

# Modbus ↔ MQTT User Manual



**Field Devices**  
(Modbus RTU/TCP)

Network

**Cloud Platform**  
(MQTT Broker)

## Modbus <> MQTT Smart Gateway

請登入以管理閘道器

使用者名稱

密碼

登入

# Modbus ↔ MQTT Gateway — User Manual

This manual covers STD firmware v1.8.03-std. Every item was checked against the source that built this image (std-work branch, commit e798980) rather than written from memory. The ADV and DIO editions differ in features — do not use this manual for them.

## 1. Overview

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The T-7688 is an industrial gateway built on the MediaTek MT7688 (LinkIt 7688). It polls Modbus registers from field devices, converts them to MQTT messages for a broker, and is managed entirely from a browser.

| Item             | Detail                                                            |
|------------------|-------------------------------------------------------------------|
| Field protocols  | Modbus RTU / ASCII (2 serial ports), Modbus TCP (up to 4 targets) |
| Uplink           | MQTT 3.1.1 (mqtt / mqttts)                                        |
| Points           | Up to 64 (Point01 – Point64)                                      |
| Management       | HTTPS web UI, English / Traditional Chinese                       |
| Outage handling  | Offline queue (RAM or USB) with automatic catch-up on reconnect   |
| Device licensing | Digital signature binding the serial number to the Ethernet MAC   |

**Note:** Not included in the STD edition: digital I/O (DIO), Modbus TCP server, the Branding page, and the Live Values page.

## 2. Factory defaults and first connection

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Every install of this firmware returns the unit to the defaults below, regardless of what it was set to before:

| Item   | Factory value                 |
|--------|-------------------------------|
| LAN IP | 192.168.0.150 / 255.255.255.0 |

| Item              | Factory value                           |
|-------------------|-----------------------------------------|
| Gateway           | 192.168.0.1                             |
| DNS               | 1.1.1.1                                 |
| Web management UI | Enabled (port 8443)                     |
| SSH               | Disabled                                |
| Web login         | admin / password1234                    |
| Point runtime     | Enabled (polls and publishes from boot) |

#### Important DNS Note

The default resolver is 1.1.1.1, not 8.8.8.8. An earlier build shipped 8.8.8.8, which was unreachable on some site networks — the broker hostname stopped resolving and every publish failed. If the site has its own DNS, change it on the Network page.

## Connecting

1. Put your PC on the 192.168.0.x subnet (e.g. 192.168.0.100) and connect to the gateway's Ethernet port.
2. Open <https://192.168.0.150/> in a browser. Port 80 redirects to HTTPS and port 443 is forwarded to the real listener on 8443; <https://192.168.0.150:8443/> also works.
3. The certificate is self-signed, so the browser shows a security warning — choose to continue.
4. Sign in with admin / password1234, then change the password immediately on the System Overview page.

The UI language can be switched between English and 中文; the choice is stored in a browser cookie.

## 3. The interface

Eight pages in the left-hand navigation:

| Page            | Purpose                                                                                        |
|-----------------|------------------------------------------------------------------------------------------------|
| System Overview | Device status, communication status, time, firmware update, password, reboot, factory IP reset |
| Network         | Ethernet IPv4 settings and an outbound connectivity test                                       |
| WiFi            | Built-in WiFi AP (hotspot) settings                                                            |
| Serial / Modbus | Port 1 / Port 2 line settings and Modbus TCP targets                                           |
| MQTT            | Broker connection, credentials / TLS, offline queue, runtime status                            |
| Points          | Create and edit up to 64 Modbus points                                                         |
| MQTT Logger     | The last 100 publishes                                                                         |
| Help            | MQTT topic reference for the currently configured Prefix                                       |

## Save vs. Apply (important)

- **Save:** writes the on-screen settings to the device's configuration files, but the running process still uses the old settings.
- **Apply:** reloads the point runtime so the new settings actually take effect.

The Serial, MQTT and Points pages all work this way. The status line shows Unchanged / Unsaved browser changes / Saved on device; apply pending / Applied on device. Always press Apply after saving — Save alone changes nothing on the wire.

## 4. System Overview

### 4.1 Status cards

| Card          | Meaning                  |
|---------------|--------------------------|
| Gateway       | Management service state |
| System uptime | Time since boot          |

| Card             | Meaning                                          |
|------------------|--------------------------------------------------|
| Firmware Release | Should read v1.8.03-std                          |
| Product Model    | MB-MQ-ABS-STD-64 on the STD edition              |
| Storage          | USB mount state and free space, or "Not Mounted" |

## 4.2 Communication status (refreshes every 5 seconds)

Three cards for Port 1, Port 2 and MQTT, driven by the runtime's own telemetry:

- **Port 1 / Port 2:** shows Running / No response / Not configured, plus "Points online n/total". A point counts as online only when its state is online and the reading is not stale. A port with no enabled points shows "Not configured".
- **MQTT:** shows Connected / Error / Unknown, plus cumulative "Publishes ok / failed".

If the runtime is not running (invalid licence, no points configured, and so on), all three cards read "Status unavailable".

## 4.3 System Time

Current Time and RTC state (Not installed / Not detected / Operating normally / Clock not advancing / Voltage-loss flag set).

Sync with browser — sets the device clock from this PC and writes it to the RTC when one is present.

Verify operation — checks that the RTC clock is genuinely advancing.

Enable NTP plus NTP server address — requires outbound internet access.

Daily reboot — NONE, or an automatic reboot at a fixed hour (00:00 – 23:00).

### Hardware Warning

"Voltage-loss flag set" means that unit's RTC backup battery is dead and its time cannot be trusted. That is a hardware fault, not a configuration problem.

## 4.4 Firmware update

Backup current firmware downloads the running firmware to a file.

Upload and flash takes a .bin file, asks for confirmation, and shows an upload and flashing progress bar.

### Warning

An invalid file can leave the device unable to boot. The upload immediately reflashes and reboots the device — never cut power during this. After the update the unit returns to the factory defaults in section 2 (IP back to 192.168.0.150, SSH off), so make sure someone can physically reach the device first.

## 4.5 Change password

Requires the current password and the new one twice. The new password must be at least 8 characters and must differ from the current one. You are signed out afterwards.

## 4.6 Finish setup & restrict access

A shipping-hardening switch. Once enabled: from the next boot, the web management interface (ports 80 / 443 / 8443) is reachable only for 60 seconds after boot, then closes automatically. Power-cycle the device to open another 60-second window.

The switch can be turned back off ("Disable restriction"), which restores permanent access. Holding Reset for 30 seconds also clears it.

## 4.7 Reboot now

After confirmation the device restarts within a few seconds. Polling and MQTT publishing stop for about a minute, and unsaved configuration changes are lost.

## 4.8 Reset to Factory (IP)

Reverts only the LAN IP to 192.168.0.150/24 and clears the access-restriction flag. It does not wipe MQTT, points, passwords or the licence. The network restarts and the current session drops — reconnect at the new address.

## 5. Network

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### 5.1 Current status

Shows interface, link state, MAC address, physical link, link speed, duplex, and received / transmitted bytes.

### 5.2 IPv4 settings

| Field                            | Notes                                                                                                                 |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Hostname                         | Letters, digits and hyphens, up to 63 characters                                                                      |
| IPv4 mode                        | Static or DHCP client                                                                                                 |
| IPv4 address / Netmask / Gateway | Required in static mode                                                                                               |
| Primary DNS                      | Should be filled in — if it is missing the whole Network page reports the configuration as unusable and will not load |
| Secondary DNS                    | Optional                                                                                                              |

In DHCP mode the address comes from the DHCP server; after applying you must find the new lease yourself to reconnect.

### 5.3 Safe apply

Apply opens a confirmation panel showing the new management URL and starts a countdown: you must sign in and confirm at the new address before the countdown expires, or the old settings are restored automatically. This prevents a bad setting from stranding the device. You have to accept the self-signed certificate warning at the new address; the old IP's login cookie is not reused.

### 5.4 Internet connectivity test

Enter a host / IP and port (for example 1.1.1.1 : 53, or your broker's address and 1883) and press Test. The device reports whether it can actually reach that host and how long it took. When MQTT keeps failing, use this first before suspecting the MQTT settings.

## 6. WiFi

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Configures the built-in WiFi in AP (hotspot) mode: enable switch, SSID, WPA2 passphrase, country code.

Leaving the passphrase blank keeps the currently configured one.

The WiFi IP address and netmask are shared with the Network page's LAN settings and are not configured here.

The status area shows MAC address, active state, IP, netmask and gateway.

## 7. Serial / Modbus

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Three tabs: Port 1, Port 2 and Modbus TCP.

### 7.1 Port 1 / Port 2 (serial)

| Item               | Port 1     | Port 2     |
|--------------------|------------|------------|
| Physical interface | RS232      | RS485      |
| Device node        | /dev/ttyS0 | /dev/ttyS1 |

Both ports are configured independently:

| Field     | Values                                |
|-----------|---------------------------------------|
| Protocol  | ascii / rtu                           |
| Baud      | 9600 / 19200 / 38400 / 57600 / 115200 |
| Data bits | 7 / 8                                 |
| Parity    | N / E / O                             |
| Stop bits | 1 / 2                                 |

The protocol is selectable per port (since v1.7.22). Earlier firmware hardcoded Port 1 to ASCII and Port 2 to RTU; both are now free to change.

## 7.2 Modbus TCP

Four targets, Socket1 – Socket4, each with:

| Field                   | Range                |
|-------------------------|----------------------|
| Enabled                 | Yes / No             |
| Host / IP               | Up to 253 characters |
| Port                    | 1 – 65535            |
| Connection timeout (ms) | 100 – 10000          |
| Reconnect interval (ms) | 100 – 86400000       |

A point uses one of these targets by selecting Socket1 – Socket4 as its Media.

## 8. MQTT

### 8.1 Runtime status

Refreshes every 5 seconds (or on Refresh) and shows: point runtime state, MQTT connection state, queue bytes and percentage used, recent enqueue rate, estimated remaining buffer time, which limit is projected to be hit first, the overflow policy (oldest queued records are discarded first), publishes successful / failed / replayed / dropped / corrupt, last successful publish time, and the last error.

### 8.2 Connection settings

| Field     | Notes / range                                                                                                                   |
|-----------|---------------------------------------------------------------------------------------------------------------------------------|
| Host / IP | Broker address, up to 253 characters. Factory value 0.0.0.0 — this field cannot be blank and must be changed to the real broker |
| Port      | 1 – 65535, factory value 1883                                                                                                   |
| Client ID | Up to 127 characters, factory value t7688-points. Must be unique per device on the same broker                                  |

| Field                | Notes / range                                                                        |
|----------------------|--------------------------------------------------------------------------------------|
| Keepalive (seconds)  | 10 – 65535, factory value 30                                                         |
| Publish timeout (ms) | 100 – 10000, factory value 5000                                                      |
| Prefix               | First segment of every topic. Must not be blank, or the point runtime will not start |

## 8.3 Username / TLS

| Field                              | Notes                                                                   |
|------------------------------------|-------------------------------------------------------------------------|
| Protocol                           | mqtt (TCP) or mqtts (TLS 1.2+)                                          |
| Username / Password                | Broker credentials. The password is write-only and is never shown again |
| Clear password                     | Tick and save to erase the stored password                              |
| Server name / SNI                  | Server name used for TLS certificate validation                         |
| CA certificate                     | Upload a private CA (PEM / CRT / CER) with the "Upload CA" button       |
| Client certificate / Client key    | For mutual TLS (mTLS), each with its own upload button                  |
| Clear CA / Clear client cert / key | Tick and save to erase that file                                        |

When mqtts is selected and no CA has been uploaded, the firmware falls back to its built-in public CA bundle (Mozilla CA bundle), so brokers using a public certificate (Let's Encrypt and similar) need no CA upload. Only private or self-signed CAs do.

## 8.4 Store and forward

| Field                | Notes                                                            |
|----------------------|------------------------------------------------------------------|
| Enable offline queue | Failed publishes are queued and replayed after the link recovers |

| Field                             | Notes                                                                                                 |
|-----------------------------------|-------------------------------------------------------------------------------------------------------|
| Use USB storage for offline cache | Switches the queue to /usb/gatewayd-spool. /usb must already be mounted or the runtime fails to start |
| Maximum queued bytes              | Capped at 4 MB without USB, 256 MB with USB                                                           |
| USB space usage                   | With USB the cap is set as a percentage (1 – 100%); the slider shows the equivalent size              |
| Replay budget per cycle           | 1 – 64 records replayed per poll cycle                                                                |
| Fixed spool directory             | Read-only: /tmp/gatewayd-spool or /usb/gatewayd-spool                                                 |

### Storage Warning

In RAM mode the queue is lost on reboot or power loss (/tmp is memory). Use USB mode when offline data must survive a restart. Capacity is not a fixed duration — point count, poll intervals and payload size all change how long the queue lasts. When full, the oldest records are discarded first.

## 9. Points

Up to 64 points, automatically identified as Point01 – Point64. The toolbar can Import / Export the whole set as JSON, which makes it easy to clone a configuration across identical machines.

### 9.1 Fields

| Field           | Notes / range                                         |
|-----------------|-------------------------------------------------------|
| Enabled         | Disabled points are not polled                        |
| Name / Topic    | Up to 48 characters; used directly as a topic segment |
| Media           | Port 1 (RS232) / Port 2 (RS485) / Socket1 – Socket4   |
| Slave / Unit ID | 1 – 247                                               |
| Modicon address | 5 digits, see the table below                         |

| Field              | Notes / range                                                          |
|--------------------|------------------------------------------------------------------------|
| Data type          | BIT / INT16 / UINT16 / INT32 / UINT32 / FLOAT32                        |
| Byte / word order  | Constrained by the data type (see below)                               |
| Scale / Offset     | Decimal strings; final value = raw × scale + offset                    |
| Read length        | 1 – 32 (max 16 for 32-bit types) — how many consecutive values to read |
| Poll interval (ms) | 100 – 86400000                                                         |
| QoS                | 0 / 1 / 2                                                              |
| Retain             | Yes / No                                                               |

Name rules: /, + and # are not allowed. Duplicate names would share one topic, so the UI blocks them.

## 9.2 Modicon address mapping

| Address prefix | Table            | Modbus function |
|----------------|------------------|-----------------|
| 0xxxx          | Coil             | FC1             |
| 1xxxx          | Discrete Input   | FC2             |
| 3xxxx          | Input Register   | FC4             |
| 4xxxx          | Holding Register | FC3             |

- 0xxxx / 1xxxx are valid only with data type BIT and byte order N/A.
- 3xxxx / 4xxxx accept INT16 / UINT16 / INT32 / UINT32 / FLOAT32.
- Byte order: 16-bit types allow only AB; 32-bit types allow ABCD / BADC / CDAB / DCBA.
- The read-only derivation line under the editor shows the result live: table, function, start address and quantity. An invalid combination shows "Invalid address, data type, or endian combination" and the point cannot be saved.

Start address = last four digits – 1 (so 40001 gives start address 0). Quantity = read length × (2 for 32-bit types, otherwise 1), capped at 32 registers, and "last four digits + quantity – 1" must not exceed 9999.

## 9.3 Read test

While editing a point, Read test performs a real read using the values currently on screen — no need to save first. It reports success or failure, the raw value and the scaled value. It also works on a brand-new unit where the point runtime has never been started.

# 10. MQTT topics (Help page)

<Prefix> is the prefix set on the MQTT page; <Name> is the point name.

## Publish (device → broker)

| Topic                           | Payload                                                                       | Description                                            |
|---------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------|
| <Prefix>/Register/<Name>        | {"point":"...", "name":"...", "raw":N, "data":N, "timestamp":N, "sequence":N} | Register value, published on the point's poll interval |
| <Prefix>/Register/<Name>/status | {"point":"...", "status":"online" or "offline"}                               | Published when a point comes online or goes offline    |
| <Prefix>/Registers/Back         | {"point":"...", "name":"...", "raw":N, "data":N,...}                          | Data buffered                                          |

| Topic              | Payload         | Description                                             |
|--------------------|-----------------|---------------------------------------------------------|
|                    |                 | while offline, republished after reconnecting           |
| <Prefix>/heartbeat | {"timestamp":N} | Liveness signal every 5 seconds, independent of polling |

## Subscribe patterns

| Pattern                 | What you receive                             |
|-------------------------|----------------------------------------------|
| <Prefix>/Register/#     | All points' values and online/offline status |
| <Prefix>/Register/+     | Point values only (excludes /status)         |
| <Prefix>/Registers/Back | Catch-up data only                           |

Only data that genuinely failed to publish live and got queued uses Registers/Back. Data that never failed will not appear on that topic.

## A note on QoS (important)

Points can be set to QoS 0, 1 or 2, but the highest QoS actually used on the wire is 1. A point set to QoS 2 additionally carries the DUP flag when replayed — hardened duplicate marking, not MQTT

exactly-once delivery. If strict exactly-once semantics are required, de-duplicate upstream (the payload's sequence field is there for that).

## 11. MQTT Logger

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Shows the last 100 MQTT publishes, newest first: time, topic, QoS (R marks retain), result (Sent / Failed (spooled)) and payload.

- Payloads longer than 256 characters are truncated.
- The log is cleared on reboot (it lives in memory only).
- If the point runtime is not running, or nothing has been published yet, the page shows "No log yet".

## 12. The physical Reset button

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Hold the Reset button down; the action depends on how long you hold it, with the WiFi status LED as feedback:

| Hold duration        | Action                                                                                | LED            |
|----------------------|---------------------------------------------------------------------------------------|----------------|
| Released before 30 s | Nothing happens, normal state restored immediately                                    | Off            |
| 30 s                 | LAN IP reverts to 192.168.0.150/24, access-restriction flag cleared, network restarts | Turns solid on |
| 30 – 60 s            | —                                                                                     | Blinking       |
| 60 s                 | SSH forced on (recovery)                                                              | Blinking       |
| 60 – 90 s            | —                                                                                     | Blinking       |
| 90 s                 | SSH forced off                                                                        | Turns solid on |

A 30-second hold is the standard rescue when a unit is unreachable because of a wrong IP or an active access restriction. For on-site debugging, hold 60 seconds to enable SSH, then hold 90 seconds to disable it again when finished.

## 13. Device licensing

Each unit ships with a licence file containing a digital signature (ECDSA P-256 / SHA-256) over its serial number plus that unit's Ethernet MAC. At startup the point runtime verifies it:

- Signature valid and the licensed MAC matches the unit's actual MAC → normal start.
- Licence missing, malformed, wrongly signed, or bound to a different MAC → the runtime refuses to start (fail-closed) and performs no Modbus polling or MQTT publishing.

Copying a licence file to another device therefore does not work. The web UI still signs in normally, but the Communication status cards and the MQTT page will keep reporting "Status unavailable".

## 14. Troubleshooting

| Symptom                                     | What to check                                                                    |
|---------------------------------------------|----------------------------------------------------------------------------------|
| Unreachable at old IP after firmware update | Every install returns to 192.168.0.150 — connect there                           |
| Browser warns cert not trusted              | Expected with self-signed cert; accept manually                                  |
| Network page will not load                  | Gateway or Primary DNS is unset; fill them in                                    |
| Saved points had no effect                  | Only Save was pressed — press Apply as well                                      |
| Communication status "Status unavailable"   | Runtime not running: check licence, non-blank Prefix, enabled points             |
| Service fails after USB spool enabled       | /usb is not mounted — mount drive or switch to RAM mode                          |
| Every MQTT publish fails                    | Test host/port with Internet Connectivity test, check DNS, credentials, TLS      |
| Port shows "No response"                    | Enabled points exist but none read: check baud/parity/protocol, wiring, slave ID |
| Port shows "Not configured"                 | No enabled points assigned to that port                                          |
| Wrong time, RTC voltage loss                | RTC battery dead. Sync with browser or enable NTP                                |

| Symptom                    | What to check                                                    |
|----------------------------|------------------------------------------------------------------|
| UI closes ~60 s after boot | Restrict access enabled. Reboot for 60s window or hold Reset 30s |

## 15. Appendix: limits at a glance

| Item                    | Value                                                                |
|-------------------------|----------------------------------------------------------------------|
| Maximum points          | 64                                                                   |
| Point name length       | 48 characters (no / + #)                                             |
| Slave / Unit ID         | 1 – 247                                                              |
| Read length             | 1 – 32 (16 for 32-bit types); derived register quantity capped at 32 |
| Poll interval           | 100 ms – 86400000 ms                                                 |
| Serial baud rates       | 9600 / 19200 / 38400 / 57600 / 115200                                |
| Modbus TCP targets      | 4 (Socket1 – Socket4)                                                |
| MQTT keepalive          | 10 – 65535 s                                                         |
| MQTT publish timeout    | 100 – 10000 ms                                                       |
| Queue cap (RAM)         | 4 MB                                                                 |
| Queue cap (USB)         | 256 MB, or a percentage of free space                                |
| Replay budget per cycle | 1 – 64                                                               |
| MQTT log                | 100 entries, payloads truncated at 256 characters                    |
| Heartbeat interval      | 5 s                                                                  |
| Web password length     | 8 characters minimum                                                 |
| Management port         | 8443 (443 forwarded, 80 redirected to HTTPS)                         |

*This document describes firmware v1.8.03-std. Later firmware may change behaviour — always check the version reported by the device itself.*