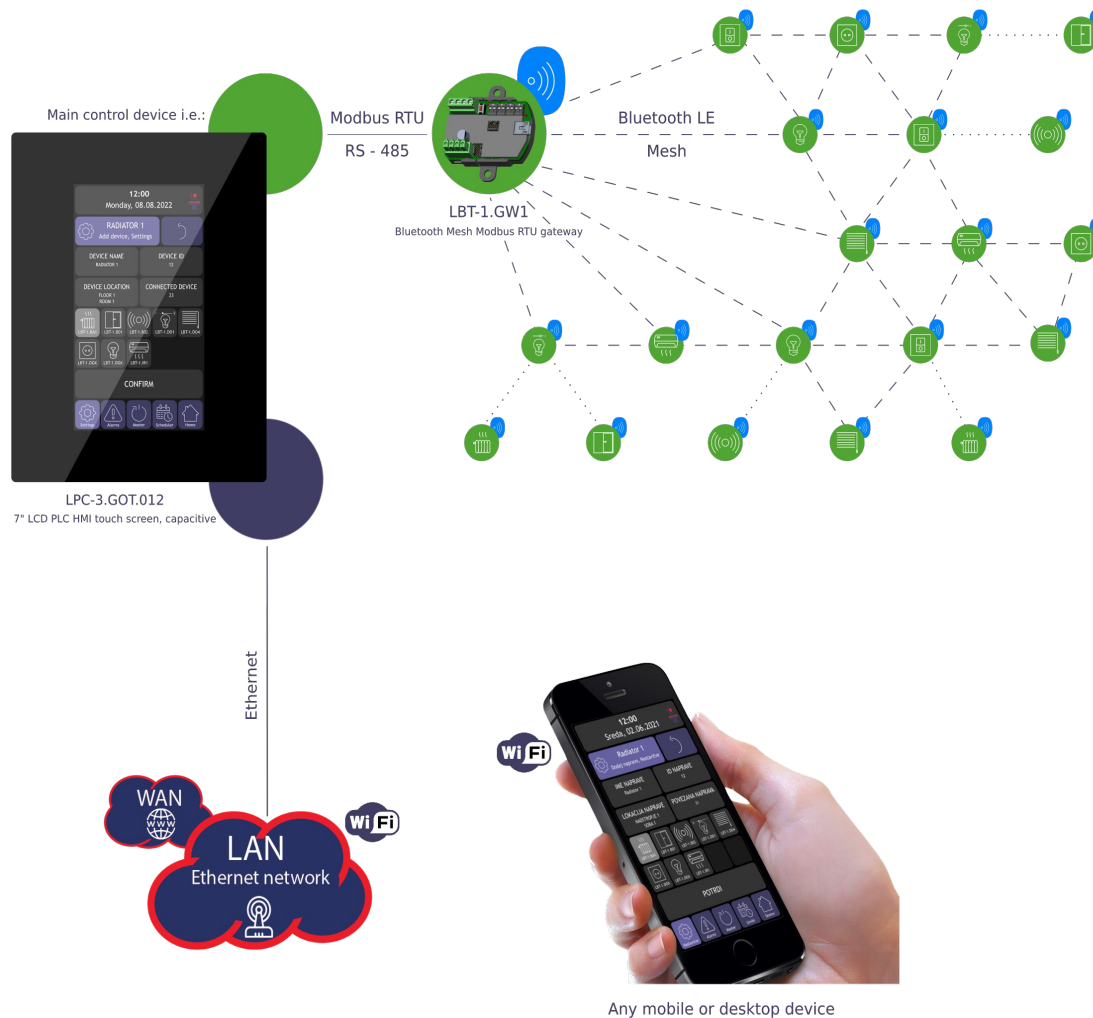


Figure 8:



8. TECHNICAL SPECIFICATIONS

Table 10: Technical specifications

Power supply	5 .. 30 V DC
RF communication interval	The parameter inside SW application
Max. power consumption	1 W
Connection type	screw type connector for stranded wire 0.75 to 2.5 mm ²
Dimensions (L x W x H)	53 x 38 x 21 mm
Weight	25 g
Ambient temperature	0 to 50 °C
Ambient humidity	max. 95 %, no condensation
Maximum altitude	2000 m
Mounting position	Any. Please read the chapter Interference warnings
Transport and storage temperature	-20 to 60 °C
Pollution degree	2
Over voltage category	II
Electrical equipment	Class II (double insulation)
Protection class	IP 20





9. MODULE LABELING

Figure 9: Label

Label (sample):

XXX-N.ZZZ.UUU
P/N: AAABBBCCDDDEEE
S/N: SSS-RR-YYXXXXXXXXXX
D/C: WW/YY

Label description:

1. **XXX-N.ZZZ** - full product name.
 - **XXX-N** - Product family
 - **ZZZ** - product
2. **P/N: AAABBBCCDDDEEE** - part number.
 - **AAA** - general code for product family,
 - **BBB** - short product name,
 - **CCDDD** - sequence code,
 - **CC** - the year of code opening,
 - **DDD** - derivation code,
 - **EEE** - version code (reserved for future HW and/or SW firmware upgrades).
3. **S/N: SSS-RR-YYXXXXXXXXXX** - serial number.
 - **SSS** - short product name,
 - **RR** - user code (test procedure, e.g. Smarteh person xxx),
 - **YY** - year,
 - **XXXXXXXXXX** - current stack number.
4. **D/C: WW/YY** - date code.
 - **WW** - week and
 - **YY** - the year of production.

Optional

1. **MAC**
2. **Symbols**
3. **WAMP**
4. **Other**





10.CHANGES

The following table describes all the changes to the document.

Date	V.	Description
21.02.25	4	Added terminology chapter, more descriptive image of mesh network and node functions description.
27.03.23	3	Table 5 update.
07.03.23	2	Table 9 update.
02/10/23	1	The initial version, issued as <i>LBT-1.GW1 Modbus RTU Bluetooth gateway User Manual</i> .





11.NOTES

