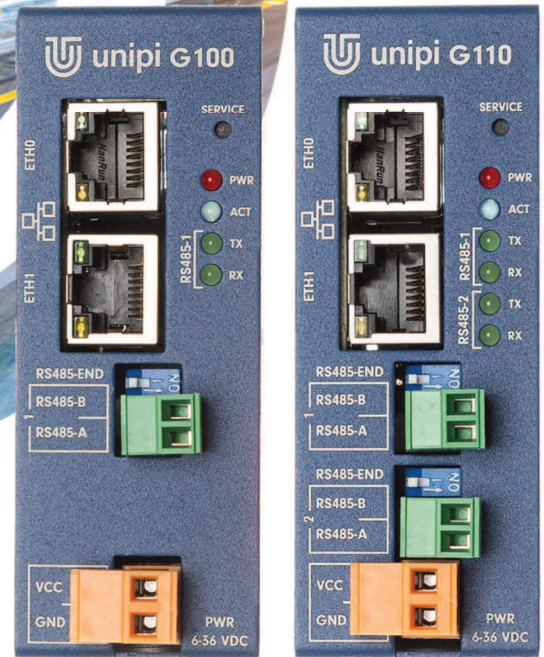


Automation

Monitoring and control

Remote access and management

HVAC



Gate G100/G110

Programmable Linux gateway and logic controller

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1 Introduction

1.1 What is the Unipi Gate?

Unipi Gate is a programmable Linux gateway and logic controller (PLC) featuring a pair of Ethernet ports and two (one) RS485 ports. Thanks to its software openness, Unipi Gate is a universal gateway applicable to the field of industrial automation and HVAC control. In these applications, the device can act as a controller or a data aggregator for SCADA or MES control systems. Due to its internet connectivity, Gate represents an ideal choice for modernization of older „brownfield“ installations. The gateway is also applicable as an end device for cloud services used as a basis for Smart City, Smart Factory, IoT, IIoT, Edge Computing and other systems aggregating large volumes of data.

1.2 What the Unipi Gate can be used for?

Due to the flexible number of serial lines, the gateway can be utilized in a wide range of projects, such as:

- Control of devices communicating via the RS485 bus (heat pumps, air conditioning systems etc.)
- RS485 – Ethernet (internet) gateway
- Monitoring and data aggregation systems
- Industrial automation and HVAC control
- SCADA and MES systems
- Complex projects (control of heating cascades and boiler rooms, air conditioning systems)
- Smart City and Smart Factory projects
- Projects in the field of IoT and IIoT
- Cloud computing or Edge computing in Industry 4.0 applications
- Modernization of older installations

1.3 Which Unipi Gate models are available?

The following table shows communication interface configurations of Gate controllers:

Model	RS485	1Gbit	100Mbit
G100	1	1	1
G110	2	1	1

Each controller also possesses the following features:

CPU	RAM	eMMC	Others
4×600 MHz	512 MB	16 GB	User LED

1.4 Standard compliance

EMC: 2014/30/EU

RoHS: 2015/863/EU

WEEE: 2012/19/EU

2 Installation and connection

2.1 Basic instructions

During the installation, always bear in mind the following instructions:

- Make sure you act in compliance with all relevant standards, norms, and government regulations
- Unplug the power supply before any manipulation with the device (installation/removal)
- Use cabling with the specified gauge
- Do not exceed the tightening torque limit of screw terminals
- Adhere to working and installation conditions of the device
- Use the shortest possible wiring. If longer wires are needed, use shielded cables. Route the cables in pairs (e.g., one neutral wire and one signal wire)
- Always keep appropriate isolation distances between alternating voltage wires, high DC voltage circuits with high frequency switching cycles, and signal wires
- Make sure all wires have an appropriate strain relief installed
- The device must be installed in a fixed, fully enclosed installation box

Note:

The device should be installed only by qualified personnel adhering to all relevant regulations and standards.

Caution:

Unipi Gate is an open device. Improper handling may result in extensive property damage, injury, or death. The installation box the device is mounted in should be accessible only with a key or other similar tool. Only qualified personnel can access the device.

2.1.1 Basic description of Unipi Gate

Unipi Gate is powered by ARM A53 quad-core CPU with 600 MHz frequency and 512 MB RAM, providing the gateway with sufficient computing power to handle demanding applications. Internal eMMC memory is used as memory storage and can be extended by a 16 GB microSD card if needed.

The RS485 interface, designed for serial communication (e.g., via Modbus protocol), is used for control and monitoring of various external devices such as boilers, air conditioning systems, electric motors, energy meters, various converters, extension modules or PLCs from different manufacturers.

The pair of Ethernet ports with 1 Gbit and 100 Mbit capacity serve for network communication with the internet or devices in a local network. The gateway can be also utilized as a network switch (bridge mode), or as a node between two separate networks.

2.2 Description of LED indicators

Label	Function	Meaning	Colour
PWR	On/Off	The device is turned on/off	Red
ACT	Blinking	Controller status indication	Green
ACT - user config.	Configurable	According to the configuration (see below)	Green
TX (RS485-1)	On	RS485 #1 is transmitting	Green
RX (RS485-1)	On	RS485 #1 is receiving	Green
TX (RS485-2)	On	RS485 #2 is transmitting	Green
RX (RS485-2)	On	RS485 #2 is receiving	Green
ETH ports	On	Connection established	Green
	Off	No connection	Green
	Blinking	Active communication	Yellow
	Off	No connection	Yellow

Aside from the description of individual LEDs above, all diodes are also used for indication of the following states and events (except the PWR LED).

2.2.1 Regular mode

Description of LED behaviour	Meaning	Off	On	Off
ACT is on	Bootloader start (uboot)	3000 ms	1750 ms	-
ACT blinks once	The bootloader is running	250 ms	75 ms	1000 ms
ACT blinks twice	The controller's OS is booting	250 ms	75 ms	-
ACT is continuously on and does regular short blinks	The OS is running, the device is ready for use	50 ms	2000 ms	-

2.2.2 Service mode

Description of LED behaviour	Meaning	Off	On	Off
ACT is on	Bootloader start (uboot)	3000 ms	>5000 ms	-
ACT blinks once	The bootloader is running	250 ms	75 ms	1000 ms
ACT blinks twice	The controller's OS is booting	250 ms	75 ms	-
ACT, TX and RX are blinking slowly	The controller is in service mode	600 ms	600 ms	-
ACT, TX and RX are blinking rapidly	Indication of flashing the OS or creating its backup	80 ms	80 ms	-

Note:

Unipi Gate controllers feature a freely programmable ACT LED that can be configured using a standard Linux way. In the OS, the LED is available in `/sys/class/leds/unipi-sysled-xh` and is set to "timer" function by default. The LED can be configured by changing the function in trigger file contained in the above-mentioned directory (echo "timer" > trigger).

2.3 Description of connectors

Terminal label	Meaning
RS485-END	An attachable RS485 termination resistor
RS485-A/RS485-B	Connection terminals A and B for the RS485 interface
VCC	Power supply's positive pole
GND	Power supply's negative pole
ETH0	10/100 Mbit/s Ethernet
ETH1	10/100/1000 Mbit/s Ethernet

2.4 Serial port mapping in Linux

Model	RS485-1	RS485-2
G100	/dev/ttyS1	-
G110	/dev/ttyS1	/dev/ttyS2

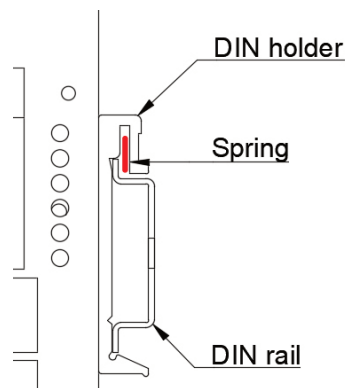
2.5 Device installation

2.5.1 Installation

All Gate controllers are designed for installation to a 35 mm DIN rail (EN 50022). An optional wall mount can be also purchased.

2.5.1.1 Installation on a DIN rail

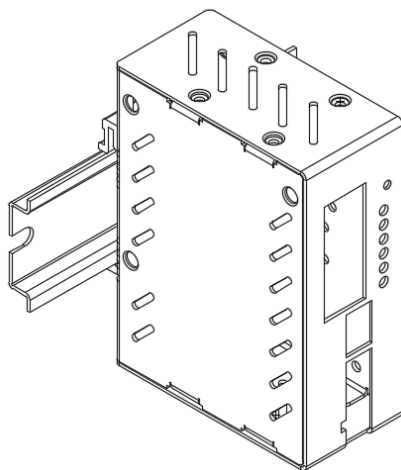
The controller can be mounted onto a DIN rail in three available positions (see pictures below). If the DIN holder is not installed, it must be fastened to the controller with screws included in the package. The holder's spring must face the device's top side. To install the device on a DIN rail, attach it to the rail from the top, pull the device down (against the spring tension) and attach the lower part.



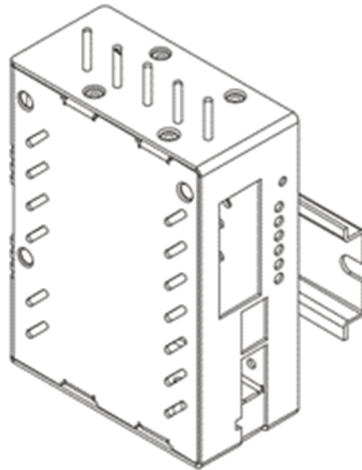
Note:

Make sure the upper edge of the DIN rail is firmly placed between the spring and the DIN holder's backplate.

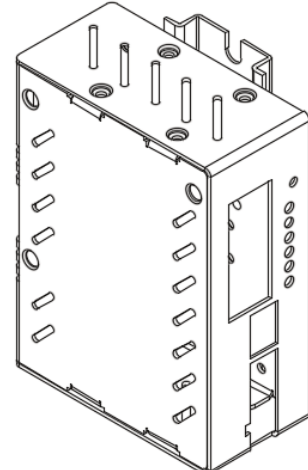
DIN holder orientation 1



DIN holder orientation 2

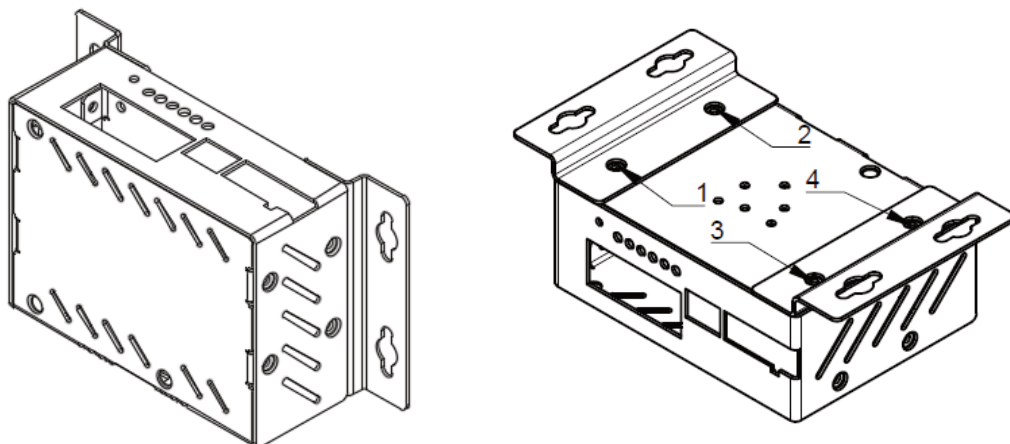


DIN holder orientation 3



2.5.1.2 On-wall installation

Unipi Gate can be also installed on an electrical distribution box mounting plate using optional accessories. Attach the first holder to the Gate controller in a way for holes 1 and 2 to overlap (see the picture). Fasten the holder by screw included in the package. Repeat the process with the second holder and holes 3 and 4. Measure and drill holes into the mounting plate. For installation, we recommend using flat head screws with a diameter of up to 4 mm.



Caution:

In installation boxes without forced air circulation, there must be at least 80 mm wide gap between the box walls and the device. If sufficient air circulation cannot be ensured, it is necessary to install a ventilation fan. Maximum intake air temperature cannot exceed values listed in Chapter 4.4.

2.5.2 Removal

To remove the controller from a DIN rail, perform the opposite of the installation process, i.e., pulling the product down against the spring tension and then pulling it away from the rail. If the controller is installed to an electrical distribution box mounting plate, remove screws fixing the controller to the plate and then unscrew both wall holders.

Note:

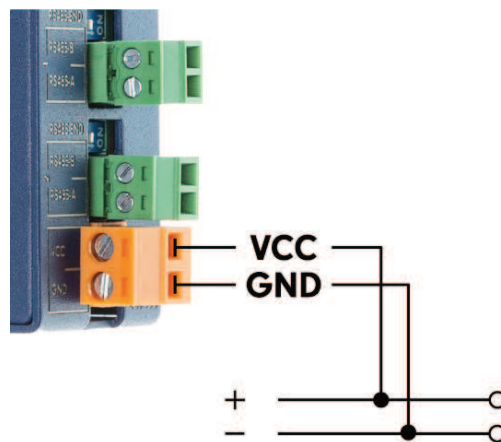
Make sure the device is not powered before its removal.

2.6 Connection

The device uses pluggable screw terminals for wire connection. The function of each terminal pole is described on the controller's chassis. Use a flat screwdriver for wiring the terminals (3–3.5 mm for power terminals, 2–2.5 mm for data terminals). Do not exceed the maximum tightening torque listed in Chapter 4.4.

2.6.1 Connecting the power supply

To ensure the correct operation of the device, it is necessary to connect 9–30 V_{DC} voltage to VCC (positive pole) and GND (negative pole) terminals of the power connector. Info about working voltage toleration and power consumption is available in the product's technical specification (chapter 4.4), datasheet and manufacturer sticker.



Caution:

Unipi Gate is Class I appliance, requiring a grounding wire connected to the ground connector marked by a ⊕ symbol. To connect the wire, use a wire loop and M4 screw with a fan washer.

2.6.2 Connection of RS485 communication lines

The RS-485 (EIA-485) communication line is connected via RS-485 terminals with labels A and B. The device features attachable 120 Ω termination resistor labelled as END (RS485-END).

Note:

Both sides of the line must have termination resistor connected to ensure the line's proper function.

3 Controller software

Thanks to the device's software openness, users are not limited only to a single software solution for control and configuration of the system. General overview and guides for compatible software solutions are available on the www.unipi.technology website, or on homepages of the supported solutions.

Unipi Gate is based on Debian OS (Linux) operating system, which can be freely configured and customized. There are several ways how to use the serial lines thanks to the open system. Programming and control methods can be divided into three groups:

- Mervis – officially supported software solution for control and monitoring that includes optional cloud services
 - DB – aggregation and analysis of historical data
 - Proxy – remote programming of the controlled technologies
 - SCADA – remote management of the controlled technologies
- Open source – officially supported OS image with a pre-installed development environment
 - Node-RED – open-source web-based programming tool that utilizes the flow-based approach. Its OS image is available for download at: <https://kb.unipi.technology>
- Custom solution or commercial third-party applications – a universal interface for I/O access suitable for programmers
 - Custom SW implementation, access to serial interfaces via standard Linux methods
 - Modbus TCP – a standard TCP-based interface
 - Option to install third-party applications.
 - Supported languages – Python, C, C++

Thanks to the software openness of the solution, our partners and customers can implement their software to create a customized OEM version of the product marketed under the customer's brand.

Additional info and user guides are available on <https://kb.unipi.technology>.

3.1 Basic settings

The Debian OS used in Unipi Gate contains pre-installed drivers for the Gate platform. By default, the device comes with pre-installed Node-RED application including a set of nodes for easy connection to devices that communicate via Modbus RTU.

3.1.1 Network configuration

Unipi Gate features Ethernet interfaces labelled as eth0 (100 Mbit) and eth1 (1 Gbit). By default, the interfaces are interconnected into a network bridge (bridge br0), acting as a two-port switch. Due to this feature, any of the ports can be used to connect the controller to a local network. The br0 MAC address is obtained from the eth0 interface.

Caution:

The device in default configuration must be connected to a local network with only a single cable. In case both interfaces would be connected to a single network, a loop may occur disabling communication in the entire network!

By default, the controller receives its IP address automatically from the DHCP server. If the attempt to obtain the IP address is unsuccessful, the controller's interfaces are set to a random IP address from 169.254.0.0 – 169.254.255.255 range. An mDNS log is also published on the network (does not apply for service mode), making the controller accessible under a unique name. Example: G100 controller with serial number 123 is accessible as "g100-sn123.local". The serial number can be found on the controller's manufacturer sticker.

3.1.2 System start-up

1. Connect the controller to a local network or directly to your PC via a network cable.
2. Connect a power supply compliant with specifications listed on the controller's manufacturer sticker and wait until the controller boots up and is ready to use (see Chapter 2.1 – description of indication LED behaviour).
3. After start-up, the controller is accessible in the network via IP address or a unique name:
 - a. Welcome page with a link to Node-RED admin interface is accessible via a web browser at <http://<ip-address>> or <http://<name>> (e.g., "g100-sn123.local", see Chapter 3.1.1).
 - b. SSH access is enabled on port 22 – username is "unipi", the password is "unipi.technology".

Caution:

For security reasons, we strongly recommend changing the default password when using active SSH access. To change the password, connect to SSH and enter the "**passwd**" command. A prompt to enter the current password will appear, followed by a prompt to enter a new password and to confirm it. A second option is to disable SSH access in the service menu. More info at <https://kb.unipi.technology>.

The Node-RED editor interface is accessible via a web browser at <http://<ip-address>:1880/>. For more info about this programming tool, please visit <https://nodered.org>.

Caution:

In the factory settings, the Node-RED interface is not secured, as any person able to connect to the IP address within the network can perform changes to the program and its configuration. To secure the system, follow the instructions available on <https://nodered.org>.

3.1.3 Service mode

Service mode is used to restore access to the controller (restoring default password by reflashing the OS, changing the network configuration, enabling/disabling SSH access) and to upload or backup the OS. In this mode, only the basic web interface is available with the remaining functions disabled. No mDNS log is published in this mode.

1. Connect the controller to a local network or directly to your PC using a network cable.
2. Press **and hold** the "SERVICE" button on the controller's front side.
3. Plug in the power supply.
4. The controller will boot up to service mode indicated by slow blinking of ACT, TX and RX LEDs.
5. You can now release the button.
6. The controller will set itself to IP address 192.168.200.200 and will simultaneously try to obtain an IP address from DHCP server. The controller will be then available on both IP addresses.
7. To enter the service interface, use a web browser and enter the IP address: <http://<ip-address>>.

Note:

Both network interfaces are set to bridge mode (bridge br0) when using the service mode. As packet forwarding between the interfaces (L2 forwarding) is disabled in this mode, the controller will not act as a network switch.

3.1.3.1 Reflashing the operating system

The controller's operating system (OS) can be reflashed using the service web interface or a USB flash disk.

Caution:

OS reflashing **will delete all data stored** on the controller's memory storage.

3.1.3.2 OS reflashing via service web interface

1. Download and extract the ZIP archive with Unipi Gate OS image from Knowledge Base (<https://kb.unipi.technology>).
2. Switch the controller to service mode and open the service web interface. Service mode is indicated by slow blinking of ACT, TX and RX LEDs.
3. Drag and drop the *archive.swu* file from the extracted archive into the Software Update dialogue window.
4. Wait until the controller finishes the operation – you can monitor the progress in the Messages dialogue window, the operation is also indicated by fast blinking of ACT, TX and RX LEDs.
5. The controller will automatically reboot after the flashing is finished.

3.1.3.3 OS reflashing using USB flash disk

1. Download and extract the ZIP archive with Unipi Gate OS image from Knowledge Base (<https://kb.unipi.technology>).
2. Prepare a USB flash disk with at least 2 GB of free memory (FAT32 format).
3. Extract the ZIP archive to the flash disk.
4. Insert the flash disk into the controller's USB port.
5. Press **and hold** the "SERVICE" button on the controller's front side and plug in the power supply.
6. The controller will start the reflashing process indicated by fast blinking of ACT, TX and RX LEDs. You can now release the button.
7. The controller will automatically reboot after the flashing is finished.

Note:

Some USB flash disks may not be compatible. If your flash disk does not work, try to use a different one or use the service web interface.

3.1.3.4 Creating an OS backup on USB flash disk

1. Prepare a USB flash disk with at least 2 GB of free memory (FAT32 format).
2. Start the device in the service mode (see above).
3. Click on the "Backup to USB flash" button located in the "Backup" dialogue window in the service web interface.
4. The controller will start creating the backup – the process is indicated by fast blinking of ACT, TX and RX LEDs.
5. Upon finishing the backup, an "Updated successfully" message will appear in the service web interface. Physically, the backup process completion is indicated by slow blinking of ACT, TX and RX LEDs (service mode indication).
6. Remove the USB flash disk from the controller and insert it into a different device to confirm the backup files were successfully uploaded to the disk.
7. You can now reboot the device, either by using the "Restart System" button in the upper right corner of the service web interface or by unplugging the power supply and plugging it back again.

4 Technical specifications

4.1 Power supply

Rated voltage - SELV	9–30 V $\overline{=}$
Power consumption	Typ. 3 W, Max. 12W
Reverse polarity protection	Yes

4.2 RS485 interface

Terminals	RS485-A, RS485-B
Galvanic isolation	Yes
Insulation voltage	1000 V
ESD protection	± 15 kV
Bitrates	2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps
Input impedance	12 k Ω
Input voltage hysteresis	70 mV
Output characteristic	$\pm 2,5$ V
RS485 pull-up/pull-down resistors	Yes, 560 Ω

4.3 Other I/O ports and interfaces

ETH0 port	10/100 Mbit/s ethernet
ETH1 port	10/100/1000 Mbit/s ethernet
USB Port	USB 3.0 (for service purposes)
Ext. memory storage	MicroSD with up to 128 GB capacity

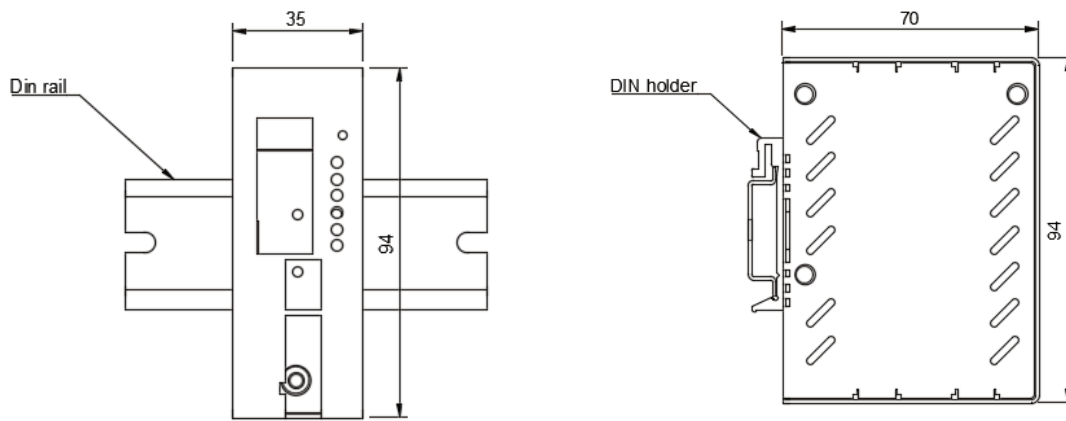
4.4 Working and installation conditions

Working conditions	0 °C ... 55 °C, relative humidity 10 % ... 95 %, without aggressive substances, condensing vapours or fog
Storage conditions	-25 °C ... +70 °C, relative humidity 10 % ... 95 %, without aggressive substances, condensing vapours and fog
Ingress protection (IEC 529)	IP20
Working position	Horizontal / Vertical
Installation	A standard 35 mm DIN rail in a distribution box, an electrical distribution box mounting plate (optional)
Connection	Pluggable screw terminals
Wire gauge	Max. 2.5 mm ² for power supply, max. 1.5 mm ² for RS485
Terminal tightening torque	Max. 0.4 Nm

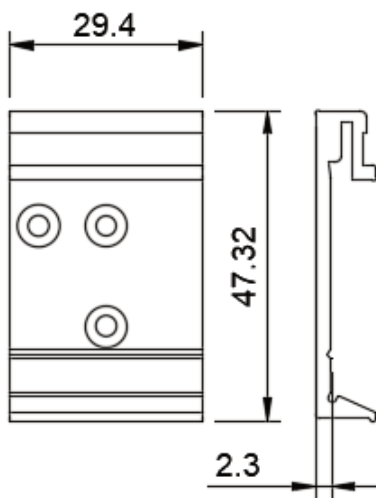
4.5 Dimensions and weight

Dimensions	35 x 94 x 70 mm
Weight	137 g (G100) / 140 g (G110)

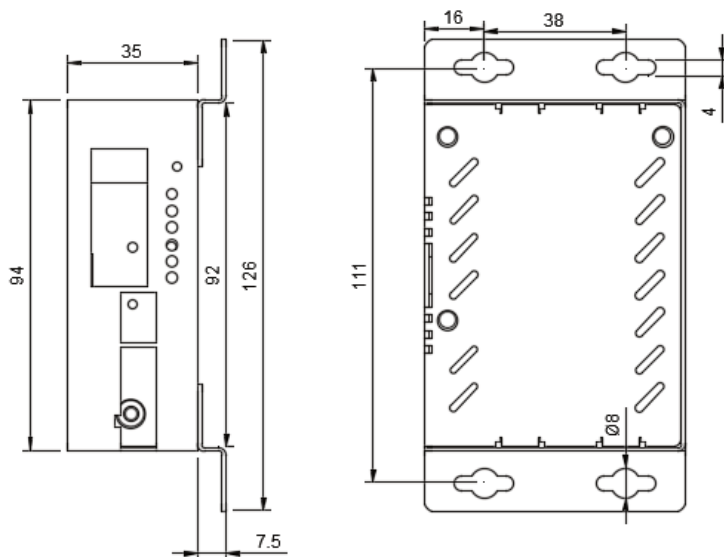
4.5.1 Unipi Gate – DIN rail installation



4.5.2 DIN holder



4.5.3 Unipi Gate – wall mount



Revisions

Date	Version
12/2020	V 1.0
4/2021	V 1.1
6/2021	V 1.2