USER MANUAL

Max IEC Gateway

Modbus TCP/RTU to IEC 60870-5-104 and IEC 60870-5-101 gateway

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Max Energic Apps · iec.maxenergic.com · support@maxenergic.com

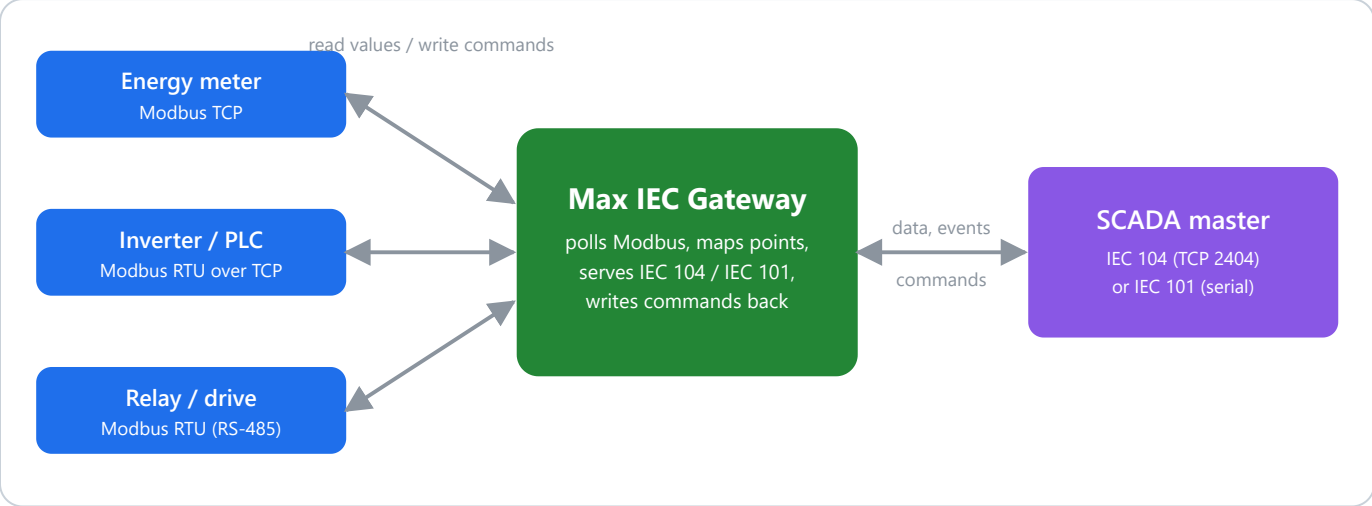
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Quick start: install the gateway, open `http://localhost:5000`, set the password, add your Modbus device on Devices, map its values on Mappings, and connect your SCADA master to port 2404 with CA 1 (chapter 16). Every change applies immediately.

1. Introduction



How the gateway sits between your Modbus devices and the SCADA master.

Max IEC Gateway is a protocol converter. It reads values from Modbus devices and gives them to a SCADA system that speaks IEC 60870-5-104 (over TCP/IP) or IEC 60870-5-101 (over a serial line). Commands from the SCADA system go back to the Modbus devices.

The gateway runs as a service on a Windows or Linux computer. There is no desktop program: you configure everything in a web browser, in the **dashboard**.

What the gateway can do

- Read Modbus TCP, Modbus RTU (RS-485/RS-232) and Modbus RTU over TCP devices. Several devices can share one serial line.
- Serve the data as an IEC 60870-5-104 server (several masters at the same time) and/or an IEC 60870-5-101 outstation.
- Single and double points (also from bits inside a register), step positions, 32-bit bitstrings, measured values (normalized, scaled, float) and energy counters (integrated totals), with or without CP56 time tags.
- Commands: single, double, set-points (normalized, scaled, float) and bitstrings, written back to coils or holding registers. Select-before-operate or direct execute.
- Deadbands, cyclic transmission, event buffering while no master is connected, clock synchronization.
- 9 device templates, CSV import/export, a traffic monitor, trends and a historian.
- Every change applies immediately. You never need to restart the service to apply a setting.

Words used in this manual

The glossary at the end explains every term. The most important ones:

Term	Meaning
Master (controlling station)	The SCADA system or test tool that asks for data and sends commands.
IOA	Information object address: the number of one data point in IEC 60870-5.
CA	Common address (ASDU address): the number of the station. Most systems use CA 1.
Type ID	The IEC data type of a point, for example M_ME_NC_1 = measured value, float.
Mapping	One line in the gateway that links a Modbus address to an IEC point.

2. Requirements

Item	Requirement
Operating system	Windows 10 or 11 (64-bit), or Linux x64 with systemd
Hardware	1 GHz CPU, 512 MB RAM, 100 MB disk plus history data
Runtime	Included. You do not need to install .NET.
Browser	Chrome, Edge or Firefox, on the gateway computer or on another computer in the network
Serial port	Only for Modbus RTU devices or IEC 101: a COM port (Windows) or /dev/tty… port (Linux), for example a USB-to-RS-485 adapter
Internet	Only for license activation, the online license check and the update check (HTTPS to iec.maxenergic.com)

Network ports

Port	Direction	Used for
2404/TCP	In	IEC 60870-5-104 masters (you can change the port)
19998/TCP	In	IEC 104 over TLS (IEC 62351-3), only when the TLS listener is on (you can change the port)
5000/TCP	In	Web dashboard (you can change the port)
502/TCP (or the device's port)	Out	Modbus TCP and RTU-over-TCP devices
443/TCP	Out	License and update check (iec.maxenergic.com)

3. Installation

Windows: installer (recommended)

1. Download `MaxIECGateway_Setup_1.3.0.exe` from the download page.
2. Run the file. Windows asks for administrator rights: click **Yes**.
3. Follow the wizard. On the **Select Additional Tasks** page you can choose:
   - **Allow the web dashboard (TCP 5000) from the local network**: tick it if you want to open the dashboard from other computers. Without it, the dashboard works only on the gateway computer.
   - **Allow IEC 60870-5-104 (TCP 2404) from the network**: tick it so SCADA masters on other computers can connect.
   - **Create a desktop shortcut (web dashboard)**: optional.
4. Click **Install**. The installer creates and starts the Windows service **Max IEC Gateway** (service name `MaxIECGateway`).
5. At the end, leave **Open the web dashboard** ticked and click **Finish**. Continue with First start.

> ⓘ **Note:** The service starts automatically with Windows (delayed start) and restarts itself after a crash. You find it in **Services** (`services.msc`) as **Max IEC Gateway**. The Start menu has shortcuts to the dashboard and to the **Gateway data folder**.

> ⚠ **Important:** If the installer reports that the service could not be created or started, it shows an error code. Run the installer again as administrator, or send the code to support@maxenergic.com.

Windows: portable ZIP

1. Download `MaxIECGateway_Portable_1.3.0.zip` and unzip it to a folder, for example `C:\MaxIECGateway`.
2. Double-click `MaxIEC.Gateway.exe`. A console window opens and shows the log.
3. Open `http://localhost:5000`. The gateway runs as long as the window is open.

> ⚠ **Important:** The portable version does not install a service and does not open firewall ports. Do not run it on a computer where the installed service is running: both use ports 5000 and 2404.

Linux (x64, systemd)

1. Download `maxiec-gateway_1.3.0_linux-x64.tar.gz` to the Linux computer.

2. Unpack it and run the installer as root:

```
tar -xzf maxiec-gateway_1.3.0_linux-x64.tar.gz
cd maxiec-gateway-1.3.0
sudo ./install-linux.sh
```

3. The script installs the program to `/opt/maxiec-gateway`, creates the service user `maxiec`, gives it access to serial ports (group `dialout` or `uucp`) and starts the systemd service `maxiec-gateway`.
4. Open `http://<linux-host>:5000` in a browser. From another computer you need the setup code: `sudo cat /var/lib/maxiec-gateway/setup-token.txt`.

```
sudo systemctl status maxiec-gateway     # is it running?
sudo systemctl restart maxiec-gateway    # restart
sudo journalctl -u maxiec-gateway -f     # live log
```

Upgrading from version 1.0

- Run the new installer over the old version. You do not need to uninstall first.
- The gateway now runs as a Windows service. The old autostart at logon is removed.
- Your database, license key and trial record are copied to the new data folder `C:\ProgramData\MaxIECGateway` (Linux: `/var/lib/maxiec-gateway`). The original files are not deleted.
- The dashboard now needs a password. Set it on the first visit (see First start).
- Your license key keeps working.

Uninstalling

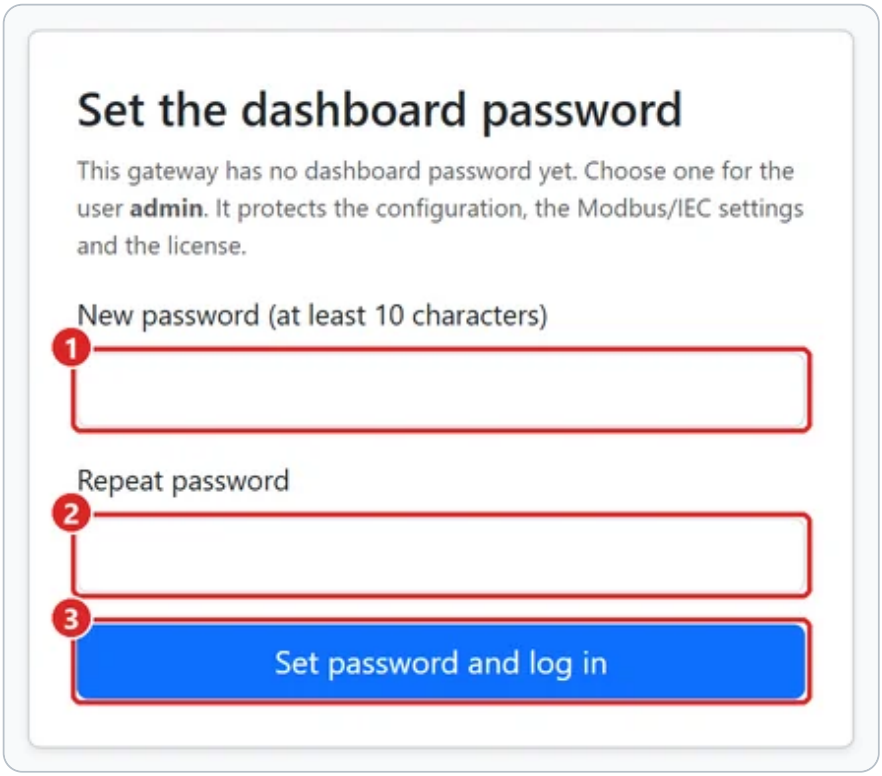
Windows: **Settings** → **Apps** → **Max IEC Gateway** → **Uninstall**. The service and the program files are removed. Your data folder `C:\ProgramData\MaxIECGateway` (database, license, trial record, password) is **kept**, so a later installation continues with the same configuration and license. Delete the folder by hand if you want to remove everything.

Linux: stop and disable the service (`sudo systemctl disable --now maxiec-gateway`), then delete `/opt/maxiec-gateway` and `/etc/systemd/system/maxiec-gateway.service`. The data in `/var/lib/maxiec-gateway` stays until you delete it.

4. First start: set the password

The dashboard is protected by a password for the user **admin**. On the first visit you choose this password.

1. On the gateway computer, open `http://localhost:5000` in your browser.
2. The page **Set the dashboard password** opens.
3. Type a password with at least 10 characters in both fields.
4. Click **Set password and log in**. The dashboard opens.



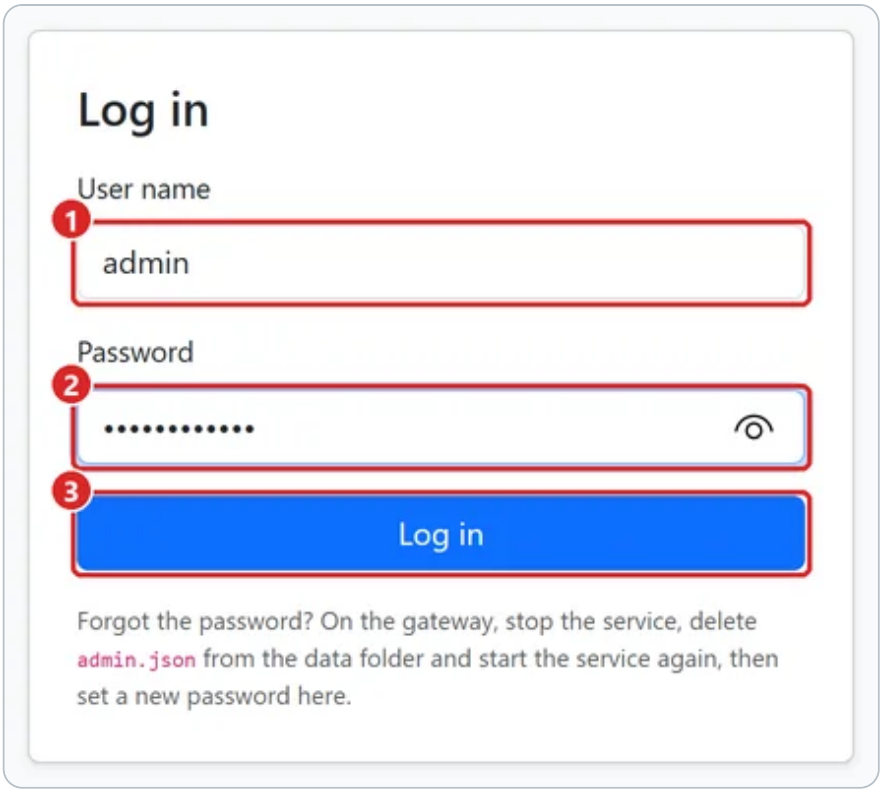
First start: choose the dashboard password.

1. New password (at least 10 characters).
2. Repeat the password.
3. Set the password and log in.

Setting up from another computer

If you open the dashboard from another computer for the first time, the page also asks for a **Setup code**. This protects a new gateway on the network. The code is in the file `setup-token.txt` in the data folder (Windows: `C:\ProgramData\MaxIECGateway`, Linux: `/var/lib/maxiec-gateway`) and in the gateway log. Or simply open `http://localhost:5000` on the gateway itself.

Logging in



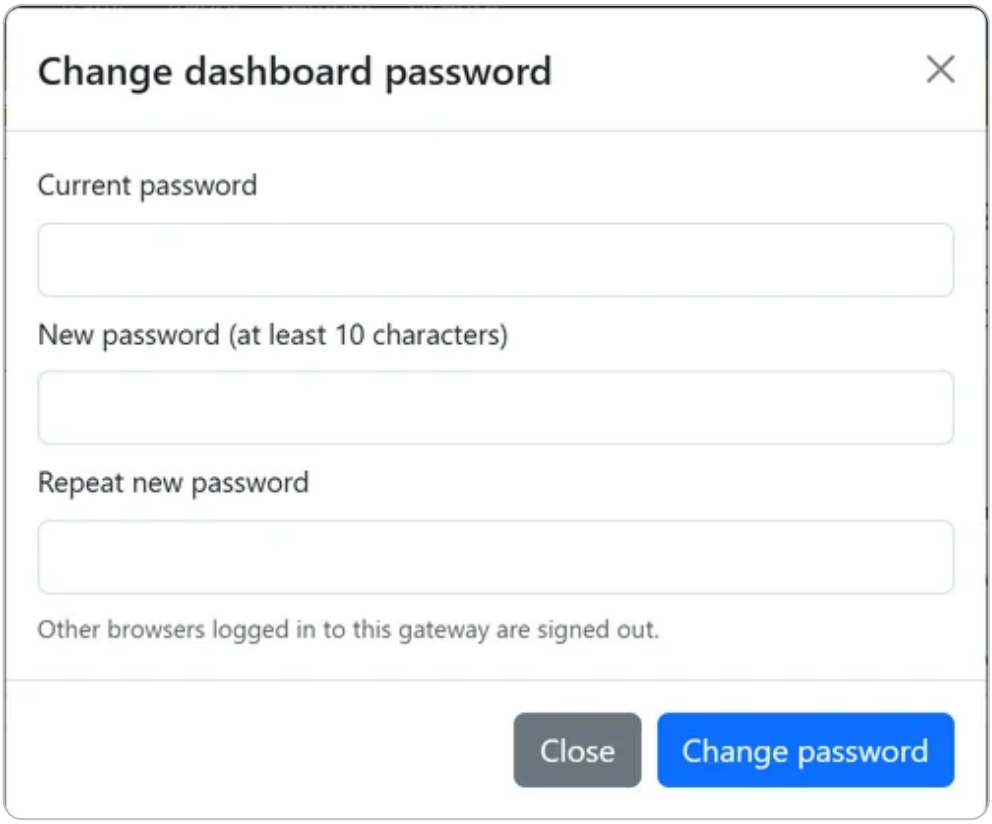
The login page.

1. User name: always **admin**.
2. Your password.
3. Log in.

- A login stays valid for 60 minutes without activity. Then you must log in again.
- After 5 wrong passwords within 15 minutes, logins from that address are blocked for 15 minutes.

Changing the password

Click **Change password** at the top right of any page. Enter the current password and the new one twice. Other browsers that are logged in are signed out.



Change the dashboard password.

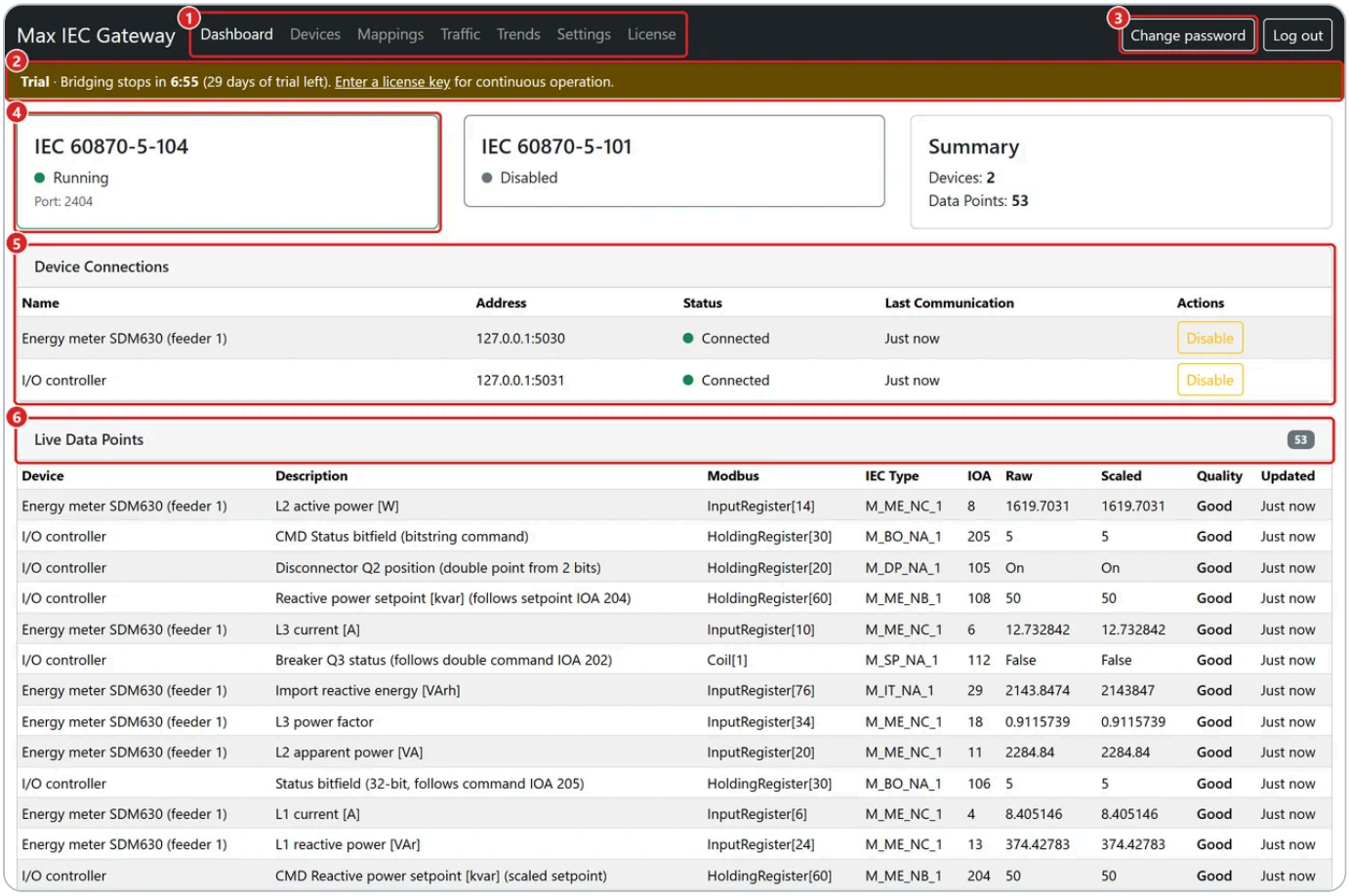
Forgot the password?

1. On the gateway computer, stop the service (Windows: Services → Max IEC Gateway → Stop; Linux: `sudo systemctl stop maxiec-gateway`).
2. Delete the file `admin.json` from the data folder.
3. Start the service again and set a new password on the first-start page.

> **Tip:** Deleting `admin.json` only resets the password. Devices, mappings and the license are not changed.

5. Dashboard tour

After login you see the **Dashboard**. It shows the state of the IEC servers, the Modbus devices and every data point.



The Dashboard page.

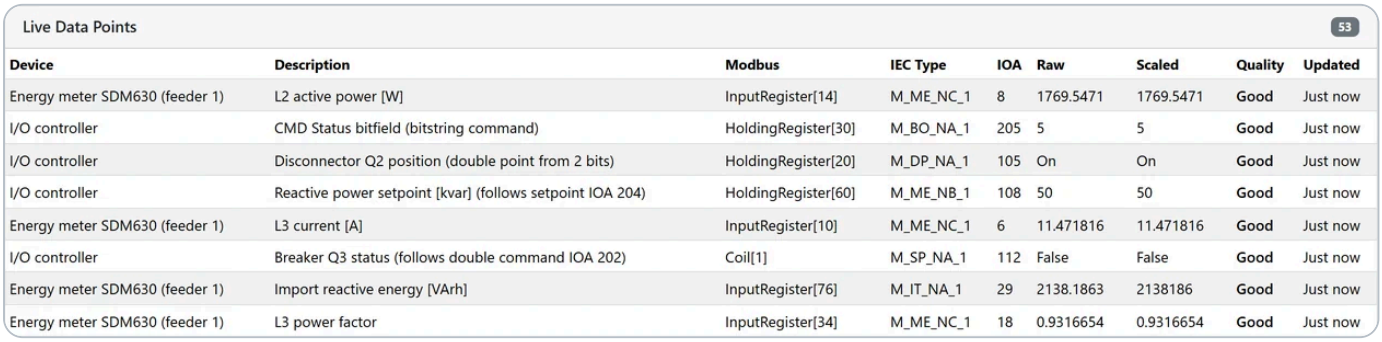
1. Menu: Dashboard, Devices, Mappings, Traffic, Trends, Settings, License.
2. Status bar: license state and whether the gateway is bridging (shown on every page).
3. Change password and Log out.
4. IEC 104 and IEC 101 server state, and a summary of devices and data points.
5. Device Connections: each enabled device, its address, Connected/Disconnected and the last communication. **Disable**/**Enable** switches polling off and on.
6. Live Data Points: every mapped point with its Modbus address, IEC type, IOA, raw value, scaled value, quality and age.

The status bar

Colour and text	Meaning
Bridging (green)	Licensed. The gateway reads Modbus and serves IEC without a time limit.
Trial · Bridging stops in mm:ss (amber)	Trial. Data flows until the 15-minute session ends. See License.
Bridging stopped (red)	Trial session over, trial expired or license not valid. The IEC servers and Modbus polling are stopped. The dashboard still works.
⚠ IEC server problem	An IEC server could not start, for example because its port is already in use.

Quality column

Quality	Meaning
Good	The last read was successful.
Invalid	The device does not answer (or was never read). The master receives the point with the IV (invalid) bit.
Overflow	The value did not fit the IEC type (for example a scaled value above 32767). The master receives the OV bit.



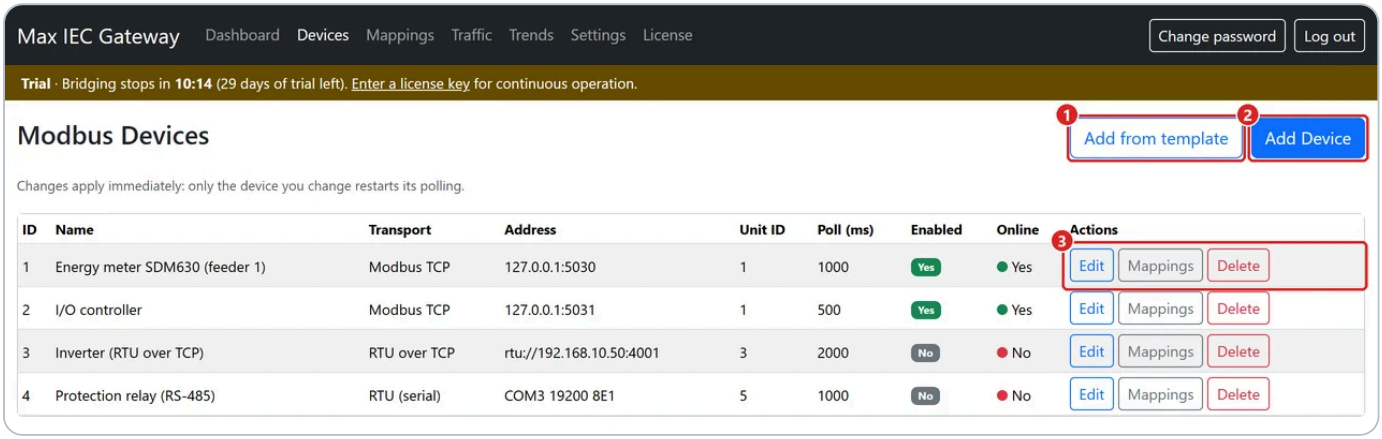
Live Data Points 53

Device	Description	Modbus	IEC Type	IOA	Raw	Scaled	Quality	Updated
Energy meter SDM630 (feeder 1)	L2 active power [W]	InputRegister[14]	M_ME_NC_1	8	1769.5471	1769.5471	Good	Just now
I/O controller	CMD Status bitfield (bitstring command)	HoldingRegister[30]	M_BO_NA_1	205	5	5	Good	Just now
I/O controller	Disconnector Q2 position (double point from 2 bits)	HoldingRegister[20]	M_DP_NA_1	105	On	On	Good	Just now
I/O controller	Reactive power setpoint [kvar] (follows setpoint IOA 204)	HoldingRegister[60]	M_ME_NB_1	108	50	50	Good	Just now
Energy meter SDM630 (feeder 1)	L3 current [A]	InputRegister[10]	M_ME_NC_1	6	11.471816	11.471816	Good	Just now
I/O controller	Breaker Q3 status (follows double command IOA 202)	Coil[1]	M_SP_NA_1	112	False	False	Good	Just now
Energy meter SDM630 (feeder 1)	Import reactive energy [VArh]	InputRegister[76]	M_IT_NA_1	29	2138.1863	2138186	Good	Just now
Energy meter SDM630 (feeder 1)	L3 power factor	InputRegister[34]	M_ME_NC_1	18	0.9316654	0.9316654	Good	Just now

Live data points (part of the dashboard).

6. Modbus devices

A **device** is one Modbus slave (one unit ID) that the gateway polls. Open the **Devices** page.

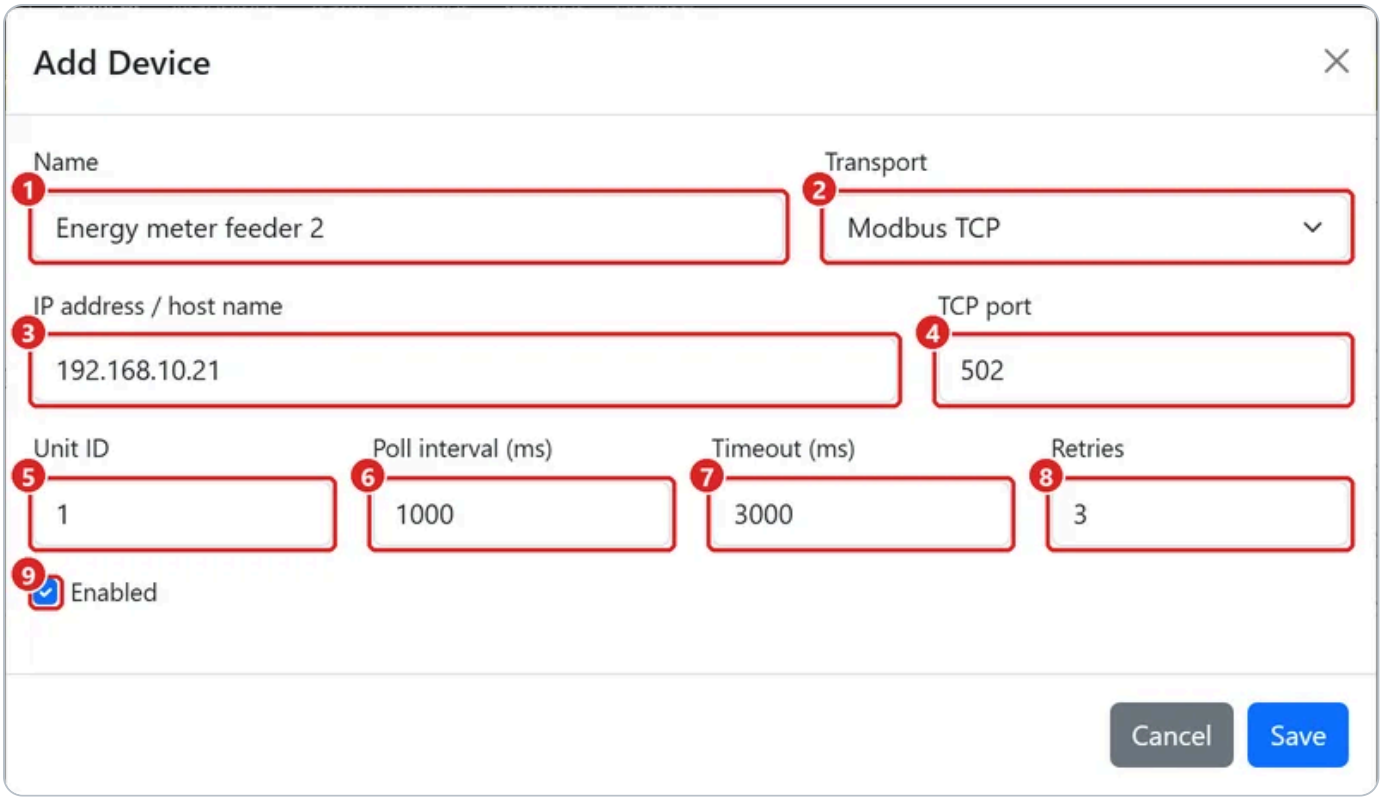


The Devices page.

1. **Add from template**: create a device with all its points from a ready-made template.
2. **Add Device**: create an empty device.
3. Per device: **Edit**, **Mappings** (opens its point list) and **Delete** (also deletes its mappings).

Add a Modbus TCP device

1. Click **Add Device**.
2. Enter a **Name**, for example *Energy meter feeder 2*.
3. Keep **Transport** = **Modbus TCP**.
4. Enter the **IP address / host name** and the **TCP port** (normally 502).
5. Enter the **Unit ID** (slave address) of the device.
6. Check poll interval, timeout and retries (see the table below).
7. Click **Save**. Polling starts at once.



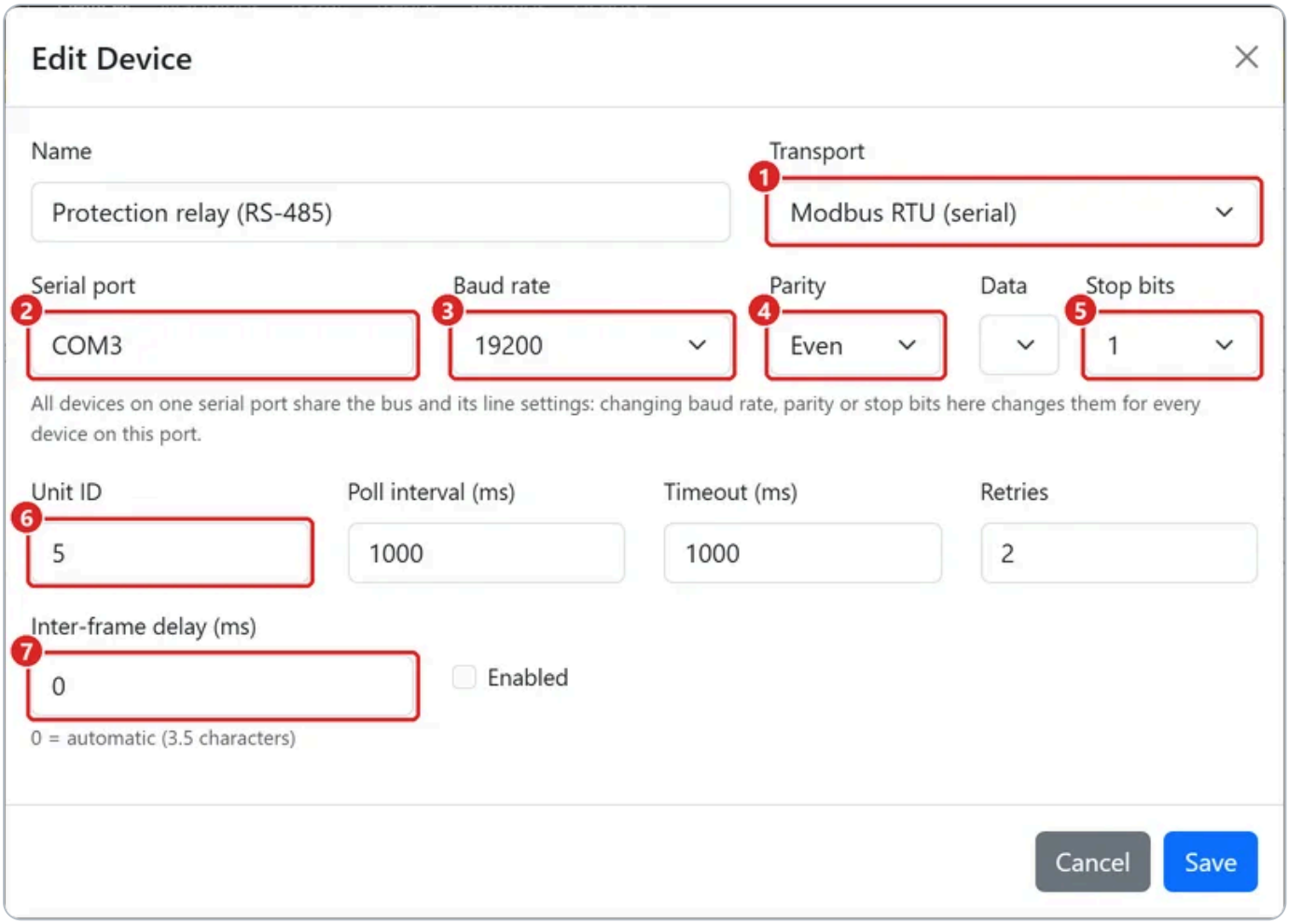
Add Device: Modbus TCP.

1. Name of the device (shown everywhere in the dashboard).
2. Transport: Modbus TCP, Modbus RTU over TCP or Modbus RTU (serial).
3. IP address or host name.
4. TCP port (default 502).
5. Unit ID (slave address).
6. Poll interval in milliseconds.
7. Timeout for one request.
8. Retries before the device counts as not answering.
9. Enabled: untick to stop polling this device.

Field	Default	Allowed	Explanation
Unit ID	1	0-247, 255	The Modbus slave address. Many Modbus TCP devices use 1 or 255.
Poll interval (ms)	1000	100 and more	How often all points of the device are read.
Timeout (ms)	3000	100-60000	How long to wait for an answer.
Retries	3	0-10	How many times a failed read is repeated. Writes are never repeated.
Inter-frame delay (ms)	0	0-1000	Serial only. Extra pause between frames; 0 = automatic (3.5 characters).

Add a Modbus RTU (serial) device

1. Click **Add Device** and choose **Transport** = **Modbus RTU (serial)**.
2. Choose the **Serial port** from the list or type it, for example `COM3` or `/dev/ttyUSB0`.
3. Set **Baud rate**, **Parity**, **Data** bits and **Stop bits** exactly as on the device.
4. Enter the device's **Unit ID** and click **Save**.



Add Device: Modbus RTU on a serial port.

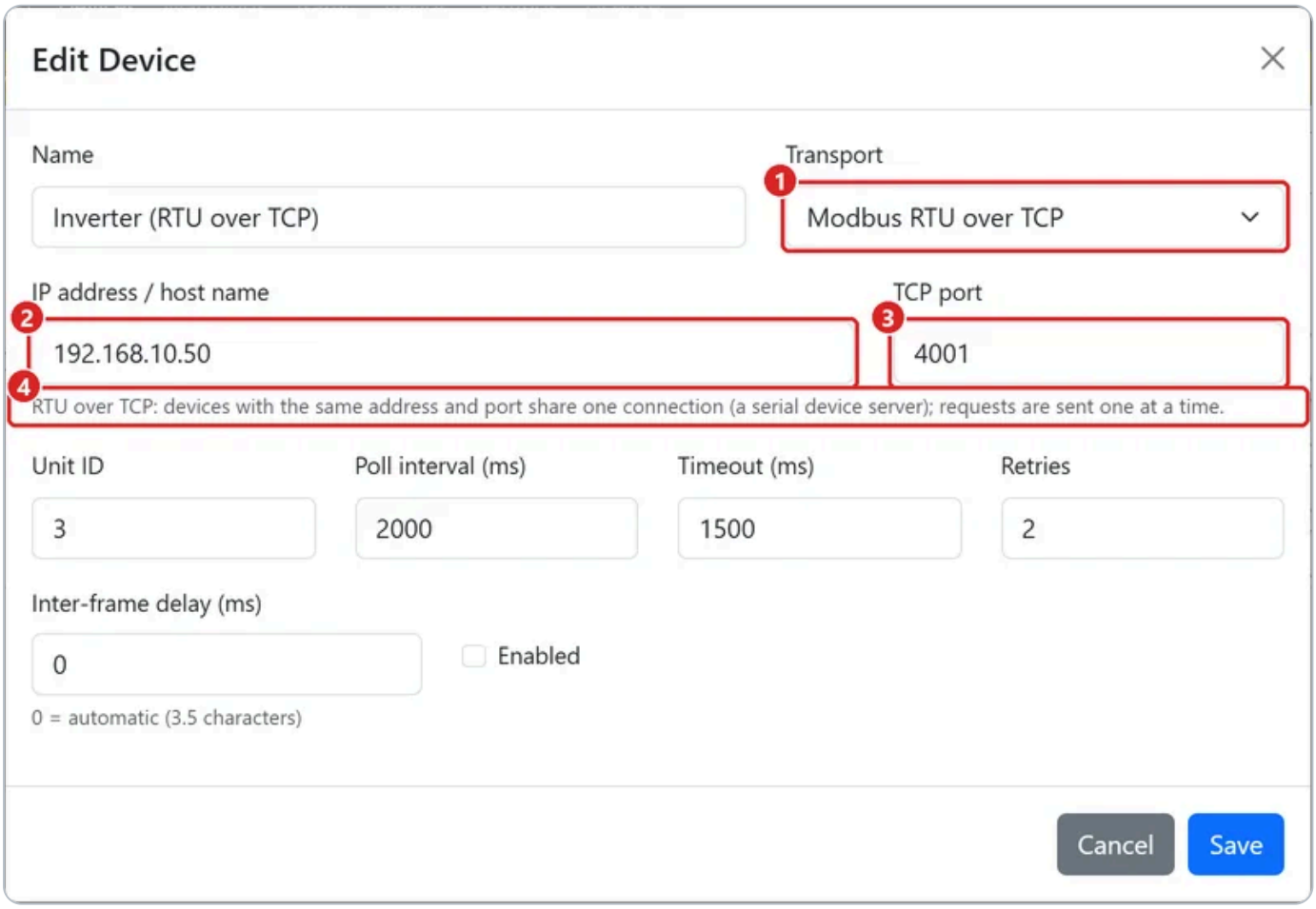
1. Transport: Modbus RTU (serial).
2. Serial port (COM3, /dev/ttyUSB0 …).
3. Baud rate.
4. Parity: None, Odd or Even.
5. Stop bits: 1 or 2.
6. Unit ID: must be different for every device on the same port.
7. Inter-frame delay: 0 = automatic.

> ⓘ **Note: Several devices on one RS-485 line:** add one device per unit ID with the same serial port. The gateway sends one request at a time on the line. All devices on one port share its line settings: if you change the baud rate, parity or stop bits of one device, they change for every device on that port. Two devices on the same port cannot have the same unit ID.

Add a Modbus RTU over TCP device

Use this for a serial device server (Ethernet-to-RS-485 converter) that passes raw RTU frames over TCP. Choose **Transport** = **Modbus RTU over TCP** and enter the converter's IP address and port. Devices with the same

address and port share one connection, and requests are sent one at a time.



Add Device: Modbus RTU over TCP (serial device server).

1. Transport: Modbus RTU over TCP.
2. IP address of the serial device server.
3. Its TCP port (often 4001 or 502).
4. Hint: devices behind the same converter share one connection.

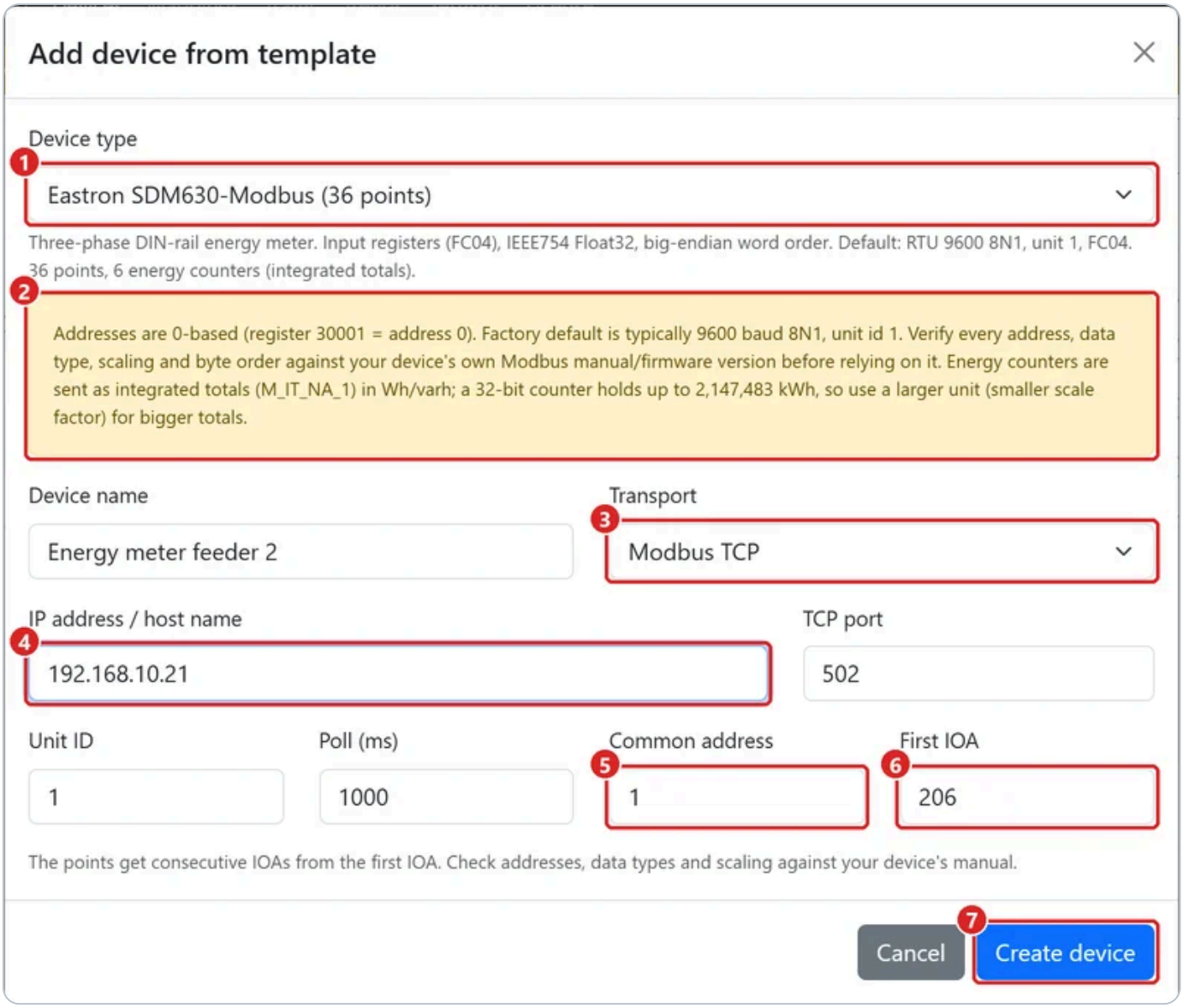
> **Tip:** If your converter translates Modbus TCP to RTU itself (a "Modbus gateway"), use **Modbus TCP** instead. Ask the converter's manual which mode it uses.

Add a device from a template

A template creates the device and all its mappings in one step. Templates included:

Template	Points	Factory communication setting
Eastron SDM120-Modbus	14	RTU 2400 8N1, unit 1
Eastron SDM630-Modbus	36	RTU 9600 8N1, unit 1
Carlo Gavazzi EM24 (DIN / Ethernet)	31	RTU 9600 8N1, unit 1 (or Modbus TCP)
Schneider Electric PowerLogic PM5000 series	24	RTU 19200 8E1 or Modbus TCP, unit 1
Schneider Electric Altivar (ATV3xx / ATV6xx)	9	RTU 19200 8E1, address 1
ABB ACS580 drive (ABB Drives profile)	13	RTU 19200 8E1, node address 1
SMA Sunny Boy / Sunny Tripower	10	Modbus TCP port 502, unit 3
SunSpec Common Model (Model 1)	4	Modbus TCP port 502
Growatt PV inverter (protocol V1.20)	17	RTU 9600 8N1, unit 1

1. Click **Add from template**.
2. Choose the **Device type**. Read the yellow notes: they tell you the factory settings and what to check.
3. Enter the device name, transport and address, and the unit ID.
4. Check **Common address** and **First IOA**. The points get consecutive IOAs starting at the first IOA. The gateway suggests the next free IOA.
5. Click **Create device**.



Add device from template.

1. Device type (template).
2. Notes: factory settings and what to verify.
3. Transport.
4. Address of the device.
5. Common address of the points.
6. First IOA: the points are numbered from here.
7. Create the device with all mappings.

⚠ **Important:** Templates are a starting point. Check every address, data type, scaling and byte order against the manual of your device and its firmware version.

Communication status point

New in 1.3.0, off by default. Each device can report its own communication state to SCADA as a single point (M_SP_NA_1). Set it in the device dialog under **Communication status point**: **Gateway default**, **Off** or **On**, plus a **Common address** (default 1) and an **IOA** (0 = no point).

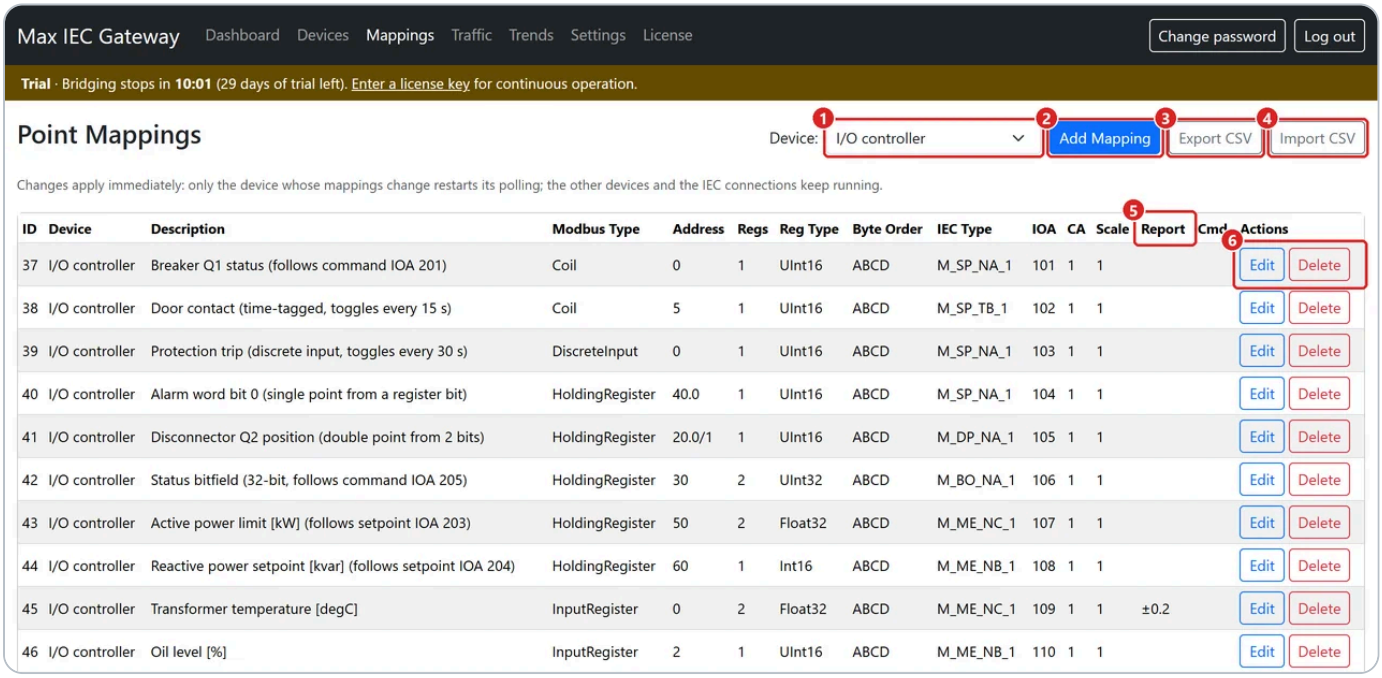
- **ON** while the device answers (a Modbus exception also counts as an answer).
- **OFF** when the device is offline (connection or poll cycle failed).
- **Invalid (IV)** while the device is not polled, for example disabled.
- Sent spontaneously on every change and included in interrogation.
- Its CA/IOA must not be used by a mapping or another device; the gateway checks this on every save and import.

In **Settings › Device communication status points**: **Status points for devices set to "gateway default"** (off) and **Send status changes with time tag** (off; spontaneous changes then use M_SP_TB_1, interrogation always uses M_SP_NA_1).

> ⓘ A device without mappings is not polled. On Modbus TCP its status point follows the connection; on RTU it stays invalid.

7. Point mappings

A **mapping** connects one Modbus value to one IEC point. Open **Mappings**. Choose a device at the top to see only its points.



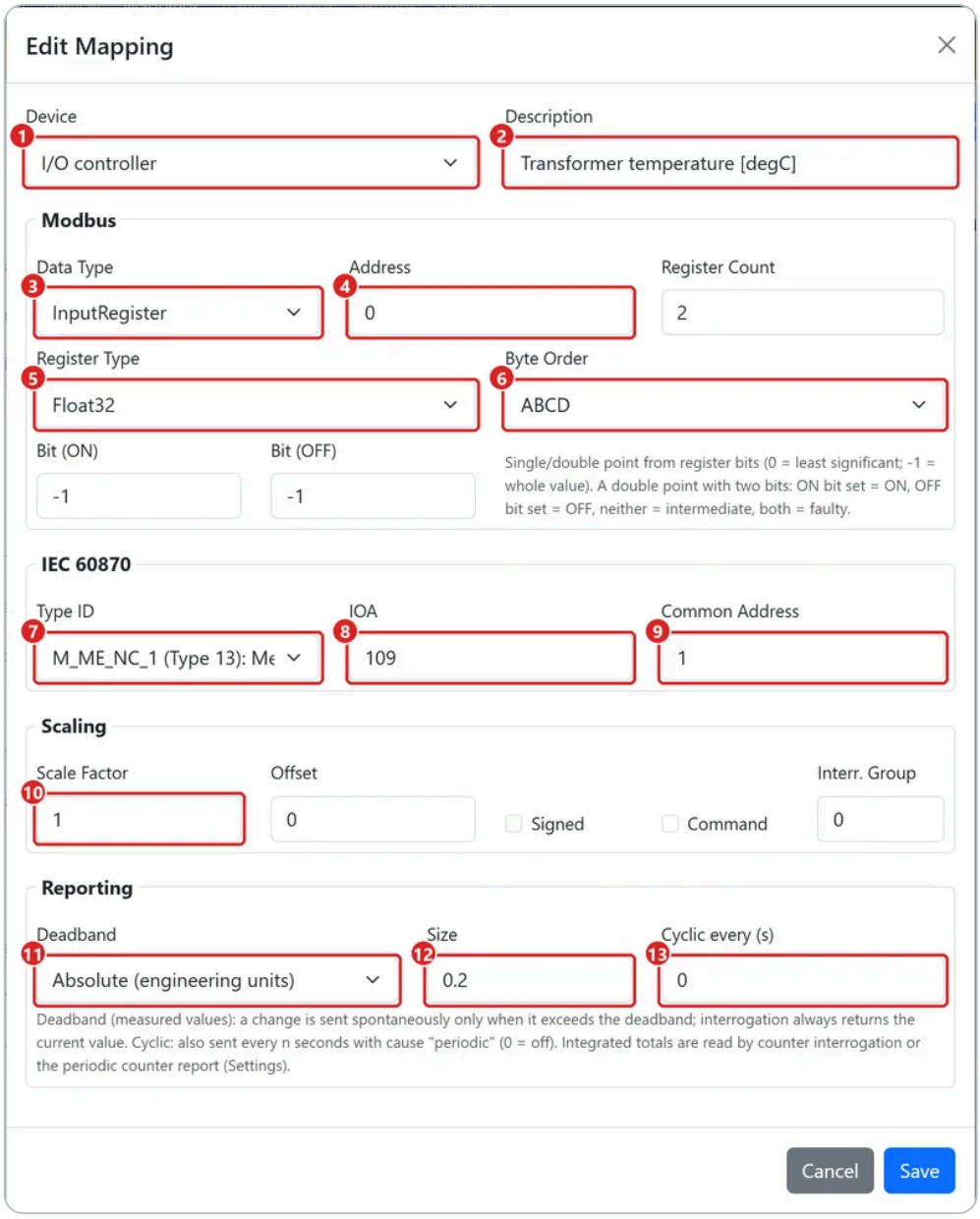
The Mappings page.

1. Device filter.
2. **Add Mapping**.
3. **Export CSV**: download the mappings as a CSV file.
4. **Import CSV**: import many mappings at once (chapter CSV import and export).
5. Report: the deadband (±) and the cyclic time of the point.
6. Per mapping: **Edit** and **Delete**.

> ⓘ **Note:** In the Address column, a bit point shows as `40.0` (register 40, bit 0), a double point from two bits as `20.0/1`.

The mapping dialog

Click **Add Mapping** (or **Edit**). The dialog has four parts: Modbus, IEC 60870, Scaling and Reporting.



Edit Mapping: a float measured value with an absolute deadband.

1. Device the value is read from.
2. Description (shown in the dashboard and the traffic monitor).
3. Modbus **Data Type**: Coil, DiscreteInput, InputRegister or HoldingRegister.
4. Modbus **Address**, 0-based (see below).
5. **Register Type**: how the register(s) are decoded.
6. **Byte Order** for 32- and 64-bit values.
7. IEC **Type ID**.
8. **IOA** of the point.
9. **Common Address** (CA).
10. **Scale Factor** (and Offset).

11. **Deadband** mode.
12. Deadband **Size**.
13. **Cyclic every (s)**.

Modbus data type and address

Data Type	Function code	Read/write	Typical use
Coil	FC01 read, FC05 write	Read and write	Breaker or relay outputs, commands
DiscreteInput	FC02	Read only	Contacts, alarms
InputRegister	FC04	Read only	Measurements
HoldingRegister	FC03 read, FC06/FC16 write	Read and write	Measurements, set-points, status words

> ⚠ **Important:** Addresses are **0-based protocol addresses**. If the device manual says *register 30001* or *40001*, enter address **0**; *40101* is address **100**. If a value looks wrong, try the address one lower or one higher.

Register type and byte order

Register Type	Registers	Range / use
UInt16	1	0 to 65535
Int16	1	-32768 to 32767
UInt32	2	0 to 4,294,967,295
Int32	2	±2,147,483,647
Float32	2	IEEE 754 single precision
Float64	4	IEEE 754 double precision
Int64	4	Signed 64-bit, e.g. energy counters
UInt64	4	Unsigned 64-bit

The **Register Count** is set automatically to what the register type needs. The **Signed** box is only for old 1.0 mappings: for new ones choose **Int16** instead.

A 32-bit value uses two registers with 4 bytes, called A B C D from the most significant byte. Devices send them in different orders:

Byte Order	Registers in address order	Common name
ABCD	AB, CD	Big-endian (Modbus standard). Most meters.
CDAB	CD, AB	Word swap ("little-endian word order"). Many PLCs.
BADC	BA, DC	Byte swap inside each register.
DCBA	DC, BA	Little-endian.

For 64-bit values the same rule applies to all four registers (CDAB reverses the register order). 16-bit values ignore the byte order. If a float shows nonsense like 1.4E-41 or -2.6E+38, try **CDAB**. More help: Modbus float byte order guide.

Which IEC Type ID for what?

You have	Use Type ID	Notes
On/off status (coil, discrete input, register bit)	M_SP_NA_1 (1), or M_SP_TB_1 (30) with time tag	Any value other than 0 is ON.
Position with two contacts (breaker, disconnector)	M_DP_NA_1 (3) or M_DP_TB_1 (31)	Two register bits: ON bit and OFF bit. See below.
Tap position −64…63	M_ST_NA_1 (5) or M_ST_TB_1 (32)	Larger values are limited and get the OV bit.
Status word (16 or 32 bits)	M_BO_NA_1 (7) or M_BO_TB_1 (33)	Sent unscaled as 32 bits.
Measurement, best accuracy	M_ME_NC_1 (13) or M_ME_TF_1 (36)	Short float. Recommended for most analog values.
Measurement as integer	M_ME_NB_1 (11) or M_ME_TE_1 (35)	Scaled value −32768…32767 after scaling.
Measurement as fraction of full scale	M_ME_NA_1 (9) or M_ME_TD_1 (34)	Normalized: sent value = (raw × scale + offset) ÷ 32767, range −1…+1.
Energy counter (kWh, pulses)	M_IT_NA_1 (15) or M_IT_TB_1 (37)	Read by counter interrogation. See Energy counters.

> 💡 **Tip:** Types with time tag CP56 (30-37) are the usual choice for IEC 104. M_SP_TA_1 (2) and M_DP_TA_1 (4) use the short CP24 time tag, which is only allowed in IEC 101.

IOA must be unique within a common address. Its maximum depends on the IOA size in Settings (3 bytes: 1-16,777,215). The **Common Address** is normally 1 (1-65534 with a 2-byte CA).

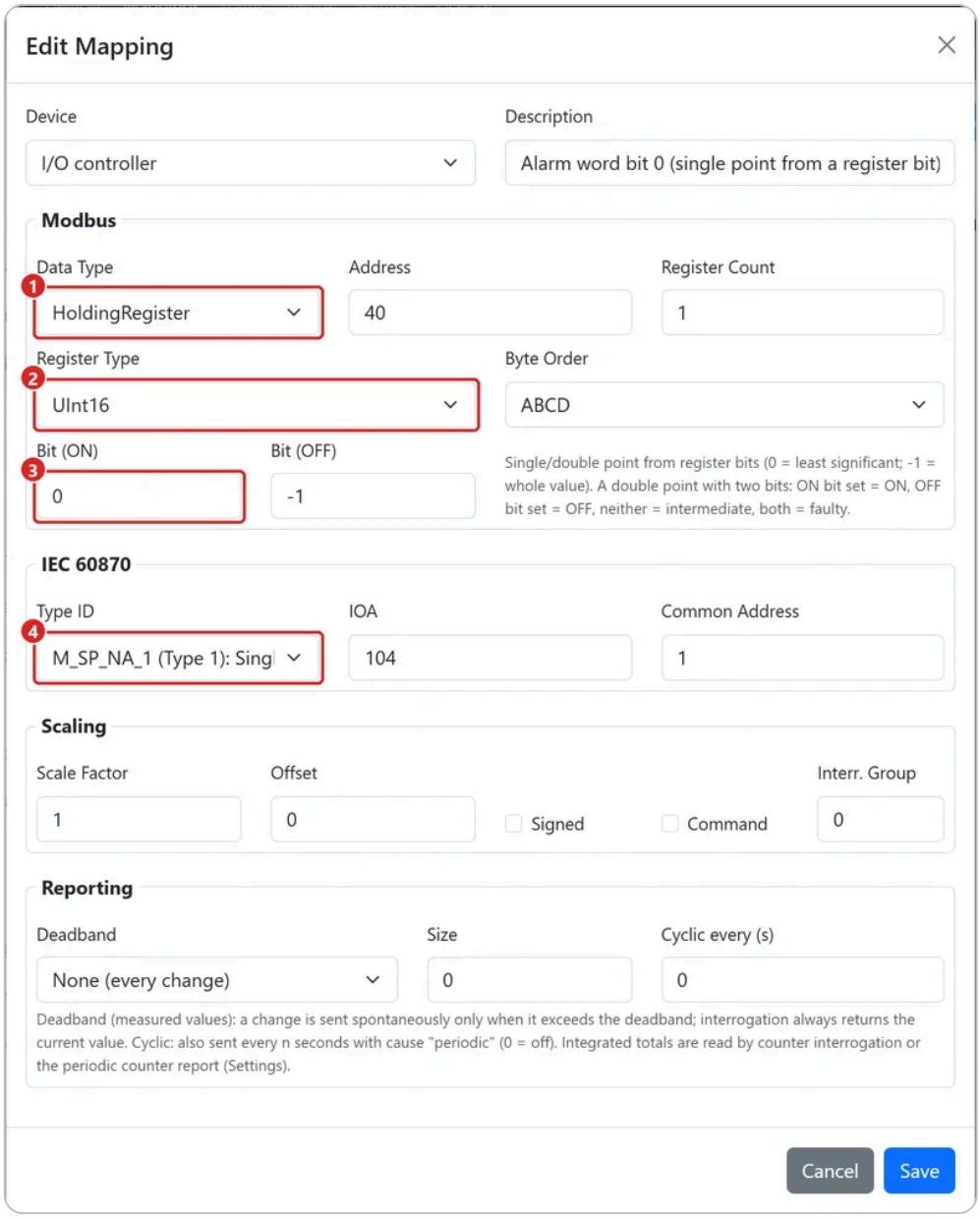
Scaling

The gateway calculates: **value sent = raw value × Scale Factor + Offset**. For commands it calculates the other way round.

Example	Raw value	Scale Factor	Offset	Sent value
Voltage in 0.1 V	2305	0.1	0	230.5
Current in mA, shown in A	12500	0.001	0	12.5
Temperature with offset (raw 0 = −40 °C)	650	0.1	−40	25.0

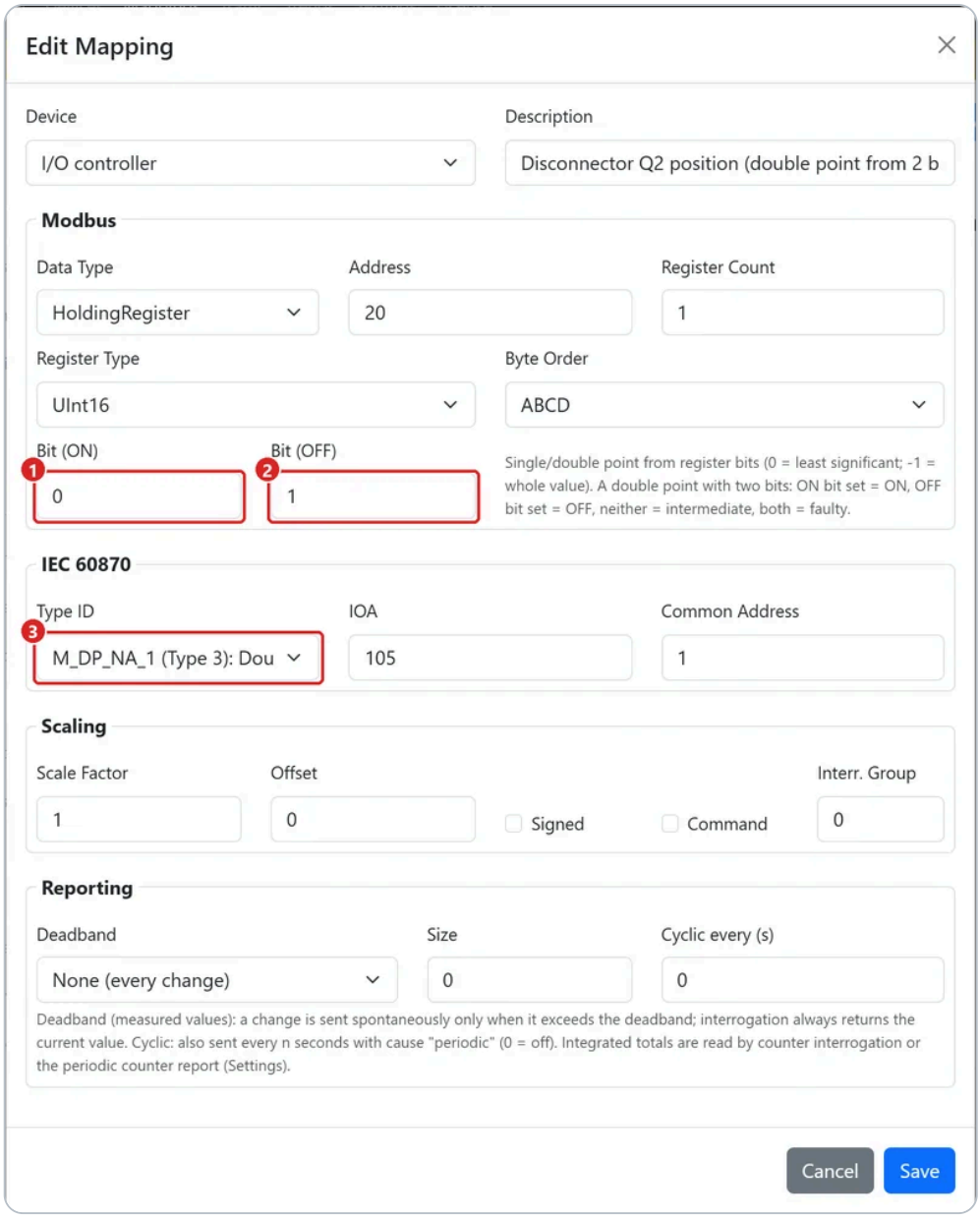
Points from register bits

Many devices pack alarms and states into one status register. Use **Bit (ON)** and **Bit (OFF)** (0 = least significant bit, −1 = not used):



A single point from bit 0 of a holding register.

1. Data Type: HoldingRegister or InputRegister (bits are only possible from registers).
2. Register Type: UInt16 (bits 0-15) or a 32/64-bit type (bits 0-31 / 0-63).
3. **Bit (ON)**: the bit number. Bit (OFF) stays −1.
4. Type ID: a single point (M_SP_*).



A double point from two bits of a register.

1. Bit (ON): the bit that means ON (closed).
2. Bit (OFF): the bit that means OFF (open).
3. Type ID: a double point (M_DP_*).

ON bit	OFF bit	Double point state
1	0	ON
0	1	OFF
0	0	Intermediate (moving)
1	1	Faulty (indeterminate)

Interrogation group

Interr. Group 0 means the point is sent only in a station interrogation (QOI 20). With 1-16 the point is also sent when the master asks for that group (QOI 21-36). For energy counters, groups 1-4 are the counter groups.

Deadband and cyclic transmission

Measured values (M_ME_*) are sent spontaneously (cause 3) when they change. The deadband reduces traffic for values that change all the time:

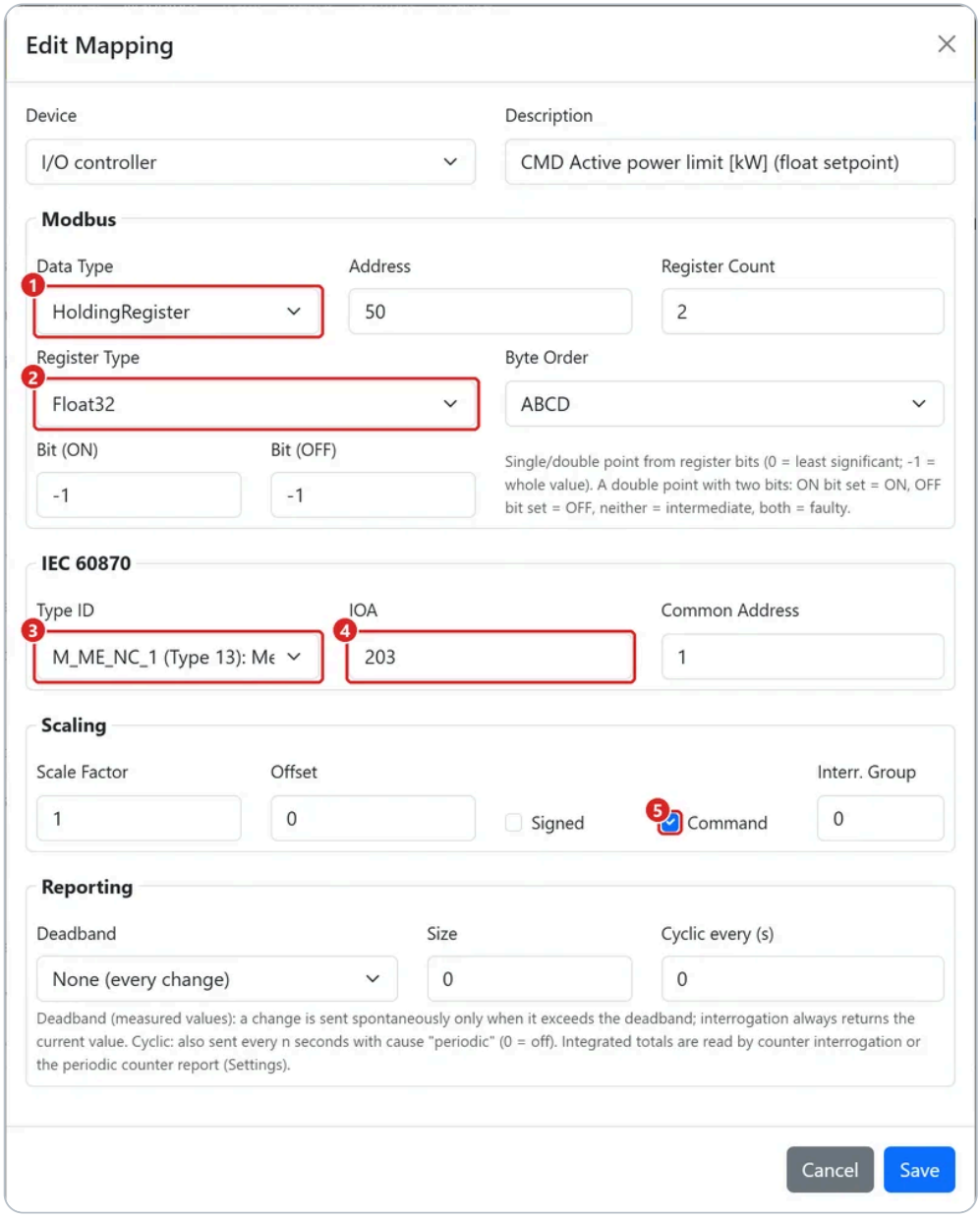
Deadband	When is a change sent?
None (every change)	Every change of the value.
Absolute (engineering units)	When the value differs from the last sent value by more than *Size*. Example: Size 0.5 for a voltage = only changes larger than 0.5 V.
Percent of last reported value	When it differs by more than *Size* % of the last sent value (0-100). Near zero, the gateway uses at least 10 % of the largest value sent so far, so a value around 0 is not sent on every tiny change.

- A general interrogation always returns the current value, whatever the deadband.
- **Cyclic every (s)**: also send the point every n seconds with cause 1 (periodic). 0 = off. Allowed: 0-86400.

> ⓘ **Note:** Changes on the Mappings page apply immediately. Only the device whose mappings changed restarts its polling; other devices and the IEC connections keep running.

8. Commands from SCADA

A **command point** lets the SCADA master write to a coil or holding register. To create one, make a mapping and tick **Command**.



A command point: float set-point to a holding register.

1. Data Type: **Coil** or **HoldingRegister** (inputs are read-only).
2. Register Type and byte order of the target register.
3. Type ID that matches the command (see table).
4. The IOA the master sends the command to.
5. **Command** ticked.

Master sends	Map the command point as	Writes to Modbus
C_SC_NA_1 (45) single command	M_SP_NA_1, Coil (or HoldingRegister)	ON = 1, OFF = 0
C_DC_NA_1 (46) double command	M_DP_NA_1, Coil (or HoldingRegister)	ON (state 2) = 1, OFF (state 1) = 0. States 0 and 3 are rejected.
C_SE_NA_1 (48) set-point, normalized	M_ME_NA_1, HoldingRegister	value × 32767, then reverse scaling
C_SE_NB_1 (49) set-point, scaled	M_ME_NB_1, HoldingRegister	value, then reverse scaling: (value − offset) ÷ scale
C_SE_NC_1 (50) set-point, float	M_ME_NC_1, HoldingRegister	value, then reverse scaling
C_BO_NA_1 (51) bitstring	M_BO_NA_1, HoldingRegister	32 bits unscaled (a 16-bit register takes values up to 0xFFFF)

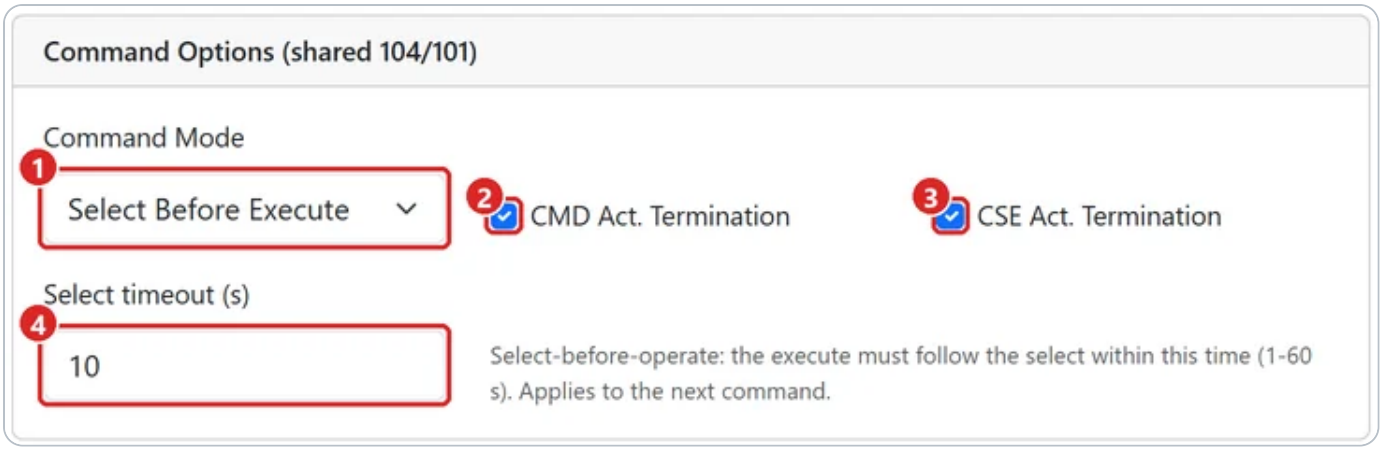
- The time-tagged versions (C_SC_TA_1 … C_BO_TA_1, types 58-64) are accepted and handled like the plain ones.
- A command point is also read and reported like a normal point, so the master sees the current value.
- Set-points that do not fit the register type are rejected, never cut off.
- Regulating step commands (C_RC_NA_1) are not supported and are rejected.

Select-before-operate and direct execute

Choose the command mode in **Settings** → **Command Options**:

Command Mode	How the master must send a command
Direct Execute	One execute (S/E = 0) operates the output.
Select Before Execute	First a **select** (S/E = 1), then an **execute** (S/E = 0) with the same value, from the same connection, within the **Select timeout**. An execute without select is rejected.

The **Select timeout (s)** is 10 s by default (1-60 s). A deactivation (cause 8) cancels a pending select. Bitstring commands have no select bit and always execute directly.



Settings: Command Options.

1. Command Mode: Direct Execute or Select Before Execute.
2. CMD Act. Termination: send ACT_TERM after single/double commands.
3. CSE Act. Termination: send ACT_TERM after set-points.
4. Select timeout (s).

What the master sees

Step	Master sends	Gateway answers
Select	Command, COT 6 (activation), S/E = 1	COT 7 activation confirmation (positive). Nothing is written yet.
Execute	Same command, COT 6, S/E = 0	Writes to Modbus, then COT 7 (positive) and COT 10 activation termination
Cancel	Same command, COT 8 (deactivation)	COT 9 deactivation confirmation; the select is cancelled

Why was my command rejected?

A rejected command gets a **negative** confirmation (P/N bit set). The Traffic page shows the reason.

Reason in the traffic monitor	Cause / fix
execute … without select (select-before-operate)	Send a select first, or switch to Direct Execute.
select for IOA … expired	The execute came after the select timeout. Send it faster or raise the timeout.
execute … does not match its select	Value or type of the execute differs from the select.
IOA … is not a command point	Tick **Command** on that mapping.
unknown IOA (COT 47) / unknown common address (COT 46)	No mapping with that CA and IOA. Check the numbers.
unsupported type (COT 44)	The master sent a type the gateway does not know.
regulating step commands are not supported	C_RC_NA_1 is not supported. Use a single or double command, or a set-point.
double command state 0/3 not permitted	Use state 1 (OFF) or 2 (ON).
Command FAILED (negative ACT_CON)	The Modbus write failed: device offline, exception from the device, or the value does not fit the register.

Pulse commands and separate open/close outputs

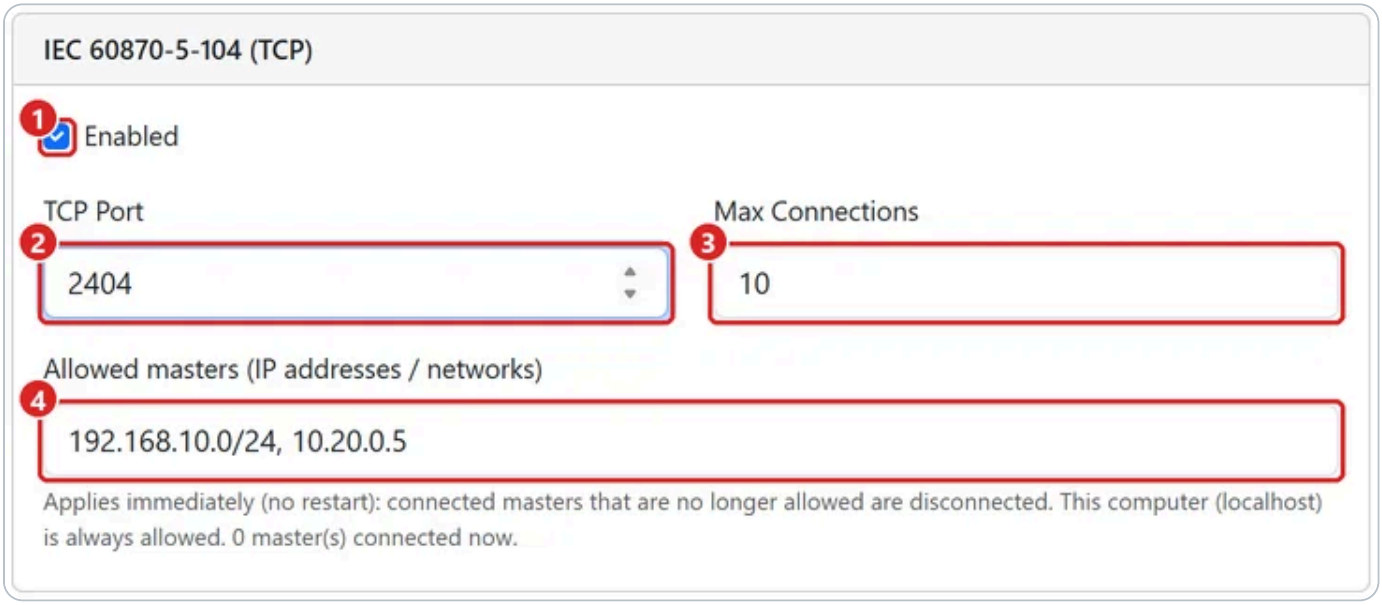
New in 1.3.0, off by default. In the mapping dialog, section **Pulse commands**:

- **Honour qualifier QU**: for single and double commands on coils or holding registers. QU 1 = short pulse, QU 2 = long pulse: the gateway writes ON, sends ACT_CON, writes OFF after the pulse time and sends ACT_TERM. QU 0 or 3 writes the value persistently. An OFF command is always written persistently. A new command for the point ends a running pulse first.
- **Short pulse / Long pulse (ms)**: 0 = use the defaults from **Settings › Command Options** (500 and 2000 ms); range 10-60000.
- **Separate open/close outputs**: for double commands (M_DP_* or C_DC_NA_1). OFF pulses the **Open output** address, ON pulses the **Close output** address, in the same Modbus table as the mapping. QU 2 = long pulse, any other QU = short.

The pulse runs in the background, so the IEC connection is never blocked. Without the option, commands work exactly as before. The CSV file has optional columns for these settings (see the CSV chapter).

9. IEC 104 settings

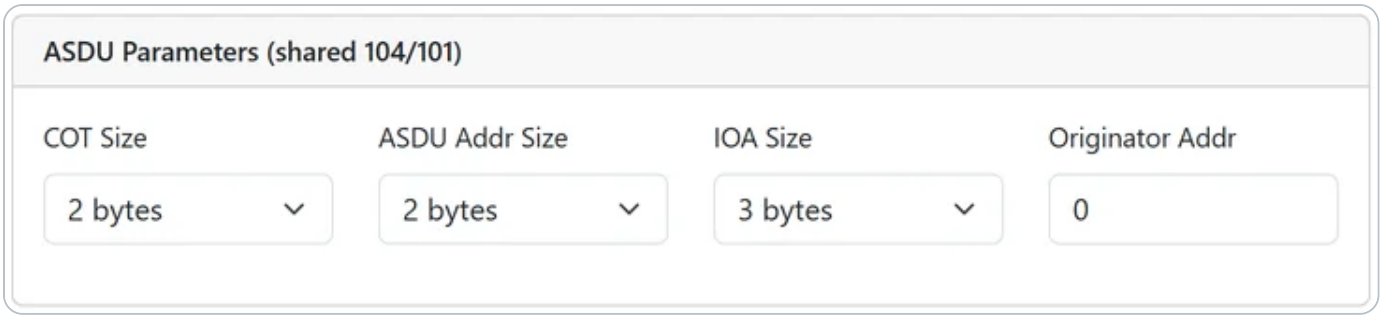
Open **Settings**. All settings apply as soon as you click **Save Configuration**. A change that makes connected masters reconnect (for example a new port) asks you first.



Settings: IEC 60870-5-104.

1. Enabled: switch the IEC 104 server on or off.
2. TCP Port (default 2404).
3. Max Connections: masters at the same time (1-64, default 10).
4. Allowed masters: IP addresses or networks that may connect.

- **Allowed masters**: for example `10.0.0.5, 192.168.1.0/24`. Empty = any address. It applies at once: connected masters that are no longer allowed are disconnected. This computer (localhost) is always allowed.
- Several masters can be connected at the same time. Each gets all data and can send commands.

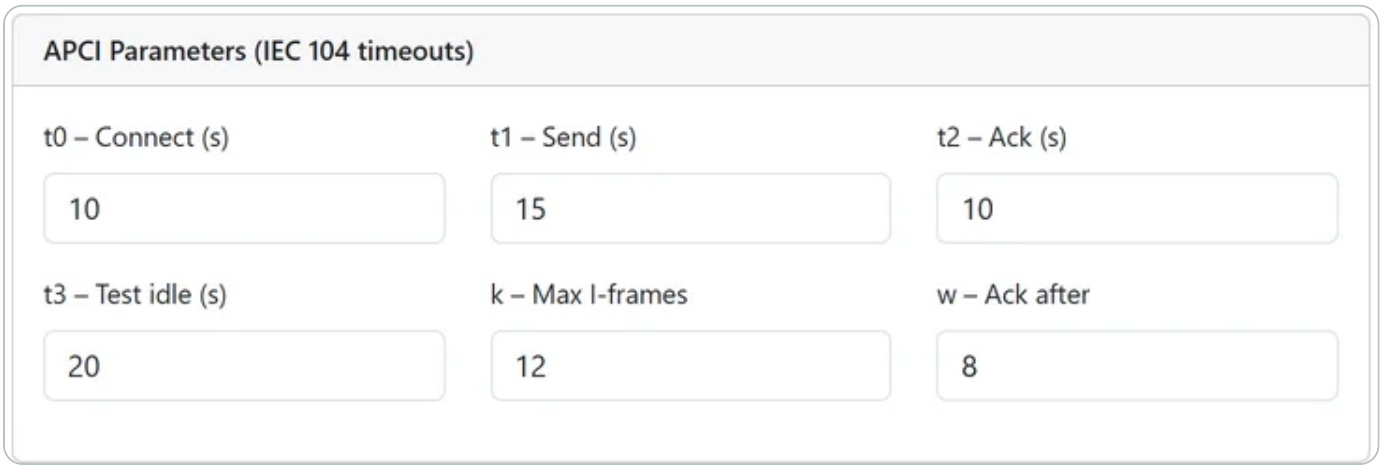


Settings: ASDU parameters (shared by IEC 104 and 101).

Field	IEC 104 standard	Explanation
COT Size	2 bytes	Cause of transmission field. 2 bytes includes the originator address.
ASDU Addr Size	2 bytes	Size of the common address (CA).
IOA Size	3 bytes	Size of the information object address.
Originator Addr	0	Originator address the gateway puts in its messages (0-255).

> ⚠ **Important:** For IEC 104 keep 2/2/3 bytes. Your master must use the same sizes, otherwise it cannot read the messages.

Timers and windows (APCI)



Settings: IEC 104 timers.

Parameter	Default	Allowed	What it does (simply)
t0 – Connect	10 s	1-255	Time allowed to open a TCP connection.
t1 – Send	15 s	1-255	If the master does not confirm sent data within t1, the connection is closed.
t2 – Ack	10 s	1-255, less than t1	The gateway confirms received data at the latest after t2.
t3 – Test idle	20 s	1-172800	If nothing is sent for t3, a test frame checks the link.
k – Max I-frames	12	1-32767	Messages the gateway may send before it must wait for a confirmation.
w – Ack after	8	1-32767, not more than k	The gateway confirms after w received messages.

> **Tip:** Keep the defaults unless your SCADA specification asks for other values. k, w and t0-t3 apply to open connections without a restart. More help: IEC 104 timers guide.

Redundancy groups

New in 1.3.0, off by default (IEC 60870-5-104 Ed. 2, clause 10.3). Normally every connected master gets its own copy of every event. With **Redundancy groups** on, the masters of one group share one event buffer: only the connection that sent STARTDT last receives data, the others wait in STOPDT and take over without losing buffered events.

- **Groups**: one group per line (or separated by `;`): an optional name, `=`, then the IP addresses, for example `SCADA-A = 10.0.0.5, 10.0.0.6`. Up to 32 groups. A master can be in one group only and must be in **Allowed masters**.
- **Masters that are in no group**: each receives every event (default), or together they form one more group (required when redundancy is on and no group is defined).
- Changes apply immediately; masters whose group changes are disconnected once and reconnect. The Settings page shows the live state of each group.

TLS listener (IEC 62351-3)

New in 1.3.0, off by default. Opens a second IEC 104 port that accepts only encrypted connections. The normal port keeps working, so masters can move to TLS one at a time.

- **TLS port**: default 19998 (IEC 62351-3); must differ from the normal port. The Windows Firewall rule is updated automatically.
- **Plain (unencrypted) listener**: untick for TLS-only operation (only while TLS is on).

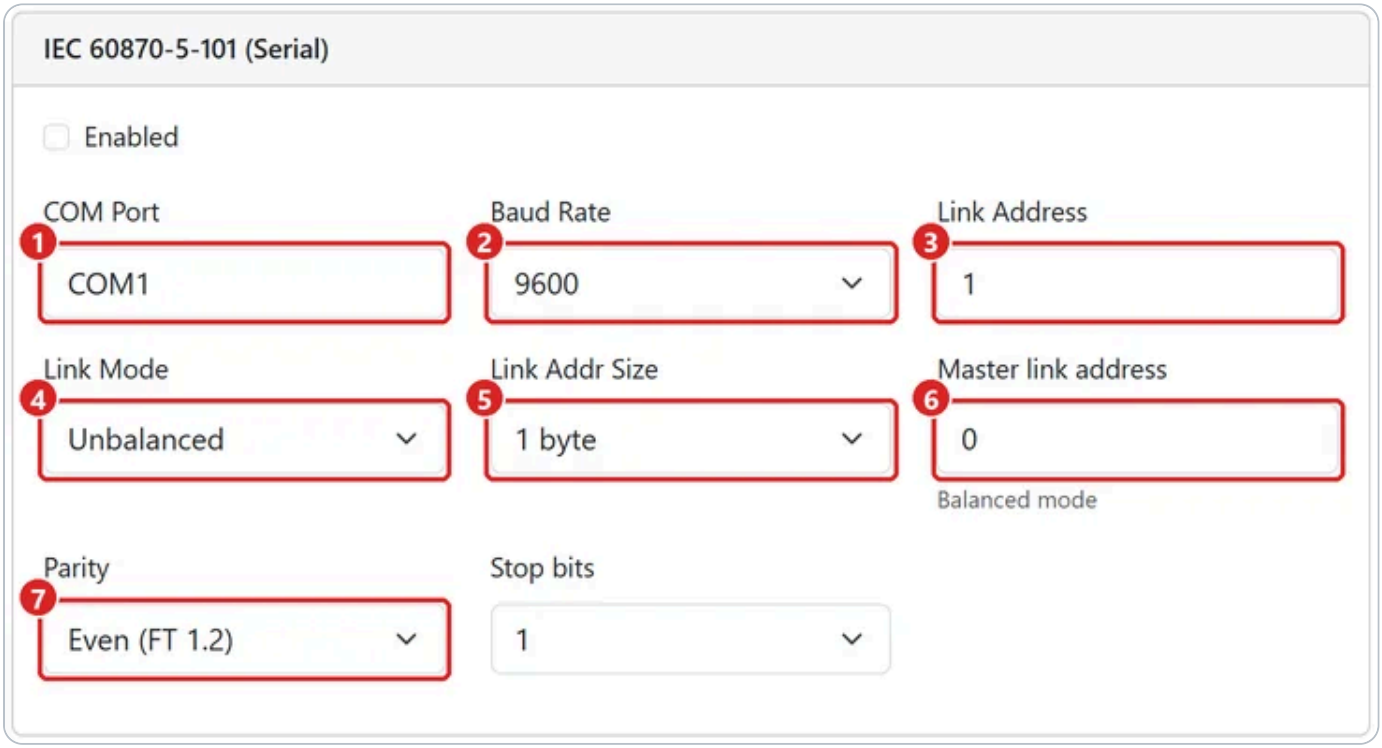
- **Server certificate (.pfx/.p12) and password**: checked when you save. The password is stored encrypted and never shown or exported; leave it empty to keep the saved one. To renew, replace the file and click Save; no restart, new connections use the new certificate.
- **Lowest TLS version**: TLS 1.2 (default, 1.3 also allowed) or TLS 1.3 only (needs Windows 11 / Server 2022 or OpenSSL 1.1.1+).
- **Require a client certificate (mutual TLS)**: a master is accepted if its certificate was issued by the trusted CA file or its SHA-1/SHA-256 thumbprint is in the list. Revocation lists are not checked.
- Failed handshakes are refused and shown in **Traffic › Connections**; the allow-list and redundancy groups work the same over TLS.

Saving the event buffer to disk

New in 1.3.0, off by default (**Settings › Events and energy counters**). Events waiting for a master are written to `event-buffer.db` in the data folder every second. After a restart or power loss they are delivered, in order, to the first master that connects (in each redundancy group). At most about the last second of events, plus events sent but not yet acknowledged, can be lost. The event buffer size still limits how many are kept. **Maximum event age (hours)**: older events are dropped (0 = no limit, up to 8760). Switching the option off deletes the saved events.

10. IEC 101 settings

IEC 60870-5-101 uses a serial line (RS-232 or RS-485). Tick **Enabled** in the IEC 101 card and set the line exactly like the master.



Settings: IEC 60870-5-101.

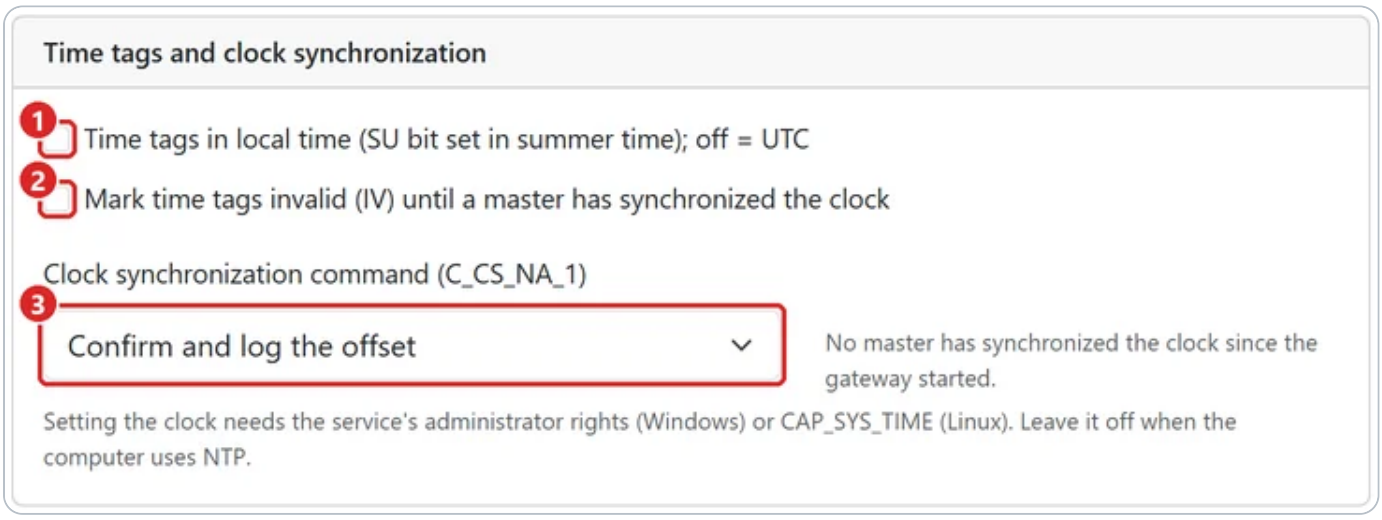
1. COM Port, e.g. COM1 or /dev/ttyS0.
2. Baud Rate (default 9600).
3. Link Address of the gateway.
4. Link Mode: Unbalanced (master polls) or Balanced (both sides may send).
5. Link Addr Size: 0, 1 or 2 bytes.
6. Master link address (balanced mode only).
7. Parity: Even is the FT 1.2 standard.

Field	Default	Explanation
Link Mode	Unbalanced	Unbalanced: the master polls the gateway (most common, also for several outstations on one line). Balanced: point-to-point, the gateway may send by itself.
Link Address	1	Address of the gateway on the line (0-255 with 1 byte).
Link Addr Size	1 byte	Must match the master.
Parity / Stop bits	Even / 1	FT 1.2 standard: 8 data bits, even parity, 1 stop bit.

- The ASDU sizes (COT, CA, IOA) from the ASDU card are used for IEC 101 too. Many IEC 101 systems use COT 1 byte, CA 1 byte, IOA 2 bytes: check your master.
- The **Event buffer** size applies to IEC 101 too; changing it restarts only the IEC 101 link.
- Changing the port or any line setting restarts only the IEC 101 link. IEC 104 keeps running.

ⓘ **Note:** IEC 101 and IEC 104 can run at the same time with the same points.

11. Time tags and clock synchronization



Settings: time tags and clock synchronization.

1. Time tags in local time (the SU bit is set in summer time). Off = UTC (default).
2. Mark time tags invalid (IV) until a master has synchronized the clock.
3. What a clock synchronization command (C_CS_NA_1) does.

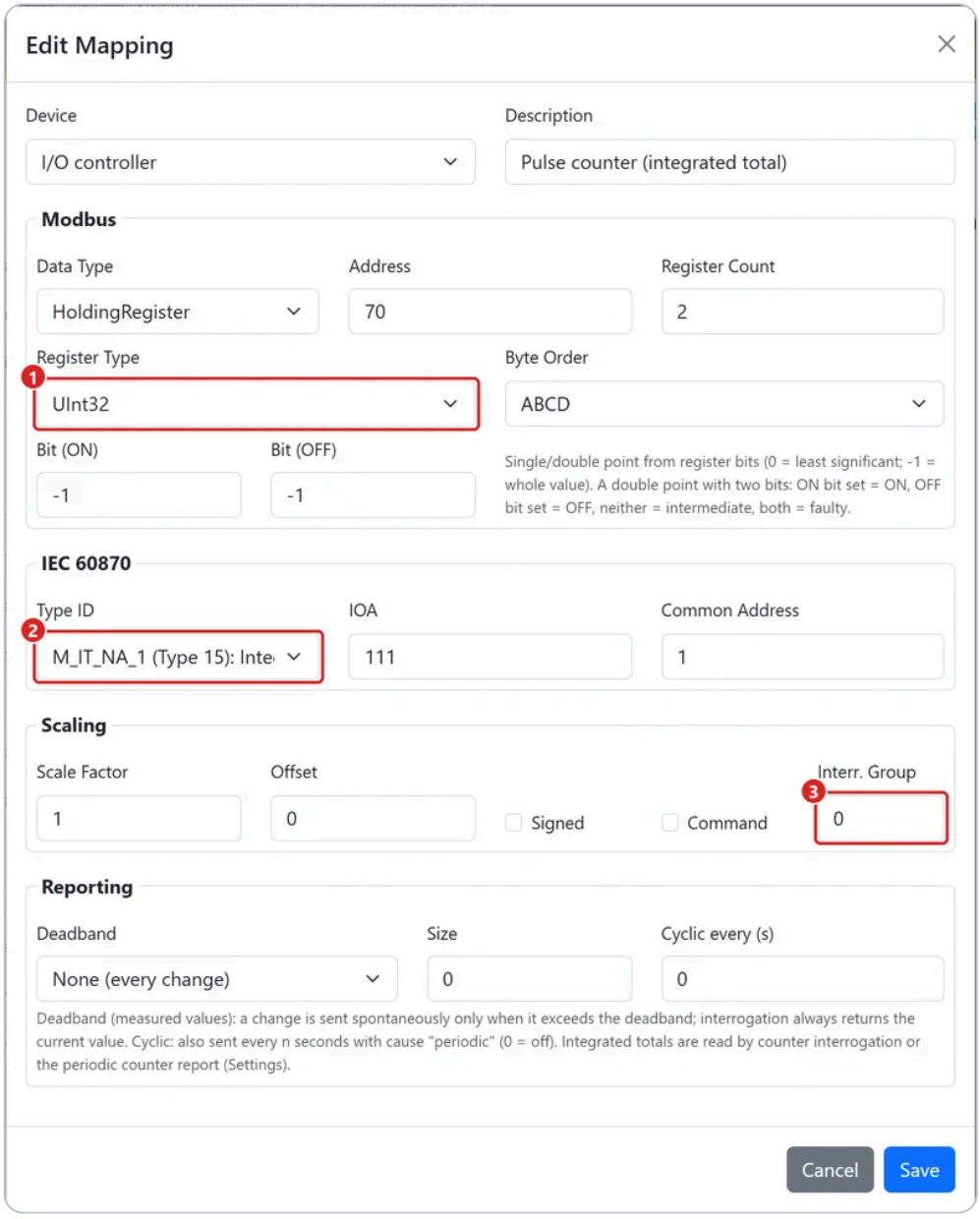
Clock synchronization	Effect
Confirm and log the offset (default)	The gateway confirms the command and writes the time difference to the log. The computer clock is not changed.
Also set this computer's clock	The gateway also sets the Windows/Linux clock. Needs administrator rights (Windows service: yes) or CAP_SYS_TIME on Linux.

Tip: If the computer uses NTP (internet time or a time server), keep the default. Two time sources fighting each other give jumping time stamps.

Since 1.3.0, as IEC 60870-5-104 requires, interrogation responses, counter interrogation and cyclic data are sent without time tag (for example M_ME_NC_1 instead of M_ME_TF_1). Spontaneous changes and read responses keep the time-tagged type you chose. If your master is configured per type, allow both.

12. Energy counters and counter interrogation

Energy registers (kWh, kvarh, pulse counts) are mapped as **integrated totals**: Type ID **M_IT_NA_1** (15) or **M_IT_TB_1** (37).



An energy counter (integrated total) from a 32-bit holding register.

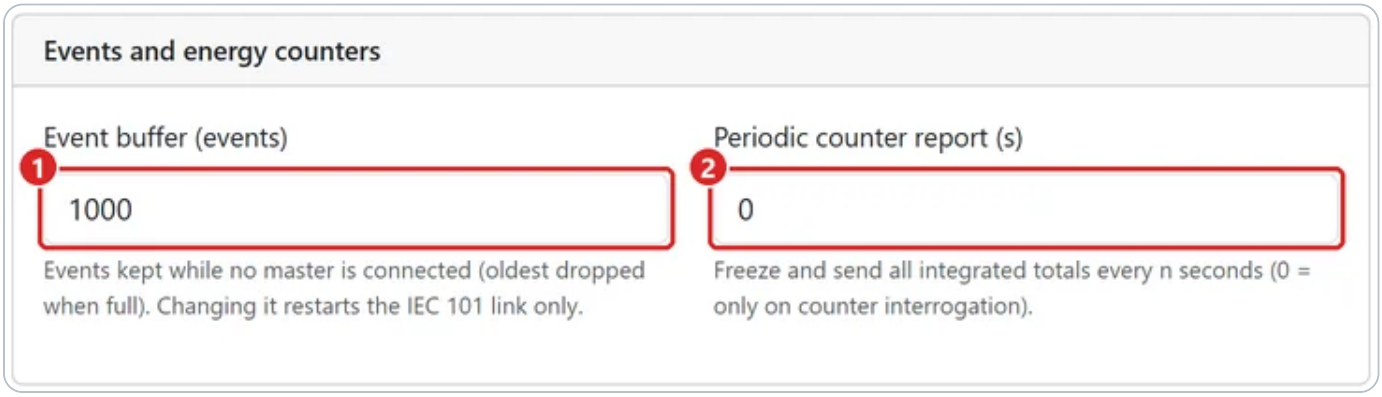
1. Register Type of the counter, e.g. UInt32, Int64 or Float32.
2. Type ID M_IT_NA_1 or M_IT_TB_1.
3. Interr. Group: counter group 1-4 (0 = general only).

- Counters are **not** sent in a general interrogation and not on every change. The master reads them with a **counter interrogation** (C_CI_NA_1, type 101).
- The value sent is a 32-bit integer (−2,147,483,648 … 2,147,483,647) after scaling. Choose the scale factor so the value fits, e.g. Wh → kWh with scale 0.001.

- Each reading carries a sequence number, a carry bit (the counter went backwards, e.g. after a rollover), an adjusted bit and an invalid bit.

Counter interrogation (QCC)	Effect
Read (FRZ 0)	Sends the frozen values (the current values if never frozen), cause 37 (general) or 38-41 (group 1-4).
Freeze (FRZ 1)	Stores the current values. Read them with a following Read.
Freeze and reset (FRZ 2)	Stores the values and starts counting from 0 again.
Reset (FRZ 3)	Counting starts from 0 again.

ⓘ **Note:** Reset happens inside the gateway: it remembers the value at the reset and sends the difference. The counter in the Modbus device is not changed.



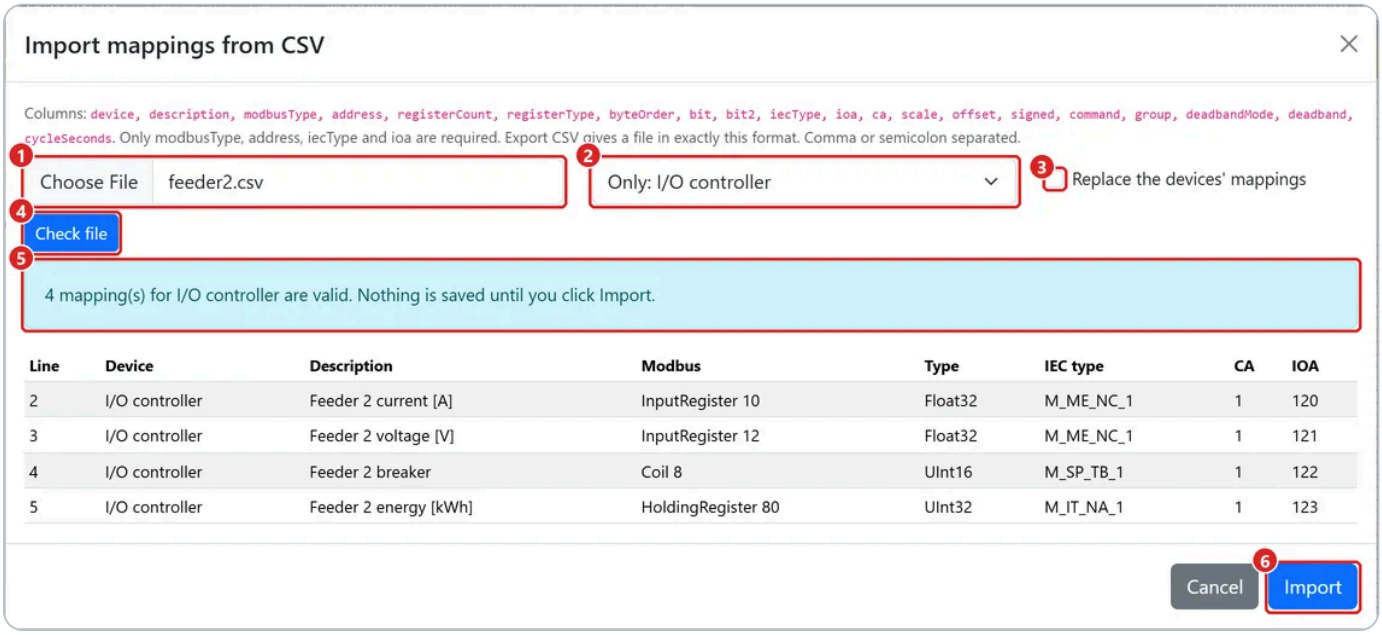
Settings: event buffer and periodic counter report.

1. Event buffer: events kept while no master is connected (10-100000, default 1000). When it is full, the oldest are dropped.
2. Periodic counter report (s): freeze and send all counters every n seconds (0 = only on counter interrogation).

13. CSV import and export

With CSV files you can prepare hundreds of points in Excel and import them in one step.

1. On **Mappings**, click **Export CSV** to get a file in the right format (or start from the example below).
2. Edit the file in Excel or a text editor. Comma or semicolon separated; a decimal comma is accepted.
3. Click **Import CSV** and choose the file.
4. Optional: choose one device (all rows go to it) and/or tick **Replace the devices' mappings**.
5. Click **Check file**. The gateway checks every row and shows a preview. Nothing is saved yet.
6. If there are errors, fix them in the file and check again. When the file is valid, click **Import**.



Import mappings from CSV: the checked preview.

1. Choose the CSV file.
2. Target: the devices named in the file, or one device.
3. Replace: delete the devices' current mappings first.
4. Check file: validate and preview.
5. Result of the check.
6. Import: saves all rows (only active when the file is valid).

> **Tip:** The import is all-or-nothing: if one row is wrong, nothing is imported.

Columns

Column	Required	Values
device	If no device is chosen in the dialog	Device name exactly as on the Devices page
description	No	Free text, up to 200 characters
modbusType	**Yes**	Coil, DiscreteInput, InputRegister, HoldingRegister (also: CO/0x/FC01, DI/1x/FC02, IR/3x/FC04, HR/4x/FC03)
address	**Yes**	0-65535, 0-based
registerCount	No	Set automatically from registerType
registerType	No (UInt16)	UInt16, Int16, UInt32, Int32, Float32, Float64, Int64, UInt64
byteOrder	No (ABCD)	ABCD, CDAB, BADC, DCBA
bit, bit2	No (−1)	Bit numbers for single/double points from register bits
iecType	**Yes**	Name or number, e.g. M_ME_NC_1 or 13
ioa	**Yes**	Information object address
ca	No (1)	Common address
scale, offset	No (1, 0)	Numbers
signed, command	No (false)	true/false, yes/no, 1/0, x
group	No (0)	Interrogation group 0-16
deadbandMode	No (None)	None, Absolute, Percent (also Abs, %)
deadband	No (0)	Number
cycleSeconds	No (0)	0-86400

Example file

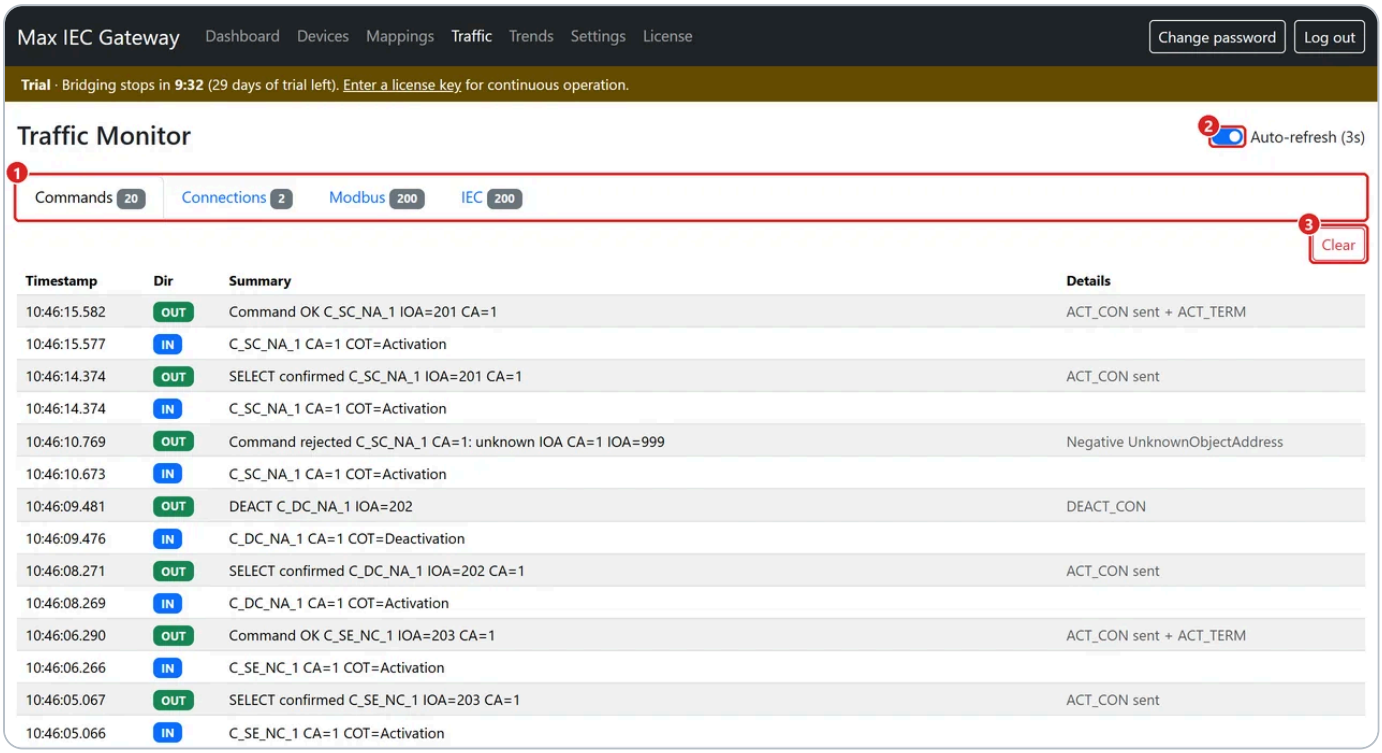
```
device,description,modbusType,address,registerType,byteOrder,iecType,ioa,ca,scale,deadbandMode,deadband
Meter feeder 2,Feeder 2 current
[A],InputRegister,10,Float32,ABCD,M_ME_NC_1,120,1,1,Absolute,0.5
Meter feeder 2,Feeder 2 voltage
[V],InputRegister,12,Float32,ABCD,M_ME_NC_1,121,1,1,Percent,1
Meter feeder 2,Feeder 2 breaker,Coil,8,UInt16,ABCD,M_SP_TB_1,122,1,1,None,0
Meter feeder 2,Feeder 2 energy
[kWh],HoldingRegister,80,UInt32,ABCD,M_IT_NA_1,123,1,1,None,0
```

ⓘ **Note:** Export CSV protects text cells against Excel formula injection. A complete backup of devices, mappings and settings is the JSON export in Settings (chapter Backup and restore).

14. Traffic monitor, trends and history

Traffic monitor

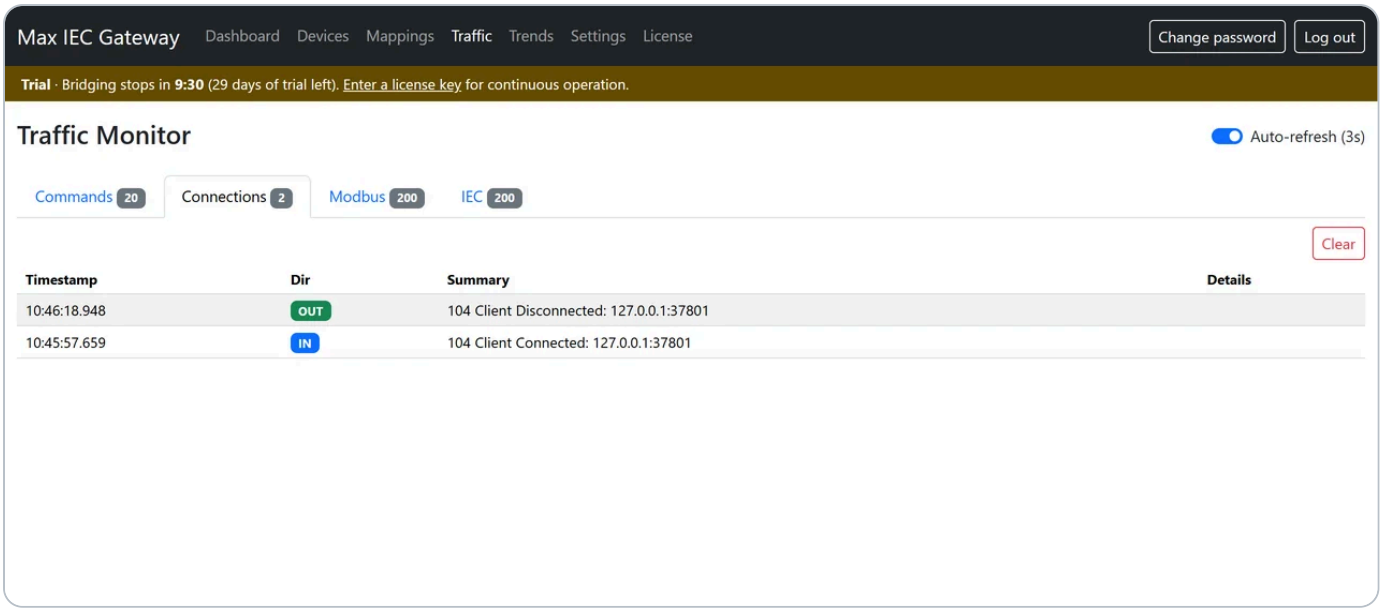
The **Traffic** page shows what happens on both sides of the gateway. It is the first place to look when something does not work.



Traffic monitor: commands with select, execute, a deactivation and a rejected command.

1. Tabs: **Commands**, **Connections**, **Modbus**, **IEC**; the badge shows the number of entries.
2. Auto-refresh every 3 s (switch off to read calmly).
3. Clear the list.

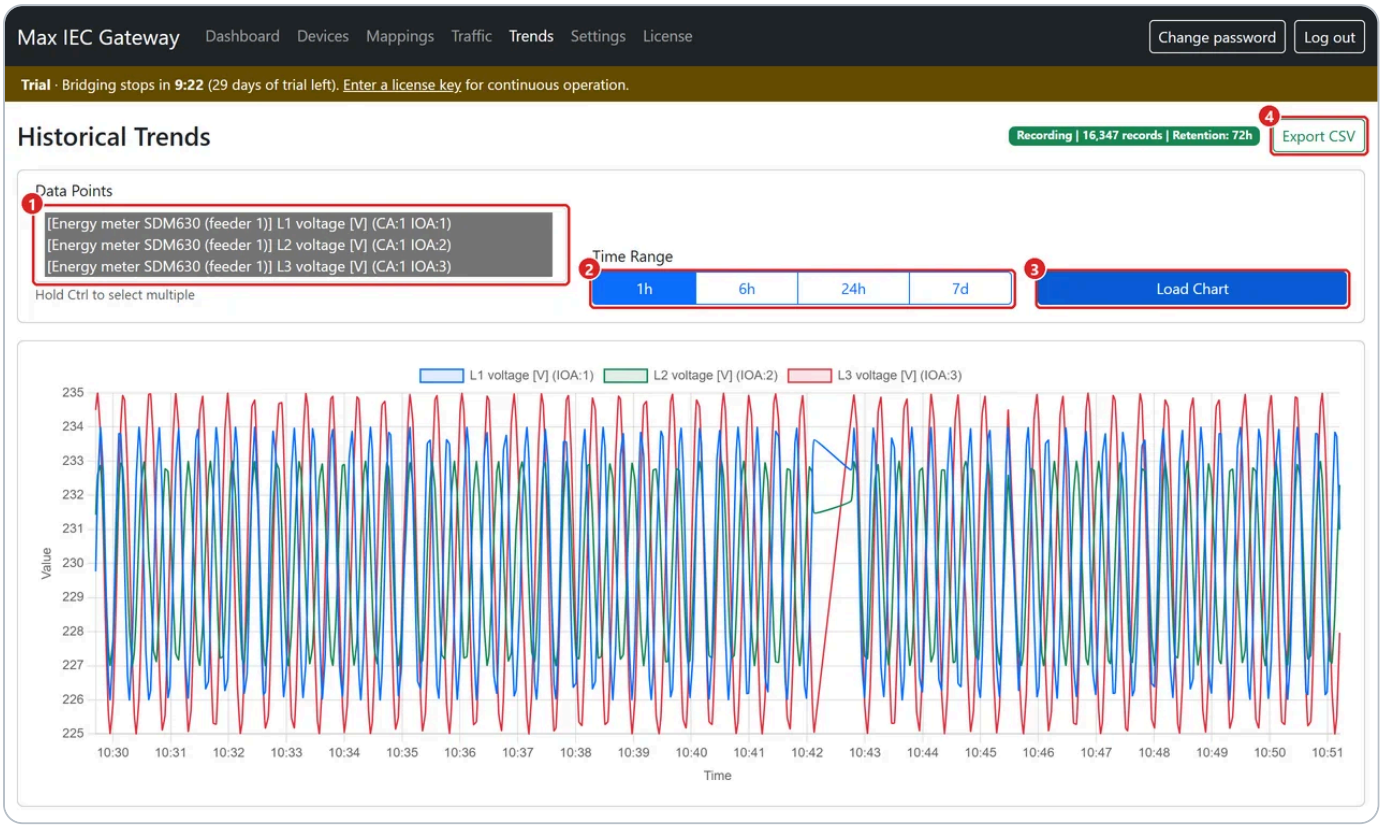
Tab	Shows
Commands	Every command received (IN) and the answer (OUT): select confirmed, command OK, rejected with the reason.
Connections	IEC masters connecting and disconnecting, with their IP address.
Modbus	The last Modbus requests and results per device.
IEC	The last IEC messages sent and received.



Traffic monitor: the Connections tab.

> ⓘ **Note:** The lists keep the latest 200 entries each. They are cleared when the service restarts.

Trends

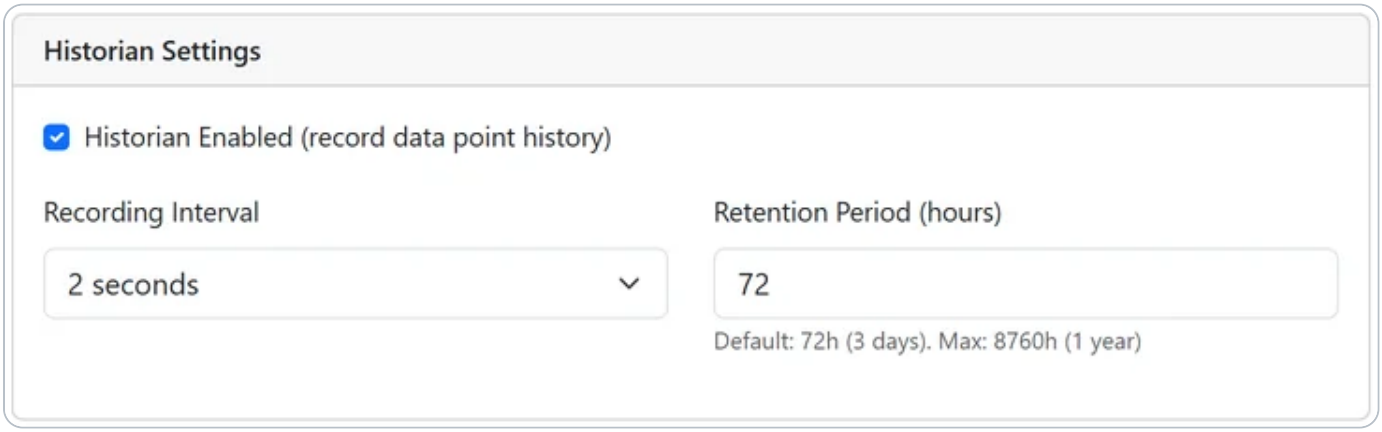


Trends: three voltages over the last hour.

1. Choose one or more data points (hold Ctrl to select several).
2. Time range: 1 h, 6 h, 24 h or 7 days.

3. **Load Chart**.
4. **Export CSV**: the history of all selected points for the chosen time range, in one file (one row per stored value, with columns for time, IOA, device, point, value and quality).

Historian settings



Settings: historian.

- **Historian Enabled**: record the values of all points.
- **Recording Interval**: 1 s to 1 h (default 2 s). Values are stored when they change, and at least every 5 minutes.
- **Retention Period (hours)**: 1-8760 (default 72 h = 3 days). Older data is deleted.

Alerts (webhook and syslog)

New in 1.3.0, off by default (**Settings › Alerts**, Admin only). The gateway can send a notification when a device goes offline or comes back, an IEC master connects or disconnects, an IEC server cannot start (or starts after a retry), the license status changes, the event buffer overflows, or a TLS handshake fails.

- **Webhook**: HTTP POST of JSON to your URL, with an optional secret used as an HMAC-SHA256 signature (`X-MaxIEC-Signature`) or sent in a header you choose; timeout 1-60 s and 0-10 retries.
- **Syslog**: RFC 5424 over UDP or TCP to host:port, with a facility (default local0).
- Choose the events and a **minimum time between repeats** (default 60 s) to avoid floods.
- **Send test alert** checks the channels; recent deliveries and failures are listed below.

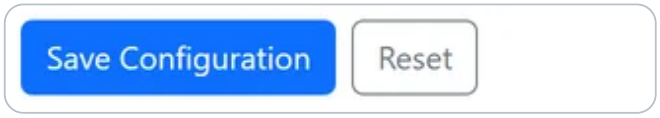
Prometheus metrics

New in 1.3.0, off by default (**Settings › Users, audit log and metrics**). Turns on `/metrics` on the dashboard port (Prometheus text format): gateway up, version, uptime, license state, per-device poll counters, response time and online state, IEC connections, events and commands, TLS handshake failures. Generate a token (shown once) and set it in Prometheus as a bearer token, or allow access without a token from the dashboard's allowed networks. While off, `/metrics` answers 404.

15. Live changes: what restarts what

You never need to restart the gateway to apply a change. Only the part that is affected restarts:

You change	What happens
A device or its mappings	Only that device restarts its polling. Unchanged points keep their value and quality.
Add from template, CSV import, delete	Same: only the affected devices restart.
Command mode, select timeout, time options, clock sync mode, counter report period	Applied at once, nothing restarts.
IEC 104 allowed masters	Applied at once. Masters that are no longer allowed are disconnected.
IEC 104 k, w, t0-t3, max connections, event buffer	Applied to the running server and its open connections.
IEC 104 enabled, port, COT/CA/IOA sizes, originator address	Only the IEC 104 server restarts. Masters reconnect. You are asked first.
Any IEC 101 setting, or the event buffer size	Only the IEC 101 link restarts.
Dashboard port, HTTPS, allowed networks	The web server moves inside the running service. Your browser is sent to the new address.
License activation	Bridging starts at once.



Save Configuration applies the settings; Reset reloads the saved values.

> **Tip:** If a restarted server cannot start (for example the new port is used by another program), the gateway goes back to the previous settings and shows the reason.

16. Connecting a SCADA master or test tool

Any IEC 60870-5-104 master can connect: a SCADA system, an RTU, or a test tool. Use these settings in the master:

Setting in the master	Value
Protocol	**IEC 60870-5-104 (T104)**. Not T101 over TCP.
IP address / port	IP address of the gateway computer, port 2404 (or the port in Settings)
Common address (CASDU / ASDU address)	1 (or what you used in the mappings)
CASDU / ASDU address size	2 bytes
IOA size	3 bytes
COT size	2 bytes ("COT with originator")
k / w / t0 / t1 / t2 / t3	12 / 8 / 10 s / 15 s / 10 s / 20 s

1. Make sure the gateway shows **IEC 60870-5-104 Running** on the Dashboard and the status bar is not red.
2. On a different computer, the Windows firewall must allow port 2404 (installer option) and the master's IP address must be allowed in **Allowed masters** (or the list must be empty).
3. Connect the master. It sends STARTDT; the gateway confirms.
4. Send a general interrogation (C_IC_NA_1, CA 1, QOI 20). You receive all points, then the activation termination.
5. Watch the **Traffic** page: the Connections tab shows the master's IP address.

> ⚠ **Important:** If the connection opens and closes again at once, the master probably uses **T101 frames over TCP** instead of T104 (in the master's log you see short frames such as `10 49 01 4A 16`). Switch the master to IEC 104 / T104.

Example: switching IOA 201 with select-before-operate

Assume IOA 201 is a command point on a coil (M_SP_NA_1 + Command) and the command mode is Select Before Execute.

	Step 1: Select	Step 2: Execute (within 10 s)
Type ID	45 (C_SC_NA_1)	45 (C_SC_NA_1)
COT	6 (activation)	6 (activation)
CA	1	1
IOA	201	201
SCS (state)	1 = ON	1 = ON
S/E	1 = select	0 = execute
QU	0	0
Gateway answers	COT 7 positive	COT 7 positive, then COT 10

If your tool asks for raw ASDU bytes (type, VSQ, COT 2 bytes, CA 2 bytes, IOA 3 bytes, SCO):

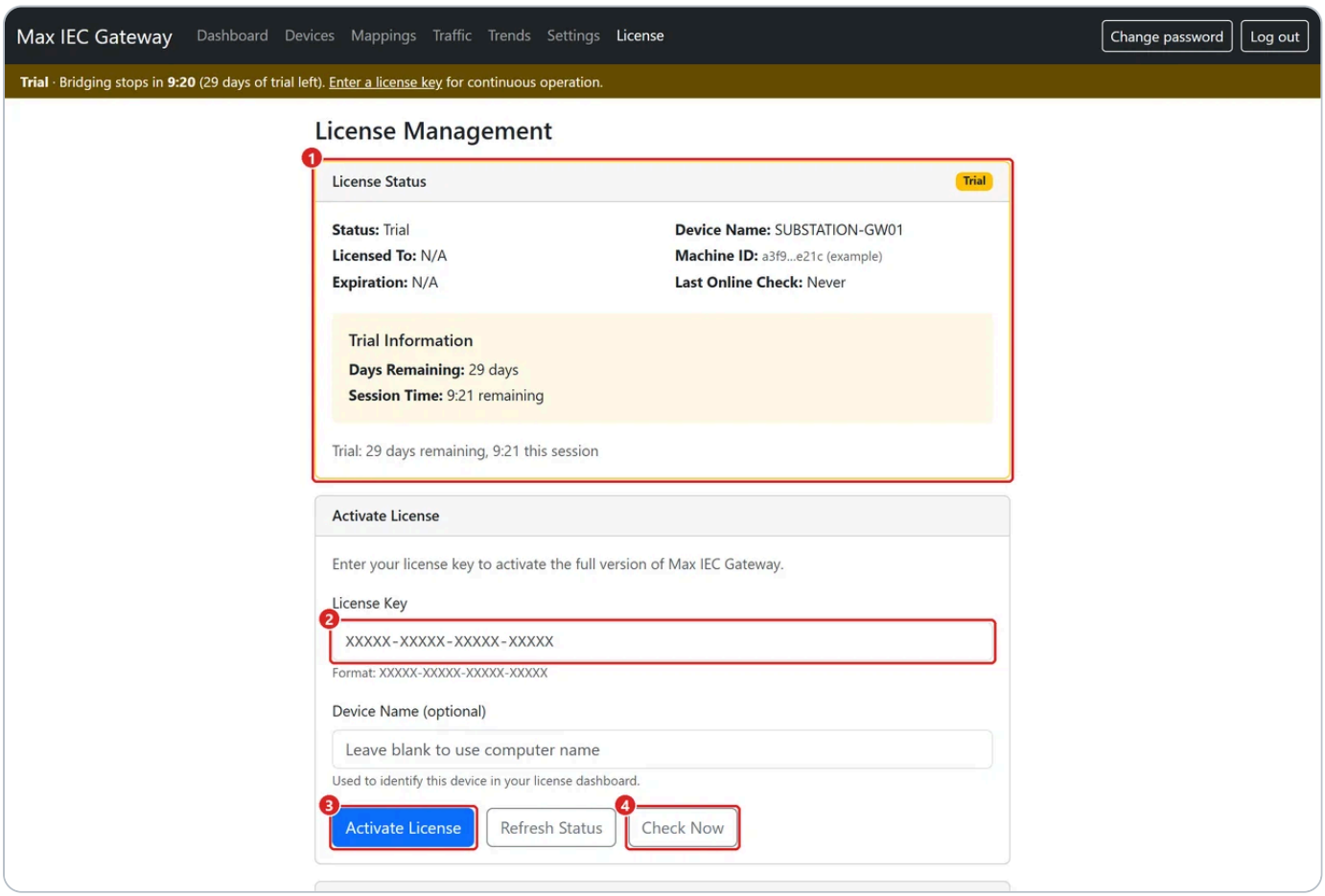
```
Select ON:   2D 01 06 00 01 00 C9 00 00 81
Execute ON:  2D 01 06 00 01 00 C9 00 00 01
Select OFF:  2D 01 06 00 01 00 C9 00 00 80
Execute OFF: 2D 01 06 00 01 00 C9 00 00 00
```

(201 = `C9 00 00`; the last byte is the SCO: bit 7 = S/E, bit 0 = state.)

Testing without hardware

Use the slave simulator of ModbusBB as a Modbus device and any IEC 104 test tool as the master. This is how the screenshots in this manual were made.

17. License



The License page during the trial (device name and machine ID replaced).

1. License Status: trial or licensed, licensed to, device name, machine ID, last online check, and the trial days and session time.
2. Enter the license key (XXXXX-XXXXX-XXXXX-XXXXX).
3. **Activate License** (needs internet).
4. **Check Now**: check the license online now.

Trial

- The trial has every feature for 30 days, without registration.
- Setting the computer clock back does not extend the trial: the gateway never counts time backwards, and once the computer has been online the trial start is also kept on the license server.
- During the trial, the gateway bridges data in sessions of 15 minutes. When a session ends, the IEC servers and Modbus polling stop; the dashboard keeps working.
- A new session starts only when the service restarts: Windows `Restart-Service MaxIECGateway` (administrator PowerShell) or Services → Max IEC Gateway → Restart; Linux `sudo systemctl restart maxiec-gateway`. Saving settings does not start a new session.
- When the 30 days are over, bridging stays stopped until you enter a license key.

Buying and activating

1. Buy a license on the pricing page ($75 one-time, lifetime license, lifetime free updates). The key arrives by e-mail.
2. Open **License** in the dashboard, type the key, optionally a device name, and click **Activate License**.
3. The status bar turns green: **Bridging**. No restart is needed.

- A license is for **one computer**. Activating on a second computer gives: *This license is already active on another computer.*
- On activation the license server issues a digitally signed license file for this computer, which the gateway checks offline. It re-checks online every 7 days; without internet it keeps working for up to 30 days after the last successful check. The License page shows the last online check. After updating from 1.1 or older, the gateway needs internet once to get its license file.
- If the license server says the key is invalid, revoked or used elsewhere, the key is removed and the gateway returns to trial mode.

Moving the license to another computer

1. On the old gateway, open **License** and click **Deactivate License** (shown when a license is active). This frees the license on the license server; bridging stops on that computer.
2. On the new computer, activate the key as above.

If the old computer no longer works, release it in the license portal with your key and purchase e-mail (up to 5 times in 30 days), or write to support@maxenergic.com. Lost the key? Request it again on the resend page.

18. Updates



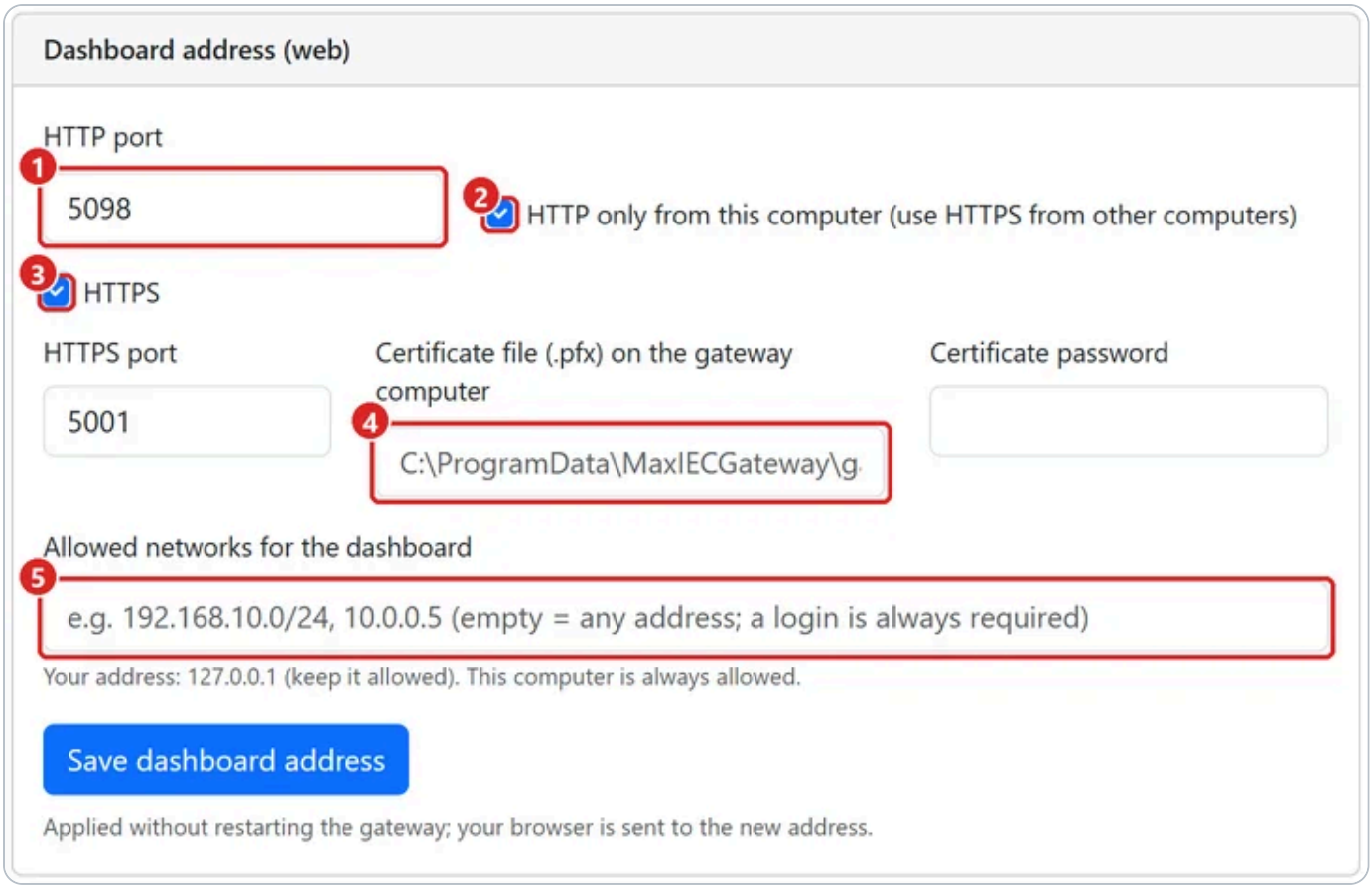
Settings: About and Check for Updates.

- The Dashboard shows a blue banner **Update Available!** when a new version exists. Or click **Check for Updates** in Settings → About.
- Download the new installer from the download page (the page lists SHA-256 checksums) and run it over the installed version. Configuration, license and password are kept.
- Linux: unpack the new tar.gz and run `sudo ./install-linux.sh` again.
- Updates are free for life for licensed customers.

19. Security

The gateway is often installed in an operational network. Use these protections:

Protection	Where	Recommendation
Dashboard password	Change password (top right)	At least 10 characters; do not reuse other passwords.
Allowed networks for the dashboard	Settings → Dashboard address	Enter the engineering network, e.g. `192.168.10.0/24`. Localhost is always allowed.
HTTPS	Settings → Dashboard address	Use a certificate (.pfx) when the dashboard is opened over the network.
IEC 104 allowed masters	Settings → IEC 104	List only the SCADA masters' IP addresses.
Windows Firewall	Installer options	Open 5000 (local subnet) and 2404 only if needed.
Select-before-operate	Settings → Command Options	Recommended for switching commands.



Settings: dashboard address, HTTPS and allowed networks.

1 HTTP port (default 5000).

2. HTTP only from this computer: other computers must use HTTPS.
3. HTTPS on/off.
4. Certificate file (.pfx) on the gateway computer, and its password.
5. Allowed networks for the dashboard.

> ⚠ **Important:** Click **Save dashboard address**. The change applies without a restart and your browser is sent to the new address. If you lock yourself out, open the dashboard on the gateway computer itself (`http://localhost:5000`): localhost is always allowed.

Users and roles

New in 1.3.0, off by default. With **Multi-user mode** on (Settings › Users, audit log and metrics), several people log in with their own account. The **admin** account stays and is always an Admin.

Role	Can do
Viewer	Read every page; change own password.
Operator	Viewer, plus enable/disable devices, clear traffic logs, re-apply saved settings, check the license online.
Admin	Everything: devices, mappings, settings, import/export, license, updates, users, alerts, metrics, audit log.

The **Users** page (Admin) adds users, changes roles, disables, resets passwords and deletes users; each change ends that user's open sessions.

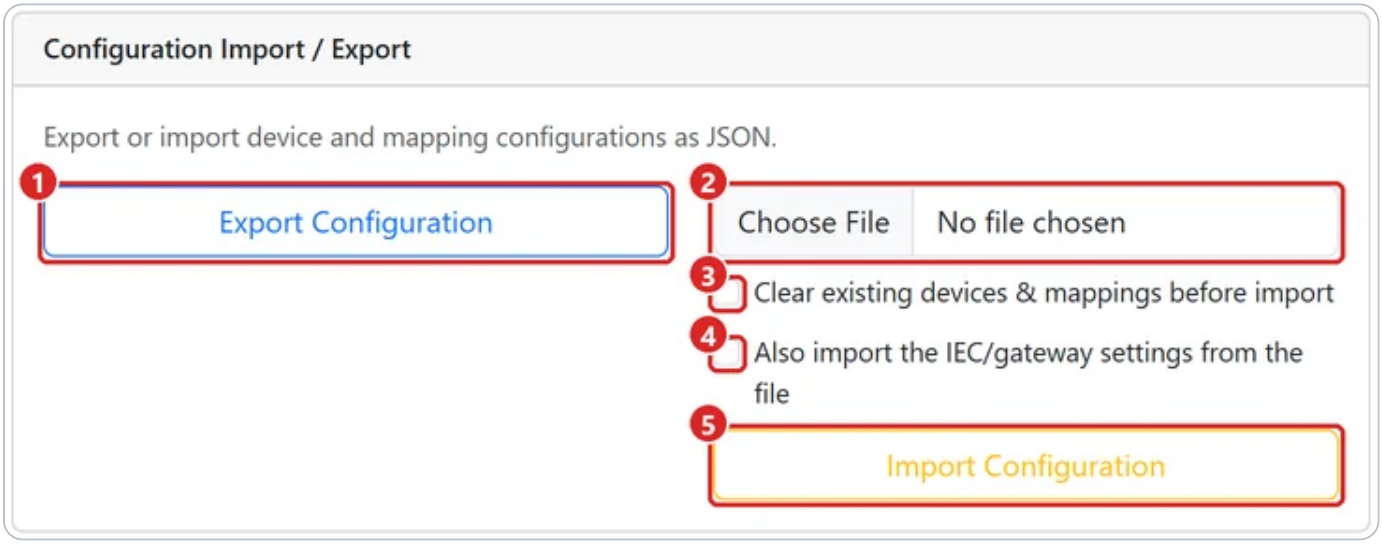
Audit log

New in 1.3.0, off by default; also works without multi-user mode. Records who did what, when and from which address: logins (also failed), logouts, settings changes (which fields; secrets only as "changed"), device and mapping changes, imports, license actions, user management and IEC commands from masters (CA, IOA, type, value, result). Keep 1-3650 days (default 90) and up to 100,000 entries. The **Audit log** page (Admin) filters by time, user, category, text and result and exports CSV. Entries cannot be edited.

Protected data folder

Since 1.3.0 the gateway limits the data folder to SYSTEM, Administrators and the service account at startup, and stores the HTTPS and TLS certificate passwords encrypted (Windows DPAPI, bound to this computer). After moving `web-settings.json` to another computer, enter the certificate password again. A gateway started by hand without "Run as administrator" uses the per-user folder.

20. Backup and restore



Settings: configuration import and export.

1. **Export Configuration**: downloads `gateway_config_<date>.json` with all devices, mappings and the gateway settings.
2. Choose an exported file to import.
3. Clear existing devices & mappings before import (otherwise the file is added).
4. Also import the IEC/gateway settings from the file.
5. **Import Configuration**.

- The import checks the whole file first and then applies it in one step: all or nothing.
- Export files of version 1.0 can be imported.
- The dashboard password and the license are not part of the export.

The data folder

File	Content
gateway.db	Devices, mappings, settings and history (SQLite)
logs\gateway-<date>.log	Log files, 7 days
license.key, license.lic, .trial	License key, signed license file and trial state
admin.json	Dashboard password (hashed)
web-settings.json	Dashboard address, HTTPS and allowed networks
setup-token.txt	One-time setup code (first start only)

Windows: `C:\ProgramData\MaxIECGateway` (Start menu: *Gateway data folder*). Linux: `/var/lib/maxiec-gateway`. To make a full copy, stop the service and copy the whole folder.

21. Troubleshooting

Problem	Possible cause	What to do
Dashboard does not open	Service not running; wrong port; firewall; address not in Allowed networks	Open `http://localhost:5000` on the gateway computer. Check the service. Check the firewall option and Settings → Dashboard address.
Service is missing or does not start	Installation was not run as administrator; port 5000 or 2404 used by another program	Run the installer again as administrator. Look at the log in the data folder. Stop the portable version if it is running.
IEC master connects and disconnects at once	Master uses T101 frames over TCP; wrong ASDU sizes; master not in Allowed masters	Set the master to IEC 104 (T104), CA 2 bytes, IOA 3 bytes, COT 2 bytes. Check the Connections tab.
Master gets no data / status bar is red	Trial session ended or license not valid	Restart the service (new trial session) or activate a license.
All points of a device are Invalid	Device offline, wrong IP/port/unit ID, wrong serial settings, cable	Check the Device Connections table and the Modbus tab of the Traffic page. Test the device with ModbusBB.
Some points Invalid, others Good	Address does not exist in the device (Modbus exception)	Check the addresses: 0-based, try ±1.
Values are wrong (very large or tiny)	Wrong register type, byte order or address	Try CDAB for floats; check Int vs UInt; check scaling.
Value changes are not sent	Deadband too large	Reduce the deadband or set it to None.
Command rejected	No select, select expired, not a command point, wrong IOA	See Why was my command rejected?
Command confirmed but nothing changes	Device ignores the write; wrong address	Check the Modbus tab and the device manual (write function, address).
Serial port busy / cannot open COM port	Another program uses the port; Linux user not in dialout group	Close the other program. On Linux run the installer again or add the user `maxiec` to `dialout`.
IEC server problem: port in use	Another program listens on 2404	Change the IEC 104 port or stop the other program.
"This license is already active on another computer"	The license is used on another computer	Deactivate it there, or release it in the license portal.

Problem	Possible cause	What to do
License stays "pending"	No internet access to iec.maxenergic.com (HTTPS)	Allow outgoing HTTPS, then click Check Now.

The log file is in the `logs` folder of the data folder (Linux: `sudo journalctl -u maxiec-gateway`). Send it with your question to support@maxenergic.com.

22. Frequently asked questions

Do I need to restart the gateway after changing a setting?

No. Every change applies immediately. Only the part that is affected restarts, see chapter 15.

Can several SCADA masters connect at the same time?

Yes, up to the Max Connections setting (default 10). Each master receives all data and can send commands.

Can IEC 104 and IEC 101 run at the same time?

Yes. Both serve the same points.

Does it support Modbus RTU?

Yes: Modbus RTU on a serial port (several devices per line) and Modbus RTU over TCP.

Are Modbus addresses 0-based or 1-based?

0-based. Register 40001 is address 0 with data type HoldingRegister.

Why do I get no energy counters in a general interrogation?

That is correct per IEC 60870-5: integrated totals are read with a counter interrogation (C_CI_NA_1).

Is select-before-operate supported?

Yes. Choose Select Before Execute in Settings → Command Options and set the select timeout (1-60 s).

Does the gateway change the computer clock?

Only if you choose "Also set this computer's clock". By default it only confirms and logs the offset.

What happens when the trial session ends?

The IEC servers and Modbus polling stop. Restart the service for a new 15-minute session, or activate a license.

How many computers can use one license?

One. You can move it to another computer at any time.

Appendix A. Supported ASDU types

Monitor direction (gateway → master):

Type	Name	Description
1	M_SP_NA_1	Single point
2	M_SP_TA_1	Single point, CP24 time (IEC 101)
3	M_DP_NA_1	Double point
4	M_DP_TA_1	Double point, CP24 time (IEC 101)
5	M_ST_NA_1	Step position
7	M_BO_NA_1	Bitstring of 32 bits
9	M_ME_NA_1	Measured value, normalized
11	M_ME_NB_1	Measured value, scaled
13	M_ME_NC_1	Measured value, short float
15	M_IT_NA_1	Integrated totals
30	M_SP_TB_1	Single point, CP56 time
31	M_DP_TB_1	Double point, CP56 time
32	M_ST_TB_1	Step position, CP56 time
33	M_BO_TB_1	Bitstring, CP56 time
34	M_ME_TD_1	Normalized, CP56 time
35	M_ME_TE_1	Scaled, CP56 time
36	M_ME_TF_1	Short float, CP56 time
37	M_IT_TB_1	Integrated totals, CP56 time

Control direction (master → gateway):

Type	Name	Description
45 / 58	C_SC_NA_1 / C_SC_TA_1	Single command
46 / 59	C_DC_NA_1 / C_DC_TA_1	Double command
48 / 61	C_SE_NA_1 / C_SE_TA_1	Set-point, normalized
49 / 62	C_SE_NB_1 / C_SE_TB_1	Set-point, scaled
50 / 63	C_SE_NC_1 / C_SE_TC_1	Set-point, short float
51 / 64	C_BO_NA_1 / C_BO_TA_1	Bitstring command (always direct)
100	C_IC_NA_1	General and group interrogation
101	C_CI_NA_1	Counter interrogation
102	C_RD_NA_1	Read command
103	C_CS_NA_1	Clock synchronization
104 / 107	C_TS_NA_1 / C_TS_TA_1	Test command

Not supported: the regulating step command C_RC_NA_1 (47) and the reset process command C_RP_NA_1 (105) get a negative confirmation. Parameter (P_*), file transfer and protection-equipment types are answered with COT 44 (unknown type).

Appendix B. Cause of transmission (COT) codes

COT	Name	Used for
1	Periodic / cyclic	Cyclic transmission of a point
3	Spontaneous	Value changes
5	Requested	Answer to a read command
6	Activation	Commands and interrogations from the master
7	Activation confirmation	Positive or negative answer to an activation
8	Deactivation	Cancel a select
9	Deactivation confirmation	Answer to a deactivation
10	Activation termination	Command or interrogation finished
20	Interrogated by station	Data in a general interrogation
21-36	Interrogated by group 1-16	Data in a group interrogation
37	Requested by general counter request	Counters in a counter interrogation
38-41	Requested by counter group 1-4	Counters of one group
44	Unknown type identification	Type not supported
45	Unknown cause of transmission	COT not allowed for this type
46	Unknown common address	No points with this CA
47	Unknown information object address	No point with this IOA

Appendix C. appsettings.json reference

Most settings are made in the dashboard. A few start-up options are in `appsettings.json` in the program folder (Windows: `C:\Program Files\Max IEC Gateway`, Linux: `/opt/maxiec-gateway`). Edit it with administrator rights and restart the service. The installer keeps your file on updates.

Key	Default	Meaning
Gateway:DataDirectory	(not set)	Other data folder. Default: C:\ProgramData\MaxIECGateway or /var/lib/maxiec-gateway.
Gateway:DatabasePath	gateway.db	Database file, relative to the data folder.
Gateway:SeedSampleDevice	true	Create a disabled example device in a new database.
Gateway:Iec104:BindAddress	(all addresses)	Listen for IEC 104 on one network card only, e.g. 192.168.10.5.
Gateway:Web:AllowedNetworks	[]	Addresses allowed to open the dashboard (also editable in Settings).
Gateway:Web:SessionTimeoutMinutes	60	Minutes of inactivity before a login expires.
Kestrel:Endpoints:Http:Url	http://0.0.0.0:5000	Dashboard address. An Https endpoint with a .pfx certificate can be added.
Serilog:MinimumLevel:Default	Information	Log detail: Debug, Information, Warning, Error.

ⓘ **Note:** The environment variable `MAXIEC_DATA_DIR` overrides the data folder.

Appendix D. Service and command-line reference

Task	Windows (administrator PowerShell)	Linux
Status	`Get-Service MaxIECGateway`	`sudo systemctl status maxiec-gateway`
Start	`Start-Service MaxIECGateway`	`sudo systemctl start maxiec-gateway`
Stop	`Stop-Service MaxIECGateway`	`sudo systemctl stop maxiec-gateway`
Restart (new trial session)	`Restart-Service MaxIECGateway`	`sudo systemctl restart maxiec-gateway`
Live log	Open the newest file in `C:\ProgramData\MaxIECGateway\logs`	`sudo journalctl -u maxiec-gateway -f`
Setup code	`type C:\ProgramData\MaxIECGateway\setup-token.txt`	`sudo cat /var/lib/maxiec-gateway/setup-token.txt`
Open the dashboard	`http://localhost:5000`	`http://<host>:5000`

Appendix E. Glossary

ACT_CON / ACT_TERM

Activation confirmation (COT 7) and activation termination (COT 10): the outstation's answers to a command.

APCI

The IEC 104 frame header with sequence numbers; controlled by k, w and t0-t3.

ASDU

Application service data unit: one IEC message with type, cause, common address and objects.

Byte order

The order of the bytes of a 32/64-bit value in Modbus registers (ABCD, CDAB, BADC, DCBA).

CA (common address)

Station address in an ASDU; usually 1.

COT

Cause of transmission: why a message is sent (spontaneous, interrogation, activation ...).

CP56Time2a

7-byte time tag with date and time to the millisecond (types 30-37).

Deadband

Minimum change before a measured value is sent again.

Double point

A position with two bits: OFF, ON, intermediate or faulty.

General interrogation (GI)

Request from the master for all current values (C_IC_NA_1, QOI 20).

Integrated totals

Counters such as energy (M_IT_*), read by counter interrogation.

IOA

Information object address: number of a data point.

IV / OV

Quality bits: invalid, overflow.

Master / outstation

The SCADA side (controlling station) and the gateway (controlled station).

Modbus RTU / TCP

Modbus on a serial line (RTU) or over Ethernet (TCP).

Select-before-operate (SBO)

Two-step command: select, then execute within the select timeout.

STARTDT / STOPDT

IEC 104 messages that start and stop data transfer on a connection.

Unit ID
Modbus slave address.