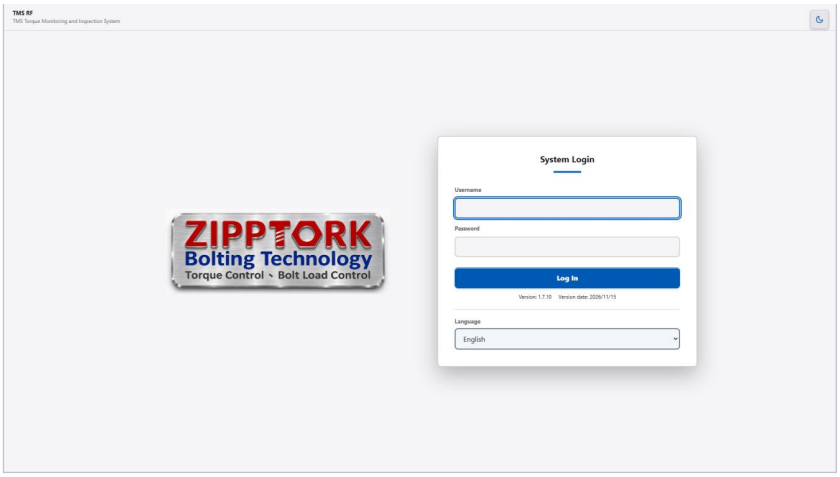
TMS RF

TMS Torque Monitoring and Inspection System

Software Installation and Operation Manual

English Edition



Applies to TMS RF 1.7.10 (Windows x64)

Supported platforms: Windows 10 / Windows 11, 64-bit PC

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Safety Instructions

- Follow the safety rules of the tool manufacturer and the factory when applying torque. TMS RF is only a measurement and recording tool; it does not control or cut off the power of external machinery.
- If a sensor shows an overload, a zero-point fault or a hardware error, stop using it immediately and send it for calibration or repair.
- Do not leave the work screen, change parameters or unplug the RF receiver while torque is being applied.
- Use sensors within their specified range and calibrate them regularly according to the calibration interval.
- Before you start work, confirm that the sensor, target torque, tolerance and unit are all correct; a wrong unit leads to wrong judgements.
- Do not run the installed version and the portable version at the same time, and do not open two TMS RF windows on the same computer.
- Modbus TCP and Open Protocol have no encryption or authentication and may only be used on a controlled factory local area network.
- Always back up your data before you upgrade, uninstall, or select “Delete the application data”; deleted data cannot be recovered.
- After your first login, change the password of the default administrator account `admin` immediately.

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Chapter 1 Product Overview and Safety Instructions

1.1 System Introduction

The TMS RF torque monitoring and inspection system (screen title “TMS Torque Monitoring and Inspection System”, hereafter TMS RF) is torque measurement software installed on a Windows computer. The computer connects to an RF 2.4G receiver over USB and receives torque and angle data from torque sensors wirelessly. TMS RF shows readings and curves in real time, judges OK/NOK automatically against the target and tolerance you set, and saves every work result in a database on the computer. You can query, export and synchronize the results, or provide them to PLCs and host systems over Modbus/Open Protocol.

This manual covers everything from system requirements, installation and first login to the operating steps for every screen, field and button, with examples. It is intended for operators, QC staff and system administrators.

1.2 Main Functions

Function	Description	See
Torque Wrench	Judges OK/NOK by the peak torque during torque application. For manual torque wrenches.	Chapter 5
Torque & Angle	Judges OK only when both torque and rotation angle reach their targets. For tightening that requires angle control.	Chapter 6
Torque Inspection	Counts the angle from “Target Torque (Angle Start)” and takes the torque value at the target angle for judgement.	Chapter 7
Power Tool	Measures the torque of power tools such as pulse and clutch tools, and shows tool information such as the pulse count.	Chapter 8
Batch Jobs	Combines several steps (modes can be mixed) into a workflow that the operator completes in order.	Chapter 9
Capability indices	Collects samples and calculates indices such as Cp and Cpk to evaluate tool or process capability.	Chapter 10
Records and export	Query by date and conditions, view details and curves, export CSV/Excel.	Chapter 11
System Settings	Units and language, sensor pairing, torque factor, torque multiplier, indicator light, error history.	Chapter 12
Communication settings	Modbus TCP, Modbus RTU and Open Protocol for exchanging results and commands with a PLC.	Chapter 13
Sync and read API	Synchronizes records to an external database or gateway; provides a local read-only API.	Chapter 14
Users and permissions	Three permission templates (A/B/C, see Section 1.4) plus per-user adjustment; every record can be traced to the operator.	Chapter 15

1.3 Work Modes at a Glance

The “Rotary Sensor” group in the left navigation menu contains five tightening/measurement modes, and the “Tool Capability” group contains the capability index test.

Navigation menu name	Judgement focus	Typical use	Chapter
Torque Wrench	Judged by peak torque	Tightening checks and spot checks with manual torque wrenches	Chapter 5
Torque & Angle	Torque and angle must both reach their targets	Tightening that requires rotation angle control	Chapter 6
Torque Inspection	Takes the torque value when the target angle is reached	Torque measurement started by angle	Chapter 7
Power Tool	Judges the pulse count first, then the peak torque	Power tools such as hydraulic pulse and clutch tools	Chapter 8
Batch Jobs	Multiple steps in order; only OK results are counted	Several bolts or several steps on one workpiece	Chapter 9
Tool Inspection	Calculates process capability such as Cpk/Cmk	Incoming inspection of new tools, periodic capability tests	Chapter 10

1.4 Roles and Permissions Overview

Every account uses one of three permission templates, shown on screen as the roles “Admin”, “Supervisor” and “User” and called A, B and C in this manual; an administrator can also turn individual functions on or off for each user.

Template	Intended for	What it can do (default)
A	System administrators	All functions, including managing users, server and sync settings.
B	Engineers, QC staff, shift leaders	Adjust work parameters, pair sensors, calibrate, change file and communication settings; can view the user list but cannot edit users or server/sync settings.
C	Shop-floor operators	Run work, view work and system settings, view and export records, run capability tests; cannot change work parameters, pairing or calibration.

For the full function list, template defaults and how to adjust each user, see Chapter 15.

1.5 System Architecture and Data Storage

TMS RF data flows in the order shown in the table below:

Order	Stage	What it does	Link to the next stage
1	Torque sensor	Torque wrench, power tool or angle-torque sensor measures torque and angle	RF 2.4G wireless
2	RF receiver	Receives sensor data	USB
3	Windows computer (TMS RF)	Measurement display, judgement, records, export	Ethernet/RS-485 (optional)
4	PLC/host system	Reads results, sends commands	—

- All data (accounts, settings, sensors, work records) is stored in the application data folder of the current Windows user. The installed version and the portable version share the same data (see Section 2.7).
- A sensor must first be paired in “System Settings → Sensor Pairing” before a work mode can use it. After a fresh installation the sensor list is empty.
- Communication (PLC), sync (database/gateway) and the read API are optional. Local work is not affected if you do not set them up.

> **Tip** The USB connection of the RF receiver, the wireless link between sensor and receiver, and the sensor's own power are three different things. A powered receiver does not mean that sensor data is being received. Rely on the sensor status shown in TMS RF.

1.6 Safety Instructions

> **Warning** TMS RF only measures, judges and records; it does not control or cut off the power of external machinery. The selection, calibration and safe operation of torque tools, sensors and torque multipliers must still follow the manufacturer's manuals and site rules. An OK judgement does not mean that the tool is calibrated or that the fastener meets the design requirements.

- Before you start work, confirm that the selected sensor, target torque, tolerance and unit are all correct; a wrong unit leads to wrong judgements.
- If a sensor shows an overload, a zero-point fault or a hardware error, stop using it immediately and send it for calibration or repair (see Section 12.7).
- Do not switch screens, change parameters or unplug the receiver while torque is being applied. When you leave the work screen, the torque application in progress is not saved.
- Do not run the installed version and the portable version at the same time, and do not open two TMS RF windows on the same computer (both share the same data).
- Write commands to a PLC or test communication only in a state that does not affect production. Modbus TCP and Open Protocol have no encryption or account authentication and may only be used on a controlled factory local area network.

- Finish any work in progress before you manage accounts or change permissions; a permission change requires that account to log in again.
- Before you upgrade or uninstall, close the program and back up your data (see Chapter 17).

1.7 How to Read This Manual

- Names of buttons, fields and options on the screen are shown in quotation marks, for example “Log In” and “Save Settings”.
- Buttons that have only an icon and no text are described by their icon, for example “← (Back)” and “Gear (Settings)”.
- Operating steps are numbered 1, 2, 3; perform them in order. Each step is followed by the result you see on the screen.
- Paths use “→” to show the click order, for example “Navigation menu → ‘System Settings’ → ‘Sensor Pairing’”.
- The sensors, accounts, stations and values in the screenshots are examples; the actual content depends on your settings. Screenshots were captured at 1920×1080; the actual screen adapts to your screen resolution and window size.

This manual uses the following callout boxes:

Tip Additional information or operating tips.

Note Items that are easy to get wrong and need special attention.

Warning Items related to personal safety, data loss or irreversible actions. Always follow them.

Example Shows an operation or calculation with real values.

Chapter 2 System Requirements and Installation

This chapter describes what the computer needs, how to choose an installation method, how to install step by step, and what to do at first startup.

2.1 System Requirements

TMS RF is a 64-bit Windows desktop application. The following conditions are required to run it. If any of them is not met, TMS RF cannot be installed or its screen cannot open:

Item	Requirement	Description
Operating system	Windows 10 or Windows 11 (64-bit)	32-bit Windows is not supported.
Microsoft Edge WebView2 Runtime	Required	The TMS RF screens are displayed by WebView2. Windows 11 usually includes it; if it is missing, the offline installer can install it automatically (see Section 2.2).
Installation rights	A standard user is enough	TMS RF is installed in the current user's folder; administrator rights are not required.
Disk space	About 19 MB for the program, plus space for data	Work records keep growing; keep at least 1 GB of free space.

Recommended specifications (operating recommendations, not enforced by the program):

Item	Recommendation
Processor	Intel Core i3/AMD Ryzen 3 or better
Memory	8 GB or more
Display	1920×1080 or higher; minimum recommended 1366×768
USB ports	At least 1 for the RF receiver; additional ports are needed for a USB indicator light or a USB to RS-485 converter
Network	Required for Modbus TCP, Open Protocol, sync, or for the standard installer to install WebView2

Peripherals:

Device	Purpose	See
RF 2.4G receiver	Plugs into a USB port of the computer and communicates wirelessly with sensors	Section 12.3
Torque sensor	Wireless device that actually measures torque or angle. Fully charge it before use and confirm that it is within its calibration period	Section 12.3
Indicator light (optional)	Signals OK/NOK with lights; connected through a COM port	Section 12.6
USB to RS-485 converter (optional)	Required for Modbus RTU communication with a PLC	Section 13.3

2.2 Choosing an Installation Method

TMS RF is provided as three files. All three have exactly the same program functions; they differ only in whether anything is installed and how the WebView2 Runtime is obtained:

File	File name	Size (approx.)	WebView2 Runtime
Offline installer	`TMS RF_1.7.10_x64-offline-setup.exe`	304 MB	Contains the full WebView2 installer; installs it automatically if the computer lacks it. No network needed
Standard installer	`TMS RF_1.7.10_x64-setup.exe`	6 MB	If the computer lacks it, a network connection is needed during installation to download it
Portable program	`ZIPPTORK TMS RF Portable.exe`	19 MB	Nothing is installed; the computer must already have WebView2

Which one to choose:

1. The production-line computer has no network, or you are not sure whether WebView2 is present: use the **offline installer**.
2. The computer can connect to the network and you want a smaller file: use the **standard installer**.
3. You do not want shortcuts and an uninstall entry and just want to run the program: use the **portable program**, but the computer must already have WebView2.

> **Note** The portable program does not carry its data with it. It reads and writes data in the same location as the installed version (see Section 2.7). If you run it from a USB flash drive, the data is still stored on this computer.

2.3 Method 1: Install with an Installer

This section applies to both the offline installer and the standard installer; their installation screens are the same.

2.3.1 Before You Install

1. Obtain the installer from your supplier and ask IT to approve running it according to company policy (the installer has no digital signature; see Section 2.5).
2. Check the file integrity: `SHA256SUMS.txt` next to the installer lists the SHA-256 value of each file. Calculate the value with PowerShell and compare (see the example in Section 2.5).
3. If TMS RF is already on the computer: finish work, log out and close the program first, then back up your data as described in Chapter 17. For the installation screens during an upgrade, see Section 17.4.
4. Close other applications you do not need.

2.3.2 Installer Language

The installer includes 16 languages (the same as the TMS RF interface languages) and **selects one automatically from the Windows display language**; no language selection window appears. If the Windows display language is not one of the 16, English is used. The installer language affects only the installation screens; the TMS RF interface language after startup is determined by the rules in Section 3.4.

2.3.3 Installation Steps

1. Double-click the installer. If a Windows security warning appears, handle it as described in Section 2.5. You see the welcome page “Welcome to TMS RF Setup” in the “TMS RF Setup” window.

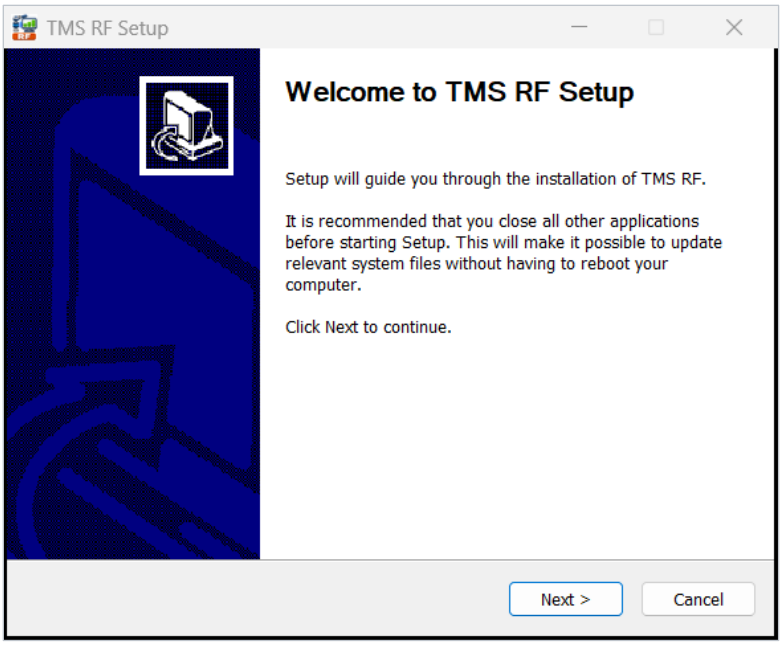

Figure 2-1 Setup wizard welcome page

2. Click “Next >”. You see the “Choose Install Location” page. “Destination Folder” defaults to the current user's `%LOCALAPPDATA%\TMS RF` (for example `C:\Users\UserName\AppData\Local\TMS RF`). “Space required” and “Space available” are shown below it.

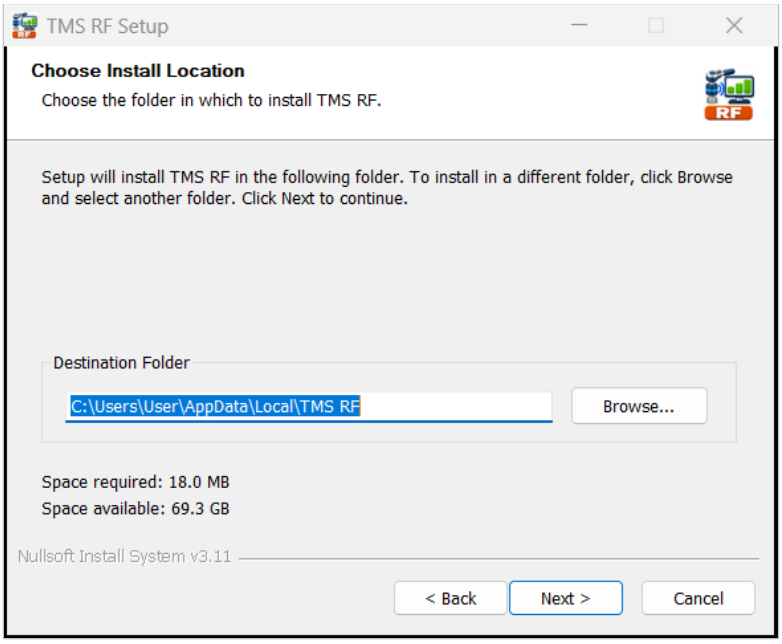

Figure 2-2 Choose Install Location

3. In most cases, use the default folder. To install to another location, click “Browse...” and select a folder.

Note On this page, clicking “Next >” **starts the installation immediately**; no confirmation page follows. Make sure the destination folder is correct before you click it.

4. Click “Next >” to start the installation. You see “Installing / Please wait while TMS RF is being installed.” and a progress bar. Installation usually takes only a few seconds. If you use the standard installer and the computer lacks WebView2, WebView2 is downloaded and installed first; this takes longer and requires a network connection.

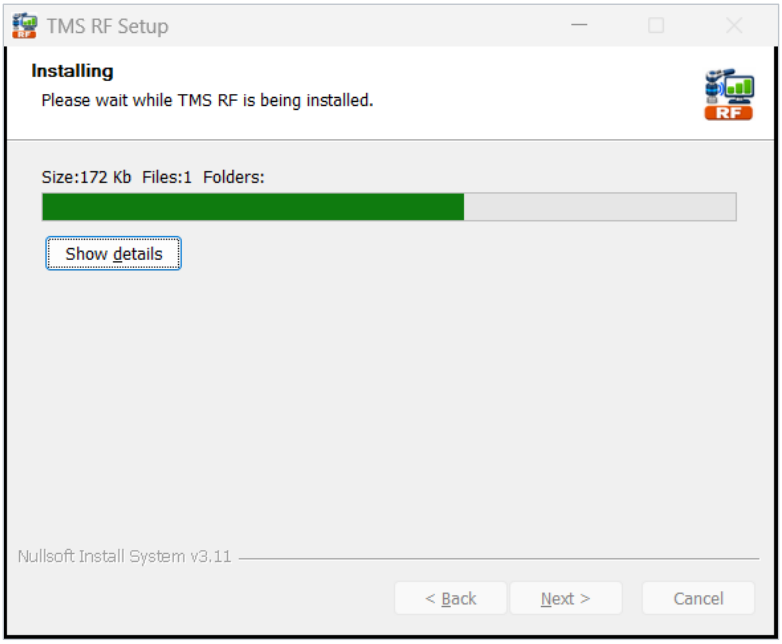

Figure 2-3 Installing

5. When the installation is finished, the heading changes to “Installation Complete / Setup was completed successfully.” and the progress bar shows “Completed”. Click “Next >”.

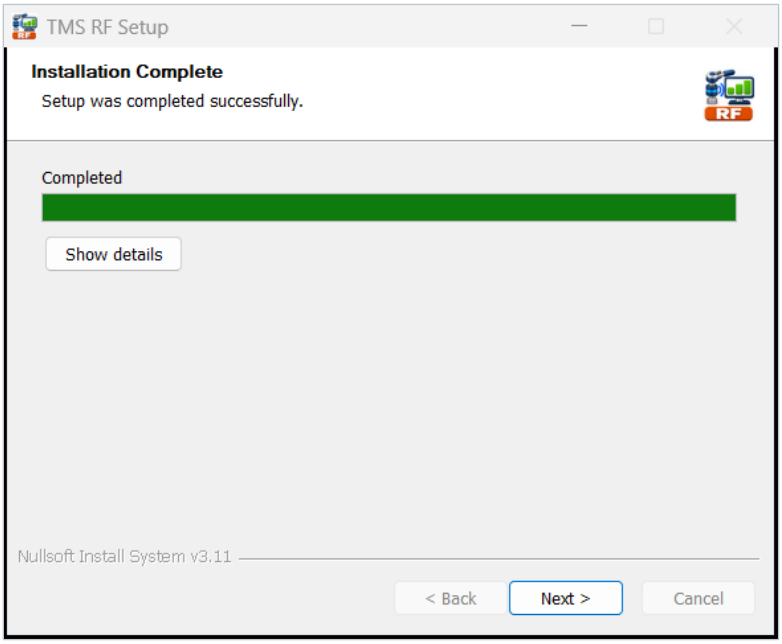

Figure 2-4 Installation complete

6. You see the “Completing TMS RF Setup” page with two options, both selected by default:

Option	Description
Run TMS RF	Starts TMS RF immediately after you click “Finish”.
Create desktop shortcut	Creates a “TMS RF” shortcut on the desktop. Clear it if you do not need it; the Start menu shortcut is always created.

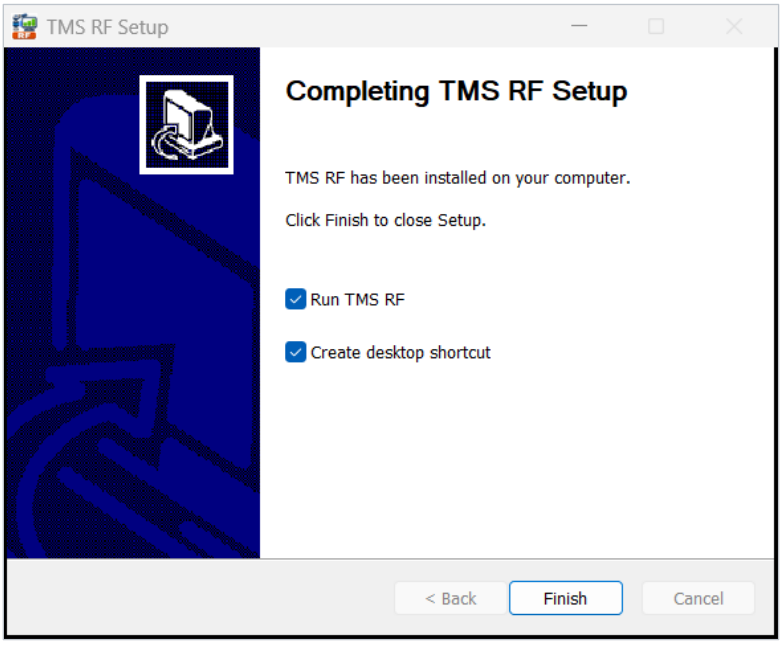

Figure 2-5 Completing setup

7. Select the options you need and click “Finish” to close the installer. If “Run TMS RF” is selected, TMS RF starts automatically; continue with Section 2.6.

> **Example** Engineer Wang installs TMS RF on a production-line computer (no network):
> ① Copy `TMS RF_1.7.10_x64-offline-setup.exe` to the computer, get IT approval, and double-click it.
> ② On the welcome page click “Next >” → keep the default installation location → click “Next >” to start the installation.
> ③ When “Completing TMS RF Setup” appears, keep both options selected and click “Finish”. The “TMS RF” icon appears on the desktop, and the program opens automatically and shows the login screen. Installation is complete.

2.3.4 Items Created by the Installation

Item	Location
Program folder	`%LOCALAPPDATA%\TMS RF` (contains `static-torque-tauri.exe` and the uninstaller `uninstall.exe`)
Start menu	“Start” → “All apps” → “TMS RF”
Desktop shortcut	“TMS RF” (created only if “Create desktop shortcut” was selected during installation)
Windows app list	“TMS RF” in “Settings” → “Apps” → “Installed apps”; you can uninstall it here (see Section 17.5)

The installation is a “current user” installation: other Windows accounts on the same computer cannot see it. If they need it, install it separately under that account.

2.3.5 Situations That May Occur During Installation

Situation	Cause and solution
Message that TMS RF is running	TMS RF is still open during installation or uninstallation. Go back to TMS RF, finish work, log out and close the window, then try again. Do not let the installer force it to close, or data may not be completely written.
The “Already Installed” page appears and asks whether to uninstall first	Another version of TMS RF is on the computer. Back up your data first, then choose as described in Section 17.4.
Message that a newer version is already installed	You are installing an older installer over a newer version. Do not downgrade; check the correct version with your supplier.
WebView2 download fails	The standard installer needs to download WebView2, but the computer cannot connect to the network or is blocked by a firewall. Use the offline installer instead, or ask IT to install WebView2 first.
WebView2 installation fails	WebView2 was not installed completely, so TMS RF cannot open. Run the installation again; if it still fails, ask IT to check permissions or company policy.
The installer is blocked and cannot run	It is blocked by SmartScreen, antivirus software or a company application control policy. Ask IT to approve it according to policy; see Section 2.5.

2.4 Method 2: Use the Portable Program

1. Check that the WebView2 Runtime is installed on the computer: open Windows "Settings" → "Apps" → "Installed apps" and search for "WebView2". You should see "Microsoft Edge WebView2 Runtime". If it is not there, use the offline installer instead, or ask IT to install it first.
2. Put `ZIPPTORK TMS RF Portable.exe` in a fixed local folder, for example `D:\TMS RF\` as specified by IT.
3. Double-click it to run it (the security warning in Section 2.5 may appear the first time), then continue with Section 2.6.

Warning The portable program and the installed version use **the same** database and settings (see Section 2.7). On the same computer and the same Windows account, do not run the portable version and the installed version at the same time, and do not open two TMS RF windows at the same time. Running both makes them write to the same database and causes communication port conflicts.

2.5 Windows Security Warning

None of the three TMS RF files has a digital signature. Therefore, when you run one for the first time, Windows may show one of the following warnings:

Warning	Description and solution
"Open File - Security Warning": The publisher could not be verified. Are you sure you want to run this software?	"Publisher" shows "Unknown Publisher" because the file has no digital signature. After confirming that the file comes from the correct source and IT has approved it, click "Run"; if you are unsure, click "Cancel".
"Windows protected your PC" (Microsoft Defender SmartScreen)	After confirming that the file comes from the correct source and IT has approved it, click "More info", then "Run anyway". If there is no "Run anyway" on the screen, company policy does not allow it; contact IT.
Antivirus software or an application control policy blocks the file directly	Ask IT to evaluate it according to company policy and add it to the allow list (for example by the file's SHA-256 value).

Note Do not disable SmartScreen or antivirus software yourself, or bypass company security policy in any other way. SHA-256 only confirms that the file is the same as when the supplier delivered it; it is not a digital signature.

Example Check the SHA-256 of the standard installer with PowerShell:
① Hold down Shift and right-click an empty area of the folder that contains the installer, then select "Open in Terminal".
② Type `Get-FileHash ".\TMS RF_1.7.10_x64-setup.exe" -Algorithm SHA256` and press Enter.
③ Compare the Hash value on the screen with the line for the same file name in `SHA256SUMS.txt`. The file is intact only if all 64 characters are identical (not case-sensitive).

2.6 Startup and the Main Window

1. Start TMS RF from “Start” → “TMS RF” or the desktop shortcut (installed version), or double-click `ZIPPTORK TMS RF Portable.exe` (portable version).
2. The main window title is “TMS RF”, and the window is **maximized automatically** at startup.
3. Automatic maximizing is **not full screen**: the window keeps the Windows title bar and the Minimize/Restore/Close buttons. Click “Restore Down” to shrink it to a normal window (1100×720); click “Maximize” to maximize it again.
4. You can zoom the screen content: hold Ctrl and press “+” to zoom in or “-” to zoom out, and press Ctrl+0 to return to the original size. You can also hold Ctrl and turn the mouse wheel.
5. At startup, TMS RF automatically restores the background services that were enabled last time (read API, Modbus TCP, Modbus RTU, Open Protocol). Services that are not enabled do not start. If one of them fails to start (for example because its port is already in use), the program still opens; check the status on the settings screens in Chapters 13 and 14.
6. When startup is complete, the login screen appears; see Section 3.1.

> **Tip** When you use Modbus TCP, Open Protocol or the read API, Windows Defender Firewall may ask whether to allow TMS RF to communicate. Follow your company's IT rules; on a typical factory local area network, select “Private networks” and click “Allow access”.

2.7 Data Storage Location

TMS RF data is stored in the application data folder of the current Windows user, regardless of where the program is installed:

Data	Location
Main database (sensors, work settings, records, accounts, communication and sync settings)	`%APPDATA%\com.tms.zipptork\static-torque.sqlite3`
Read API settings file (created only after the settings have been changed)	`%APPDATA%\com.tms.zipptork\read-api.json`
Preferences such as interface language, light/dark theme and the last receiver port used	`%LOCALAPPDATA%\com.tms.zipptork\`
Encryption key for the sync destination connection information	“Generic Credentials” in Windows Credential Manager (name contains `static-torque`). When you restore data on another computer, you must enter the sync connection information again (see Chapter 14)

> **Tip** Type `%APPDATA%\com.tms.zipptork` in the File Explorer address bar and press Enter to open the folder that contains the main database.

> **Note** Versions earlier than 1.4.1 stored their data in `%APPDATA%\com.tms.static-torque` and `%LOCALAPPDATA%\com.tms.static-torque`. The first time the new version starts after an upgrade, it copies that data to the folders above automatically and leaves the old folders unchanged (see Section 17.4.5).

Key points:

1. **The installed version and the portable version share the same data**. Sensors, accounts and settings created with the portable version are still used after you switch to the installed version, and vice versa.
2. **Data does not travel with the program file**: if you run the program from a USB flash drive, the data is still written to this computer; another computer has separate data.
3. **Each Windows account has its own data**.
4. Uninstalling the program does **not** delete this data by default (see Section 17.5).
5. For backup and restore, see Chapter 17.

2.8 First Run and the Default Administrator Account

The first time TMS RF starts on a computer (with no TMS RF data on it), the program creates the database automatically in the background and then shows the login screen directly; no setup wizard appears.

2.8.1 Status After the First Startup

Item	Status after the first startup
User accounts	Only one default administrator: username `admin`, role A (shown on the screen as “Admin”), with all permissions.
Sensors	The list is empty; pair sensors first (see Section 12.3).
Work settings and records	No settings and no records. In each mode, select a sensor and save the settings before you can start work (see Chapter 4).
Modbus TCP, Modbus RTU, Open Protocol	Disabled by default; no communication port is opened.
Read API	Enabled by default, readable only from the local computer (`127.0.0.1`) on port 8080, torque unit N·m. If port 8080 is used by another program, TMS RF still opens; you can change or disable it on the screen described in Chapter 14.
Interface language	Applied automatically from the Windows display language; English is shown if it is not one of the 16 supported languages (see Section 3.4).

Warning The default administrator account is `admin`, and **the initial password is also `admin`**. These credentials are published in this manual and anyone may know them; the program does not force you to change them after login. **Immediately** after your first login, change the password as described in Section 2.8.2, and confirm that you can log in with the new password before handing the computer over for use on site.

Note If the computer already has TMS RF data (any version has been run before, including the portable version), the program does **not** create `admin` again. Log in with an existing account.

2.8.2 First Login and Changing the Initial Password

1. Start TMS RF. You see the login screen titled “System Login”, with “Username”, “Password” and “Log In” (see Section 3.1).
2. Enter `admin` in “Username” and `admin` in “Password”, then click “Log In”. You see the main screen; because there are no settings yet, the settings screen of “Torque Wrench” is shown on the right.
3. If the left navigation menu is collapsed, click “Toggle navigation menu” at the top left to expand it first; then click “User Management” at the bottom left of the navigation menu. The user list contains only the `admin` row.
4. In the “Actions” column of the `admin` row, click “Reset Password”. You see the “Reset Password” dialog, which shows “Username:admin” and the two fields “New Password” and “Confirm New Password”.
5. Enter the same new password in both fields and click “Confirm Change”. The dialog closes and the screen shows “Password reset”.
6. Open the navigation menu, click “Log Out”, then log in with `admin` and the new password to confirm that it works.

Example System administrator Mr. Chen finishes the installation, logs in with `admin`/`admin`, resets the password to a strong password that meets company rules, then logs out and in again to confirm. Next, in “User Management”, he creates his own personal administrator account `mgr_chen` (template A) and a template C account for each operator (see Chapter 15). From then on he logs in with his personal account, so records can be traced to a person.

Key points:

1. Resetting only the password does not log out the current session; therefore, log out and log in again as in step 6 to confirm.
2. Spaces before and after the password are ignored.
3. The program checks only that the password is not empty and that both entries match; it does not check length or complexity. Set a password strong enough to meet your company's security rules.
4. Users cannot change their own passwords. All passwords are reset in “User Management” by an administrator with the “Edit · User Management” permission (see Chapter 15).

5. Keep at least two personal template A accounts so that the system can still be managed if the only administrator forgets the password. The last effective administrator cannot be deleted or downgraded.

Screen message	Cause and solution
“Incorrect username or password”	The username or password is wrong, or `admin` in the existing data on the computer has had its password changed or has been deleted. Check upper/lower case, turn off any IME, and try again. If you are using existing data, get an account from the previous administrator. After repeated wrong entries, each retry is delayed slightly (up to about 2 seconds). This protects against password guessing; the program has not frozen.
“Please fill in all fields”	“New Password” or “Confirm New Password” was empty when resetting the password. Fill in both fields, then click “Confirm Change”.
“New passwords do not match”	The two fields differ. Enter the same password again.
You forgot the passwords of all administrator accounts	There is no password recovery function on the screen. Contact your supplier. Do not delete the database to “reset” it; that erases all sensors, settings and records.

2.9 Installation Checklist

Before handing the computer over for use on site, check each item:

Check item	How to check	Result
The program opens normally	Start it from the Start menu or the desktop shortcut; the login screen appears	□
The window is displayed correctly	The window is maximized automatically; you can click “Restore Down” to shrink it and maximize it again	□
The default password has been changed	`admin` can log in with the new password; the old password `admin` cannot log in	□
Personal accounts have been created	Administrators and operators each have their own account (Chapter 15)	□
Interface language and units are correct	The login screen and main screen are in the required language; the units in “System Settings → Global Settings” are correct (Section 12.2)	□
Receiver and sensors work	The receiver and paired sensors are visible in “System Settings → Sensor Pairing” (Section 12.3)	□
Trial measurement	Complete one measurement on a test workpiece in the mode you use; the judgement and record are correct (Chapter 4)	□
Communication (if used)	The PLC can read the results (Chapter 13)	□

Chapter 3 Login, Language and Main Screen Navigation

This chapter describes how to log in to TMS RF, how to switch the interface language and theme, and the navigation menu and top bar buttons of the main screen after login. For the content of each work mode screen, see Chapters 5 to 10.

3.1 Login Screen

Path: the first screen after TMS RF starts; you also return to it when you click “Log Out” in the navigation menu.

The login screen confirms the user's identity. Before logging in, you can also select the interface language and the light/dark theme. Logging in requires no permission, only a valid account. After a fresh installation the only account is the default administrator account; for the username and initial password, see Section 2.8.

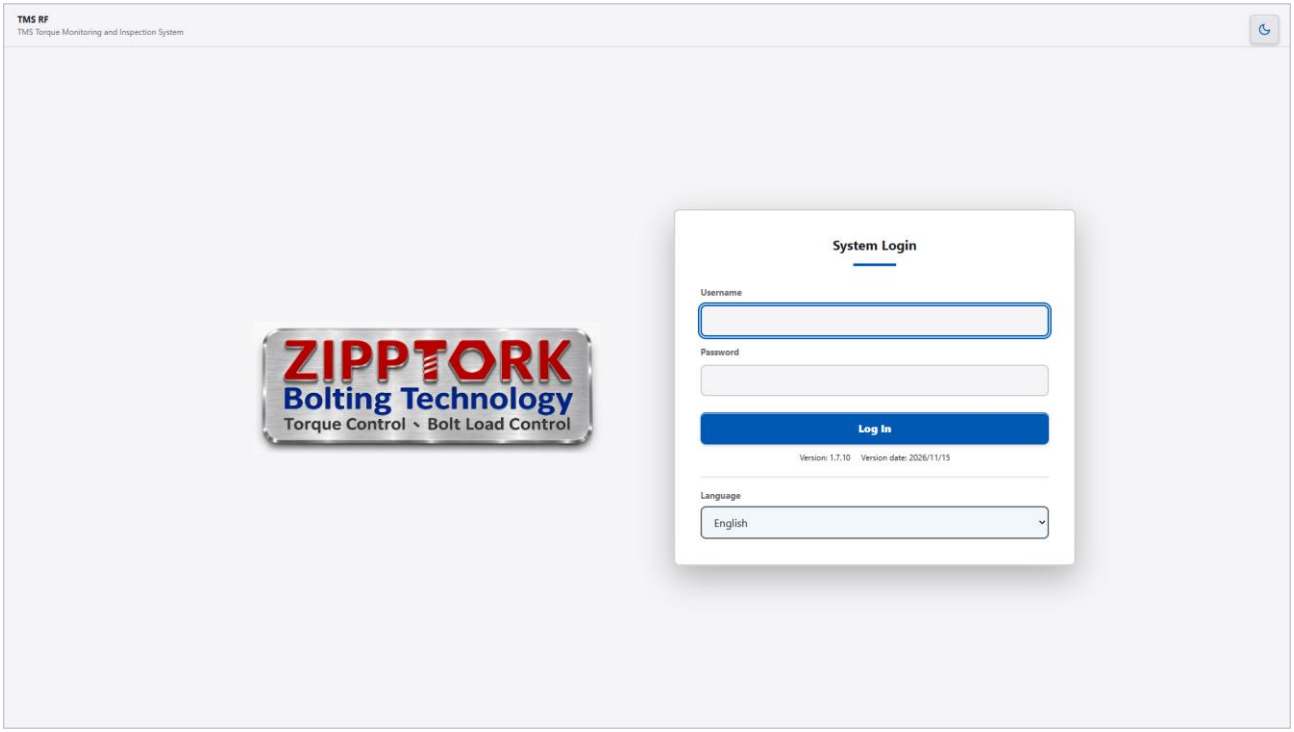

Figure 3-1 Login screen

3.1.1 Screen Description

Area/button	Description
“TMS RF” at the top left	Product name, with the system name “TMS Torque Monitoring and Inspection System” below it.
Moon/sun icon at the top right	“Toggle light / dark mode”. A moon is shown in the light theme and a sun in the dark theme.

Area/button	Description
ZIPPTORK logo on the left	Brand logo; it changes with the light/dark theme. In a narrow window it moves above the login card.
“System Login”	Title of the login card.
“Username”	Enter the username. The cursor is already in this field when the screen opens.
“Password”	Enter the password; it is shown as masked characters.
“Log In”	Submits the username and password.
“Version”, “Version date”	Version and build date of the current program; the date is shown in the Windows regional format.
“Language”	Drop-down list of the 16 interface languages. Select the language before you log in; the same language is used after you enter the system.

When TMS RF starts for the first time after a fresh installation, the light theme is used; click the moon icon at the top right to switch to the dark theme (Figure 3-2). A computer on which an earlier version was already in use keeps its previous theme after the upgrade. The screenshots in this manual use the light theme.

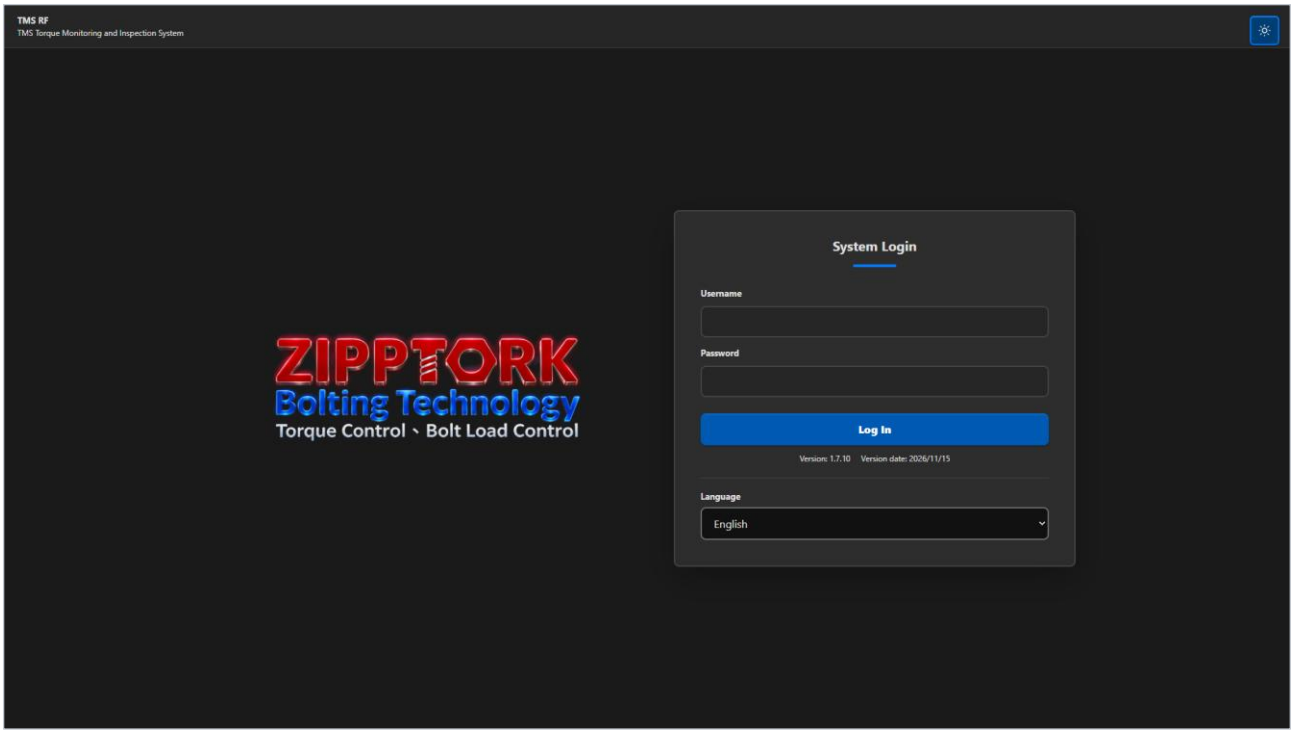

Figure 3-2 Login screen (dark theme)

3.1.2 Fields

Field	Description	Range and default
Username	Name of the account to log in with.	Required; case-sensitive; leading and trailing spaces are removed automatically; the last username is not remembered.
Password	Password of that account.	Required; case-sensitive; leading and trailing spaces are removed automatically.
Language	Interface language; applied as soon as you select it.	16 languages. At first startup it is applied automatically from the Windows display language; unsupported languages show English (see Section 3.4).

3.1.3 Buttons

Button	Description
Log In	Checks the username and password. On success, a beep sounds and the main screen opens. It cannot be submitted while the username or password is empty, and it cannot be clicked again while processing.
Toggle light / dark mode	Immediately switches the color scheme of the whole interface and remembers the choice for the next startup. It does not affect measurement, judgement or records.
Language (drop-down list)	Immediately switches the language of the whole interface and remembers the choice; it is kept after login and at the next startup.

> **Tip** Language and theme are settings of this computer (the same Windows user) and are shared by all TMS RF accounts. A different user logging in does not change the language or theme.

3.1.4 Operating Steps: Logging In

1. Start TMS RF. You see the login screen with the cursor in the “Username” field.
2. If needed, select the interface language in “Language”. The whole screen changes to the selected language immediately.
3. Enter the username in “Username”.
4. Enter the password in “Password”. Pay attention to upper/lower case and use an alphanumeric input method.
5. Click “Log In”, or press Enter in the “Password” field. While the login is being checked, the button shows “Logging in…” and cannot be clicked again, so the login is not submitted twice.
6. When login succeeds, the computer beeps once and the main screen opens: the navigation menu is on the left and the “Torque Wrench” page opens on the right (see Section 3.2). If “Torque Wrench” has not been set up yet, the settings screen is shown; if it has, the work screen is shown and work starts automatically.

> **Example** Operator Wang Xiaoming's username is op_wang.
> He enters op_wang in “Username” and the password the administrator gave him in “Password”, then clicks “Log In”.
> After a beep, the main screen opens. The administrator has already set up the torque wrench mode, so the right side shows the “Torque Wrench Work” screen directly with the status “Pending”, and he can start tightening.

3.1.5 When Login Fails

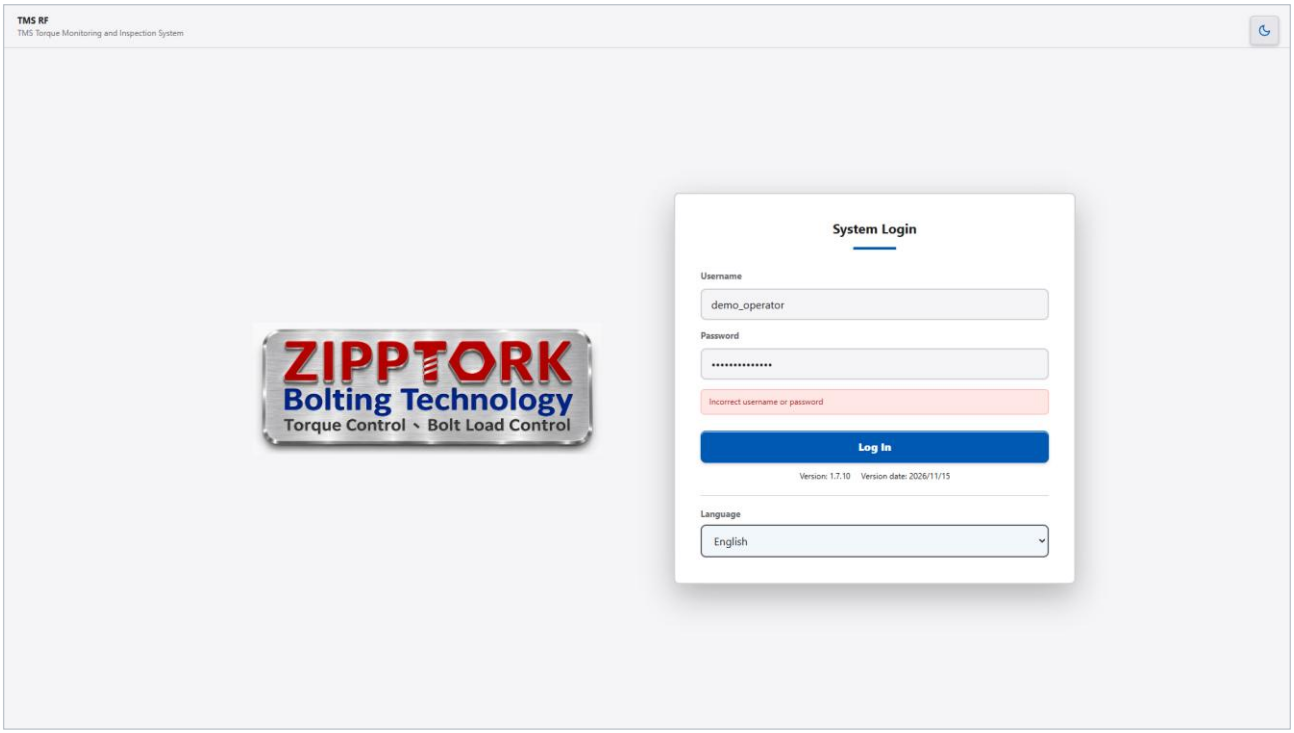

Figure 3-3 Login screen: wrong username or password

When login fails, the button returns to “Log In”, the reason is shown in red below the “Password” field, and the username and password fields keep what you entered. Correct the entry and click “Log In” again.

Screen message	Cause and solution
“Incorrect username or password”	The account does not exist, has been deleted, or the password is wrong. For security, the screen does not say whether the username or the password is wrong. Check upper/lower case and the input method and try again. If you forgot your password, ask an administrator to reset it (see Section 15.6).
“The sign-in service is temporarily unavailable.”	The local data cannot be read at the moment. Wait and try again; if it still fails, close and restart TMS RF. If it keeps happening, record the information as described in Section 16.8 and contact your supplier.
“Unable to connect to the local service. Open the desktop application to continue.”	The screen was not opened from the TMS RF program (for example, it was opened in an ordinary web browser). Start TMS RF from the Start menu or the desktop shortcut.

Screen message	Cause and solution
"Permissions updated. Please sign in again."	Your role or function permissions have just been changed and saved, and the program has logged you out automatically. Log in again to use the new permissions.
A prompt asking you to fill in the field appears next to a field	The username or password was left empty. Fill it in and click "Log In" again. The prompt is shown by Windows, and its wording may differ slightly depending on the Windows version.
"Failed to load records. Displayed data has not been updated." is shown at the version date	The Windows date format cannot be read at the moment. This does not affect login. If it still appears after a restart, check the Windows region settings.

Tip After 3 or more consecutive wrong entries for the same account, each later login attempt responds only after a delay of 0.25 to 2 seconds. This protects against password guessing; the program has not frozen. The delay is removed after a successful login, or if there are no more wrong entries within 10 minutes.

3.2 Main Screen and Navigation Menu

Path: opens automatically after a successful login.

The main screen has three parts: the top bar at the very top, the navigation menu on the left, and the content area on the right. Use the navigation menu to switch between work modes, System Settings, Tool Inspection and User Management, or to log out. All accounts see the main screen; which menu items can be used depends on the account's function permissions (see Section 3.2.4 and Chapter 15).

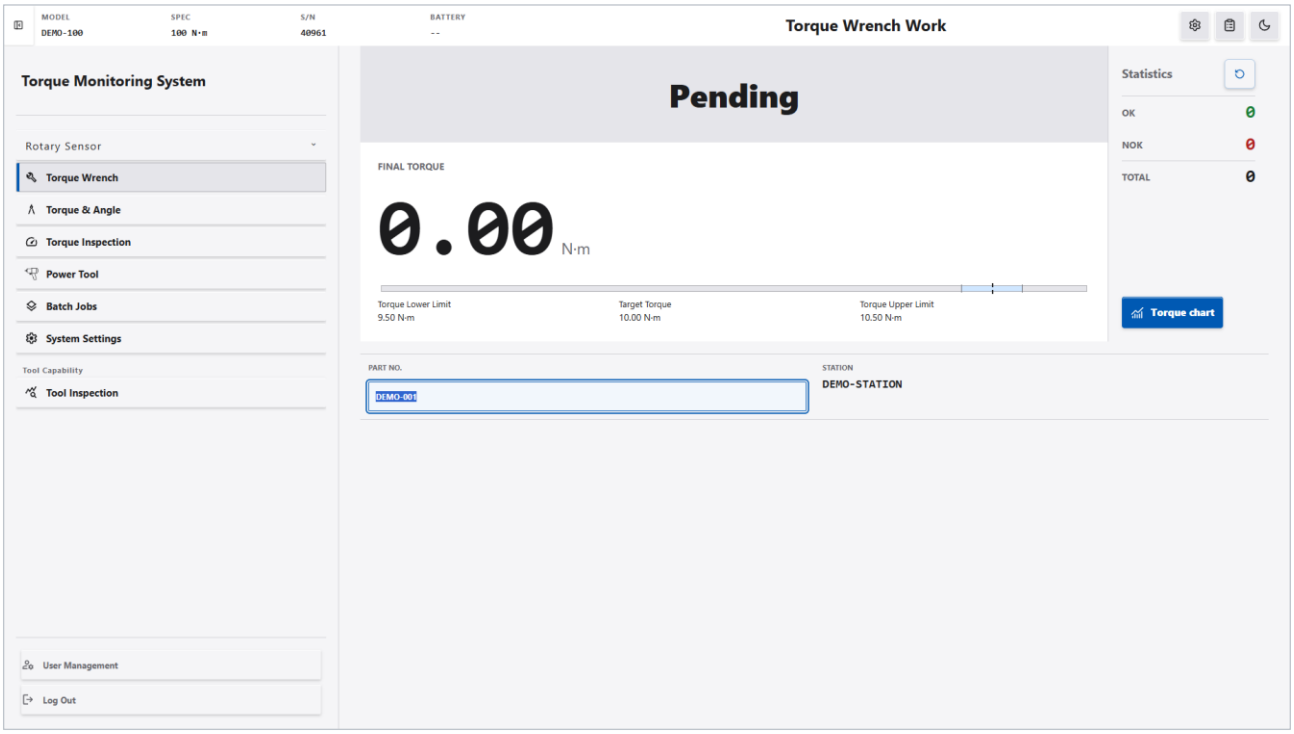

Figure 3-4 Main screen and navigation menu

3.2.1 Screen Description

Area/button	Description
Top bar	The row at the very top of the screen. On the left is “Toggle navigation menu”; in the middle are the sensor summary and the page title; on the right are the page buttons and “Toggle light / dark mode” (see Section 3.3).
“Torque Monitoring System”	Title of the navigation menu.
“Rotary Sensor” group	Click the group title to collapse or expand it. Contains “Torque Wrench”, “Torque & Angle”, “Torque Inspection”, “Power Tool”, “Batch Jobs” and “System Settings”.
“Tool Capability” group	Contains “Tool Inspection”.
Current page marker	The item currently open is marked with a colored bar on the left and a background color.
Bottom of the menu	“User Management” and “Log Out”. “User Management” appears only if the account has the “View · User List” permission.
Content area on the right	The page currently open. If a work mode has not been set up yet, its settings screen is shown; if it has, its work screen is shown. While loading, “Loading...” is shown.

> **Tip** The navigation menu has no records item. To view records, click “Work Records” in the top bar of a work mode page, or go to “System Settings” → “Records & export” (see Chapter 11).

3.2.2 Navigation Menu Items

Item	Screen opened	Permission required	Description
Torque Wrench	Torque wrench work or settings screen	“Run · Work” or “View · Work Settings”; with neither, the item is grayed out and cannot be clicked	Chapter 5
Torque & Angle	Torque and angle work or settings screen	Same as above	Chapter 6
Torque Inspection	Torque inspection work or settings screen	Same as above	Chapter 7
Power Tool	Power tool work or settings screen	Same as above	Chapter 8
Batch Jobs	Batch job work or settings screen	Same as above	Chapter 9
System Settings	System settings screen (“Global Settings” is shown first)	“View · System Settings”; without it the item is grayed out and cannot be clicked	Chapter 12

Item	Screen opened	Permission required	Description
Tool Inspection	Tool inspection work or settings screen	"View · Work Settings", or both "Run · Work" and "Run · Tool Inspection"; with none of these, the item is grayed out and cannot be clicked	Chapter 10
User Management	User management screen	"View · User List"; without it the item is not shown	Chapter 15
Log Out	Login screen	No permission required	Section 3.5

3.2.3 Operating Steps: Switching Pages

1. If the navigation menu is collapsed, click "Toggle navigation menu" at the far left of the top bar. The navigation menu expands. When the window is 759 pixels wide or narrower, the navigation menu is collapsed by default after login.
2. Click the item you want to use, for example "Torque Inspection". The right side switches to that page and the navigation menu collapses automatically.
3. The first time you use a mode, you see its settings screen; complete the settings as described in the chapter for that mode. If the mode is already set up, you see the work screen, and the program automatically starts work with the selected sensor.

Tip When a navigation item has focus, you can also move between items with the arrow keys on the keyboard; the page switches to whichever item you move to.

Warning The program does not ask for confirmation when you switch pages. As soon as you leave the work screen (click another navigation item, move with the arrow keys, click "Settings" or "Work Records" in the top bar, open System Settings or User Management, or log out), the program stops the current work automatically. Finish the workpiece you are tightening or measuring and confirm the result before you switch pages.

3.2.4 Menus Seen by Different Accounts

The navigation menu and available functions depend on the account's function permissions. The table below shows the defaults of the three roles (for role descriptions, see Section 15.1). An administrator can adjust each user individually; the account's actual settings apply.

Item	User	Supervisor	Admin
The five work modes and “Tool Inspection”	Can open them and run work; the settings screen can be opened but not saved	Can open them, run work and save settings	All available
System Settings	Can open it; can switch language and units, but cannot save settings such as sensor pairing and torque factor	Can open and change it, except sync settings	All available
“Work Records” in the top bar	Can query and export	Can query, export and delete	All available
User Management	Not shown	Can only view the list	Can add, edit, reset passwords and delete

> **Example** Operator op_wang has the role “User”, and the administrator has not adjusted his permissions individually.
> After he logs in, the navigation menu shows “Torque Wrench”, “Torque & Angle”, “Torque Inspection”, “Power Tool”, “Batch Jobs” and “System Settings” in the “Rotary Sensor” group, and “Tool Inspection” in the “Tool Capability” group.
> The bottom of the menu shows only “Log Out”, not “User Management”.
> He can work on the work screens and click “Work Records” to query and export records. When he opens “System Settings”, he can see the sensor list but cannot pair sensors or save the torque factor.
> If the administrator allows “View · User List” for his account and saves, he must log in again; after that, “User Management” appears at the bottom of the menu, but he can only view it.

3.2.5 Messages at the Top of the Screen

The following messages may appear above the content area on any page.

Screen message	Cause and solution
“PC alarm sound could not play. Check the speaker/audio device and rely on the on-screen indicator instead.”	The computer's audio device cannot be used, so the OK/NOK sounds cannot be heard. Check the speakers and the Windows audio device; until it is fixed, watch the on-screen lights and the records instead.
“API display unit is not synchronized.”	The display unit of the read API failed to synchronize. Click the “Refresh” icon to the right of the message to retry (for the read API, see Section 14.3).

Screen message	Cause and solution
“Work stop could not be confirmed. ...”	When you left the work screen, the command to stop work was not confirmed. First check that the RF receiver is still connected and the sensor has stopped working; if necessary, enter that mode again and leave it normally. Before any PLC write, make sure work has stopped (see Chapter 16).
“sensor warning” or “sensor error” banner	The sensor reports a condition such as low battery, overload or zero drift; the details are shown after the banner. When the TMS RF window is not in the foreground, a Windows notification is also shown. For solutions, see Chapter 16.
“Sensor error, work stopped” dialog	A sensor error that stops work occurred during work. Click “Go to sensor pairing” to check the sensor; if the account does not have the “View · System Settings” permission, the dialog shows a “Log Out” button instead; log out and contact an administrator. When you log in again after logging out this way, work does not start automatically: once the sensor error has been cleared, a “Work” button appears above the content area, and work starts only when you click it.
“Unable to load sync status.”	Reading the number of records waiting to be synced failed after login. See Section 14.4.
“Failed to load torque wrench settings.” (in other modes, “Failed to load torque and angle settings.” and so on)	Reading the settings failed when the work mode page was opened. Click “Reload settings” next to the message; if it still fails, see Chapter 16. After the settings are reloaded successfully, a mode whose settings are complete does not start work automatically; a “Work” button appears above the content area, and work starts only when you click it.
“Failed to load torque wrench settings.” (or the message of another mode) without “Reload settings” next to it	The mode has not been set up and the account does not have the “View · Work Settings” permission, or the account does not have the permission to run the mode. Have an account with the permission complete the setup first, or ask an administrator to adjust the permissions (see Section 5.2.14 and Chapter 15).

3.3 Common Top Bar Buttons

Path: at the very top of every page after login (see Figure 3-4).

The top bar is fixed at the very top of the screen. “Toggle navigation menu” and “Toggle light / dark mode” are on every page; the sensor summary and title in the middle, and “Settings”, “Work Records”, “Work” and “Back” on the right, depend on the current page. The top bar itself requires no permission; whether each button can be used depends on the rules of the page (see each chapter).

3.3.1 Top Bar from Left to Right

1. “Toggle navigation menu” (a sidebar icon when the navigation menu is expanded, a three-line icon when it is collapsed): on every page.
2. Page summary: work mode pages show “Model”, “Spec”, “S/N” and “Battery” of the selected sensor.
3. Page title: for example “Torque Wrench Work”, “Torque Wrench — Settings”, “User Management”.
4. Page buttons: depend on the page; see Section 3.3.2.

5. “Toggle light / dark mode”: always at the far right; when “Back” is present, “Back” is to the left of this button.

3.3.2 Buttons

Button	Description
Toggle navigation menu (sidebar/three-line icon)	Collapses or expands the left navigation menu. Does not save or switch screens.
Settings (gear icon)	Appears on the work screen. Switches to the settings screen of the same mode. You leave the work screen, so work stops automatically.
Work Records (clipboard icon)	Opens the records page showing only the records of the current mode (see Chapter 11). Requires the “View · Work Records” permission. When clicked on the work screen, work stops automatically; when clicked on the settings screen, unsaved changes are not kept.
Work	Appears on the settings screen. Checks and saves the settings and, on success, switches to the work screen; if the check fails, you stay on the settings screen and an error is shown.
Back (left arrow icon)	Leaves the current screen; the effect depends on the page: on a work mode settings screen it first checks and saves the settings, then opens the work screen; on a records page it returns to the original work mode; in System Settings and User Management it returns to the previous level or to the page you came from (see Chapters 12 and 15).
Toggle light / dark mode	Switches the color scheme of the whole interface and remembers the choice for the next startup.

> **Note** “Back” on a work mode settings screen saves the settings; it does not discard changes. To discard changes, switch to another page with the navigation menu instead; unsaved changes are not kept.

3.3.3 Operating Steps

1. On any page, click “Toggle light / dark mode” at the far right of the top bar. The whole interface switches between light and dark, and the choice is kept at the next startup.
2. On the work screen of a work mode, click “Work Records”. The records page opens and shows only the records of that mode; at the same time, work in that mode stops automatically.
3. On the records page, click “Back”. You return to the page of the original work mode, and the work screen starts work again.

> **Example** An operator finishes a workpiece on the “Torque Wrench Work” screen and wants to check the result.
> He clicks “Work Records” in the top bar. “Torque Wrench — Records” opens, with the record just completed at the top.
> After checking, he clicks “Back” and returns to the “Torque Wrench Work” screen with the status “Pending”, ready for the next workpiece.

3.4 Language and Date/Time Formats

The screen text and numbers of TMS RF follow the interface language; dates and times follow the Windows regional format and time zone. The two are set separately and can differ. For the language menu on the login screen, see Figure 3-1; for the language selection window after login, see Section 12.2.

3.4.1 How the Interface Language Is Determined

1. At first startup, the language is applied automatically from the Windows display language. For Chinese, Traditional Chinese regions such as Taiwan and Hong Kong get “繁體中文”, and other Chinese regions get “简体中文”. For other languages, only the language is considered, not the region; for example, Spanish (Mexico) gets “Español”. Languages not in the supported list show “English”.
2. Until you select a language yourself, the language is determined again from the Windows display language at every startup; if you change the Windows display language, TMS RF changes with it.
3. Once you select a language on the login screen or in “System Settings” → “Global Settings”, your choice is always kept and no longer follows Windows.
4. When you select “العربية”, the whole interface is laid out from right to left; other languages are laid out from left to right.
5. The language setting belongs to the Windows user of this computer and is shared by all TMS RF accounts.
6. The installer language is determined separately and is unrelated to the interface language (see Chapter 2).

The 16 supported interface languages (shown in the menu by their own names): 繁體中文 (Traditional Chinese), English, 日本語 (Japanese), Italiano (Italian), Português (Portuguese), Español (Spanish), 简体中文 (Simplified Chinese), 한국어 (Korean), Bahasa Indonesia (Indonesian), Deutsch (German), Français (French), Tiếng Việt (Vietnamese), ภาษาไทย (Thai), Türkçe (Turkish), Русский (Russian), العربية (Arabic).

3.4.2 Operating Steps: Changing the Language Before Login

1. On the login screen, click the “Language” drop-down list. You see the 16 languages.
2. Click the language you want. The login screen changes to the selected language immediately.
3. Log in. The screens after login use the same language.

3.4.3 Operating Steps: Changing the Language After Login

1. Navigation menu → “System Settings” → “Global Settings”.
2. Click “Language”. The language selection window opens.

3. Click the language you want. The whole interface changes to the selected language immediately, without a restart (see Section 12.2 for details).

> **Example** An Italian technician comes to support the site. On the login screen he selects “Italiano” in “Language”, and the login screen changes to Italian immediately; after login the whole interface is in Italian. After he logs out, the next colleague switches the login screen back to “繁體中文”.

3.4.4 Number Format

1. Numbers on the screen show the decimal point and thousands separator according to the conventions of the interface language, and always use the Arabic digits 0–9 (including in the Arabic interface).
2. Numeric input fields also interpret the decimal point according to the interface language. When the interface is Italiano, Português, Español, Bahasa Indonesia, Deutsch, Français, Tiếng Việt, Türkçe or Русский, the decimal point is a comma “,”; in the other interface languages it is a period “.”.
3. A number written incorrectly is judged invalid; it is not automatically changed to another value.

> **Example** To enter a target torque of 12.5 N·m: when the interface is 繁體中文 or English, enter “12.5”; when the interface is Deutsch or Italiano, enter “12,5”.

> **Note** When you switch the interface language, the decimal point used in numeric fields changes too. At multilingual sites, check the current interface language before you enter a target torque.

3.4.5 Date and Time Format

1. Dates and times are shown in the regional format of the current Windows user (including formats customized in Windows) and converted to the computer's time zone (including daylight saving time). They are independent of the interface language.
2. Dates use the Windows short date format, and times use the Windows time format.
3. After you change the regional format in Windows, the format is read again when you switch back to the TMS RF window.
4. If the date format cannot be read at the moment, no date is shown there; an error message is shown instead (see Section 3.1.5).

> **Example** When the interface language is English and the Windows regional format is “Chinese (Traditional, Taiwan)”, the screen text is in English, but record times are still shown in the Taiwan format (for example 2026/11/15).

3.4.6 Operating Steps: Changing the Date/Time Format

The date/time format is not set in TMS RF. Change it in Windows according to your company's IT rules.

1. Open Windows “Settings” → “Time & language” → “Language & region” and select the format you need in “Regional format”. The actual names may differ slightly depending on the Windows version (for example, in Windows 10 it is “Time & Language” → “Region”).

2. Switch back to the TMS RF window and check that dates and times use the new format.

3.5 Logging Out and the Login Session

Path: bottom of the navigation menu → “Log Out” (see the bottom left of Figure 3-4). If the navigation menu is collapsed, first click “Toggle navigation menu” at the far left of the top bar.

Logging out ends the current account's login so that the next user can log in with their own account. Every account can log out; no permission is required.

3.5.1 What Happens When You Log Out

1. Sensor work started by this login that is still in progress is stopped.
2. You return to the login screen, and the “Username” and “Password” fields are cleared.
3. There is no confirmation window; logout happens as soon as you click.
4. The interface language and theme do not change.
5. After the next user logs in, the “Torque Wrench” page opens on the right by default.

3.5.2 Operating Steps: Logging Out at Shift Change

1. On the work screen, finish the current workpiece and confirm the result.
2. If the navigation menu is collapsed, click “Toggle navigation menu” to expand it.
3. Click “Log Out” at the bottom of the menu. You return to the login screen with empty username and password fields.
4. The next user logs in with their own account (see Section 3.1).

> **Example** Day-shift operator `op_wang` finishes his last workpiece and the screen shows “OK”. He clicks “Log Out” and returns to the login screen; night-shift operator `op_lee` logs in with his own username and password, and all records produced after that are recorded under `op_lee`.

3.5.3 Login Validity Period

1. Each login is valid for 8 hours after login; continued use does not extend it.
2. The login becomes invalid when TMS RF is closed; you must log in again at the next startup.
3. When it expires, the program stops the work started by this login; later operations show “Your session has expired. Please sign in again.”. The screen does not return to the login screen automatically; click “Log Out” and log in again.
4. When an administrator saves your role or function permissions, or deletes your account, your login becomes invalid immediately and work in progress also stops. If you change your own permissions in “User Management”, the program logs you out immediately and the login screen shows “Permissions updated. Please sign in again.”.
5. Resetting only the password does not invalidate the current login; a logged-in user can continue until logging out or until the 8 hours expire.

Example op_wang logs in at 08:00 and never logs out. At 16:00 (8 hours after login), the login expires, the work in progress is stopped, and later operations show “Your session has expired. Please sign in again.”. He clicks “Log Out” and logs in again; after returning to the work screen, he can continue working.

Warning A shift longer than 8 hours, or an administrator changing account permissions during work, stops the work in progress. Log out at shift change and let the next user log in; before managing accounts, tell the people concerned to finish their work first (see Chapter 15).

3.5.4 Error Messages

Screen message	Cause and solution
“Your session has expired. Please sign in again.”	More than 8 hours have passed since login, or your role has been changed. Click “Log Out”, log in again, and enter the work mode page again.
“Please sign in.”	Your login has been canceled (for example, an administrator changed your permissions or deleted your account). Click “Log Out” and log in again.
“You do not have permission to perform this operation.”	Your account does not have permission for this operation. Ask an administrator to check your role and function permissions (see Chapter 15).
“Permissions updated. Please sign in again.”	Your permissions have just been changed, and the program has logged you out automatically. Log in again.

Chapter 4 Quick First-Time Setup

This chapter is the recommended workflow for using TMS RF for the first time. By following this chapter in order, a system administrator can go from logging in on a freshly installed computer to completing the first trial measurement and finding its record. Each step only says what to do and what you will see; for detailed screen descriptions, see the sections each step refers to.

4.1 Preparation

Item	What to prepare	Description
Program	TMS RF installed, or the portable program in place	For installation, see Chapter 2.
Administrator account	Default administrator account `admin` and the initial password	See Section 2.8.
Hardware	RF receiver and a charged torque sensor	When the receiver is connected to the computer, Windows recognizes it as a COM port; for wiring, follow the hardware instructions.
Staff list	Username, initial password and role for each user	For the functions operators, QC staff, supervisors and administrators need, see Chapter 15.
Work parameters	Work mode, target torque, tolerance, torque unit, station and part number rules	Provided by process engineering or QC; TMS RF does not decide these values for you.
Calibration data (if needed)	External reference instrument (torque meter for calibration)	Prepare only if sensor readings need to be corrected (see Section 12.4).
External connections (if needed)	PLC communication parameters, sync target or read API connection information	Prepare only if data must be exchanged with other systems (see Chapters 13 and 14).

> **Note** This chapter assumes the computer has fresh data. If TMS RF has run on this computer before (including the portable version), the existing accounts, sensors and settings are kept, and the `admin` password may have been changed; get an account from the previous administrator. Before upgrading, back up your data as described in Chapter 17.

4.2 First-Time Setup Steps

For first-time use, complete the setup in the following order. For details of each step, see Sections 4.2.1 to 4.2.8 and the sections in parentheses.

1. Log in as `admin` and change the password immediately (Sections 2.8 and 15.6).
2. Create staff accounts (Section 15.5).

3. Set the global torque unit and interface language (Section 12.2).
4. Pair sensors (Section 12.3).
5. If needed, set the torque factor (Section 12.4).
6. Select a work mode and complete its settings (Chapters 5 to 10).
7. Make one trial measurement and check the judgement (Section 5.3).
8. View the records (Chapter 11).

4.2.1 Step 1: Log In as admin and Change the Password

1. Start TMS RF. The window is maximized automatically (not full screen; it can be restored to a normal window), and the login screen is shown.
2. Enter `admin` in “Username” and the initial password listed in Section 2.8 in “Password”, then click “Log In”. You see the main screen; the right side shows the “Torque Wrench — Settings” screen because nothing has been set up in the fresh data yet.
3. Bottom of the navigation menu → “User Management”. The user list contains only the `admin` row, with the role “Admin”.
4. In the `admin` row, click the key icon “Reset Password”. The “Reset Password” window opens and shows “Username:admin”.
5. Enter the same new password in “New Password” and “Confirm New Password”, then click “Confirm Change”. The window closes and the screen shows “Password reset”.
6. Click “Log Out”, then log in with `admin` and the new password to confirm that login succeeds.

> **Warning** The initial password is written in this manual, and anyone may know it. The program does not force you to change it; always change it immediately after the first login, before handing the computer over for use on site.

4.2.2 Step 2: Create Staff Accounts

1. In “User Management”, click “+ Add User”. The add form appears on the right, and “Role” defaults to “User”.
2. Enter the “Username” and “Password”.
3. Select the “Role”: “User” for operators, “Supervisor” for QC staff or shop-floor supervisors, and “Admin” for system administrators.
4. Click “Add” at the bottom of the form. The screen shows “User created”, and the new account appears in the list.
5. Repeat steps 1 to 4 to create a personal account for each person.

> **Tip** Create at least one more “Admin” account and have another responsible person keep it. The system has no password recovery function; if the only administrator forgets the password, no other account can reset it (see Section 15.7).

4.2.3 Step 3: Set the Torque Unit and Language

1. Navigation menu → “System Settings”. You see “Global Settings”.
2. Click “Torque Unit” and select the unit used on site. The default is N·m. This unit is used for record display and the read API; the target torque unit of each work mode is selected separately on the settings screen of that mode.
3. Click “Language” and select the interface language. The whole interface changes to the selected language immediately.
4. Both fields take effect as soon as you select them; no separate save is needed (see Section 12.2 for details).

4.2.4 Step 4: Pair a Sensor

After a fresh installation the sensor list is empty; pair the sensors you will use first.

1. Check that the RF receiver is connected to the computer and that the sensor is charged and switched on.
2. Navigation menu → “System Settings” → “Sensor Pairing”. The program detects the receiver automatically; on success it shows “Connected” and the COM port name. If “Not connected” is shown, check that the receiver is connected properly and click “Rescan”.
3. Put the sensor into pairing mode.
4. Click a channel (03–62) in “Select channel”. If there are several sensors at the same site, use a different channel for each.
5. Click “Start pairing”. After about 1 second the pairing result is shown: “Sensor information” shows the model, spec, serial number and battery level, and the sensor appears in the list on the right (see Section 12.3 for details).

4.2.5 Step 5: Set the Torque Factor (If Needed)

Do this step only if sensor readings need to be corrected with an external reference instrument; otherwise go directly to step 6.

1. Check that the sensor to be calibrated is connected and in use in “Sensor Pairing”.
2. Navigation menu → “System Settings” → “Torque Factor Settings”.
3. Click “Add Configuration”, enter a “Configuration Name”, and select the sensor in “Torque Sensor”.
4. Apply torque to the external reference instrument and the sensor at the same time. “Displayed Torque” automatically reads the value of the selected sensor (N·m).
5. Enter the reading of the reference instrument (N·m) in “Measured Torque”. “Torque Factor” automatically shows the result of “Measured Torque ÷ Displayed Torque”.
6. While “Displayed Torque” still has a reading, click “Save Configuration”. The screen shows “Torque factor settings saved.” (see Section 12.4 for details).

> **Example** The reference instrument reads 50.60 N·m, and at the same time "Displayed Torque" is 50.00 N·m.
> Torque factor = 50.60 ÷ 50.00 = 1.0120.
> When "Displayed Torque" has no reading or is 0, "Save Configuration" cannot be clicked.

4.2.6 Step 6: Select a Work Mode and Complete Its Settings

This step uses the torque wrench as an example. For the settings of other modes, see Section 6.3 (Torque & Angle), Section 7.3 (Torque Inspection), Section 8.3 (Power Tool), Section 9.3 (Batch Jobs) and Chapter 10 (Tool Inspection).

1. Navigation menu → "Torque Wrench". If it has not been set up yet, you see the "Torque Wrench — Settings" screen; if it has, click "Settings" in the top bar to open it.
2. Select the sensor you just paired in "Torque Sensor". The allowed range is shown below "Target Torque", for example "Allowed range (10%–100%): 10 – 100 N·m"; the target torque is not filled in automatically.
3. Enter "Station" and "Part Number" if needed. Both fields can be left empty. In every mode, an empty field is recorded as blank (see Section 5.2.10). If every product must be traceable, enter or scan the part number before applying torque.
4. Select the "Torque Unit" first, then enter the value in "Target Torque". The target torque must be between 10% and 100% of the sensor spec.
5. Click "±" or "+" to select the "Tolerance Type", and enter an integer from 1 to 30 (%) in "Tolerance Range".
6. Click "Work" in the top bar. The screen shows "Torque wrench settings were saved and activated.", switches to the "Torque Wrench Work" screen and starts work (see Section 5.4 for details).

4.2.7 Step 7: Trial Measurement

1. On the "Torque Wrench Work" screen, check that the top bar shows the model, serial number and battery level of the selected sensor, and that the verdict banner shows "Pending".
2. Following the site safety procedures, tighten a test workpiece with the wrench, then release it.
3. While you apply torque, "Final Torque" rises with it; after you release, the verdict banner shows "OK" or "NOK", and the statistics on the right increase by 1. Click "Torque chart" to view the curve of this measurement (see Section 5.3 for details).

4.2.8 Step 8: View the Records

1. On the work screen, click "Work Records" in the top bar. "Torque Wrench — Records" opens, with the trial measurement you just made at the top.
2. Open the details of that record and check the final torque, target torque and result (see Section 11.4 for details).
3. Click "Back" to return to the work screen.

Example A new production line uses a torque wrench sensor with a spec of 100 N·m. The process requires a target torque of 50 N·m with a tolerance of ±5%.
The administrator logs in as `admin`, changes the password, and then creates `adm_chen` (Admin) and `op_wang` (User).
"Global Settings" keeps "N·m" and "繁體中文".
In "Sensor Pairing", he selects channel 10 and clicks "Start pairing"; the sensor appears in the list.
No external reference instrument correction is used, so the torque factor is skipped.
In "Torque Wrench — Settings", he selects this sensor, selects N·m in "Torque Unit", enters 50 in "Target Torque" (within the allowed range of 10 to 100 N·m), selects "±" in "Tolerance Type", enters 5 in "Tolerance Range", and clicks "Work".
OK range = 50 × (1 − 5%) to 50 × (1 + 5%) = 47.5 to 52.5 N·m.
He tightens once as a trial; the final torque is 49.8 N·m, and the screen shows "OK". He clicks "Work Records"; the result of the top record is OK.

Tip After completing the steps above, set up the torque multiplier (Section 12.5), indicator light (Section 12.6), PLC communication (Chapter 13) and sync or read API (Chapter 14) as needed, and make regular backups a habit (Chapter 17). Test external connections in a non-production environment and with authorization first.

4.3 First-Time Setup Checklist

After completing the steps in Section 4.2, check each item and tick the "Result" column.

Check item	How to check	Result
The program starts normally	The login screen appears after startup, and the window is maximized (not full screen; it can be restored) (Chapter 2)	□
The default password has been changed	Login with `admin` and the new password succeeds; login with the initial password shows "Incorrect username or password" (Section 4.2.1)	□
There are at least two administrators	In the "User Management" list, at least two accounts have the role "Admin" (Section 15.7)	□
Staff accounts have been created	Every person has their own account; after an operator logs in, there is no "User Management" at the bottom of the navigation menu (Chapter 15)	□
Units and language are correct	"Torque Unit" and "Language" in "Global Settings" meet the site's needs (Section 12.2)	□
Sensors are paired	"Sensor Pairing" shows the receiver as connected, and the sensors actually used are in the list (Section 12.3)	□
Torque factor (if needed)	In the saved configurations of "Torque Factor Settings", the factor from this calibration is at the top (Section 12.4)	□
Work settings are saved	The header of the work screen shows the correct sensor, and the range bar shows the correct target torque and upper and lower limits (Chapters 5 to 10)	□

Check item	How to check	Result
Judgement works	After the trial measurement, “OK” or “NOK” is shown as expected (Section 5.3)	□
Records can be queried	Clicking “Work Records” shows the trial measurement record (Chapter 11)	□
Backup method confirmed	You know where the data is stored and how to make a cold backup (Section 2.7, Chapter 17)	□

4.4 Common Problems During First-Time Setup

Situation	Cause and solution
Windows blocks the program at startup, or a warning about an unknown publisher appears	The TMS RF installer and program have no digital signature. Run them only after approval according to company IT policy; do not disable SmartScreen or antivirus software yourself (see Section 2.5).
Login shows “Incorrect username or password”	The username or password was entered incorrectly, or this computer already has old data and the `admin` password has been changed. Check upper/lower case and the input method; if you are using old data, get an account from the previous administrator (see Section 3.1).
The navigation menu has no “User Management”, or “System Settings” is grayed out and cannot be clicked	The current account does not have the “View · User List” or “View · System Settings” permission. Log in with an “Admin” account instead (see Chapter 15).
“Sensor Pairing” cannot find the RF receiver	The receiver is not connected properly, Windows has not recognized it yet, or the COM port is used by another program. Reconnect the receiver, close any program that may be using the COM port, and click “Rescan” (see Section 12.3).
“Save Configuration” in “Torque Factor Settings” cannot be clicked	“Displayed Torque” has no reading or is 0. Check that the sensor is connected and in use, and save while torque is applied (see Section 12.4).
Work settings cannot be saved	No sensor is selected, the target torque is empty or outside 10% to 100% of the sensor spec, or the tolerance range is not an integer from 1 to 30. Correct it according to the error message on the screen (see Section 5.4 and the settings section of each mode).
“You do not have permission to perform this operation.” is shown when saving	The current account does not have the “Edit · Work Parameters, Pairing and Calibration” permission (“User” does not have it by default). Use a “Supervisor” or “Admin” account for the settings instead (see Chapter 15).
The record cannot be found after the trial measurement	The filter conditions or date range do not include that record. If the screen shows “No records match these filters.”, click “Clear filters”; if the screen shows an error message instead of an empty list, see Chapters 11 and 16.

Chapter 5 Torque Wrench

5.1 Mode Overview

The “Torque Wrench” mode is used for tightening with manual torque wrenches. It judges OK or NOK by the maximum (peak) torque of each torque application.

Each torque application starts when the torque rises above 0 and ends when you release the wrench and the torque returns to 0. The system takes the peak torque of that application, compares it with the set target torque and tolerance, judges automatically and saves it as a record. This mode judges torque only, not angle; the measurement method is always peak and does not need to be switched.

The work screen has no “Start” or “Stop” button: work starts automatically when you enter the work screen and stops automatically when you leave it (see Section 5.2).

Complete the following preparation before use:

1. Pair the torque sensor in Sensor Pairing under “System Settings” and connect the RF receiver (see Chapter 12). After a fresh installation the sensor list is empty, so you must pair first.
2. In “Torque Wrench — Settings”, select the sensor, enter the target torque and tolerance, and save (see Section 5.4).

Work modes in the “Rotary Sensor” group of the navigation menu:

Mode	Judged by	Chapter
Torque Wrench	Peak torque of each torque application	This chapter
Torque & Angle	Angle or torque, depending on the control mode	Chapter 6
Torque Inspection	Torque when the target angle is reached	Chapter 7
Power Tool	Peak torque of each power tool operation	Chapter 8
Batch Jobs	Multiple steps on one workpiece, performed in order	Chapter 9

5.2 Elements Shared by the Work and Settings Screens

This section describes the screen elements and behavior shared by the four modes Torque Wrench, Torque & Angle, Torque Inspection and Power Tool. Chapters 6, 7 and 8 describe only what differs in each mode; for the shared parts, refer back to this section.

5.2.1 Header Bar

Both the work screen and the settings screen have a header bar at the top.

Area/button	Description
"Toggle navigation menu" (sidebar or three-line icon)	Expands or collapses the left navigation menu (see Chapter 3).
"Model", "Spec", "S/N", "Battery"	Data of the sensor selected in the current settings; "--" is shown if no sensor is selected. "Spec" is the rated torque of the sensor, always in N·m regardless of the torque unit; the screen shows it as "100 N·m" or "100 Nm", which mean the same.
Screen title	For example "Torque Wrench Work", "Torque Wrench — Settings".
"Settings" (gear icon)	Work screen only. Switches to the settings screen of this mode. The button is not shown if the account does not have the "View · Work Settings" permission.
"Work"	Settings screen only. Saves the settings first and, on success, switches to the work screen.
"Work Records" (clipboard icon)	Switches to the records screen, filtered to the records of this mode.
"Back" (left arrow icon)	Settings screen only. **Saves the settings first** and, on success, switches to the work screen.
"Toggle light / dark mode" (moon icon)	Switches the whole program between the light and dark themes (see Chapter 3).

5.2.2 Automatic Start and Stop of Work

The work screen has no start or stop button; the system handles this automatically:

1. When you enter the work screen, the system loads the current settings and automatically tells the selected sensor to start sending data. If the RF receiver is not open yet, the system automatically detects it once on the port used last time.
2. Before starting work, the system checks that: the RF receiver is connected; the sensor selected in the settings is still in the sensor list; the target torque is within 10%–100% of the sensor spec (for Torque & Angle and Torque Inspection, also that the target angle is within 1–360 degrees); and the current account has the "Run · Work" permission.
3. If a condition is not met, work cannot start, and the reason is shown in red at the bottom of the work screen. For solutions, see the error message table of each mode and Chapter 16.

4. When you leave the work screen (click “Settings” or “Work Records”, switch to another mode, or log out), the system stops work automatically. A torque application that has not been released is not saved.

Tip After removing the cause that prevented work from starting, switch to another mode in the navigation menu and back to the original mode to start work again.

Note In the following two cases work does not start automatically; a “Work” button is shown above the content area instead, and work starts only when you click it: after reading the settings failed, you click “Reload settings” and the settings are read successfully; or you log in again after logging out with the “Log Out” button of the sensor error dialog (see Section 5.2.3).

Note If stopping work fails, the red message “Work stop could not be confirmed. Check the RF receiver connection and work session status before PLC writes or restart testing.” appears at the top of the screen. Check that the RF receiver connection is working before you perform PLC writes or other follow-up work.

5.2.3 RF Disconnection and Sensor Errors

The work screen does not show text such as “Connected”; the system tracks the RF connection status in the background:

- When the connection is normal, the screen keeps updating the final torque, range bar, curve and battery level.
- When the RF connection is lost, the final torque returns to 0, the curve is cleared, and the torque application in progress is discarded and not saved; data received during the disconnection is not used. After the connection is restored, apply torque again.

To check or re-establish the RF connection, go to Sensor Pairing under “System Settings” (see Chapter 12).

When a sensor reports a problem, a banner appears at the top of the screen:

- “sensor warning”: for example “Low battery - please charge as soon as possible” or “Has been used for 5,000 cycles - recommended for use after verification”. You can continue working, but deal with it as soon as possible.
- “sensor error”: for example “Torque overload - automatic power-off protection”, “Zero point drift - please recalibrate” or “Hardware damaged - please return to factory for repair”. Work stops immediately, and the “Sensor error, work stopped” dialog appears in the middle of the screen and covers the work screen.

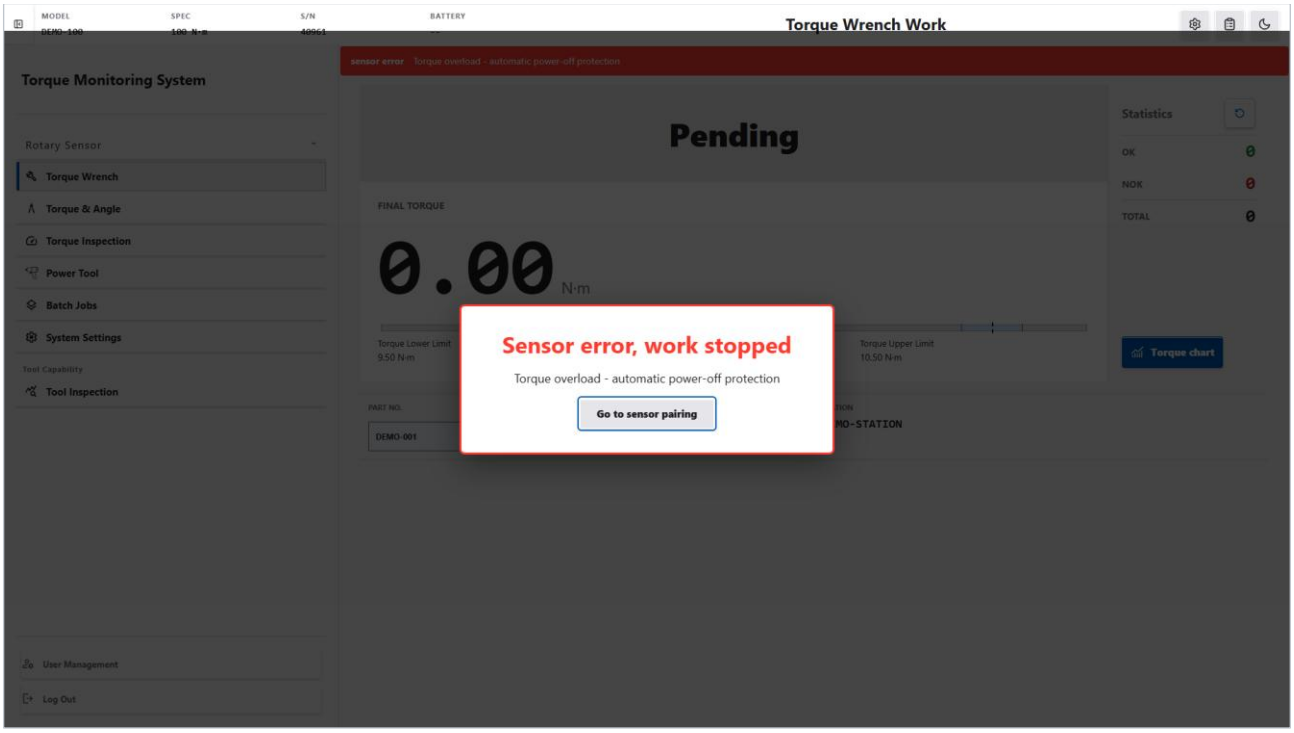

Figure 5-1 Torque wrench work: sensor error dialog

The dialog shows the error and the “Go to sensor pairing” button. Click this button to switch to the sensor pairing screen; if the account does not have the “View · System Settings” permission, the dialog shows a “Log Out” button instead; log out and contact an administrator. For errors and solutions, see Chapter 16.

5.2.4 Battery Level

“Battery” in the header shows the battery percentage of the selected sensor, for example “80%”; “--” is shown if no data has been received yet.

- To avoid flickering numbers, the work screen updates the value only when a new reading differs from the displayed value by 10 percentage points or more; the first reading is shown immediately. When the RF connection is lost, the last recorded battery level is shown.
- The settings screen shows the last recorded battery level of the sensor.
- Low battery is signaled by the “Low battery - please charge as soon as possible” banner, not by the battery number.

5.2.5 Result Panel and Final Torque

In all four modes, the middle of the work screen is the result panel, which has the same layout (see Figure 5-2):

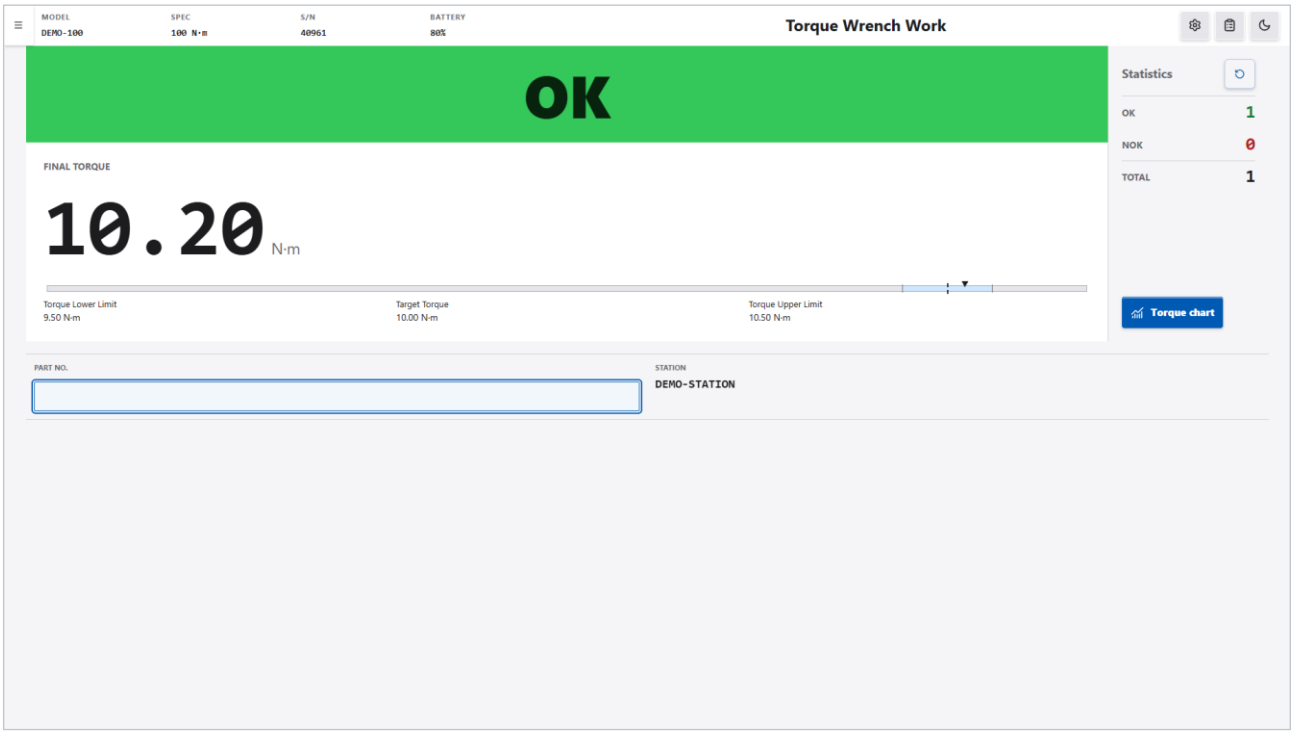

Figure 5-2 Result panel (torque wrench, judgement OK)

Area	Description
Verdict banner (top)	Shows only the judgement, in large text: “Pending” (gray background), “OK” (green background) or “NOK” (red background).
Reading area (below the banner)	“Final Torque” in large text with its unit, and the range bar below it. Torque & Angle also has “Final Angle”; in Torque Inspection the large reading is “Angle Torque” (see Chapters 6 and 7).
Statistics panel (right side)	The counters of this mode, for example “OK”, “NOK” and “Total”; to the right of the heading “Statistics” is the reset button, which has only the ↺ icon and no text and shows “Reset” when you move the mouse pointer over it; at the bottom is the button that opens the chart dialog (see Section 5.2.6).
Parameter row (bottom)	“Part No.” (editable) and “Station”. When batch work is enabled, a “Batch Progress” row is added. Setting values such as the target torque and tolerance are not shown here; see the range bar or the settings screen. Power Tool also has a second row, which shows the work time, the pulse count and so on (see Chapter 8).

The two kinds of torque on the screen have different meanings:

Name	Where to see it	Meaning
Final Torque	Large number in the reading area	Maximum torque (peak) of the current torque application so far. It rises during torque application; after release it keeps the peak of this application until the next torque application starts. The "Final Torque" saved in the record and used for judgement is this peak (see Chapter 11).
Target Torque	"Target Torque" on the settings screen; range bar of the work screen	The judgement reference you set. It changes only after you save on the settings screen.

The "Real-time Torque" line in the chart dialog is the torque at each sample point; the large "Final Torque" is the maximum of these values.

Final torque is converted in this order: sensor reading converted to N·m → multiplied by the "Torque Ratio" when "Enable torque multiplier" is "On" → multiplied by the torque factor in System Settings → converted to the torque unit of this mode for display. The torque ratio is entered on the settings screen of each mode (for Torque Wrench, see Section 5.4); for the torque factor, see Chapter 12. The curve and records use the same conversion.

Decimal places of torque values: below 100, two decimal places; 100–999, one decimal place; 1000 and above, no decimal places.

The range bar below the reading shows where the final torque lies relative to the OK range:

- Marks: "Torque Lower Limit", "Target Torque" (dashed) and "Torque Upper Limit"; the OK range between the lower and upper limits is shaded light blue. The name and value of each mark are listed below the bar; for how they are calculated, see Section 5.2.7.
- Triangular pointer: the position of the final torque; it moves as torque is applied. No pointer is shown while there is no reading yet.
- The right end of the bar is about 1.1 times the largest mark; when the final torque goes beyond it, the bar extends, so the pointer does not stop at the right end.
- The range bar is not shown when the settings are not completed or the target torque is empty.

> **Note** "Target Torque" on the settings screen shows at most two decimal places; this does not mean the data is truncated. The system saves and judges with the full value; the screen only shows it rounded. For example, 10 N·m switched to kgf·cm is shown as "101.97", but the full converted value is saved.

5.2.6 Chart Dialog

Click the chart button at the bottom of the statistics panel (“Torque chart” for Torque Wrench) to open the chart dialog (see Figure 5-3).

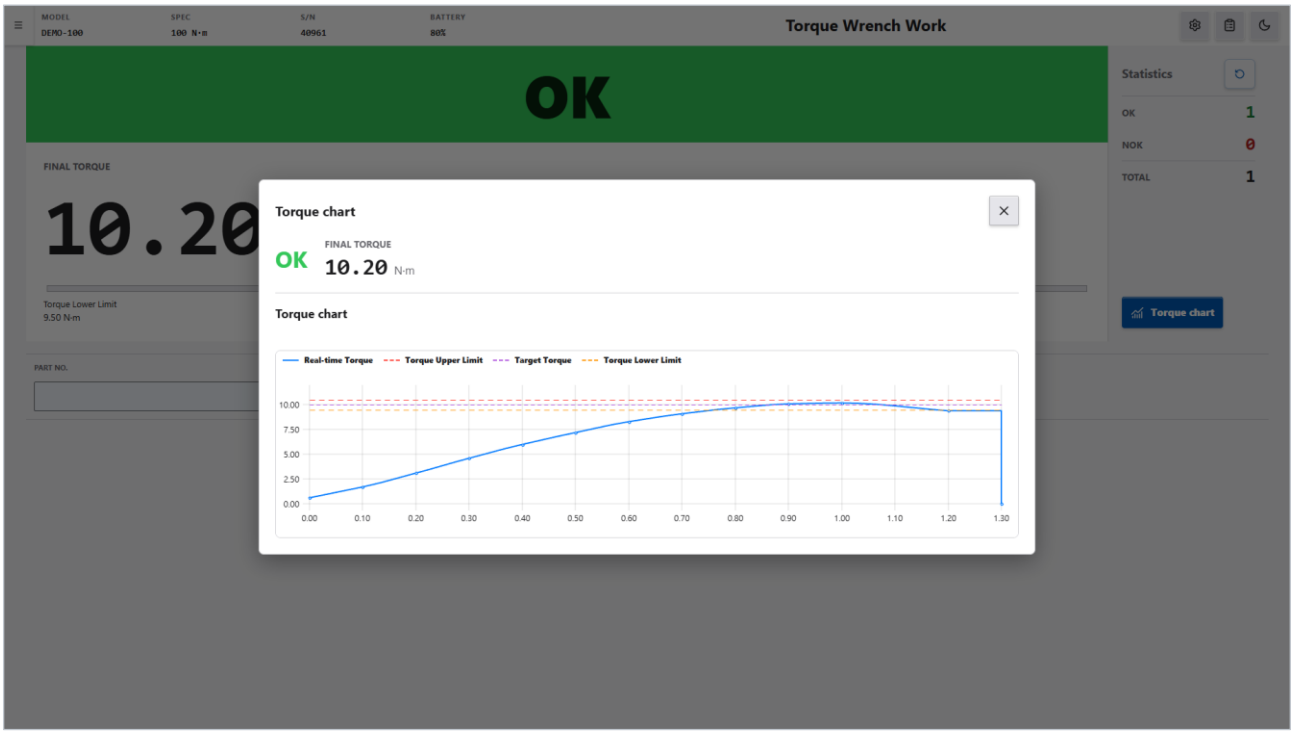

Figure 5-3 Chart dialog (torque wrench)

- The dialog title is the same as the button text. The judgement and readings are shown at the top, and the chart below them.
- Legend: “Real-time Torque” (solid line) and “Torque Upper Limit”, “Target Torque” and “Torque Lower Limit” (dashed lines). Torque & Angle and Torque Inspection also have angle lines (see Chapters 6 and 7). The upper and lower limit dashed lines use the same values as the range bar.
- The horizontal axis is the time (seconds) since the current torque application started; the vertical axis is the torque unit of this mode.
- The curve is a smoothed curve that passes through every sample point; the sample points are marked with small dots. Smoothing affects only how the curve is drawn; it does not change the sampled values, the judgement, or the values in records and exports.
- Torque Wrench and Torque & Angle: when you release the wrench and the torque returns to 0, the curve runs horizontally from the last reading to the moment the torque returned to zero, then drops vertically to 0.
- Each time a torque application starts, the previous curve is cleared and drawing restarts from 0 seconds; after release, the curve of this application is kept until the next torque application. The curve keeps at most the latest 600 points.
- When you move the mouse over the curve, the time and torque of that point are shown.

- The dialog does not open automatically when the judgement is NOK; to check the curve, click the chart button yourself.
- Click "×" (Close) at the top right or press Esc to close the dialog. Closing the dialog does not clear the curve.
- The curve is cleared when the RF connection is lost.

Note While the chart dialog is open, work continues and the judgement and statistics are updated as usual, but you cannot use the other fields of the work screen, for example "Part No.". Close the dialog before you scan the next workpiece.

5.2.7 Tolerance and OK Range

"Tolerance Type" and "Tolerance Range" determine the OK range, and also the marks of the range bar and the upper and lower limit dashed lines in the chart dialog. Judgement always compares values converted to N·m, so the result does not depend on the display unit.

Tolerance Type	Torque lower limit	Torque upper limit
"±"	Target torque × (1 − tolerance range %)	Target torque × (1 + tolerance range %)
"+"	Target torque	Target torque × (1 + tolerance range %)

Torque between the lower and upper limits (inclusive) is OK; otherwise it is NOK.

Example M8 bolt, sensor with a spec of 100 N·m, target torque 25 N·m, tolerance type "±", tolerance range 10%.
Torque lower limit = 25 × (1 − 10%) = 22.5 N·m; torque upper limit = 25 × (1 + 10%) = 27.5 N·m; OK range 22.5–27.5 N·m.
Peak 24.8 N·m → OK; peak 28.1 N·m → NOK (above the upper limit); peak 21.9 N·m → NOK (below the lower limit).
With the same conditions but tolerance type "+": OK range = 25 to 25 × (1 + 10%) = 25.0–27.5 N·m, and a peak of 24.8 N·m → NOK.

5.2.8 Indicator Light and Alarm Sound

When a judgement result is available, the system signals it with both a computer sound and the indicator light (three-color light):

Judgement status	Computer sound	Indicator light
OK	No sound	Green light flashes at 2 Hz
NOK	Two short high-pitched beeps	Red light and buzzer operate at 2 Hz; the buzzer stops after 2 seconds
Pending	No sound	All off

- The indicator light requires its COM port to be assigned in “System Settings” first (see Chapter 12); if none is assigned, only the screen and the computer sound signal the result.
- When you save on the settings screen and enter the work screen, the computer beeps once with a low tone.

5.2.9 Sensor Selection Field

The “Torque Sensor” drop-down list in “Sensor information” on the settings screen lists the paired sensors.

- The first option, “Select a paired torque sensor”, means that no sensor is selected. After a fresh installation the list contains only this option; pair a sensor first (see Chapter 12).
- The other options have the format “model / spec Nm / serial number” (see Figure 5-8). A sensor with no spec set shows “Specification not set” and cannot be saved once selected.
- The list updates automatically when sensor pairing is added or changed on another screen.
- After you select a sensor, “Model”, “Spec”, “S/N” and “Battery” in the header change to that sensor's data, and a hint such as “Allowed range (10%–100%): 10 – 100 N·m” is shown below “Target Torque”; the lower and upper limits are calculated from the selected sensor's spec and the current torque unit. The system does not fill in the target torque automatically: in a new setup “Target Torque” is empty, so enter a value within the range shown in the hint.
- When you select another sensor, the “Target Torque” you entered is cleared and must be entered again; other fields such as station and part number are kept. For the other torque fields of Torque & Angle and Torque Inspection, see Chapters 6 and 7. Saved settings do not change until you save.
- When you select the first option, “Select a paired torque sensor”, “Target Torque” becomes empty and the settable range hint is not shown.

5.2.10 Station and Part Number

“01 / Work Info” on the settings screen has the two fields “Station” and “Part Number”. Leading and trailing spaces are removed when you save.

Behavior in the parameter row at the bottom of the work screen:

- “Station” only shows the set value and cannot be changed on the work screen.
- “Part No.” is an input box that is filled with the set value when you enter the screen. You can type it or scan it with a barcode scanner; a number entered on the work screen is used only for the current work and is not written back to the settings. If “Part Number” in the settings has a value, the record uses that value instead (see Section 5.3.6).
- When you enter the work screen, the cursor is automatically placed in “Part No.” with its content selected, so scanning a new barcode replaces it directly. Pressing Enter only confirms and reselects the content; it does not submit anything or switch screens.

- The part number at the moment each torque application starts is recorded; changing it during the torque application does not affect this record.
- When the judgement is OK and the number was not changed during the torque application, “Part No.” is cleared automatically and gets the cursor, ready for scanning the next workpiece; when the judgement is NOK, the number is kept for rework.

“Station” and “Part Number” are both optional. If they are left empty, the corresponding field in the record is blank; no code is filled in automatically. This is the same in all four modes (for Batch Jobs, see Chapter 9).

5.2.11 Torque Unit

The settings screen of each mode has its own “Torque Unit”: kgf·cm, kgf·m, N·m, ozf·in, lbf·in or lbf·ft. New settings default to N·m.

- When you switch the unit, the torque values on the screen are automatically converted to the equivalent in the new unit; the actual torque does not change. Select the unit first, then enter the values.
- The final torque, target torque, range bar and curve on the work screen are all shown in the unit of this mode.
- The sensor “Spec” is always in N·m.
- If the unit in the settings is not in the list above but can be converted (for example gf·cm, mN·m, cN·m), it is converted automatically and N·m is selected when the settings screen opens; this takes effect after you save.
- If the unit cannot be recognized, “Unsupported torque unit: (unit)” is shown; you must select a unit again and re-enter the torque before you can save.
- Records, export and the read API use the global torque unit in “System Settings” and are not affected by the torque unit of each mode (see Chapters 11, 12 and 14).

5.2.12 Settings Check

When you click “Save Settings”, “Work” or “Back”, the system checks the fields first and saves only if all checks pass:

- A sensor with a valid spec must be selected.
- The target torque must not be empty and must be within 10%–100% of the selected sensor spec (converted to the current unit); the range is shown in the hint below the field (see Section 5.2.9).
- The target angle (Torque & Angle, Torque Inspection) must be within 1–360 degrees.
- When “Enable torque multiplier” is “On”, “Torque Ratio” (and, for Torque & Angle and Torque Inspection, also “Gear Ratio”) must be a number greater than 0.
- For the rules of other fields, see the field table of each mode.

Out-of-range values are **not** changed automatically to the upper or lower limit, and the system does not correct them by itself. Change them according to the message and save again. If the check or saving fails, you stay on the settings screen and your entries are kept.

> **Example** With a sensor spec of 100 N·m and the torque unit N·m, the settable target torque range = 100 × 10% to 100 × 100% = 10–100 N·m, and "Allowed range (10%–100%): 10 – 100 N·m" is shown below the field.
> If you enter 8, "Target torque must be between 10% and 100% of the selected sensor capacity (10.00 to 100.0 N·m)." is shown; the value is not changed to 10 automatically.
> With the same sensor and lbf·ft, the hint changes to "Allowed range (10%–100%): 7.38 – 73.75 lbf·ft".

5.2.13 Settings Screen Buttons

The settings screen buttons behave the same in all four modes:

Button	Description
"Save Settings"	Checks and saves the settings and, on success, switches to the work screen and starts work automatically. Cannot be clicked while the settings are loading.
"Work" (header)	Same as the save button: saves first and, on success, switches to the work screen.
"Back" (left arrow in the header)	Same as the save button: saves first and, on success, switches to the work screen. It does **not** discard changes.
"Work Records" (clipboard icon in the header)	Does not save; switches directly to the records screen filtered to this mode. Unsaved changes are lost.
"Reset"	Clears the form to its empty initial values; it does **not save**. To apply, you still have to save, and you must fill in the required fields again.

> **Warning** Both "Back" and "Work" on the settings screen save the current form content first. If you only want to view the settings without changing them, do not change any field, or click "Work Records" or leave through the navigation menu instead.

"Work Parameters" on the right side of the settings screen shows the form values in real time, including unsaved changes; "--" is shown for empty fields.

5.2.14 Permissions

Action	Permission required
Enter the work screen, start work, save each measurement result	"Run · Work"
Open the settings screen (including the "Settings" button in the header of the work screen)	"View · Work Settings"
Save on the settings screen (including "Work" and "Back")	"Edit · Work Parameters, Pairing and Calibration"
Click "Work Records"	"View · Work Records"

All three default templates A, B and C have “View · Work Settings”, “Run · Work” and “View · Work Records”; template C does not have “Edit · Work Parameters, Pairing and Calibration” by default. An administrator can adjust permissions for each user (see Chapter 15).

- With “Run · Work” but without “View · Work Settings”: you can enter the work screen of a mode whose settings are complete and work there, and the header has no “Settings” button; for a mode whose settings are not complete, the settings screen does not open, and the message that the settings failed to load (for example “Failed to load torque wrench settings.”) is shown above the content area without “Reload settings” next to it. Have an account with the permission complete the setup first.
- With “View · Work Settings” but without “Run · Work”: clicking a work mode only opens the settings screen and does not enter the work screen; after saving, you also stay on the settings screen.
- With neither: the work modes in the navigation menu are grayed out and cannot be clicked.
- Without “Edit · Work Parameters, Pairing and Calibration”, you can open the settings screen and change fields, but saving shows “You do not have permission to perform this operation.” and the settings do not change.
- Without “View · Work Records”, clicking “Work Records” does nothing.

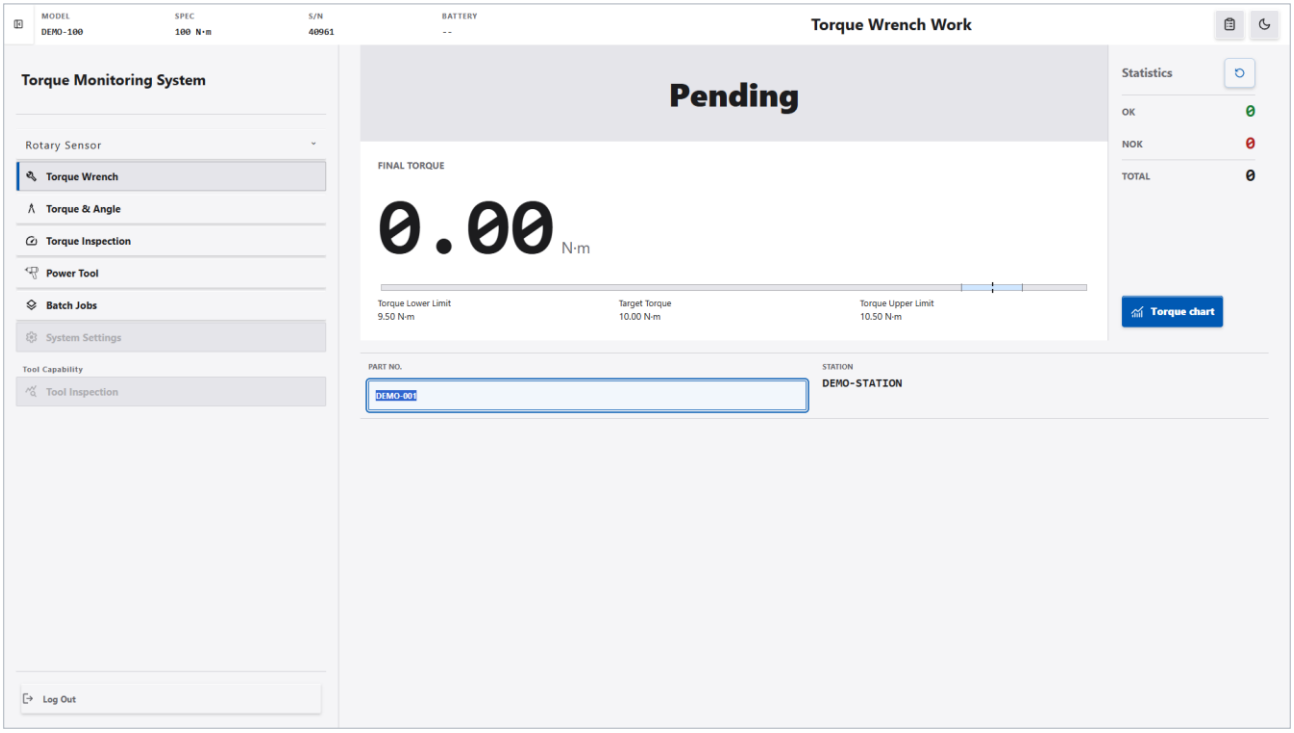

Figure 5-4 Account with only “Run · Work”: no “Settings” button in the header

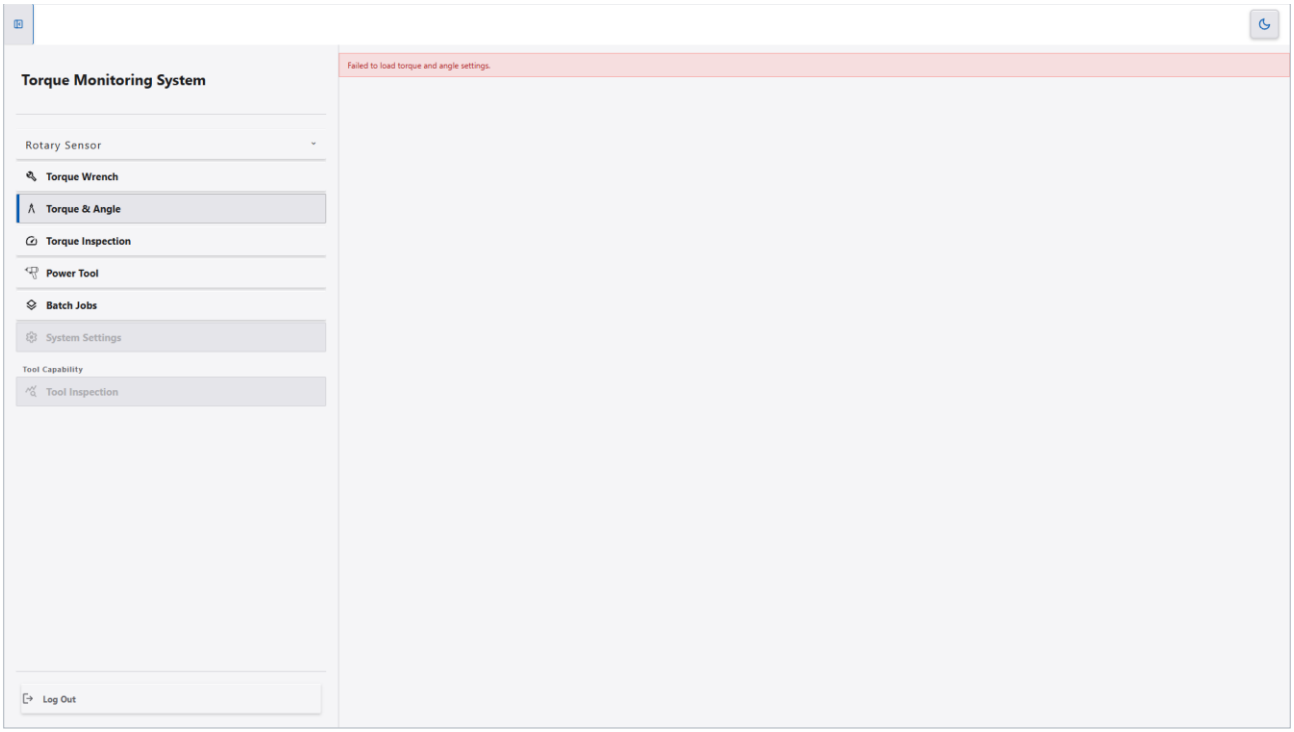

Figure 5-5 Account with only “Run · Work”: opening a mode whose settings are not complete

5.3 Torque Wrench Work Screen

Path: navigation menu → “Rotary Sensor” → “Torque Wrench”.

Operators use this screen for the actual tightening. Work starts automatically when you enter it, and the final torque and range bar are shown in real time. Each time the wrench is released, OK or NOK is judged automatically, a record is saved and the statistics are updated. The curve is viewed in the chart dialog.

Entering this screen, starting work and saving results require the “Run · Work” permission; for other permissions, see Section 5.2. If the torque wrench settings have never been saved, clicking “Torque Wrench” opens the settings screen first (see Section 5.5).

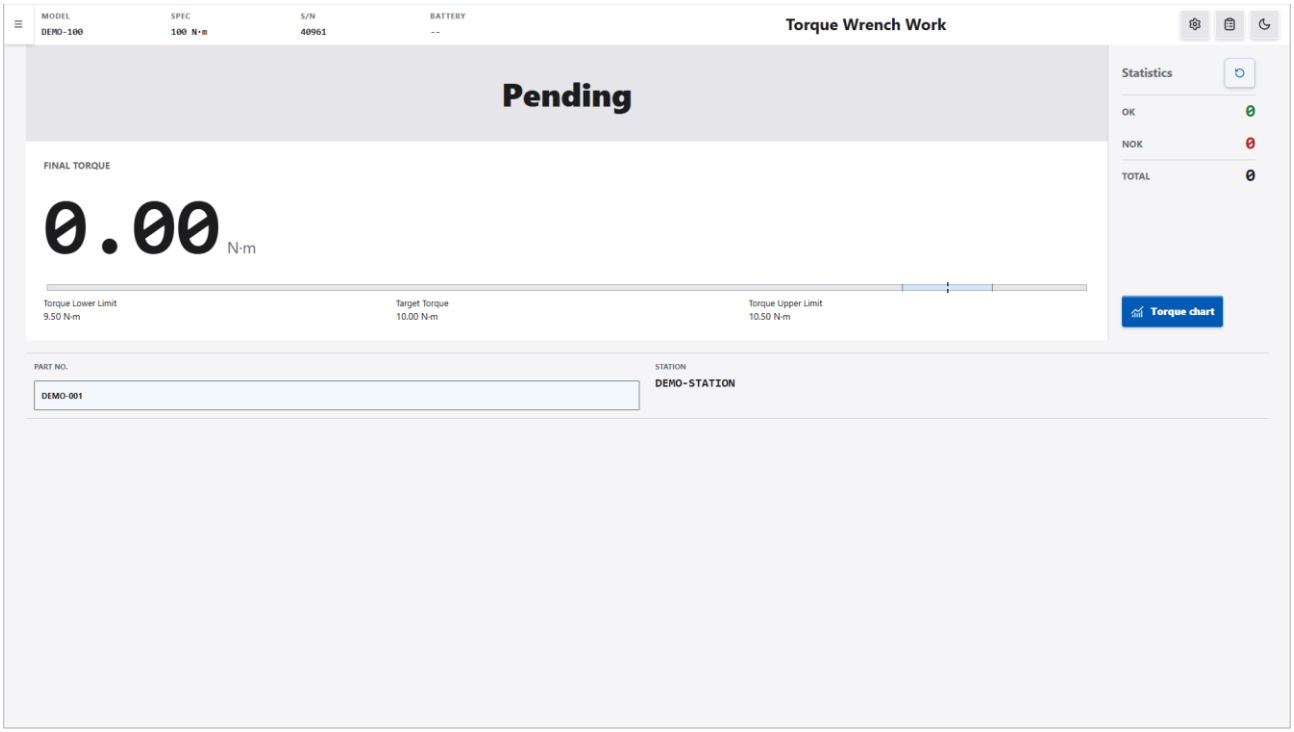

Figure 5-6 Torque wrench work screen

5.3.1 Screen Description

Area/button	Description
Header bar	Sensor information, the title “Torque Wrench Work”, “Settings”, “Work Records” and the theme toggle (see Section 5.2).
Verdict banner	“Pending”, “OK” or “NOK”; see “Judgement Status” below.
“Final Torque”	Peak torque of the current torque application and its unit; the range bar below marks the torque lower limit, target torque, torque upper limit and the position of the current reading (see Section 5.2.5). This mode does not show angle.
“Statistics” (right side)	The three counters “OK”, “NOK” and “Total”, and the reset button to the right of the heading (only the ↺ icon; shows “Reset” when you move the mouse pointer over it).
“Torque chart” (bottom of the statistics panel)	Opens the chart dialog, which shows the torque curve of the current torque application with the upper and lower limit dashed lines (see Section 5.2.6).
Parameter row	“Part No.” (editable) and “Station”. For the target torque and the upper and lower limits, see the range bar; other setting values are viewed and changed on the settings screen.
“Batch Progress”	Shown only when batch work is enabled, as a separate row below the parameter row: the number of completed OK results / the batch quantity (for example “2 / 5”) and a progress bar.
Message line	Shown in red below the parameter row when an error occurs; normally hidden.
“Batch Complete”	Appears in the middle of the screen for about 1 second when batch work is enabled and the OK count reaches the batch quantity.

5.3.2 Judgement Status

Status	Screen display	When it appears
Standby	The verdict banner shows “Pending” (gray background); final torque 0.00; no pointer on the range bar; empty curve	Just after entering the screen, after clicking “Reset”, after the RF connection is lost
Measuring	The verdict banner shows “Pending”; the final torque rises and the range bar pointer moves with it; the curve is drawn in real time in the chart dialog	While torque is applied with the wrench. When a new torque application starts, the previous OK/NOK returns to “Pending”
OK	The verdict banner shows “OK” (green background); no sound; “OK” and “Total” increase by 1; “Part No.” is cleared automatically	The wrench is released and the peak is within the OK range
NOK	The verdict banner shows “NOK” (red background); two warning beeps; “NOK” and “Total” increase by 1; “Part No.” is kept	The wrench is released and the peak is outside the OK range

When the wrench is released, the screen immediately shows OK or NOK so that the operator sees the result at once; at the same time, the system judges again with the current settings and saves the record. The statistics increase by 1 only after saving is complete, and the screen then shows the saved result. For the OK range calculation, see Section 5.2.

5.3.3 Statistics and Batch Progress

- “OK”, “NOK” and “Total” count only results saved successfully since you entered the screen this time; failed saves are not counted.
- When batch work is enabled, each OK increases “Batch Progress” by 1; NOK does not. When “Batch Quantity” is reached, “Batch Complete” appears for about 1 second and the progress is reset to 0 and counted again.
- When batch work is not enabled, “Batch Progress” is not shown on the screen.
- “Reset” sets the statistics and batch progress to 0, clears the curve, returns the judgement status to “Pending”, and discards a torque application that has not been released. It **does not delete saved records**.
- When you leave the work screen and enter it again, the statistics and batch progress start from 0; saved records are not affected.

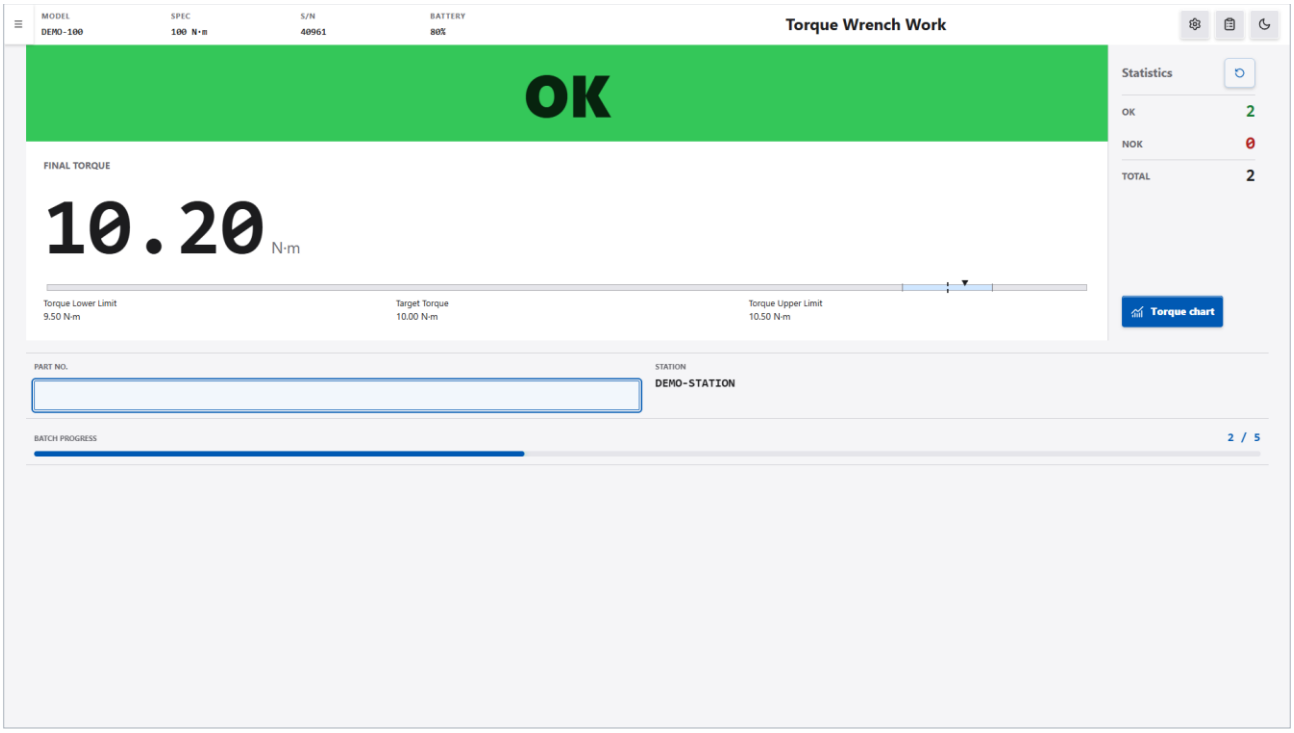

Figure 5-7 Torque wrench work screen (batch work enabled)

5.3.4 Operating Steps

1. In the navigation menu, click “Rotary Sensor” → “Torque Wrench”. The screen shows “Torque Wrench Work” with the verdict banner showing “Pending” (see Figure 5-6).
2. Check that the sensor “Model” and “S/N” in the header and the “Torque Lower Limit”, “Target Torque” and “Torque Upper Limit” on the range bar match the work instruction. If not, click “Settings” to change them (see Section 5.4).
3. Check that “Battery” in the header shows a percentage and that there is no red message at the bottom of the screen.
4. The cursor is in “Part No.”. Scan the barcode or enter the part number, then press Enter.
5. Apply torque with the wrench to tighten. “Final Torque” rises, the range bar pointer moves with it, and the verdict banner stays “Pending”.
6. Release the wrench. The verdict banner immediately shows “OK” or “NOK”; for NOK the computer gives two warning beeps, and if an indicator light is set up, it operates at the same time (see Section 5.2).
7. After saving is complete, the statistics increase by 1. For OK, “Part No.” is cleared automatically so that you can scan the next workpiece directly; for NOK, the number is kept, so rework the joint and apply torque again. To check the curve, click “Torque chart”; when you have finished, press Esc or click “×” to close the dialog, then scan the next workpiece.
8. Repeat steps 4–7. To restart counting from 0, click the reset button (↺ icon) in the statistics panel.
9. When work is finished, click “Work Records” to view the results (see Chapter 11). The system stops work automatically when you leave this screen.

Each “apply torque → release” produces one torque wrench record containing the final torque, judgement result, part number, station, target torque, tolerance and curve.

5.3.5 Error Messages

Screen message	Cause and solution
“Failed to load torque wrench settings.”	Reading the settings failed. Click “Reload settings” next to the message; if it still fails, log in again and retry; if it keeps happening, see Chapter 16. If the message is shown without “Reload settings”, see Section 5.2.14.
“Failed to load the paired torque sensor list.”	Reading the sensor list failed. Switch to another mode and back; if it still fails, see Chapter 16.
“Failed to start work.”	Starting work failed. Check the status of the RF receiver and sensor, then switch to another mode and back.
“Failed to start work.” (cause: the RF receiver is not open, and automatic detection also failed)	The RF receiver is not open, and automatic detection also failed. Rescan and connect it in Sensor Pairing (see Chapter 12).
“Failed to start work.” (cause: the RF receiver cannot be found, or another program is using its COM port)	Check the USB connection and close other programs that are using that COM port.
“Failed to start work.” (cause: the RF receiver did not respond in time)	Check that the sensor is switched on and within reception range, then rescan.
“Failed to start work.” (cause: the RF receiver is not connected or has been disconnected, and automatic detection failed)	The RF receiver is not connected or has been disconnected. Rescan and connect it, then enter this screen again.
“Failed to start work.” (cause: the sensor selected in the work settings is no longer in the sensor list)	The sensor selected in the settings is no longer in the list. Go back to the settings screen, select a sensor again and save.
“Failed to start work.” (cause: the serial number or channel of the current sensor is invalid)	The sensor pairing data is incomplete. Pair the sensor again (see Chapter 12).
“Failed to start work.” (cause: the saved target torque is outside 10% to 100% of the sensor capacity)	The saved target torque is outside the sensor spec range, for example because the sensor data has changed. Go back to the settings screen, correct it and save.
“Failed to start work.” (cause: the device did not respond in time, or the device service is temporarily unavailable)	The device did not respond when work started. Check the receiver and sensor status and enter this screen again; if it keeps happening, see Chapter 16.
“Failed to save the measurement result.” (cause: the result could not be saved, for example because the measurement service is temporarily unavailable)	Saving this result failed, and it was not counted in the statistics. Check the status and apply torque again.

Screen message	Cause and solution
"峰值扭矩必須大於 0。" / "初始扭矩必須大於 0。" (shown in Chinese even when the display language is English; they mean: peak torque must be greater than zero / initial torque must be greater than zero)	Saving this result was rejected. Apply torque again; if it keeps appearing, note the message and contact an administrator.
"You do not have permission to perform this operation."	The account does not have the "Run · Work" permission. Ask an administrator to adjust the permissions (see Chapter 15).
"The record was saved, but the records could not be refreshed."	The result has been saved; only the record list was not updated. There is no need to apply torque again; refresh the records screen to confirm.
"Invalid binary realtime data format."	Real-time data that cannot be parsed was received. Check that the sensor and receiver work normally and enter this screen again.
"Realtime torque monitoring is unavailable."	Real-time data cannot be received. Restart TMS RF; if it still fails, see Chapter 16.

5.3.6 Notes

Note If "Part Number" in "Torque Wrench — Settings" has a value, the record always uses the number from the settings; a number entered or scanned on the work screen is not written to the record. To scan the part number of each workpiece, leave "Part Number" in the settings empty. If nothing is entered on either the settings or the work screen, the part number in the record is blank.

Note If the sensor selected in the settings has been unpaired, work cannot start. Go back to the settings screen, select a sensor again and save.

Note If the RF connection is lost or "Reset" is clicked during a torque application, the torque application in progress is discarded and not saved, and the judgement status returns to "Pending". Apply torque again.

5.4 Torque Wrench Settings

Path: navigation menu → "Rotary Sensor" → "Torque Wrench" → "Settings" at the top right.

This screen sets the sensor, target torque, tolerance, batch and torque multiplier used by the torque wrench mode. After a successful save, the settings take effect immediately, and the screen switches to the work screen automatically and starts work.

The "Edit · Work Parameters, Pairing and Calibration" permission is required; without it, you can open the screen and change fields but cannot save.

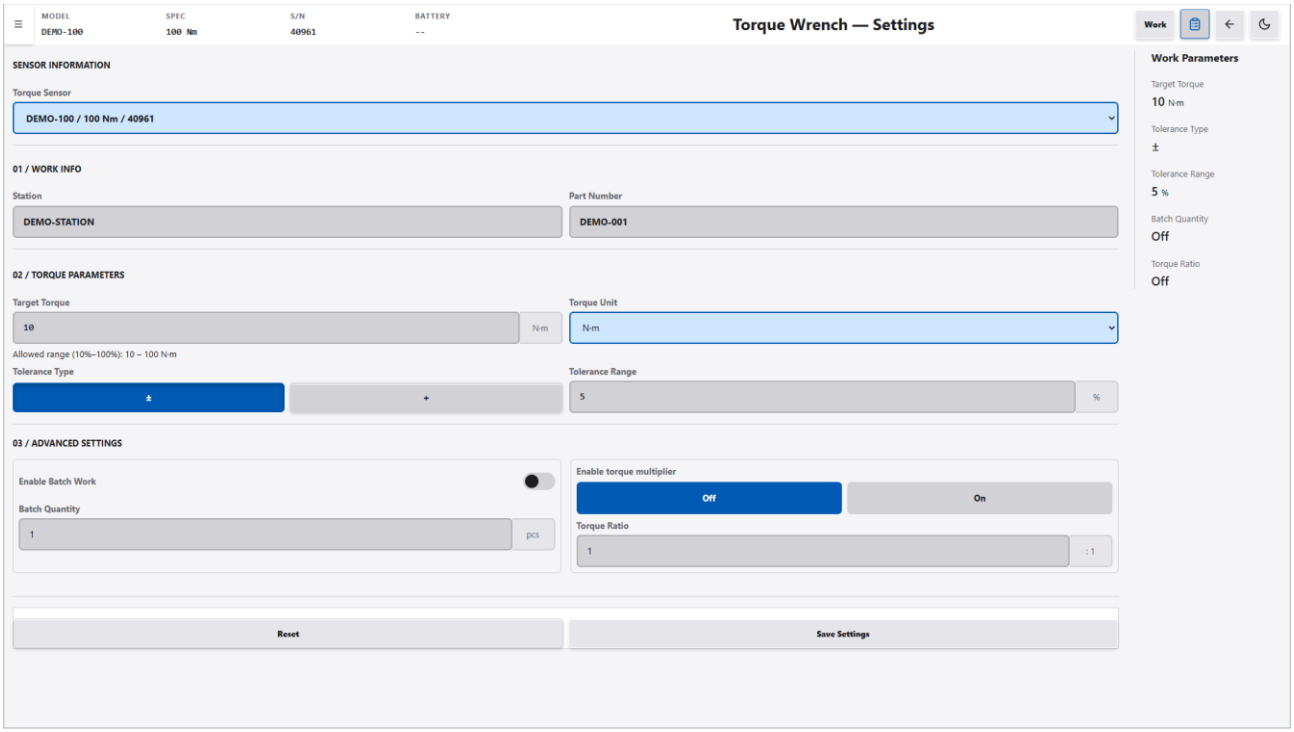

Figure 5-8 Torque wrench settings screen

5.4.1 Screen Description

Area/button	Description
Header bar	Sensor information, the title “Torque Wrench — Settings”, “Work”, “Work Records”, “Back” and the theme toggle (see Section 5.2).
“Sensor information”	“Torque Sensor” drop-down list (see Section 5.2).
“01 / Work Info”	“Station”, “Part Number”.
“02 / Torque Parameters”	“Target Torque” (the current unit is shown on the right), “Torque Unit”, “Tolerance Type” (“±”, “+”; the blue one is the current choice), “Tolerance Range” (%).
“03 / Advanced Settings”	On the left, the “Enable Batch Work” switch and “Batch Quantity” (pcs); on the right, “Enable torque multiplier” (“Off”, “On”) and the “Torque Ratio” input box (“: 1”).
Message line	Shows “Torque wrench settings were saved and activated.” after a successful save; if the check or saving fails, the reason is shown in red.
“Reset”, “Save Settings”	Buttons at the bottom of the form; see the button table below.
“Work Parameters” (right side)	Shows “Target Torque”, “Tolerance Type”, “Tolerance Range”, “Batch Quantity” and “Torque Ratio” in real time; “Off” is shown when batch or torque multiplier is off.

5.4.2 Fields

Field	Description	Range and default
Torque Sensor	Sensor used by this mode. The selected sensor determines the settable range of the target torque; when you select another sensor, “Target Torque” is cleared.	Required; only paired sensors with a valid spec can be selected.
Station	Work location, for example a production line code. Shown on the work screen but cannot be changed there.	Optional; if empty, it is blank in the record.
Part Number	Default value of “Part No.” on the work screen. If it has a value, the record always uses this value (see Section 5.3).	Optional; if empty, you can enter it for each workpiece on the work screen.
Target Torque	Reference torque for judging OK/NOK, in the unit selected in “Torque Unit”; converted automatically when you switch units. The settable range hint is shown below the field (see Section 5.2).	Required; empty in a new setup; 10%–100% of the sensor spec; shows at most two decimal places, the full value is saved.
Torque Unit	Unit for entering and displaying torque in this mode.	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; default N·m.
Tolerance Type	“±” allows deviation in both directions; “+” allows only values above the target torque (see Section 5.2).	“±” or “+”; default “±”.
Tolerance Range	Allowed deviation as a percentage.	Required; integer from 1 to 30; preset to 10 for the first setup.
Enable Batch Work	When on, the work screen calculates batch progress from the OK count.	On/Off; default Off.
Batch Quantity	Number of OKs required per batch.	Required when batch work is enabled; integer greater than 0; default 1.
Enable torque multiplier	Select “On” when the wrench is used with a torque multiplier; the final torque, curve and judgement are all multiplied by the “Torque Ratio”.	Off/On; default Off.
Torque Ratio	Torque amplification factor of the torque multiplier, used only in the torque wrench mode. It can be entered only when “Enable torque multiplier” is “On”. If no torque ratio has ever been entered in this mode, the torque ratio from the torque multiplier settings in “System Settings” is filled in and used (see Chapter 12); once you enter a value here and save, this mode uses that value instead: it is not affected by System Settings and does not change System Settings or the other modes.	A number greater than 0; not used when the torque multiplier is off, but the entered value is kept.

5.4.3 Buttons

Button	Description
“Save Settings”	Checks and saves. On success, it shows “Torque wrench settings were saved and activated.”, beeps once with a low tone, switches to the work screen and starts work; on failure, you stay on this screen.
“Work”, “Back”	Same as “Save Settings”; they save first (see Section 5.2).
“Work Records”	Does not save; switches to the records screen filtered to torque wrench records. Unsaved changes are lost.
“±”/“+”	Selects the tolerance type; takes effect only after you save.
“Off”/“On”	Selects whether the torque multiplier is applied; takes effect only after you save. Selecting “On” by mistake multiplies both the torque and the judgement by the torque ratio.
“Reset”	Clears the form: no sensor selected; station, part number, target torque, tolerance range and batch quantity empty; unit N·m, tolerance type “±”, batch and torque multiplier off. It does not save. “Torque Ratio” shows 1; if you save after resetting, the torque ratio previously entered for this mode is cleared, and this mode returns to using the torque ratio from the torque multiplier settings in “System Settings”.

5.4.4 Operating Steps

1. On the torque wrench work screen, click “Settings” at the top right. The screen shows “Torque Wrench — Settings”, with the form filled with the currently saved settings (see Figure 5-8).
2. Select a sensor in “Torque Sensor”. The header changes to that sensor's data, and the settable range is shown below “Target Torque”; when you select another sensor, “Target Torque” is cleared.
3. Enter “Station” and “Part Number” if needed; they can be left empty. To scan each workpiece on the work screen, leave “Part Number” empty.
4. Select the “Torque Unit” first, then enter the value in “Target Torque”.
5. Click “±” or “+” to select the tolerance type, and enter an integer from 1 to 30 in “Tolerance Range”.
6. If you need batch counting, turn on “Enable Batch Work” and enter the “Batch Quantity”. If the wrench is used with a torque multiplier, click “On” and enter the torque ratio of the torque multiplier in “Torque Ratio”, for example 3.5.
7. Check the values and unit against “Work Parameters” on the right.
8. Click “Save Settings”. The message line shows “Torque wrench settings were saved and activated.”, the computer beeps once with a low tone, and the screen switches to “Torque Wrench Work” and starts work automatically.
9. Check in the header and on the range bar of the work screen that the new settings have been applied.

The new settings are used from the next torque application. Saved records keep the settings that applied at the time and are not affected by the change.

5.4.5 Error Messages

Screen message	Cause and solution
“Select a torque sensor.”	No sensor has been selected. Select a paired sensor.
“Select a torque sensor with a valid capacity.”	The sensor spec is invalid, or the sensor in the original settings is no longer in the list. Select a sensor again; if the spec is wrong, correct it in Sensor Pairing (see Chapter 12).
“Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is empty or out of range. Change it to a value within the range in the message.
“Tolerance range must be an integer from 1 to 30.”	The tolerance range is empty, has decimals or is out of range. Enter an integer from 1 to 30.
“Batch quantity must be an integer greater than 0.”	Batch work is enabled but the quantity is invalid. Enter an integer greater than 0, or turn off batch work.
“Failed to save torque wrench settings.” (cause: batch work is off and the batch quantity is 0 or negative)	Batch work is off, but the quantity is 0 or negative. Change it to an integer of 1 or more, or leave it empty.
“Torque multiplier ratios must be finite values greater than zero.”	The torque multiplier is on, but “Torque Ratio” is empty, 0 or negative. Enter the torque ratio of the torque multiplier, or set the torque multiplier to “Off”.
“Unsupported torque unit: (unit)”	The unit in the settings cannot be recognized. Select a unit again and re-enter the target torque.
“You do not have permission to perform this operation.”	The account does not have the “Edit · Work Parameters, Pairing and Calibration” permission. Ask someone with the permission to make the change, or ask an administrator to adjust the permissions (see Chapter 15).
“Failed to save torque wrench settings.” (cause: the selected sensor no longer exists, or its capacity is invalid)	When saving, the sensor no longer exists or its spec is invalid. Select a sensor again; pair it again if necessary.
“Failed to save torque wrench settings.” (cause: the target torque is outside 10% to 100% of the sensor capacity when checked again in N·m)	The second check in N·m failed, for example because the sensor spec was changed after the screen was opened. Enter the screen again and enter a value within 10% to 100% of the sensor capacity.
“Your session has expired. Please sign in again.”	The login has timed out. Log in again and then save (see Chapter 3).
“Failed to save torque wrench settings.” (cause: another saving failure, for example the work settings service is temporarily unavailable)	Saving failed for another reason. Try again later; if it keeps happening, see Chapter 16.
“Failed to load torque wrench settings.”	Reading the settings failed. Enter this screen again and retry; if it keeps happening, see Chapter 16.

5.5 Empty Target and Station When Settings Are Not Completed

Path: navigation menu → “Rotary Sensor” → “Torque Wrench” (when the torque wrench settings have never been saved).

If the torque wrench settings have never been saved successfully, clicking “Torque Wrench” does not open the work screen; it opens the settings screen directly. You see this state the first time you use this mode after a fresh installation. After the first successful save, clicking “Torque Wrench” opens the work screen directly.

Completing the first setup requires the “Edit · Work Parameters, Pairing and Calibration” permission; template C does not have it by default, so use an account with the permission (see Chapter 15). If the account does not have the “View · Work Settings” permission, this screen does not open, and “Failed to load torque wrench settings.” is shown above the content area without “Reload settings” next to it (see Section 5.2.14). Opening this screen itself does not require a sensor or an RF connection.

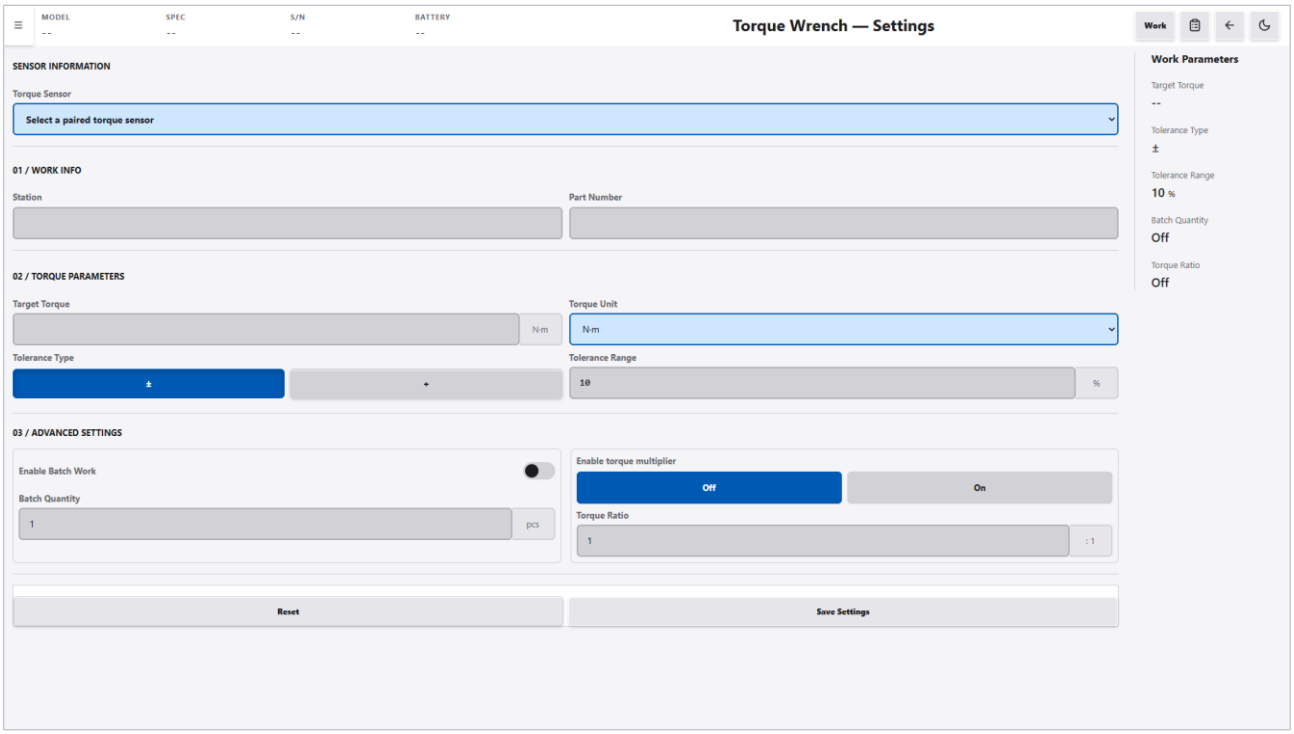

Figure 5-9 Torque wrench settings screen (settings not completed)

5.5.1 Fields When Settings Are Not Completed

The screen layout is the same as in Section 5.4. “Model”, “Spec”, “S/N” and “Battery” in the header show “--”, and “Target Torque” in “Work Parameters” on the right shows “--”. The initial state of each field is shown below. These are the system's initial values, not recommended work values; change them according to the work instruction.

Field	Description	Range and default
Torque Sensor	Shows “Select a paired torque sensor”, meaning that no sensor is selected; the system does not select a sensor automatically.	Required; cannot be saved without a selection.
Station	Empty. If saved empty, the station in the record is also blank; no code is filled in automatically.	Optional.
Part Number	Empty. If nothing is entered on either the settings or the work screen, the part number in the record is blank.	Optional.
Target Torque	Empty means not set yet, not 0. After you select a sensor, it is still empty, and the settable range is shown below the field.	Required; 10%–100% of the sensor spec.
Torque Unit	Preset to N·m.	One of the six units.
Tolerance Type	Preset to “±”.	”±” or ”+”.
Tolerance Range	Preset to 10.	Integer from 1 to 30.
Enable Batch Work/Batch Quantity	Preset to Off and 1.	The quantity is an integer greater than 0.
Enable torque multiplier/Torque Ratio	The torque multiplier is preset to Off; “Torque Ratio” shows the torque ratio from the torque multiplier settings in System Settings and can be changed only after the torque multiplier is turned on.	Off/On; the torque ratio is a number greater than 0.

5.5.2 When Settings Cannot Be Saved

If any of the following is true, clicking “Save Settings”, “Work” or “Back” keeps you on this screen and shows an error, so you cannot enter the work screen:

1. No sensor is selected, or the selected sensor's spec is invalid. The screen may show “Select a torque sensor.” or “Select a torque sensor with a valid capacity.”; the solution is the same: select a paired sensor; if the list is empty, complete sensor pairing first (see Chapter 12).
2. “Target Torque” is empty or not within 10%–100% of the sensor spec.
3. “Tolerance Range” is empty, has decimals or is not within 1–30, for example because it became empty after you clicked “Reset”.
4. “Enable Batch Work” is on, but “Batch Quantity” is not an integer greater than 0; or the torque multiplier is on, but “Torque Ratio” is not a number greater than 0.
5. The account does not have the “Edit · Work Parameters, Pairing and Calibration” permission, and the screen shows “You do not have permission to perform this operation.”.

Leaving “Station” and “Part Number” empty does **not** affect saving or starting work.

After the settings are saved successfully, the system still checks the RF receiver connection, the sensor and the “Run · Work” permission when you enter the work screen (see Section 5.2). If these conditions

are not met, the settings have been saved, but the work screen shows a message that work cannot start (see Section 5.3).

5.5.3 Completing the First Setup

1. Check that the torque sensor has been paired in Sensor Pairing under “System Settings” (see Chapter 12).
2. In the navigation menu, click “Rotary Sensor” → “Torque Wrench”. The settings screen with uncompleted settings is shown (see Figure 5-9).
3. Select a sensor in “Torque Sensor”. The header shows that sensor's data, and the settable range is shown below “Target Torque”.
4. Following the work instruction, select the “Torque Unit”, enter “Target Torque”, and check “Tolerance Type” and “Tolerance Range”.
5. Fill in “Station” and “Part Number” only if needed; they can be left empty.
6. Set batch and torque multiplier as needed (see Section 5.4).
7. Click “Save Settings”. On success, “Torque wrench settings were saved and activated.” is shown and the screen switches to the work screen; on failure, correct the entries according to the message and click it again.

5.6 Operating Example

This section walks through a complete job from setup to judgement.

Example Work conditions: one M8 bolt per workpiece, work instruction 25 N·m ±10%, a batch of 5 workpieces, part number scanned for each workpiece.
Sensor spec 100 N·m; settable target torque range = 100 × 10% to 100 × 100% = 10–100 N·m, so 25 N·m is within range.
OK range = 25 × (1 − 10%) to 25 × (1 + 10%) = 22.5–27.5 N·m.
① In “Torque Wrench — Settings”, select the sensor; select N·m in “Torque Unit” and enter 25 in “Target Torque”; click “±” for the tolerance type and enter 10 in “Tolerance Range”.
② Turn on “Enable Batch Work” and enter 5 in “Batch Quantity”; leave “Part Number” empty so that each workpiece can be scanned on the work screen.
③ Click “Save Settings”. The screen switches to “Torque Wrench Work”, the range bar shows torque lower limit “22.50 N·m”, target torque “25.00 N·m” and torque upper limit “27.50 N·m”, and the batch progress row shows “0 / 5”.
④ Scan workpiece WP-0001, apply torque to 24.80 N·m and release: judgement “OK”, OK = 1, Total = 1, batch progress “1 / 5”, and “Part No.” is cleared automatically.
⑤ Scan workpiece WP-0002, apply torque to 28.10 N·m and release: 28.10 is greater than the upper limit 27.5, so the judgement is “NOK” with two warning beeps; NOK = 1, Total = 2, batch progress stays at “1 / 5”, and “Part No.” keeps WP-0002.
⑥ After reworking WP-0002 according to the site rework procedure, apply torque again to 25.30 N·m: judgement “OK”, batch progress “2 / 5”.

⑦ When the 5th OK is completed, “Batch Complete” appears in the middle of the screen for about 1 second, and batch progress returns to “0 / 5”.
⑧ Click “Work Records” to see the records (see Chapter 11): for example, one record for WP-0001 (OK) and two for WP-0002 (one NOK, then one OK after rework).

Tip If the work instruction allows only values above the target torque, for example “25 N·m, +10%”, change the tolerance type to “+”. The OK range becomes 25.0–27.5 N·m, and a peak of 24.80 N·m is judged NOK (see Section 5.2).

Chapter 6 Torque and Angle

6.1 Mode Overview

The “Torque & Angle” mode is used for tightening that first tightens to a seating torque and then turns to a specified angle. Each torque application records both the peak torque and the final angle, and OK or NOK is judged according to the control mode.

Each torque application starts when the torque rises above 0 and ends when you release the wrench and the torque returns to 0. After release, the system saves the peak torque and final angle of this application as a record and judges it. This mode has **no** on-screen judgement at the moment of release: OK or NOK is shown only after saving is complete, and until then the judgement status stays “Pending”.

This chapter describes only what is specific to this mode. For the header, automatic start and stop of work, RF connection, battery level, result panel and range bar, chart dialog, torque conversion, tolerance calculation, indicator light and alarm sound, sensor selection, station and part number, torque unit, settings check, settings screen buttons and permissions, see Section 5.2.

Before use, pair a torque sensor that can report angle and connect the RF receiver (see Chapter 12). When you enter the work screen, in addition to the conditions in Section 5.2, the system checks that “Target Angle” is within 1–360 degrees.

6.1.1 When Angle Counting Starts

“Seating Torque” on the settings screen determines the starting point of the angle:

1. When the seating torque is greater than 0: the moment the torque first reaches the seating torque during torque application is taken as 0 degrees, and only the angle turned after that is counted. Until the torque reaches the seating torque, the angle is shown as 0.
2. When the seating torque is 0: the angle reported by the sensor is used directly.
3. The “Final Angle” of a torque application is the maximum angle during the application, shown to 1 decimal place.
4. When “Enable torque multiplier” is “On”, the torque is multiplied by the “Torque Ratio” and the angle is divided by the “Gear Ratio”. Both ratios are entered on the settings screen of this mode (see Section 6.3).

All torque values compared here are the values after the torque factor and the torque ratio of the torque multiplier are applied (see Section 5.2).

6.1.2 Judgement Rules

The judgement method is determined by "Control mode" on the settings screen:

Control mode	OK condition	Settings not used for judgement
"Angle"	Peak torque ≥ seating torque, **and** the final angle meets the "Angle tolerance standard": with "≥", final angle ≥ target angle; with "≤", final angle ≤ target angle	Target torque, torque tolerance standard, tolerance range (used only for the range bar and the curve reference lines)
"Torque"	Peak torque is within the OK range of the target torque, calculated in the same way as for the torque wrench (see Section 5.2)	Target angle, angle tolerance standard, angle range (used only for the range bar, the curve reference lines and the record)

Both "≥" and "≤" of the angle tolerance standard include equality.

Note When the control mode is "Angle", the result is OK as long as the seating torque is reached and the angle meets the condition, even if the peak torque is far above the "Target Torque". When the control mode is "Torque", the angle does not affect the judgement, whatever it is. Select the correct control mode according to the work instruction.

Example Control mode "Angle", seating torque 20 N·m, target angle 90 degrees, angle tolerance standard "≥".
OK condition: peak torque ≥ 20 N·m and final angle ≥ 90.0 degrees.
Peak 46.30 N·m, final angle 92.4 degrees → OK.
Peak 41.20 N·m, final angle 84.0 degrees → NOK (84.0 < 90).
Released at a peak of 18.50 N·m → the torque did not reach 20 N·m, so the angle never started counting (0.0 degrees) → NOK.

Example Control mode "Torque", target torque 40 N·m, torque tolerance standard "±", tolerance range 5%.
OK range = 40 × (1 − 5%) to 40 × (1 + 5%) = 38.0–42.0 N·m.
Peak 41.20 N·m → OK (whatever the final angle is); peak 43.00 N·m → NOK.

6.1.3 Differences from the Torque Wrench Mode

Item	Torque Wrench (Chapter 5)	Torque & Angle (this chapter)
Judged by	Peak torque and tolerance	Angle or torque, depending on the control mode
When the result appears	Shown at release, confirmed after saving	Shown only after saving is complete
Tolerance range	Integer from 1 to 30	0 or more, decimals allowed
Additional settings	None	Seating torque, control mode, target angle, angle tolerance standard, angle range, gear ratio

Item	Torque Wrench (Chapter 5)	Torque & Angle (this chapter)
Filled in automatically when a sensor is selected	Nothing; enter the target torque yourself	Seating torque = 20% of spec; enter the target torque yourself
Large readings on the work screen	“Final Torque”	“Final Torque” and “Final Angle”, each with its own range bar

6.2 Torque and Angle Work Screen

Path: navigation menu → “Rotary Sensor” → “Torque & Angle”.

Operators use this screen for the actual tightening. Work starts automatically when you enter it, and the final torque, final angle and their two range bars are shown in real time. Each time the wrench is released, a record is saved; after saving is complete, OK or NOK is shown and the statistics are updated. The curve is viewed in the chart dialog.

Starting work and saving results require the “Run · Work” permission; for other permissions, see Section 5.2. If the Torque & Angle settings have never been saved, clicking “Torque & Angle” opens the settings screen first (see Section 6.3).

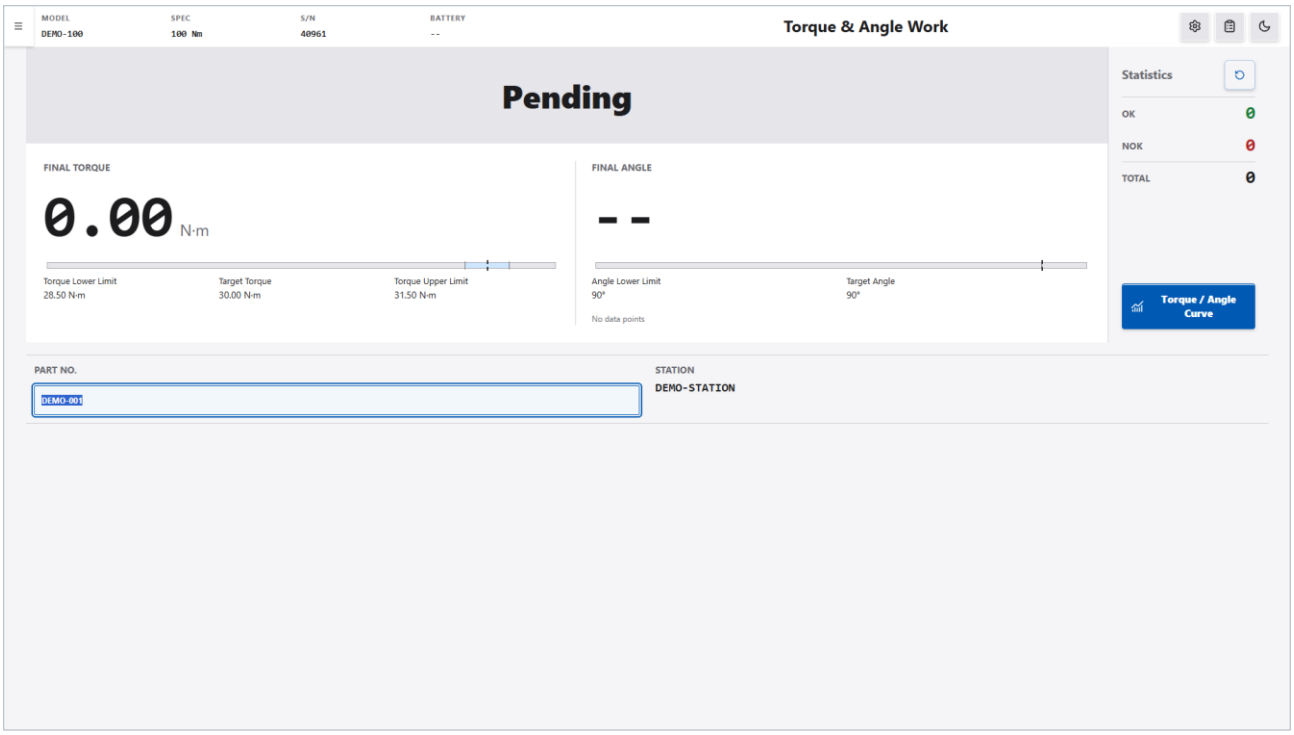

Figure 6-1 Torque & Angle work screen

6.2.1 Screen Description

Area/button	Description
Header bar	Sensor information, the title “Torque & Angle Work”, “Settings”, “Work Records” and the theme toggle (see Section 5.2).
Verdict banner	“Pending”, “OK” or “NOK”; see “Judgement Status” below.
“Final Torque”	Peak torque of the current torque application and its unit; the range bar below marks the torque lower limit, target torque, torque upper limit and the position of the current reading (see Section 5.2.5). When the control mode is “Angle”, the torque upper and lower limits are for reference only and are not used for judgement.
“Final Angle”	Maximum angle of the current torque application from the starting point (one decimal place, with “°” at the top right of the number); “--” is shown until angle data is received. The marks of the range bar below depend on the control mode; see “Range Bar of the Final Angle” below. The small text below the range bar is “Live Angle” when real-time data is received and “No data points” when there is none.
“Statistics” (right side)	The three counters “OK”, “NOK” and “Total”, and the reset icon button to the right of the heading (↺, no text; shows “Reset” when you move the mouse pointer over it).
“Torque / Angle Curve” (bottom of the statistics panel)	Opens the chart dialog, which shows the torque line, angle line and reference dashed lines of the current torque application; see “Chart Dialog” below.
Parameter row	“Part No.” (editable) and “Station”. Setting values such as the control mode, seating torque, tolerance and torque multiplier are not shown on the work screen; view and change them on the settings screen.
“Batch Progress”	Shown only when batch work is enabled, in a row of its own below the parameter row: the number of completed OK results / the batch quantity, and a progress bar.
Message line	Shown in red below the parameter row when an error occurs; normally hidden.
“Batch Complete”	Appears in the middle of the screen for about 1 second when batch is enabled and the OK count reaches the batch quantity.

Range Bar of the Final Angle

The marks depend on the control mode and the angle tolerance standard, and use the same values as the angle dashed lines in the chart dialog:

Control mode	Angle tolerance standard	Range bar marks
"Angle"	"≥"	"Angle Lower Limit" and "Target Angle", both equal to the target angle.
"Angle"	"≤"	"Target Angle" and "Angle Upper Limit", both equal to the target angle.
"Torque"	"±"	"Angle Lower Limit" = target angle − angle range; "Target Angle"; "Angle Upper Limit" = target angle + angle range.
"Torque"	"+"	"Angle Lower Limit" = target angle; "Target Angle"; "Angle Upper Limit" = target angle + angle range.

The triangular pointer marks the position of the final angle; no pointer is shown while there is no angle reading yet. When the control mode is "Torque", the angle marks are for reference only and are not used for judgement (see Section 6.1).

Chart Dialog

Click "Torque / Angle Curve" at the bottom of the statistics panel to open the chart dialog. For opening and closing the dialog and for the smoothed curve, see Section 5.2.6; this mode also has the following:

- Legend: "Real-time Torque", "Torque Upper Limit", "Target Torque", "Torque Lower Limit", "Live Angle", and the same angle dashed lines as the range bar of the final angle (those of "Angle Upper Limit", "Target Angle" and "Angle Lower Limit" that have a value).
- The angle line is counted from the starting point; when the seating torque is greater than 0, the angle line stays at 0 until the torque reaches the seating torque.
- When you release the wrench and the torque returns to 0, the torque line runs horizontally from the last reading to the moment the torque returned to zero, then drops vertically to 0 (the same as for Torque Wrench).
- Where some sample points have no angle data, the angle line is broken there and is not drawn at 0 degrees; an angle of 0 degrees that was actually measured is drawn as usual.
- When you move the mouse over the curve, the time, real-time torque and live angle of that point are shown.

6.2.2 Judgement Status

Status	Screen display	When it appears
Standby	The verdict banner shows “Pending” (gray background); final torque 0.00; final angle “--” and “No data points”; no pointer on the range bars; empty curve	Just after entering the screen, after clicking “Reset”
Measuring	The verdict banner shows “Pending”; the final torque rises; once the torque reaches the seating torque, the final angle starts increasing; the pointers of both range bars move with them; the chart dialog draws the torque line and the angle line at the same time	While torque is applied with the wrench, and after release until saving is complete. When a new torque application starts, the previous OK/NOK returns to “Pending”
OK	The verdict banner shows “OK” (green background); no sound; “OK” and “Total” increase by 1; “Part No.” is cleared automatically	Saving is complete and the judgement rules in Section 6.1 are met
NOK	The verdict banner shows “NOK” (red background); two warning beeps; “NOK” and “Total” increase by 1; “Part No.” is kept	Saving is complete and the judgement rules are not met

The OK/NOK on the screen is the saved judgement result. After release, the final torque and final angle keep the values of this application until the next torque application starts. For the indicator light and alarm sound, see Section 5.2.

6.2.3 Operating Steps

1. In the navigation menu, click “Rotary Sensor” → “Torque & Angle”. The screen shows “Torque & Angle Work” with the verdict banner showing “Pending” and the final angle “--” (see Figure 6-1).
2. Check that the marks of the two range bars (torque lower limit, target torque, torque upper limit and target angle) match the work instruction. Other settings such as the control mode and seating torque are not shown on the work screen; to view or change them, click “Settings” (see Section 6.3).
3. Check that “Battery” in the header shows a percentage and that there is no red message at the bottom of the screen.
4. The cursor is in “Part No.”. Scan the barcode or enter the part number, then press Enter.
5. Apply torque to tighten. “Final Torque” rises and the range bar pointer moves with it; once the torque reaches the seating torque, “Final Angle” starts increasing. The verdict banner stays “Pending”.
6. Release the wrench after turning to the required angle. The system saves and judges; when it is done, the verdict banner shows “OK” or “NOK” and the statistics increase by 1. For NOK, the computer gives two warning beeps.
7. For OK, “Part No.” is cleared automatically; for NOK, the number is kept, so rework the joint and apply torque again. To check the curve, click “Torque / Angle Curve”; when you have finished, press Esc or click “×” to close the dialog, then scan the next workpiece.

8. Repeat steps 4–7. To restart counting from 0, click the reset icon button in the statistics panel.
9. When work is finished, click “Work Records” to view the results (see Chapter 11).

Each “apply torque → release” produces one Torque & Angle record containing the peak torque, final angle, control mode, target values, tolerance, judgement result and curve.

6.2.4 Statistics and Reset

- “OK”, “NOK” and “Total” count only results saved successfully since you entered the screen this time. When you leave the screen and enter it again, they start from 0.
- When batch is enabled, each OK increases “Batch Progress” by 1; when “Batch Quantity” is reached, “Batch Complete” appears for about 1 second and the progress is reset to 0. When batch is not enabled, “Batch Progress” is not shown.
- “Reset” sets the statistics and batch progress to 0, clears the curve, final torque and final angle, returns the verdict banner to “Pending”, and discards a torque application that has not been released. It **does not delete saved records**.

6.2.5 Error Messages

Screen message	Cause and solution
“Failed to load torque and angle settings.”	Reading the settings failed. If a “Reload settings” button is shown next to the message, click it to read the settings again; after they are read successfully, work does not start automatically, so click “Work” on the screen. If it still fails, enter the screen again from the navigation menu.
“Failed to start work.”	Starting work failed. Check the status of the RF receiver and sensor, then switch to another mode and back.
“Failed to start work.” (cause: an RF receiver problem, for example the receiver is not open and automatic detection also failed)	Same as for the torque wrench; for solutions, see Section 5.3.
“Target angle must be between 1 and 360 degrees.”	The saved target angle is out of range. Go back to the settings screen, correct it and save.
“Failed to save the measurement result.”	Saving this result failed, or the result was saved but the record list was not updated. Check on the records screen whether this record exists; if not, apply torque again.
“Realtime torque monitoring is unavailable.”	Real-time data cannot be received. Restart TMS RF; if it still fails, see Chapter 16.
“Invalid binary realtime data format.”	Real-time data that cannot be parsed was received. Check that the sensor and receiver work normally and enter this screen again.

6.2.6 Notes

> **Note** "Part No." is optional. If it is empty when the torque application starts (nothing entered on either the settings or the work screen), the part number in the record is blank; no code is filled in automatically. If you need traceability by part number, enter or scan the part number before each torque application.
>
> **Note** When the RF connection is lost, the torque application in progress is discarded and not saved, the curve is cleared, the final torque returns to 0, and the final angle returns to "--". The verdict banner keeps the previous judgement and does not return to "Pending" automatically. Rely on the result after you apply torque again.

> **Tip** Whenever saving fails, this screen shows "Failed to save the measurement result.". If it happens repeatedly, note the time and check the number of records on the records screen.

6.3 Torque and Angle Settings

Path: navigation menu → "Rotary Sensor" → "Torque & Angle" → "Settings" at the top right.

This screen sets the sensor, seating torque, target torque, control mode, target angle and angle conditions, as well as batch and torque multiplier. After a successful save, the settings take effect immediately, and the screen switches to the work screen automatically and starts work.

The "Edit · Work Parameters, Pairing and Calibration" permission is required; without it, you can open the screen and change fields but cannot save.

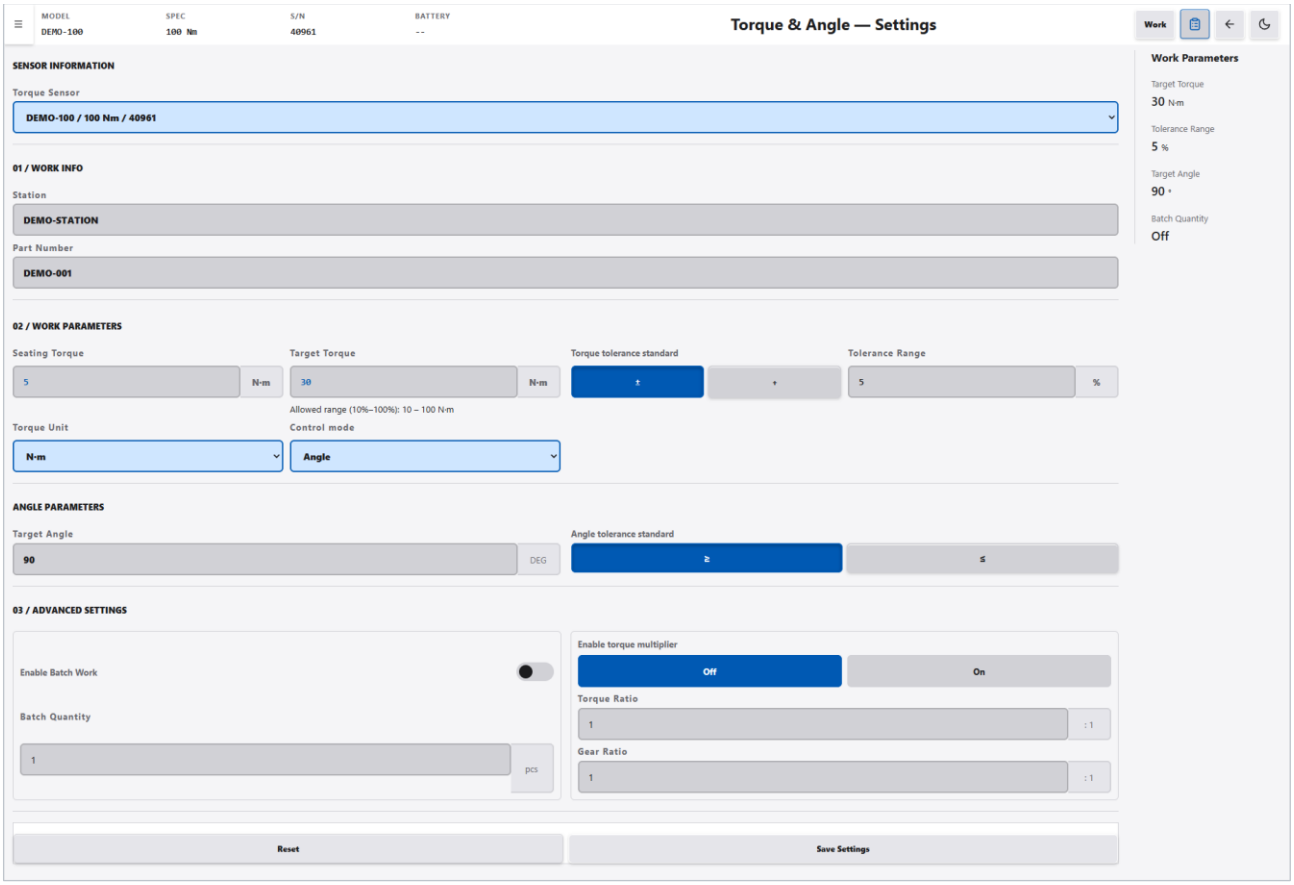

Figure 6-2 Torque & Angle settings screen

6.3.1 Screen Description

Area/button	Description
Header bar	Sensor information, the title “Torque & Angle — Settings”, “Work”, “Work Records”, “Back” and the theme toggle (see Section 5.2).
“Sensor information”	“Torque Sensor” drop-down list (see Section 5.2).
“01 / Work Info”	“Station”, “Part Number”.
“02 / Work Parameters”	“Seating Torque”, “Target Torque”, “Torque tolerance standard” (“±”, “+”), “Tolerance Range” (%), and the “Torque Unit” and “Control mode” drop-down lists.
“Angle parameters”	“Target Angle” (DEG) and the “Angle tolerance standard” buttons; when the control mode is “Torque”, there is also “Angle Range” (DEG).
“03 / Advanced Settings”	On the left, the “Enable Batch Work” switch and “Batch Quantity” (pcs); on the right, “Enable torque multiplier” (“Off”, “On”) and the “Torque Ratio” and “Gear Ratio” input boxes (“: 1”).
Message line	Shows “Torque and angle settings were saved locally.” after a successful save; if the check or saving fails, the reason is shown in red.
“Reset”, “Save Settings”	Buttons at the bottom of the form; scroll down if the window is not tall enough.
“Work Parameters” (right side)	Shows “Target Torque”, “Tolerance Range”, “Target Angle” and “Batch Quantity” in real time; “Off” is shown when batch is off.

6.3.2 Fields

Field	Description	Range and default
Torque Sensor	Sensor used by this mode. After selection, the seating torque is filled in automatically with 20% of the spec (converted to the current unit); "Target Torque" is cleared and must be entered yourself.	Required; only paired sensors with a valid spec can be selected.
Station	Work location. Shown on the work screen but cannot be changed there.	Optional; if empty, it is blank in the record.
Part Number	Default value of "Part No." on the work screen; can be overwritten on the work screen.	Optional; if nothing is entered on either the settings or the work screen, it is blank in the record.
Seating Torque	When the torque reaches this value, the angle starts counting from 0; in control mode "Angle", it is also the minimum torque for OK. Enter 0 to disable the start threshold and use the sensor angle directly.	Required; 0 or more. The system does not check whether it is less than the target torque.
Target Torque	Judgement reference in control mode "Torque"; in control mode "Angle", used only for the range bar and the curve reference lines. After you select a sensor, "Allowed range (10%–100%): lower limit – upper limit unit" is shown below the field.	Required; 10%–100% of the sensor spec; empty for the first setup; shows at most two decimal places, the full value is saved.
Torque tolerance standard	"±" or "+" (see Section 5.2). Used for judgement only in control mode "Torque".	Default "±".
Tolerance Range	Allowed torque deviation as a percentage; also determines the torque upper and lower limits of the curve. Used for judgement only in control mode "Torque".	Required; 0 or more, decimals allowed; preset to 10 for the first setup.
Torque Unit	Unit for entering and displaying torque. When switched, the seating torque and target torque are converted together.	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; default N·m.
Control mode	Judges by "Angle" or "Torque" (see Section 6.1). When switched, "Angle tolerance standard" is reset to the default of that mode.	"Angle" or "Torque"; default "Angle".
Target Angle	Angle judgement reference, in DEG (degrees).	Required; 1–360, decimals allowed; empty for the first setup.
Angle tolerance standard (control mode "Angle")	"≥": final angle must be ≥ target angle; "≤": final angle must be ≤ target angle. Both include equality.	"≥" or "≤"; default "≥".

Field	Description	Range and default
Angle tolerance standard (control mode “Torque”)	“±” or “+”; determines the direction of the angle reference lines and is not used for judgement.	Default “±”.
Angle Range	Shown only in control mode “Torque”. Width (degrees) of the angle reference range; used only for the curve reference lines and the record.	Required in control mode “Torque”; 0 or more, decimals allowed; preset to 10 for the first setup.
Enable Batch Work	When on, the work screen calculates batch progress from the OK count.	On/Off; default Off.
Batch Quantity	Number of OKs required per batch.	Required when batch work is enabled; integer greater than 0; default 1.
Enable torque multiplier	Select “On” when a torque multiplier is used: the torque is multiplied by the “Torque Ratio” and the angle is divided by the “Gear Ratio”.	Off/On; default Off.
Torque Ratio	Torque amplification factor of the torque multiplier, with “: 1” on the right. It can be entered only when “Enable torque multiplier” is “On”. If neither a torque ratio nor a gear ratio has ever been entered in this mode, the torque multiplier settings in “System Settings” are filled in and used (see Chapter 12); once you change the torque ratio or gear ratio here and save, this mode uses the two values on the screen: they are not affected by System Settings and do not change System Settings or the other modes.	A number greater than 0; not used when the torque multiplier is off, but the entered value is kept.
Gear Ratio	Angle reduction factor of the torque multiplier, with “: 1” on the right. It can be entered only when “Enable torque multiplier” is “On”, and it is saved together with “Torque Ratio” (see the previous row).	A number greater than 0; not used when the torque multiplier is off, but the entered value is kept.

Note When you select a sensor, “Seating Torque” is filled in automatically with 20% of the spec, and “Target Torque” is cleared and must be entered yourself; other fields such as “Target Angle” are kept. In control mode “Angle”, the seating torque is also the minimum torque for OK. Change it according to the work instruction; do not simply keep the automatically filled value.

6.3.3 Buttons

Button	Description
“Save Settings”	Checks and saves. On success, it shows “Torque and angle settings were saved locally.”, beeps once with a low tone, switches to the work screen and starts work; on failure, you stay on this screen.
“Work”, “Back”	Same as “Save Settings”; they save first (see Section 5.2).

Button	Description
"Work Records"	Does not save; switches to the records screen filtered to Torque & Angle records. Unsaved changes are lost.
"±"/"+" (torque tolerance standard)	Selects the torque tolerance standard; takes effect only after you save.
"Control mode" drop-down list	Selects "Angle" or "Torque". After switching, the angle tolerance standard is reset; check it again.
"≥"/"≤" or "±"/"+" (angle tolerance standard)	Selects the angle condition; takes effect only after you save.
"Off"/"On" (Enable torque multiplier)	Selects whether the torque multiplier is applied. Selecting "On" by mistake converts both torque and angle.
"Reset"	Clears the form: no sensor selected; station, part number, seating torque, target torque, tolerance range, target angle, angle range and batch quantity empty; unit N·m, torque tolerance standard "±", control mode "Angle", angle tolerance standard "≥", batch and torque multiplier off. It does not save; you must fill in the form again before you can save. "Torque Ratio" shows 1 and "Gear Ratio" shows the gear ratio from the torque multiplier settings in "System Settings"; if you save after resetting without changing these two values, the torque ratio and gear ratio previously entered for this mode are cleared, and this mode returns to using the torque multiplier settings in "System Settings".

6.3.4 Operating Steps

1. On the Torque & Angle work screen, click "Settings" at the top right. The screen shows "Torque & Angle — Settings", with the form filled with the currently saved settings (see Figure 6-2).
2. Select a sensor in "Torque Sensor". The header changes to that sensor's data, "Seating Torque" is filled in automatically, and "Target Torque" becomes empty, with the settable range shown below the field.
3. Enter "Station" and "Part Number" if needed.
4. Select the "Torque Unit", then change "Seating Torque" and enter "Target Torque".
5. Select the "Control mode": "Angle" to judge by angle, "Torque" to judge by torque.
6. When the control mode is "Angle": enter a value from 1 to 360 in "Target Angle", and click "≥" (final angle must be ≥ target angle) or "≤" (final angle must be ≤ target angle).
7. When the control mode is "Torque": set "Torque tolerance standard" and "Tolerance Range"; if you need angle reference lines, also set the angle tolerance standard and "Angle Range".
8. Set batch and torque multiplier as needed. When a torque multiplier is used, click "On" and enter the ratios of the torque multiplier in "Torque Ratio" and "Gear Ratio".

9. After checking against “Work Parameters” on the right, click “Save Settings”. On success, “Torque and angle settings were saved locally.” is shown, the computer beeps once with a low tone, and the screen switches to the work screen and starts work automatically.

The new settings are used from the next torque application. Saved records keep the settings that applied at the time and are not affected by the change.

6.3.5 Screen When Settings Are Not Completed

If the settings of this mode have never been saved successfully, clicking “Torque & Angle” in the navigation menu opens this screen directly. In this state, “Torque Sensor” shows “Select a paired torque sensor”, “Seating Torque”, “Target Torque” and “Target Angle” are empty, “Tolerance Range” is preset to 10 and “Angle Range” to 10 (not shown in control mode “Angle”), the control mode is “Angle”, the angle tolerance standard is “≥”, and batch and torque multiplier are off; “Torque Ratio” and “Gear Ratio” show the ratios from the torque multiplier settings in “System Settings” and can be changed only after the torque multiplier is turned on. These are the system's initial values, not recommended work values; change them according to the work instruction.

If you save directly, “Initial torque must be 0 or greater.” is shown first (seating torque empty). Select a sensor and fill in the seating torque, target torque, target angle and other fields in order, and you can save; leaving station and part number empty does not affect saving.

6.3.6 Error Messages

When you save, the fields are checked in the order of the first 10 rows of the table below; the check stops at the first error and shows that message. After the fields pass, the system checks the permission and sensor data. On failure, you stay on the settings screen and the form content is kept.

Screen message	Cause and solution
“Unsupported torque unit: (unit)”	The unit in the settings cannot be recognized. Select a unit again and re-enter the torque values.
“Initial torque must be 0 or greater.”	“Seating Torque” is empty or negative. Enter a value of 0 or more.
“Select a torque sensor.” / “Select a torque sensor with a valid capacity.”	No sensor is selected, or the sensor spec is invalid or the sensor is no longer in the list. Select a paired sensor with a valid spec.
“Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is empty or out of range. Change it to a value within the range in the message.
“Target angle must be between 1 and 360 degrees.”	The target angle is empty or out of range. Enter 1–360.
“Tolerance range must be 0 or greater.”	The tolerance range is empty or negative. Enter a value of 0 or more.

Screen message	Cause and solution
"Angle range must be 0 or greater."	In control mode "Torque", the angle range is empty or negative. Enter a value of 0 or more.
"Batch quantity must be an integer greater than 0."	Batch is enabled but the quantity is invalid. Enter an integer greater than 0, or turn off batch.
"Torque multiplier ratios must be finite values greater than zero."	The torque multiplier is on, but "Torque Ratio" is empty, 0 or negative. Enter the torque ratio of the torque multiplier, or set the torque multiplier to "Off".
"Gear ratios must be finite values greater than zero."	The torque multiplier is on, but "Gear Ratio" is empty, 0 or negative. Enter the gear ratio of the torque multiplier, or set the torque multiplier to "Off".
"You do not have permission to perform this operation."	The account does not have the "Edit · Work Parameters, Pairing and Calibration" permission. Ask someone with the permission to make the change, or ask an administrator to adjust the permissions (see Chapter 15).
"Failed to save torque and angle settings." (cause: the target torque is 0 or less, the torque tolerance range or angle range is negative, or the batch quantity is not a positive integer)	The second check during saving failed. Check the target torque, tolerance range, angle range and batch quantity, and correct the wrong entry.
"Failed to save torque and angle settings." (cause: the angle condition or control mode is invalid, or they do not match)	The angle condition or control mode data is abnormal. Select the control mode and angle tolerance standard again, then save.
"Failed to save torque and angle settings." (cause: the selected sensor no longer exists, or the target torque is outside 10% to 100% of the sensor capacity when checked again in N·m)	When saving, the sensor no longer exists, or the second range check in N·m failed. Select a sensor again or correct the target torque.
"Failed to save torque and angle settings." (cause: another saving failure, for example the work settings service is temporarily unavailable)	Saving failed for another reason. Try again later; if it keeps happening, see Chapter 16.
"Failed to load torque and angle settings."	Reading the settings failed, or the account does not have the "View · Work Settings" permission. Check the permission and enter the screen again.
"Failed to load the paired torque sensor list."	Reading the sensor list failed. Leave the screen and enter it again.

6.4 Operating Example

> **Example** Work conditions: an M10 bolt is tightened with the torque-angle method, first to a seating torque of 20 N·m and then a further 90 degrees; too small an angle is judged NOK.
> Sensor spec 100 N·m: settable target torque range = 100 × 10% to 100 × 100% = 10–100 N·m; the target angle of 90 degrees is within 1–360 degrees.

OK condition: peak torque ≥ 20 N·m and final angle ≥ 90.0 degrees.

① In “Torque & Angle — Settings”, select the sensor. The system fills in a seating torque of 20 (20% of spec); “Target Torque” is empty, and “Allowed range (10%–100%): 10 – 100 N·m” is shown below the field.

② Select N·m in “Torque Unit”; keep “Seating Torque” at 20; enter 40 in “Target Torque” and 10 in “Tolerance Range”. In angle mode, these two values are used only for the range bar and the curve reference lines (36.0–44.0 N·m).

③ Select “Angle” in “Control mode”, enter 90 in “Target Angle”, and click “≥” for “Angle tolerance standard”.

④ Click “Save Settings”. The screen switches to the work screen, and “Angle Lower Limit” and “Target Angle” on the range bar of “Final Angle” are both marked at 90°.

⑤ Scan workpiece WP-1001 and apply torque. When the torque reaches 20 N·m, “Final Angle” starts increasing from 0; release at 92.4 degrees with a peak of 46.30 N·m. After saving, the verdict banner shows “OK”: 46.30 ≥ 20 and 92.4 ≥ 90. Although the range bar pointer of “Final Torque” goes beyond the torque upper limit of 44.0 N·m, angle mode does not judge by it.

⑥ Scan workpiece WP-1002 and release at only 84.0 degrees. After saving, the verdict banner shows “NOK” (84.0 < 90) with two warning beeps, and “Part No.” keeps WP-1002.

⑦ After reworking according to the site rework procedure, apply torque again, release at 91.0 degrees, and “OK” is shown.

Tip If the work instruction changes to judging by torque (for example 40 N·m ±5%), change “Control mode” to “Torque”. The OK range is 38.0–42.0 N·m, and the angle is only drawn as a reference line and recorded; it does not affect the judgement (see Section 6.1).

Chapter 7 Torque Inspection

7.1 Mode Overview

The “Torque Inspection” mode measures the torque at the moment the joint has turned a specified angle after the torque reaches a start value, and judges OK or NOK by that torque.

The settings screen has only one start value, “Target Torque (Angle Start)”. This value is both the starting point of the angle and the center value for judgement. The torque at the moment the “Target Angle” is reached is called the “Angle Torque”, and the system judges by the angle torque.

This chapter describes only what is specific to this mode. For the header, automatic start and stop of work, RF connection, battery level, result panel and range bars, chart dialog, torque conversion, tolerance calculation, indicator light and alarm sound, sensor selection, station and part number, torque unit, settings check, settings screen buttons and permissions, see Section 5.2.

Before use, pair a torque sensor that can report angle and connect the RF receiver (see Chapter 12). When you enter the work screen, in addition to the conditions in Section 5.2, the system checks that “Target Angle” is within 1–360 degrees.

7.1.1 Flow of One Measurement

1. When torque application starts (torque greater than 0), the system starts a new measurement and records the part number at that moment.
2. When the torque reaches “Target Torque (Angle Start)”, the angle at that moment is recorded as the reference, and all later angles are counted from this reference.
3. When the angle counted from the start reaches the “Target Angle”, the system interpolates the torque at that angle from the readings before and after it, locks it as the “Angle Torque” and shows it as the large reading on the work screen.
4. When you release the tool and the torque returns to 0, the measurement ends. If an angle torque was obtained, the system saves and judges it; if you release before reaching the target angle, **no record is produced** and the judgement status stays “Pending”.

When “Enable torque multiplier” is “On”, the torque is multiplied by the “Torque Ratio” and the angle is divided by the “Gear Ratio”. Both ratios are entered on the settings screen of this mode (see Section 7.3).

7.1.2 Judgement Rules

The angle torque is converted to N·m and compared with the OK range of the target torque (angle start), calculated in the same way as for the torque wrench (see Section 5.2):

- Tolerance type “±”: OK if target torque × (1 − tolerance range %) ≤ angle torque ≤ target torque × (1 + tolerance range %).

- Tolerance type "+": OK if target torque ≤ angle torque ≤ target torque × (1 + tolerance range %).
- Otherwise NOK.

The system judges and saves only if the angle torque is greater than half of the torque lower limit (with tolerance type "+", the torque lower limit is the target torque). If it is not, no record is produced, nothing is counted in the statistics, and the screen shows "Failed to save the measurement result.".

> **Example** Sensor spec 100 N·m, target torque (angle start) 20 N·m, tolerance type "±", tolerance range 10%, target angle 15 degrees.
> OK range = 20 × (1 − 10%) to 20 × (1 + 10%) = 18.0–22.0 N·m.
> Saving threshold = torque lower limit 18.0 × 50% = 9.0 N·m; the angle torque must be greater than 9.0 N·m to be judged.
> After the torque reaches 20 N·m, the joint turns another 15 degrees, and the angle torque is 21.40 N·m → OK.
> Angle torque 23.10 N·m → NOK (above the upper limit 22.0).
> After the torque reaches 20 N·m, the tool is released after only 12 degrees → no angle torque, no record, and the screen stays "Pending".

7.1.3 Torque Values on the Screen

This mode uses the following kinds of torque; keep them apart:

Name	Meaning	Used for judgement
Angle Torque	The large reading on the work screen. Torque at the point where the target angle is reached after the start; "--" is shown until it is obtained. The triangular pointer on the range bar marks this value; no pointer is shown until it is obtained. Stays displayed after release until the next torque application.	Yes
Target Torque (Angle Start)	Setting value; both the angle starting point and the center value for judgement. The "Torque Lower Limit", "Target Torque" and "Torque Upper Limit" of the range bar and the curve are calculated from this value and the tolerance.	Yes (as the reference)
Final Torque	Maximum torque of the current measurement (the peak, with the torque factor and the torque ratio of the torque multiplier applied). Not shown on the work screen; saved in the record and visible in the record details (see Chapter 11).	No

In the chart dialog, the "Real-time Torque" line is the torque at each sample point, and the "Final Torque" in the record is the highest of them.

Note The large reading on the work screen is the “Angle Torque”, not the real-time torque and not the peak. After torque application starts and before the target angle is reached, the reading stays “--” and the range bar has no pointer; this is normal. The value appears only when the target angle is reached, and it does not change if you keep applying torque afterwards. The “Torque Lower Limit” and “Torque Upper Limit” of the range bar are the OK range of the angle torque, and the pointer marks the angle torque that is used for judgement. To see the real-time torque and angle during torque application, open the chart dialog.

Example Target torque (angle start) 20 N·m, tolerance type “±”, tolerance range 10%, OK range 18.0–22.0 N·m.
When the joint turns past the target angle, the angle torque is 21.40 N·m; torque is then applied further up to 24.60 N·m before the tool is released.
“Angle Torque” shows 21.40 N·m, and the range bar pointer is between the torque lower limit 18.0 and the torque upper limit 22.0. The 24.60 N·m is the final torque; it is not shown on the work screen and is only saved in the record.
The judgement uses the angle torque: 18.0 ≤ 21.40 ≤ 22.0 → the verdict banner shows “OK”.

7.2 Work Screen

Path: navigation menu → “Rotary Sensor” → “Torque Inspection”.

Use this screen for torque inspection on site. Work starts automatically when you enter it, and the angle torque and the range bar are shown. Each time you turn past the target angle and release, the system judges OK or NOK automatically by the angle torque, writes a record and updates the statistics. Curves are viewed in the chart dialog.

Starting work and saving results require the “Run · Work” permission; for other permissions, see Section 5.2. If the Torque Inspection settings have never been saved, clicking “Torque Inspection” opens the settings screen first (see Section 7.3). While loading, the screen shows “Loading...”.

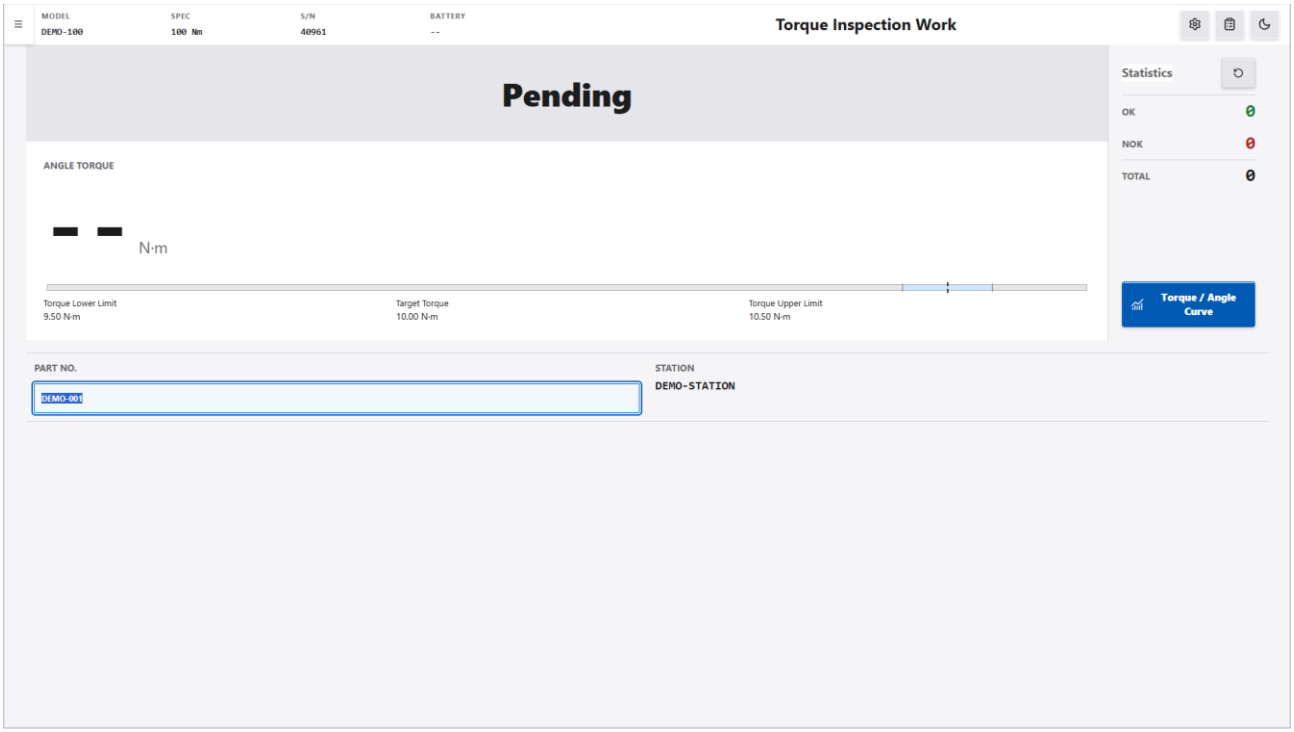

Figure 7-1 Torque Inspection work screen

7.2.1 Screen Description

Area/button	Description
Header bar	Sensor information, the title “Torque Inspection Work”, “Settings”, “Work Records” and the theme toggle (see Section 5.2).
Verdict banner	“Pending”, “OK” or “NOK”; see “Judgement Status” below.
“Angle Torque”	The only large reading on this screen: the torque locked when the target angle is reached, with the unit; “--” until it is obtained. OK/NOK is judged by this value (see Section 7.1). The range bar below marks the positions of the torque lower limit, target torque, torque upper limit and angle torque (see Section 5.2.5); there is no pointer until the angle torque is obtained.
“Statistics” (right side)	The three counters “OK”, “NOK” and “Total”, and the reset icon button to the right of the heading (↺, no text; shows “Reset” when you move the mouse pointer over it).
“Torque / Angle Curve” (bottom of the statistics panel)	Opens the chart dialog; see “Chart Dialog” below.
Parameter row	“Part No.” (editable) and “Station”. Setting values such as the tolerance, target angle and torque multiplier are not shown on the work screen; view and change them on the settings screen.
“Batch Progress”	Shown only when batch work is enabled, in a row of its own below the parameter row: the number of completed OK results / the batch quantity, and a progress bar.
Message line	Shown in red below the parameter row when an error occurs; normally hidden.
“Batch Complete”	Appears in the middle of the screen for about 1 second when batch is enabled and the OK count reaches the batch quantity.

Chart Dialog

Click “Torque / Angle Curve” at the bottom of the statistics panel to open the chart dialog. For opening and closing it and for the smoothed curve, see Section 5.2.6; this mode also has the following:

- Legend: “Real-time Torque”, “Torque Upper Limit”, “Target Torque”, “Torque Lower Limit”, “Live Angle” and “Target Angle”. The torque upper and lower limits are calculated from the target torque and tolerance; for the angle, only one dashed line, “Target Angle”, is drawn, with no angle lower and upper limits.
- The angle line is counted from the starting point and is 0 before the start.
- When you release the tool, the torque line does **not** drop vertically to 0; the vertical drop is used only for Torque Wrench and Torque & Angle (see Section 5.2.6).
- Where some sample points have no angle data, the angle line is broken at those points and is not drawn as 0 degrees; an angle of 0 degrees that is actually measured is drawn as usual.
- When you move the mouse over the curve, the time, live torque and live angle at that point are shown.
- The top of the dialog shows the judgement status, and “Angle Torque” with its range bar.

7.2.2 Judgement Status

Status	Screen display	When it appears
Standby	The verdict banner shows “Pending” (gray background); angle torque “--”; no pointer on the range bar	Just after entering the screen, after clicking “Reset”
Measuring	The verdict banner shows “Pending”; the angle torque stays “--” until the target angle is reached; when the target angle is reached, “Angle Torque” shows a value and the pointer appears on the range bar	During torque application, and after release until saving is complete. When a new torque application starts, the previous OK/NOK returns to “Pending”
OK	The verdict banner shows “OK” (green background); no sound; “OK” and “Total” increase by 1; “Part No.” is cleared automatically	Saving is complete and the angle torque is within the OK range
NOK	The verdict banner shows “NOK” (red background); two warning beeps; “NOK” and “Total” increase by 1; “Part No.” is kept	Saving is complete and the angle torque is outside the OK range

If you release before reaching the target angle, no record is produced, the judgement status stays “Pending” and the statistics do not change. After release, the angle torque keeps the value of this measurement until the next torque application starts. For the indicator light and alarm sound, see Section 5.2.

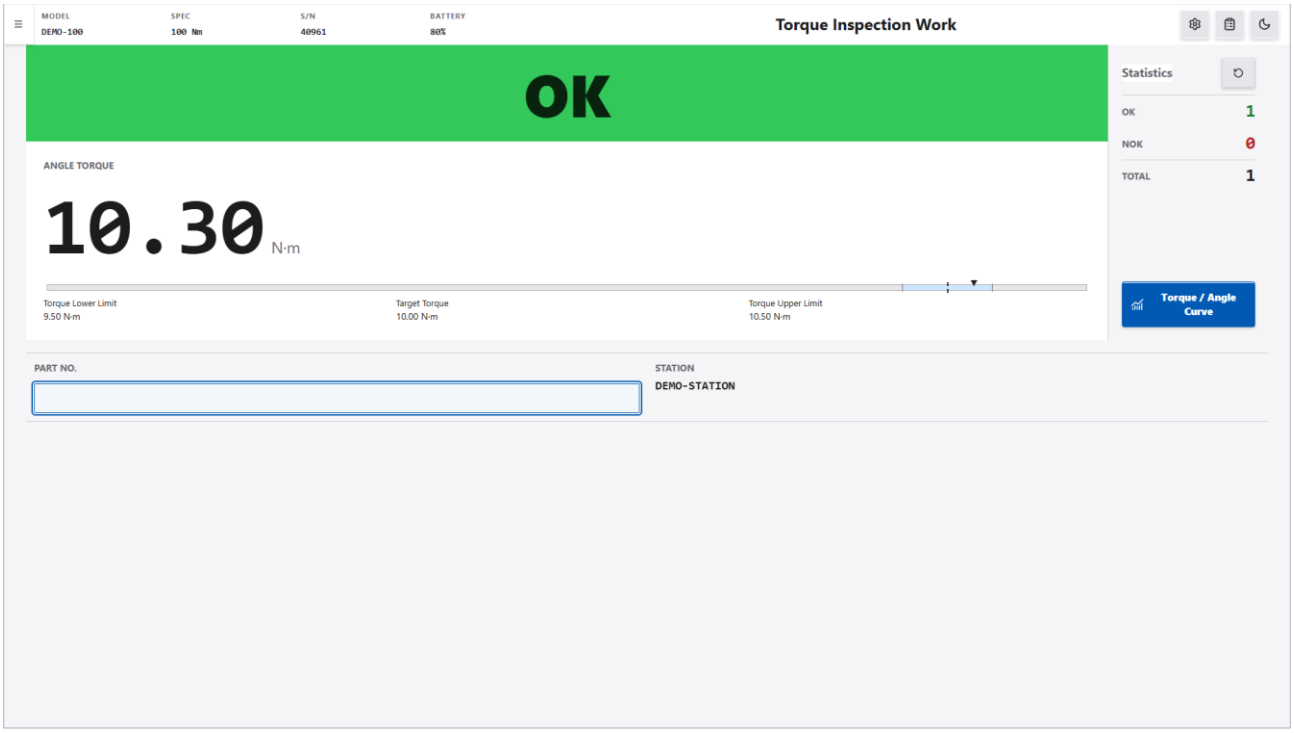

Figure 7-2 Torque Inspection work screen (angle torque captured, judgement OK)

7.2.3 Operating Steps

1. In the navigation menu, click “Rotary Sensor” → “Torque Inspection”. The screen first shows “Loading...”, then “Torque Inspection Work” with the verdict banner showing “Pending” and the cursor in “Part No.” (see Figure 7-1).
2. Check that the sensor model, serial number and battery level in the header match the sensor you actually use. If not, click “Settings” to change them (see Section 7.3).
3. Check that “Torque Lower Limit”, “Target Torque” and “Torque Upper Limit” on the range bar match the work instruction. Other settings such as the target angle are not shown on the work screen; to view them, click “Settings”.
4. Scan or enter the part number in “Part No.” and press Enter.
5. Start applying torque. Once the torque reaches the seating torque, the angle starts accumulating; until the target angle is reached, “Angle Torque” stays “--”.
6. Keep applying torque until the target angle is exceeded; “Angle Torque” shows a value and the pointer appears on the range bar.
7. Release the tool. After saving is complete, the verdict banner shows “OK” or “NOK”, and the corresponding counter and “Total” increase by 1. The judgement is based on the “Angle Torque” shown on the screen (see Section 7.1.3). For OK, “Part No.” is cleared automatically, ready for the next workpiece; for NOK, the number is kept. To check the curve, click “Torque / Angle Curve”; when you are done, press Esc or click “×” to close the dialog, then scan the next workpiece.
8. When batch is enabled, each OK increases “Batch Progress” by 1; when the batch quantity is reached, “Batch Complete” is shown in the middle of the screen and the progress is reset to 0.

9. To view the records, click “Work Records” at the top right (see Chapter 11).

Each time you turn past the target angle and release, one Torque Inspection record is added, containing the angle torque, final torque, final angle, judgement result and curve.

7.2.4 Statistics and Reset

- “OK”, “NOK” and “Total” count only results written successfully since you entered the screen this time. When you leave the screen (for example by clicking “Settings” or switching to another mode) and enter it again, they start from 0.
- When batch is enabled, only OK increases “Batch Progress” by 1. When batch is not enabled, “Batch Progress” is not shown.
- “Reset” clears the judgement status, angle torque, curve and batch progress. It does **not** reset “OK”, “NOK” and “Total” to 0, and it does not affect records already written. To restart the counters from 0, leave the screen and enter it again.

7.2.5 Error Messages

Screen message	Cause and solution
“Failed to load torque measurement settings.”	Reading the settings or torque factor failed. If a “Reload settings” button is shown next to the message, click it to read the settings again; after they are read successfully, work does not start automatically, so click “Work” on the screen. If it still fails, enter again from the navigation menu; if it still fails, see Chapter 16.
“Failed to start work.”	Starting work failed. Check the RF receiver connection and the “Run · Work” permission, then leave and enter this screen again.
“Failed to start work.” (cause: an RF receiver problem, for example the receiver did not respond in time)	Same as for the torque wrench; for solutions, see Section 5.3.
“Failed to save the measurement result.”	Writing the result failed, and no record was produced this time. Measure again.
“Failed to save the measurement result.” (cause: writing the result was rejected, most often because the angle torque did not exceed half of the torque lower limit)	Writing the result was rejected. The most common cause is that the angle torque did not exceed half of the torque lower limit (see Section 7.1). Check that the target torque, tolerance and target angle match the actual workpiece and measure again; no record was produced this time.
“You do not have permission to perform this operation.”	The account does not have the “Run · Work” permission, so the result cannot be written. Ask an administrator to adjust the permissions (see Chapter 15).
“Realtime torque monitoring is unavailable.”	Real-time data cannot be received. Leave and enter this screen again; if it still fails, restart TMS RF.
“Invalid binary realtime data format.”	Real-time data in a wrong format was received. Check that the sensor and receiver work normally and enter this screen again.

7.2.6 Notes

> **Note** "Part No." is optional. If it is empty when the torque application starts (nothing entered on either the settings or the work screen), the part number in the record is blank; no code is filled in automatically. If you need traceability by part number, enter or scan the part number before each measurement.
>
> **Note** If the RF connection is lost during torque application, the measurement in progress is discarded and not saved, the angle torque returns to "--", and the curve is cleared; the verdict banner keeps the previous judgement. Rely on the result after you measure again.

7.3 Torque Inspection Settings

Path: navigation menu → "Rotary Sensor" → "Torque Inspection" → "Settings" at the top right.

This screen sets the sensor, work information, "Target Torque (Angle Start)", tolerance, target angle, batch and torque multiplier used by Torque Inspection. After a successful save, a beep sounds and the screen switches to the work screen automatically and starts work.

The "Edit · Work Parameters, Pairing and Calibration" permission is required; without it, you can open the screen and change fields but cannot save. While the settings are loading, all fields and buttons are temporarily disabled, and "Work Parameters" on the right shows "--".

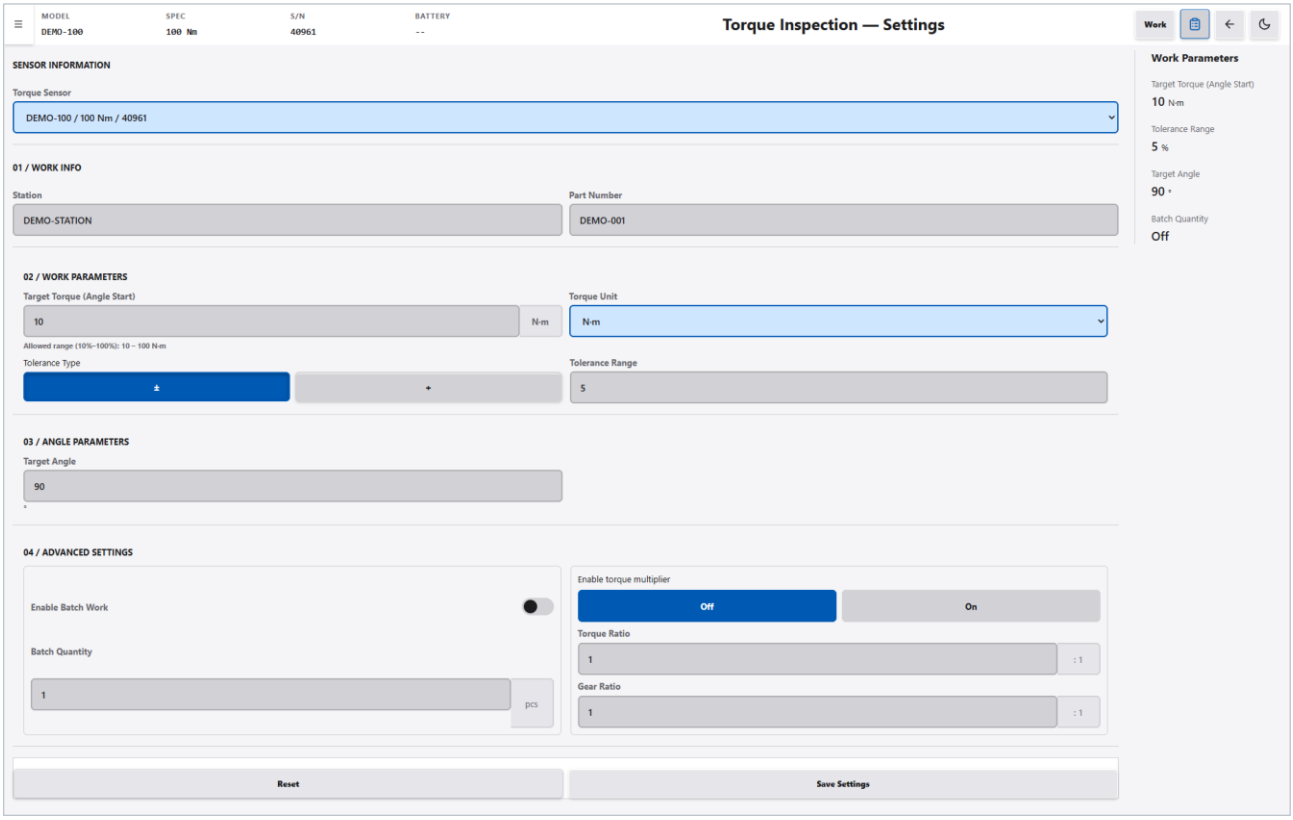

Figure 7-3 Torque Inspection settings screen

7.3.1 Screen Description

Area/button	Description
Header bar	Sensor information, the title “Torque Inspection — Settings”, “Work”, “Work Records”, “Back” and the theme toggle (see Section 5.2). When you select another sensor, the header information updates accordingly.
“Sensor information”	“Torque Sensor” drop-down list (see Section 5.2).
“01 / Work Info”	“Station”, “Part Number”.
“02 / Work Parameters”	“Target Torque (Angle Start)” (the current unit is shown on the right), “Torque Unit”, “Tolerance Type” (“±”, “+”; the blue one is the current choice), “Tolerance Range”.
“03 / Angle Parameters”	“Target Angle” (degrees).
“04 / Advanced Settings”	On the left, the “Enable Batch Work” switch and “Batch Quantity” (pcs); on the right, “Enable torque multiplier” (“Off”, “On”) and the “Torque Ratio” and “Gear Ratio” input boxes (“: 1”).
Message line	Shows “Torque measurement settings were saved locally.” after a successful save and switches to the work screen; if the check or saving fails, the reason is shown in red and you stay on this screen.
“Reset”, “Save Settings”	Buttons at the bottom of the form; scroll down if the window is not tall enough.
“Work Parameters” (right side)	Shows “Target Torque (Angle Start)”, “Tolerance Range”, “Target Angle” and “Batch Quantity” in real time, including unsaved changes; “--” is shown for empty fields, and “Batch Quantity” shows “Off” when batch is not enabled.

7.3.2 Fields

Field	Description	Range and default
Torque Sensor	Sensor used by this mode. When you select another sensor, “Target Torque (Angle Start)” is cleared and must be entered again; the selected sensor determines the settable range.	Required; only paired sensors with a spec greater than 0 can be selected. The list is empty after a fresh installation.
Station	Work location. “Station” on the work screen shows this value.	Optional; if empty, it is blank in the record.
Part Number	Initial value of “Part No.” on the work screen. A number changed on the work screen is not written back to this field.	Optional; if nothing is entered on either the settings or the work screen, it is blank in the record.

Field	Description	Range and default
Target Torque (Angle Start)	Starting point of the angle and also the center value for judgement (see the rules below). After you select a sensor, "Allowed range (10%–100%): lower limit – upper limit unit" is shown below the field.	Required; 10%–100% of the sensor spec (converted to the current unit); empty for the first setup; shows at most two decimal places, the full value is saved.
Torque Unit	Unit for entering and displaying torque. When switched, the target torque is converted automatically.	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; default N·m.
Tolerance Type	"±" symmetrical in both directions; "+" allows only values above the target torque (see Section 7.1).	"±" or "+"; default "±".
Tolerance Range	Allowed deviation as a percentage; also determines the torque upper and lower limits of the curve.	Required; integer from 1 to 30; default 10.
Target Angle	Angle to turn from the starting point; the "Angle Torque" is taken at this angle. When the torque multiplier is on, the sensor angle is divided by the gear ratio before comparison.	Required; 1–360, decimals allowed; empty for the first setup.
Enable Batch Work	When on, the work screen shows batch progress.	On/Off; default Off.
Batch Quantity	Number of OK workpieces to complete per batch; used only when batch work is enabled.	Integer greater than 0; checked even when batch is not enabled; default 1.
Enable torque multiplier	When on, the torque is multiplied by the "Torque Ratio" and the angle is divided by the "Gear Ratio"; when off, both are calculated as 1.	Off/On; default Off.
Torque Ratio	Torque amplification factor of the torque multiplier, with ": 1" on the right. It can be entered only when "Enable torque multiplier" is "On". If no torque ratio or gear ratio has ever been entered for this mode, the torque multiplier settings in "System Settings" are filled in and used (see Chapter 12); after you change the torque ratio or gear ratio here and save, this mode uses the two values on the screen, is not affected by the System Settings, and does not change the System Settings or the other modes.	A value greater than 0; when the torque multiplier is off, it is not used in the calculation, and the entered value is kept.
Gear Ratio	Angle reduction factor of the torque multiplier, with ": 1" on the right. When the torque multiplier is on, the sensor angle is first divided by the gear ratio and then compared with the target angle. It can be entered only when "Enable torque multiplier" is "On", and it is saved together with "Torque Ratio" (see the previous row).	A value greater than 0; when the torque multiplier is off, it is not used in the calculation, and the entered value is kept.

When you save, the fields are checked in the following order, and only the first error is shown at a time: torque unit → whether the target torque is empty or negative → whether a sensor is selected → whether the target torque is within the sensor range → target angle → tolerance range → batch quantity →

torque ratio of the torque multiplier → gear ratio of the torque multiplier. After these pass, the system checks the permission and sensor data once more.

7.3.3 Rules for Target Torque (Angle Start)

This mode has only one start value, “Target Torque (Angle Start)”. This value is both the angle starting point and the center value for judgement; the system saves it as both the “Seating Torque” and the “Target Torque”, and the two are identical after saving.

1. **The current start value is shown when the screen opens**: this field shows the “Seating Torque” of the current settings. If you only open, browse, or change it and leave without saving, the settings stay unchanged.
2. **Saving synchronizes both values**: when you click “Save Settings”, “Work” or “Back” and saving succeeds, the system writes the value of this field to both the seating torque and the target torque. Saved measurement records are not rewritten, and the settings of other work modes are not affected.
3. **Range check only, no automatic clamping**: this field must be within 10%–100% of the selected sensor spec (converted to the current unit). If the current value is out of range, the screen still shows the original value; when you save, a range error is shown and saving is refused. The system does **not** change it to the upper or lower limit automatically; enter a value within the range manually and save again.
4. **At most two decimal places are shown; the data is not truncated**: after you leave the field, after switching units, and in “Work Parameters” on the right, at most 2 decimal places are shown, but the system saves the full value. For example, if you enter “10.123”, “10.12” is shown after you leave the field, and 10.123 is saved; 10 N·m switched to lbf·ft shows “7.38”, and switching back to N·m shows “10”.
5. **Selecting another sensor clears it**: when you select another sensor in the drop-down list, this field becomes empty and the value you entered is not kept; enter it again within the settable range shown below the field. Other fields such as “Target Angle” are kept. Simply opening the screen does not clear it.
6. **Empty for the first setup**: if the settings have never been saved, this field is empty and “Work Parameters” shows “--”. Select a sensor and then enter the value manually.

> **Example** Sensor spec 50 N·m, torque unit N·m: settable range = 50 × 10% to 50 × 100% = 5–50 N·m. After you select this sensor, “Allowed range (10%–100%): 5 – 50 N·m” is shown below this field. If the value you enter is 4 N·m, the screen still shows 4, and when you save, “Target torque must be between 10% and 100% of the selected sensor capacity (5.00 to 50.00 N·m).” is shown; the value is not changed to 5 automatically.

Note When Torque Inspection settings are applied remotely by a PLC (see Chapter 13), the seating torque and target torque may be written as different values. The work screen then works with both values: the angle starts counting from the “Seating Torque”, and judgement uses the “Target Torque”. To make them identical, check the value on this screen and click “Save Settings”.

Tip When this field is empty, has a wrong format or is negative, the screen message is “Initial torque must be 0 or greater.”; the “initial torque” in the message refers to this field.

7.3.4 Buttons

Button	Description
“Save Settings”	Checks in order and saves; on success, a beep sounds and the screen switches to the work screen; on failure, you stay on this screen and an error is shown.
“Work”, “Back”	Same as “Save Settings”; they save first and do **not** discard changes (see Section 5.2).
“Work Records”	Does not save; opens the records screen filtered to Torque Inspection records. Unsaved changes are lost.
“±”/“+”	Selects the tolerance type; takes effect only after you save.
“Off”/“On” (Enable torque multiplier)	Selects whether the torque multiplier is applied; takes effect only after you save.
“Reset”	Clears all fields to their empty initial values: no sensor selected; station, part number and target torque empty; unit N·m, tolerance type “±”, tolerance range 10, target angle empty, batch off, batch quantity 1, torque multiplier off. It does not save, and it does **not** restore the last saved values. “Torque Ratio” shows 1, and “Gear Ratio” shows the gear ratio of the torque multiplier settings in “System Settings”; if you save after a reset without changing these two values again, the torque ratio and gear ratio previously entered for this mode are cleared, and the mode goes back to using the torque multiplier settings in “System Settings”.

Tip If you clicked “Reset” and want to discard it, do not save; click “Work Records” or leave through the navigation menu instead. When you enter this screen again, you see the original settings.

7.3.5 Operating Steps

1. On the Torque Inspection work screen, click “Settings” at the top right (for first use, click “Torque Inspection” in the navigation menu). The screen shows “Torque Inspection — Settings” and “Work Parameters” on the right; for the first setup the target torque and target angle are empty and “Work Parameters” shows “--”.
2. Select a sensor in “Torque Sensor”. The model, spec and serial number in the header update immediately, and “Target Torque (Angle Start)” becomes empty, with the settable range shown below the field.
3. Enter data in “Station” and “Part Number” if needed; they can be left empty. If the part number is left empty, you can enter it for each workpiece on the work screen; if it is entered in neither place, the part number in the record is blank (see Section 7.2).

4. Select the “Torque Unit”. If a target torque has already been entered, it is converted to the new unit automatically.
5. In “Target Torque (Angle Start)”, enter the angle starting point, which is also the judgement center value, and check that it is within 10%–100% of the sensor spec.
6. Select the tolerance type “±” or “+”, and enter an integer from 1 to 30 in “Tolerance Range”.
7. Enter 1–360 degrees in “Target Angle”.
8. In “04 / Advanced Settings”, turn on “Enable Batch Work” and enter “Batch Quantity” if needed; when you use a torque multiplier, click “On” and enter the ratios of the actual torque multiplier in “Torque Ratio” and “Gear Ratio”.
9. Check the values against “Work Parameters” on the right.
10. Scroll down and click “Save Settings”. On success, a beep sounds and the screen switches to the work screen, where “Target Torque” on the range bar shows the value you just entered; on failure, correct the entries according to the error message and click it again.

After a successful save, clicking “Torque Inspection” next time opens the work screen directly with the new settings. If you leave without saving, the settings stay unchanged.

7.3.6 Error Messages

Screen message	Cause and solution
“Failed to load torque measurement settings.”	Reading the settings failed when the screen opened, or the account does not have the “View · Work Settings” permission. The screen then shows empty initial values, not the current settings; do not save directly. Leave and enter again; if it still fails, check the permission or see Chapter 16.
“Failed to load the paired torque sensor list.”	Reading the sensor list failed. Leave and enter again, and check the account permissions.
“Unsupported torque unit: (unit)”	The torque unit in the settings cannot be recognized, and the unit cannot be switched. Click “Reset” to restore the unit to N·m, fill in all fields again and save.
“Initial torque must be 0 or greater.”	“Target Torque (Angle Start)” is empty, has a wrong format or is negative. Enter a valid value.
“Select a torque sensor.”	“Select a paired torque sensor” is selected as the sensor. Select a paired sensor.
“Select a torque sensor with a valid capacity.”	The selected sensor is no longer in the list, or its spec is not set. Select another sensor, or add the spec in Sensor Pairing (see Chapter 12).
“Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is out of range; the range in parentheses is converted to the current unit. Enter a value within the range; the system does not correct it automatically.
“Target angle must be between 1 and 360 degrees.”	The target angle is empty or out of range. Enter 1–360.

Screen message	Cause and solution
"Tolerance range must be an integer from 1 to 30."	The tolerance range is empty, has decimals or is out of range. Enter an integer from 1 to 30.
"Batch quantity must be an integer greater than 0."	The batch quantity is empty, 0, negative or has decimals (it is checked even when batch is not enabled). Enter a positive integer, for example 1.
"Torque multiplier ratios must be finite values greater than zero."	The torque multiplier is on, but "Torque Ratio" is empty, 0 or negative. Enter the torque ratio of the torque multiplier, or set the torque multiplier to "Off".
"Gear ratios must be finite values greater than zero."	The torque multiplier is on, but "Gear Ratio" is empty, 0 or negative. Enter the gear ratio of the torque multiplier, or set the torque multiplier to "Off".
"You do not have permission to perform this operation."	The account does not have the "Edit · Work Parameters, Pairing and Calibration" permission. Ask an administrator to adjust the permissions (see Chapter 15).
"Failed to save torque measurement settings." (cause: the target torque is outside 10% to 100% of the sensor capacity when checked again in N·m)	The second check during saving failed, for example because the sensor spec was changed after this screen was opened. Enter this screen again and enter a value for the new spec.
"Failed to save torque measurement settings." (cause: the selected sensor no longer exists)	The sensor was deleted after this screen was opened. Enter this screen again and select another sensor.
"Failed to save torque measurement settings." (cause: another saving failure, for example the work settings service is temporarily unavailable)	Saving failed for another reason, for example the data could not be written. Try again later; if it still fails, see Chapter 16.
"Please sign in." / "Your session has expired. Please sign in again."	Not logged in or the login timed out, for example because the original login became invalid after the account permissions were changed. Log in again (see Chapter 3) and then make the settings.

7.4 Operating Example

Example Work conditions: sensor spec 100 N·m; target torque (angle start) 20 N·m, tolerance ±10%, target angle 15 degrees; part number scanned for each workpiece.
Settable target torque range = 100 × 10% to 100 × 100% = 10–100 N·m, so 20 N·m is within range.
OK range = 20 × (1 − 10%) to 20 × (1 + 10%) = 18.0–22.0 N·m; saving threshold: the angle torque must be greater than 18.0 × 50% = 9.0 N·m.
① In "Torque Inspection — Settings", select the sensor. "Target Torque (Angle Start)" is empty, and "Allowed range (10%–100%): 10 – 100 N·m" is shown below the field; enter 20.
② Click "±" for the tolerance type, enter 10 in "Tolerance Range" and 15 in "Target Angle", and leave "Part Number" empty.

③ Click “Save Settings”. The range bar of the work screen shows torque lower limit “18.00 N·m”, target torque “20.00 N·m” and torque upper limit “22.00 N·m”, and “Angle Torque” is “--”.
④ Scan workpiece WP-2001 and apply torque. When the torque reaches 20 N·m, the angle starts accumulating from 0; when the joint turns past 15 degrees, “Angle Torque” shows 21.40 N·m and the pointer appears on the range bar.
⑤ Release the tool. After saving, the verdict banner shows “OK” (angle torque 18.0 ≤ 21.40 ≤ 22.0), OK = 1, Total = 1, and “Part No.” is cleared automatically. Even if you keep applying torque to a higher value after turning past 15 degrees, neither “Angle Torque” nor the judgement is affected (see Section 7.1.3).
⑥ Scan workpiece WP-2002; the measured angle torque is 23.10 N·m. After release, the verdict banner shows “NOK” (above the upper limit 22.0) with two warning beeps, and “Part No.” keeps WP-2002.
⑦ Scan workpiece WP-2003; after the torque reaches 20 N·m, the tool is released after only 12.0 degrees. “Angle Torque” stays “--”, no record is produced, the judgement status stays “Pending” and the statistics do not change; measure again.

Tip If the work instruction allows only values above the target torque, for example “20 N·m, +10%”, change the tolerance type to “+”. The OK range becomes 20.0–22.0 N·m, and the saving threshold becomes 20.0 × 50% = 10.0 N·m.

Chapter 8 Power Tool

The “Power Tool” mode inspects the tightening torque of pulse, impact and clutch-type power tools. Each time the tool tightens, the system records the highest torque (the peak) of that tightening, compares it with the target torque, judges OK or NOK and writes a record automatically. This mode does not measure angle.

For the elements shared by all modes, such as the header sensor information, RF connection, result panel and range bar, chart dialog, indicator light and alarm sound, units, station and part number, see Section 5.2; this chapter describes only what is specific to the power tool.

8.1 Mode Overview

8.1.1 Selecting the Tool Type

“Tool Type” on the settings screen has three options: “Pulse”, “Impact” and “Clutch”. All three types judge by the peak torque; they differ in which torque data the system reads and in when “one tightening” is considered finished.

Tool type	Suitable tools	Basis for judgement
Pulse	Tools that strike continuously with a pulse unit, such as hydraulic pulse wrenches and pneumatic pulse wrenches	Peak torque of this tightening; reads the pulse torque data of the sensor; one tightening ends only when 2 consecutive readings return to 0
Impact	Pneumatic or electric impact wrenches (hammer type)	Peak torque of this tightening; reads the impact torque data of the sensor; one tightening ends only when 2 consecutive readings return to 0
Clutch	Clutch-type (shut off when the torque is reached) electric or pneumatic screwdrivers and wrenches	Peak torque of this tightening; reads the pulse torque data of the sensor; ends as soon as the reading returns to 0 for the first time

Between two strikes of a pulse or impact tool, the reading may briefly return to 0, so the tightening ends only after 2 consecutive readings of 0; after a clutch shuts off, the torque returns to zero immediately, so the tightening ends the first time the reading returns to 0.

> **Tip** Select the tool type that matches the tool you actually use. If you select the wrong type, the torque data the system reads and the way tightenings are separated both change, and the judgement result may be incorrect.

8.1.2 Flow of One Tightening

1. When the reading rises above 0, the system starts a new tightening: the previous result is cleared, the status returns to “Pending”, and the current part number is recorded. If “Work time reminder” is turned on, timing starts at the same time (see Section 8.2.4).
2. During the tightening, “Final Torque” shows the highest value of this tightening so far, and the range bar pointer moves with it; for pulse and impact tools, “Pulse Count” is updated as well.
3. When the reading returns to 0 and meets the end condition in the table in “Selecting the Tool Type”, this tightening ends. The system judges OK or NOK by the peak and writes one record.

A record is produced whenever a reading above 0 has occurred during the tightening. If the RF connection is lost, the tightening in progress is discarded and no record is produced.

8.1.3 Judgement Rules

The torque factor has already been applied to the peak torque (see Chapter 12). The judgement method depends on “Tolerance Type”:

- “+ -”: OK if target torque × (1 − tolerance range %) ≤ peak ≤ target torque × (1 + tolerance range %); otherwise NOK.
- “+”: OK if target torque ≤ peak ≤ target torque × (1 + tolerance range %); otherwise NOK.

The “Torque Lower Limit”, “Target Torque” and “Torque Upper Limit” of the range bar on the work screen use the same calculation (see Section 5.2.5).

“Work Time” is not used for judgement; it is used only for the work time reminder.

> **Example** An impact wrench tightens frame bolts; the torque may only be higher than the target, never lower.
> Sensor spec 500 N·m, “Target Torque” 300, “Torque Unit” N·m, “Tolerance Type” set to “+”, “Tolerance Range” 15.
> OK range: 300 ≤ peak ≤ 300 × 1.15 = 345.00 N·m. The “Torque Lower Limit” and “Target Torque” of the range bar are both 300.0 N·m, and the “Torque Upper Limit” is 345.0 N·m (torque values of 100 or more are shown with one decimal place).
> Peak 312.40 N·m → OK; peak 296.80 N·m → NOK (below the target); peak 351.00 N·m → NOK (above the upper limit).

8.1.4 Torque Names on the Screen

Name	Description
Final Torque	The large value in the result panel: the highest reading of this tightening so far (the peak). It keeps rising during the tightening; after the tightening ends, it stays displayed until the next tightening starts. The “Final Torque” saved in the record and used for judgement is this peak; you can view it in the record details (see Chapter 11).
Target Torque	The value entered on the settings screen; the center value for judgement; also shown on the range bar of the work screen. Up to two decimal places are displayed; this does not mean the data is truncated.

In the chart dialog, the “Real-time Torque” line is the torque at each sample point, and the large “Final Torque” is the highest of them.

8.2 Work Screen

Path: navigation menu → “Rotary Sensor” → “Power Tool”.

Use this screen to inspect power tools on the shop floor. The screen shows the final torque and the range bar in real time; each tightening is judged and written as a record automatically, and the OK, NOK and total counts are accumulated. Curves are viewed in the chart dialog.

Entering this screen, starting work and saving results require the “Run · Work” permission; “Settings” in the header requires the “View · Work Settings” permission and is not shown without it (see Section 5.2); clicking “Work Records” requires the “View · Work Records” permission. By default, all three roles A, B and C have these permissions; an administrator can adjust them for each user (see Chapter 15).

If the power tool settings have never been saved, clicking “Power Tool” opens the settings screen first (see Section 8.3); you enter this screen only after saving.

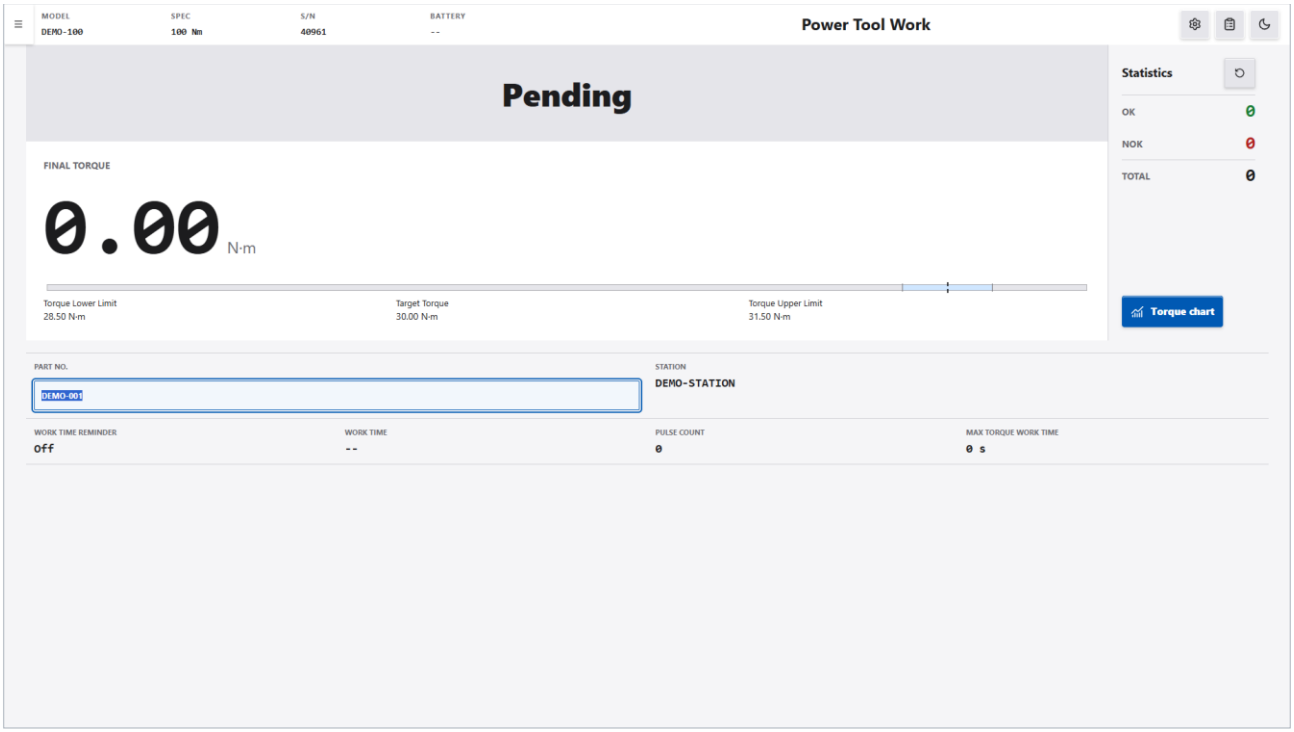

Figure 8-1 Power Tool work screen

8.2.1 Screen Description

Area / button	Description
Left side of the header	Model, spec, serial number and battery level of the current sensor (see Section 5.2).
Page title	“Power Tool Work”; when the tool type is clutch, “Power Tool-Clutch Work”. When the work time reminder appears, a “Work time reminder” label with a yellow background is added below the title (see Section 8.2.4).
“Settings” (gear icon)	Switches to the power tool settings screen (see Section 8.3). Leaving this screen stops work and resets the statistics to zero.
“Work Records” (clipboard icon)	Opens the records page with the power tool records selected (see Chapter 11). Without the “View · Work Records” permission, clicking it does nothing.
Toggle light / dark mode (moon icon)	Switches the screen colors.
Verdict banner	Shows “Pending” (gray background) when there is no result yet; after judgement, shows “OK” (green background) or “NOK” (red background), and drives the indicator light and alarm sound at the same time (see Section 5.2).
“Final Torque”	Peak of this tightening, with the unit; the range bar below marks the positions of “Torque Lower Limit”, “Target Torque”, “Torque Upper Limit” and the current reading (see Section 5.2.5).

Area / button	Description
Statistics panel (right side)	The heading “Statistics” and three counters: “OK”, “NOK” and “Total”, with a divider line above “Total”. To the right of the heading is the reset icon button (↺, no text; shows “Reset” when you move the mouse pointer over it): clicking it sets the three counters to 0; the judgement result, final torque, curve and batch progress do not change, and saved records are not deleted. When you leave this screen and come back, counting also starts from 0.
“Torque chart” (bottom of the statistics panel)	Click it to open the chart dialog (see the description below).
First parameter row	“Part No.” (editable) and “Station”.
“Batch Progress”	Shown only when batch work is enabled, in a row of its own below the first parameter row: the number of completed OK results / the batch quantity, and a progress bar.
Second parameter row	“Work time reminder”, “Work Time”, and the measurement information of this tightening (“Pulse Count”, “Max Torque Work Time” and so on, depending on the tool type; see Section 8.2.2). Read-only. The target torque, tolerance and tool type are not shown on the work screen; to view or change them, click “Settings”.
Error message	When an error occurs, it is shown in red text below the parameter row.

This screen has no “Start” or “Stop” button: work starts automatically when you enter the screen and stops automatically when you leave it (see Section 5.2).

The curve is not shown on the work screen; click the chart button at the bottom of the statistics panel to view it in the chart dialog. For the legend, smoothed display, how to close the dialog and notes, see Section 5.2.6. In this mode the chart has torque lines only (“Real-time Torque” with the upper and lower limits and the dashed target line). Each time a tightening starts, the previous curve is cleared; after the tightening ends, the curve of this tightening is kept until the next tightening.

8.2.2 Information Shown for Each Tool Type

Item	Pulse, Impact	Clutch
Page title	Power Tool Work	Power Tool-Clutch Work
Second parameter row	“Work time reminder”, “Work Time”, “Pulse Count”, “Max Torque Work Time”	“Work time reminder”, “Work Time”, “Detect Work Time”, “Target Work Time”
“Pulse Count”	Maximum pulse count reported by the sensor for this tightening	Not shown
“Max Torque Work Time” / “Detect Work Time”	“Max Torque Work Time”: time from the start of the tightening to the highest torque (s, up to two decimal places)	“Detect Work Time”: time from the start of the tightening to the highest torque (ms)
“Target Work Time”	Not shown	In ms; for reference only; not used for judgement

"Pulse Count", "Max Torque Work Time" and "Detect Work Time" are kept until the next tightening starts. The chart button and the chart dialog title are "Torque chart" for all three tool types; the work screen does not show the tool type, and the clutch can be recognized by the page title. For the clutch work screen, see Figure 8-4.

8.2.3 Fields

Field	Description	Range and default
Part No.	The part number to record for this tightening; enter it manually or with a barcode scanner. When you enter the screen, the field gets the focus and its content is selected.	When you enter the screen, the "Part Number" from the settings screen is filled in; changes made here are not saved back to the settings. Optional: if the field is empty when the tightening starts, the part number of that record is blank; no code is filled in automatically.
Batch progress	Completed OK count / batch quantity. Only OK increases it.	When the batch quantity is reached, "Batch Complete" flashes green in the middle of the screen for about 1 second and the progress is reset to 0. Not shown when batch is not enabled.
Work time reminder	Shows "On" or "Off" from the settings. When it is on, "Work Time" to its right shows the set number of seconds, and a reminder appears when the tightening time approaches "Work Time" (see Section 8.2.4); when it is off, "Work Time" shows "--".	Takes effect only when "Work Time" is greater than 0.5 seconds.

The automatic clearing rules for the part number are the same as in Section 5.2.10: when the result is OK and the number was not changed during the tightening, it is cleared automatically and gets the focus again; when the result is NOK, the number is kept for rework.

8.2.4 Work Time Reminder

When "Work time reminder" in the settings is "On", the system reminds the operator each time a tightening approaches the "Work Time".

- Timing starts from the first reading above 0 of this tightening; a reading of 0 does not start timing.
- The reminder appears when "Work Time − 0.5 seconds" has elapsed. For example, with a "Work Time" of 3 seconds, it appears 2.5 seconds after the tightening starts. If "Work Time" is 0.5 seconds or less, no reminder is given.
- When the reminder appears, an amber frame with a light yellow overlay appears around the whole window, visible on the header, the navigation menu and the work area; at the same time, a "Work time reminder" label with a yellow background appears below the header title.

- The frame first pulses brighter and dimmer 2 times, then stays on steadily. If Windows is set to turn off animation effects, it stays on steadily from the start without pulsing.
- While the chart dialog is open, the amber frame and the “Work time reminder” label are shown on the chart dialog instead.
- The reminder is only a visual cue: it does not block mouse clicks, the cursor does not leave “Part No.”, and it does not affect the OK/NOK judgement.
- The reminder disappears when this tightening ends (the reading returns to 0 and meets the end condition in Section 8.1.1), and timing starts again with the next tightening. If the tightening ends before the reminder time, no reminder appears. The reminder also disappears when the RF connection is lost or you leave the work screen.

8.2.5 Operating Steps

1. In the navigation menu, click “Power Tool”. The screen shows “Loading...”, then the work screen opens and the verdict banner shows “Pending”.
2. Check that the sensor model, serial number and battery level in the header match the sensor you actually use; when you use a clutch tool, the page title should be “Power Tool-Clutch Work”. If they do not match, click “Settings” to change them (see Section 8.3).
3. Check that “Torque Lower Limit”, “Target Torque” and “Torque Upper Limit” on the range bar match the work instruction.
4. Enter or scan the part number in “Part No.”; you can leave it empty if you do not need to record a part number.
5. Start tightening with the tool. “Final Torque” rises and the range bar pointer moves with it; for pulse and impact tools, “Pulse Count” increases. If the work time reminder is turned on, an amber frame and the “Work time reminder” label appear when the tightening time approaches “Work Time” (see Section 8.2.4).
6. After the tool stops and the reading returns to 0, the result changes to “OK” or “NOK”, and the corresponding counter and “Total” each increase by 1.
7. When batch is enabled, each OK increases “Batch Progress” by 1; when the batch quantity is reached, “Batch Complete” is shown in the middle of the screen.
8. To check the curve, click “Torque chart” at the bottom of the statistics panel; when you are done, press Esc or click “×” to close the dialog, then scan the next part.
9. To view the records, click “Work Records” at the top right (see Chapter 11).

Example A pulse wrench tightens flange bolts, target 120 N·m ±8%, 8 bolts per flange (for the settings, see the example in Section 8.3).
Scan part number FL-0001 → tighten bolt 1, peak 118.60 N·m → "OK", the range bar pointer is between "Torque Lower Limit" 110.4 N·m and "Torque Upper Limit" 129.6 N·m, "Batch Progress" 1 / 8, the part number field is cleared.
Scan FL-0001 → tighten bolt 2, peak 131.20 N·m → "NOK" (above the upper limit of 129.60), the progress stays 1 / 8 and the part number is kept.
Retighten bolt 2 until OK; after all 8 bolts are OK in sequence, "Batch Complete" is shown in the middle of the screen and the progress returns to 0 / 8.

Tip If you need to trace each product, enter or scan the part number before each tightening. If it is not entered, the part number in the record is blank.

8.2.6 Error Messages

Screen message	Cause and solution
"Failed to load power tool settings."	Reading the settings failed. If a "Reload settings" button is shown next to the message, click it to read the settings again; after they are read successfully, work does not start automatically, so click "Work" on the screen. If it still fails, enter again from the navigation menu; if it still fails, see Chapter 16.
"Failed to start work."	Starting work failed. Check that the RF receiver is connected and the account has the "Run · Work" permission, then leave this screen and enter it again.
"找不到可用的 RF 接收器 COM 通訊埠。" (shown in Chinese even in English: no COM port is available for the RF receiver)	The receiver is not connected. Rescan the receiver in System Settings (see Chapter 12).
"找不到 RF 接收器，請確認已連接並保持通電。" (shown in Chinese even in English: the RF receiver cannot be found; check that it is connected and powered on)	Check that the receiver is plugged into a USB port, and close other programs that are using that port.
"裝置回應逾時，請確認接收器連線是否穩定。" (shown in Chinese even in English: the device response timed out. Check that the receiver connection is stable)	Check that the sensor is switched on, then rescan the receiver.
"Failed to save the measurement result." (cause: the result could not be saved, for example because the measurement service is temporarily unavailable)	This result was not written and no record was produced. Tighten again; if it keeps happening, see Chapter 16.
"動力工具擷取需要大於 0 的峰值扭矩。" (shown in Chinese even in English: power tool capture requires a peak torque greater than 0)	The received peak was 0. Tighten again; if it keeps happening, check the sensor and the "Tool Type" setting.

Screen message	Cause and solution
"不支援的扭矩單位。" (shown in Chinese even in English: unsupported torque unit)	The torque unit in the settings cannot be recognized. Open the settings screen, select the "Torque Unit" again and save.
"You do not have permission to perform this operation."	The account does not have the "Run · Work" permission, so the result cannot be written. Ask an administrator to adjust the permissions (see Chapter 15).
"Realtime torque monitoring is unavailable." or "Invalid binary realtime data format."	The screen cannot receive correct real-time data. Leave this screen and enter it again; if it still fails, restart the program and check that the receiver and sensor work normally.

8.3 Power Tool Settings

Path: navigation menu → "Rotary Sensor" → "Power Tool" → "Settings" at the top right.

Set the sensor, station, target torque, tolerance, tool type, work time reminder and batch used in this mode. After a successful save, a prompt sound plays and the screen switches to the work screen (see Section 8.2).

The "Edit · Work Parameters, Pairing and Calibration" permission is required; without it, you can open the screen and change fields, but saving shows "You do not have permission to perform this operation." and the settings do not change. By default, roles A and B have this permission; role C does not.

Before you start, pair at least one torque sensor with a spec greater than 0 in System Settings (see Chapter 12). After a fresh installation the sensor list is empty, and you cannot save without a sensor.

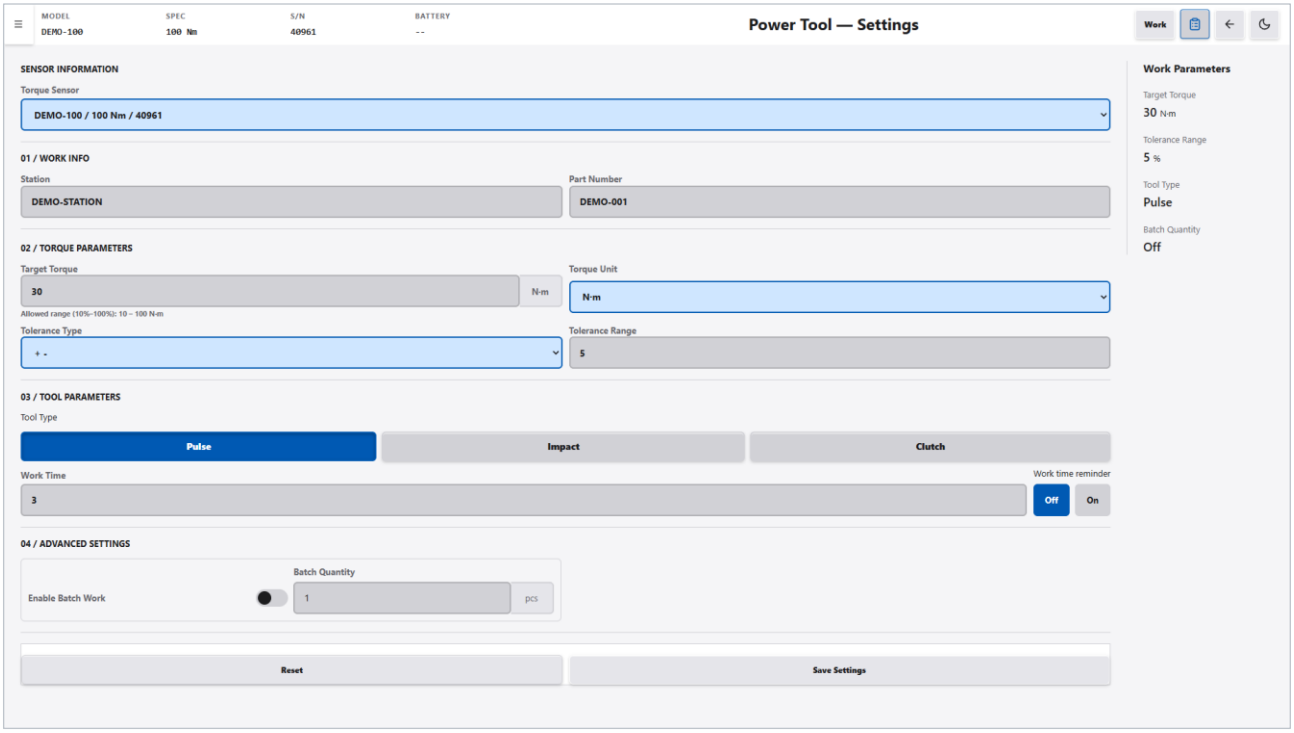

Figure 8-2 Power Tool settings screen

8.3.1 Screen Description

Area / button	Description
Left side of the header	Model, spec, serial number and battery level of the currently selected sensor; updated when you select another sensor.
“Work” (top right)	Checks and saves, then switches to the work screen on success. Same as “Save Settings”.
“Work Records” (clipboard icon)	Opens the records page with the power tool records selected. Unsaved changes are discarded.
“Back” (← icon)	Checks and saves, then switches to the work screen on success. It does not mean “discard changes” (see Section 5.2).
Sensor information	The “Torque Sensor” drop-down list; the options are shown as “model / spec Nm / serial number”.
01 / Work Info	“Station”, “Part Number”; both are optional.
02 / Torque Parameters	“Target Torque”, “Torque Unit”, “Tolerance Type”, “Tolerance Range”.
03 / Tool Parameters	The three “Tool Type” buttons “Pulse”, “Impact” and “Clutch”; the one with a blue background is the current selection. When “Pulse” or “Impact” is selected, “Work Time” and “Work time reminder” are shown below; when “Clutch” is selected, these two are hidden (see Section 8.4).
04 / Advanced Settings	The “Enable Batch Work” switch and “Batch Quantity” (pcs).
Work Parameters (right side)	Shows the unsaved “Target Torque”, “Tolerance Range”, “Tool Type” and “Batch Quantity” on the screen in real time; empty fields show “--”, and when batch is not enabled, “Batch Quantity” shows “Off”.
“Reset”	Clears all fields to empty initial values (see the note below). It does not save, and it does not restore the last saved values.
“Save Settings”	Checks and saves. On success, a prompt sound plays and the screen switches to the work screen; on failure, you stay on this screen and the error is shown in red.

While the settings are loading, all fields and buttons are temporarily disabled, and the summary on the right shows “--”.

8.3.2 Fields

Field	Description	Range and default
Torque Sensor	The sensor used in this mode. When you select another sensor, “Target Torque” is cleared and must be entered again.	Required. Only paired sensors are listed; when none is selected, “Select a paired torque sensor” is shown.
Station	The station name shown on the work screen and in the records.	Optional; if it is left empty, the station in the record is blank; no code is filled in automatically. Leading and trailing spaces are removed. Empty at first setup.

Field	Description	Range and default
Part Number	Initial value of the “Part No.” field on the work screen.	Optional; if it is left empty, you can enter the part number for each part on the work screen. Empty at first setup.
Target Torque	The center value for judgement, in the unit set in “Torque Unit”. After you select a sensor, “Allowed range (10%–100%): lower limit – upper limit unit” is shown below the field.	Required. 10%–100% of the selected sensor spec (converted to the current unit). Empty at first setup. Up to two decimal places are displayed.
Torque Unit	The unit for entering and displaying torque. When you switch it, the target torque is converted automatically.	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; N·m at first setup.
Tolerance Type	“+ -”: symmetrical above and below; “+”: only above the target is allowed. For the judgement method, see Section 8.1.	“+ -” at first setup.
Tolerance Range	Allowed deviation as a percentage.	Required, 0 or greater, decimals allowed; 10 at first setup. If you enter 0, the peak must exactly equal the target to be judged OK.
Tool Type	The type of tool actually used; for how to choose, see Section 8.1.	“Pulse”, “Impact”, “Clutch”; “Pulse” at first setup.
Work Time	Reference time for the work time reminder, in seconds (the unit is not shown on the settings screen; the parameter row of the work screen shows it as “s”). Not used for judgement.	Required when the tool type is pulse or impact; 0 or greater, up to 3 decimal places; 3 at first setup.
Work time reminder	Whether the work time reminder is shown on the work screen when the tightening time approaches “Work Time” (see Section 8.2.4).	“Off”, “On”; “Off” at first setup. Takes effect only when “Work Time” is greater than 0.5 seconds.
Enable Batch Work	When turned on, the work screen counts the batch progress.	Off at first setup.
Batch Quantity	Number of OK pieces to complete per batch.	Required when batch is enabled; an integer greater than 0; 1 at first setup. When batch is not enabled, you can leave it empty (saved as 1); if you fill it in, it must also be a positive integer.

Note “Reset” sets the sensor to not selected, clears the station and part number, clears the target torque and tolerance range, sets the unit back to N·m, the tolerance type to “+ -” and the tool type to “Pulse”, clears the work time, turns the work time reminder off, and turns batch off and clears the batch quantity. After a reset, you must fill in the fields again before you can save; if you do not want to keep your changes, leave this screen through the navigation menu instead, and the saved settings do not change.

8.3.3 Operating Steps

1. On the power tool work screen, click “Settings” at the top right. On first use, clicking “Power Tool” in the navigation menu opens this screen directly.
2. In “Torque Sensor”, select the sensor to use. The header information is updated, and “Target Torque” becomes empty, with the settable range shown below the field.
3. Enter the “Station” and “Part Number” if needed; both can be left empty. To scan the part number for each part on the work screen, leave “Part Number” empty.
4. Select the “Torque Unit”, enter the “Target Torque”, and check that it is within 10%–100% of the sensor spec.
5. Select the “Tolerance Type” and enter the percentage in “Tolerance Range”.
6. In “Tool Type”, click the type of the actual tool. If you select “Pulse” or “Impact”, enter the “Work Time” and select the “Work time reminder”; for “Clutch”, see Section 8.4.
7. If needed, turn on “Enable Batch Work” and enter the “Batch Quantity”.
8. Check “Work Parameters” on the right.
9. Click “Save Settings”. On success, you hear a prompt sound and the screen switches to the work screen, where the range bar reflects the new settings; on failure, correct the input according to the red message and click again.

After saving, the next click on “Power Tool” opens the work screen directly. Existing records are not affected and keep the settings that applied when they were created.

> **Example** A pneumatic pulse wrench tightens flange bolts, target 120 N·m ±8%, 8 bolts per flange; the operator should be reminded when a tightening takes longer than 2.5 seconds.
> ① For “Torque Sensor”, select a sensor with a spec of 200 N·m (the target torque can be entered from 20.00 to 200.00 N·m).
> ② Enter LINE-A-03 in “Station” and leave “Part Number” empty (it is scanned during work).
> ③ Select N·m for “Torque Unit”, enter 120 in “Target Torque”, select “+ -” for “Tolerance Type” and enter 8 in “Tolerance Range”.
> ④ OK range: lower limit 120 × (1 − 0.08) = 110.40 N·m, upper limit 120 × (1 + 0.08) = 129.60 N·m.
> ⑤ Click “Pulse” in “Tool Type”, enter 2.5 in “Work Time” and select “On” for “Work time reminder”. From 2.5 − 0.5 = 2.0 seconds after each tightening starts, an amber frame and the “Work time reminder” label appear on the window until this tightening ends.
> ⑥ Turn on “Enable Batch Work” and enter 8 in “Batch Quantity”.
> ⑦ “Work Parameters” on the right shows target torque 120 N·m, tolerance range 8%, tool type “Pulse” and batch quantity 8. Click “Save Settings” to enter the work screen (for the work process, see the example in Section 8.2).

8.3.4 Error Messages

The screen shows only the first failed check at a time, in this order: torque unit → sensor → target torque → tolerance range → work time → batch quantity. Leaving “Station” and “Part Number” empty does not cause an error.

Screen message	Cause and solution
“Failed to load power tool settings.”	Reading the settings failed. The screen then shows empty initial values, not the current settings; do not save directly. Leave and enter again; if it still fails, check the permissions or see Chapter 16.
“Failed to load the paired torque sensor list.”	Reading the sensor list failed. Leave and enter again; check the account permissions.
“Unsupported torque unit: (unit)”	The torque unit in the settings cannot be recognized, and the unit cannot be switched. Click “Reset” to set the unit back to N·m, fill in all fields again and save.
“Select a torque sensor.”	No sensor is selected. Select a paired sensor.
“Select a torque sensor with a valid capacity.”	The selected sensor is no longer in the list, or it has no spec. Select another sensor, or add the spec in System Settings (see Chapter 12).
“Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is empty or out of range. Enter a value within the range in the message; the system does not correct it automatically.
“Tolerance range must be 0 or greater.”	The tolerance range is empty or negative. Enter a value of 0 or greater.
“Work time must be 0 or greater.”	The tool type is pulse or impact, and the work time is empty or negative. Enter a number of seconds of 0 or greater.
“Batch quantity must be an integer greater than 0.”	The batch quantity is 0, negative or a decimal. Enter a positive integer; when batch is not enabled, you can also clear it.
“You do not have permission to perform this operation.”	The account does not have the “Edit · Work Parameters, Pairing and Calibration” permission. Ask an administrator to adjust the permissions (see Chapter 15).
“Failed to save power tool settings.” (cause: the target torque is outside 10% to 100% of the sensor capacity when checked again in N·m)	The sensor spec was changed after this screen was opened. Enter this screen again and enter a value according to the new spec.
“Failed to save power tool settings.” (cause: the selected sensor no longer exists)	The sensor was deleted after this screen was opened. Enter this screen again and select another sensor.

Screen message	Cause and solution
“Failed to save power tool settings.” (cause: another saving failure, for example the work settings service is temporarily unavailable)	Saving failed. Try again later; if it still fails, see Chapter 16.
“Please sign in.” or “Your session has expired. Please sign in again.”	Not logged in, the login timed out, or the account permissions were changed. Log in again (see Chapter 3) and then make the settings.

8.4 Clutch Settings

Path: navigation menu → “Rotary Sensor” → “Power Tool” → “Settings” at the top right → click “Clutch” in “Tool Type” under “03 / Tool Parameters”.

The clutch settings are on the same settings screen as in Section 8.3. This section describes only the differences after you select “Clutch”; fields, buttons, permissions and error messages not mentioned here are the same as in Section 8.3.

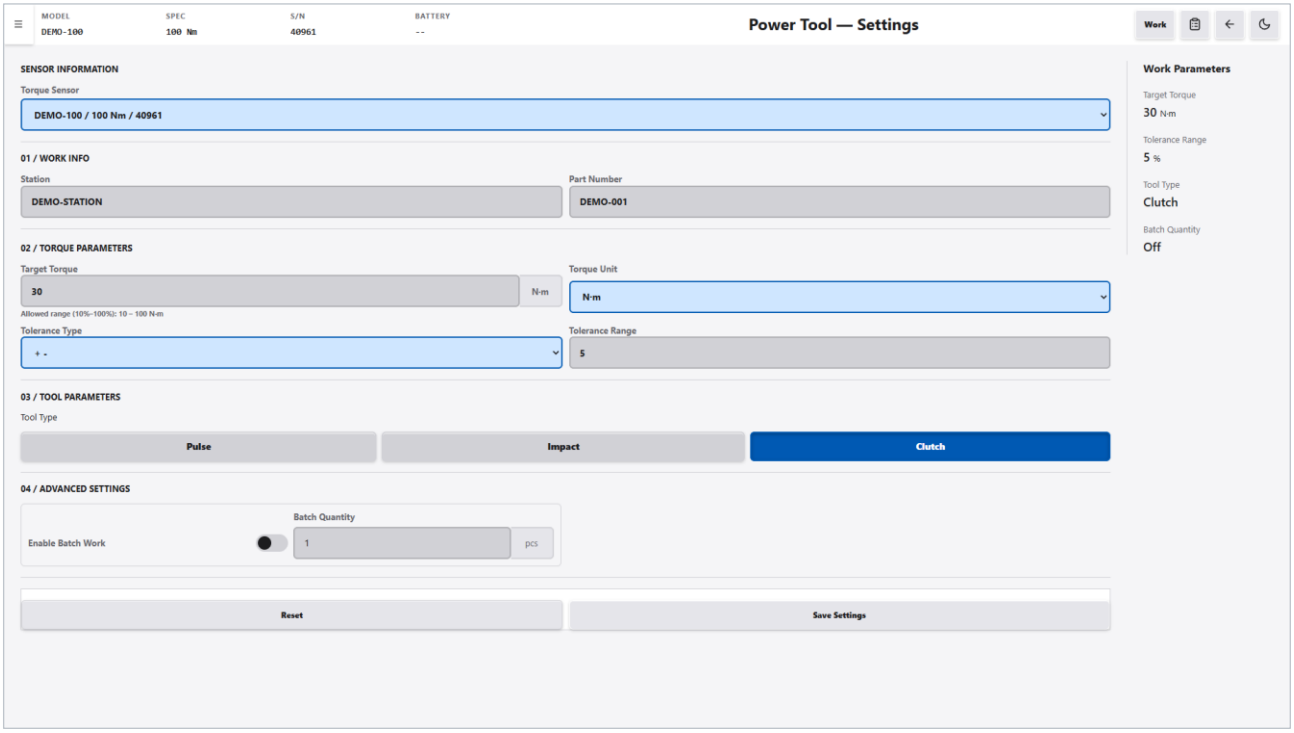

Figure 8-3 Power Tool settings screen (Clutch)

8.4.1 Differences on the Settings Screen

Area / field	After selecting “Clutch”
03 / Tool Parameters	Only the three “Tool Type” buttons are shown, with “Clutch” on a blue background; “Work Time” and “Work time reminder” are hidden.
Work Parameters	“Tool Type” shows “Clutch”.
Work Time (hidden)	Not checked when saving. An existing value is kept; if it was empty, it is saved as 0.
Work time reminder (hidden)	Keeps the selection made before switching. If it was “On” before switching, the work time reminder still appears on the clutch work screen (see Section 8.2.4).

> **Note** If you do not need the work time reminder during clutch work, first click “Pulse”, set “Work time reminder” to “Off”, then click “Clutch” and save.

8.4.2 Clutch Work Screen

After saving, the work screen title changes to “Power Tool-Clutch Work”.

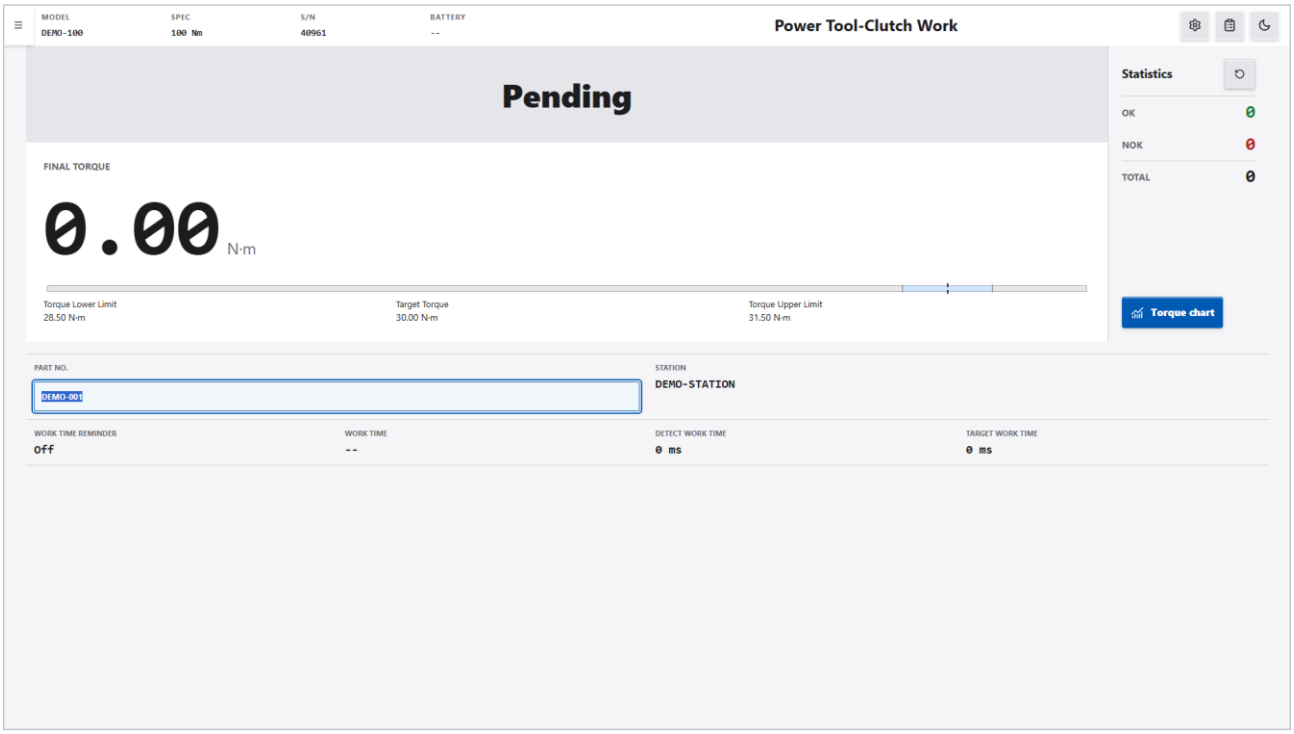

Figure 8-4 Power Tool-Clutch work screen

Compared with pulse and impact tools, the clutch work screen differs as follows (for the full comparison, see Section 8.2):

- The tightening ends and is judged as soon as the reading returns to 0 for the first time, so the result is shown immediately after the clutch shuts off.
- The second parameter row shows “Detect Work Time” (ms); “Pulse Count” and “Max Torque Work Time” are not shown.

- An extra “Target Work Time” (ms) appears at the end of the parameter row; it is for reference only, is not used for judgement and cannot be changed on the settings screen. “Work time reminder” stays in the parameter row and shows the selection kept from before the switch (see Section 8.4.1); when it is “On”, “Work Time” shows the kept number of seconds, and when it is “Off”, it shows “--”.
- The judgement rules are the same as for pulse and impact tools: only the peak torque is compared with the target torque (see Section 8.1). “Final Torque” and the range bar are also shown in the same way.

8.4.3 Operating Steps

1. Open the power tool settings screen (see Section 8.3).
2. If you do not need the work time reminder, first click “Pulse” and check that “Work time reminder” is “Off”.
3. Click “Clutch”. “Work Time” and “Work time reminder” are hidden, and “Tool Type” on the right changes to “Clutch”.
4. Check the sensor, target torque, tolerance type, tolerance range and batch as described in Section 8.3; fill in the station if needed.
5. Click “Save Settings”. On success, the screen switches to “Power Tool-Clutch Work”.
6. Enter the part number and start tightening. When the clutch shuts off and the reading returns to 0, “OK” or “NOK” is shown immediately.
7. Click “Work Records” at the top right to view the clutch records (see Chapter 11).

Example A clutch-type electric screwdriver tightens the panel screws of a control box, target 4.5 N·m ±10%.
① For “Torque Sensor”, select a sensor with a spec of 10 N·m (the target torque can be entered from 1.00 to 10.00 N·m).
② Enter BOX-02 in “Station”, select N·m for “Torque Unit”, enter 4.5 in “Target Torque”, select “+ -” for “Tolerance Type” and enter 10 in “Tolerance Range”.
③ OK range: 4.5 × 0.9 = 4.05 N·m to 4.5 × 1.1 = 4.95 N·m.
④ First click “Pulse” and check that “Work time reminder” is “Off”, then click “Clutch” and click “Save Settings”.
⑤ The work screen title shows “Power Tool-Clutch Work”. The screwdriver shuts off with a peak of 4.62 N·m → “OK”, and “Detect Work Time” shows the number of milliseconds from the start to the highest torque.
⑥ The next screw has a peak of 3.98 N·m → “NOK” (below the lower limit of 4.05); check the clutch setting of the screwdriver and tighten again.

8.4.4 Error Messages

For error messages and solutions, see Section 8.2 (work screen) and Section 8.3 (settings screen).

Situations specific to the clutch:

Screen message	Cause and solution
No error message, but an amber frame and the “Work time reminder” label appear on the clutch work screen during tightening	“Work time reminder” was “On” before switching to clutch. Open the settings, first click “Pulse” and change “Work time reminder” to “Off”, then click “Clutch” and save.
No message, but one tightening produces several records	The tool type may be set to “Clutch” while the actual tool is a pulse or impact tool that strikes continuously. Select the correct tool type and save.

Chapter 9 Batch Jobs

A batch job chains several tightening steps into one repeatable procedure. Each step has its own sensor, work mode, target values and OK count, and the operator completes all steps in order on one work screen. For example, for wheel hub bolts you pre-tighten 5 bolts with the torque wrench, then tighten 5 bolts by torque and angle, and finally re-check 5 bolts. You can set this up as one batch with 3 steps.

For elements shared by all modes, such as the result panel, range bar, chart dialog, RF connection, battery level, indicator light, sensor selection and units, see Section 5.2. This chapter covers only what is specific to batch jobs.

9.1 Mode overview

9.1.1 Batches, steps, groups and categories

Name	Description
Batch	An executable procedure made up of several steps run in order. Each batch has a system-assigned ID (“Pset ID”, 001 to 999), plus a user-entered “Batch Number”, “Batch Name” and “After batch completion” action.
Step	One tightening task in the batch. Each step has its own work mode, torque sensor, target values, tolerance and “Batch Count” (how many OK results this step needs).
Batch group	The upper-level grouping of batches, for example by production line or vehicle model. Every batch must belong to a group. A group has a “Group No.”, “Group Code” and “Group Name”.
Batch category	An optional classification tag, for example by product line or process. Categories do not affect measurement or judgement; they are used only for classification and queries.

You can add groups and categories directly on the batch settings screen (see Section 9.5), or maintain them centrally on the “Batch Group Management” screen (see Section 9.6).

9.1.2 Supported step types

Step type	Judgement	Extra values on the work screen
Torque Wrench	Whether the peak torque of this tightening is within the tolerance of the target torque	None
Torque & Angle	Control mode “Angle”: torque reaches the seating torque and the final angle meets the angle condition; control mode “Torque”: whether the peak torque is within the tolerance	Final angle
Power Tool	Whether the peak torque of this tightening is within the tolerance	Impact, Pulse: pulse count; Clutch: Detect Work Time
Torque Inspection	Whether the torque at the moment the target angle is reached (angle torque) is within the tolerance	Angle torque, live angle, final angle

For the fields and settings of each type, see Section 9.4.

9.1.3 How a batch advances

1. When you open the work screen, the system finds the first step that is not yet complete and starts work automatically with that step's sensor and settings.
2. Each tightening (torque rises from 0 and returns to 0) creates one record and is judged OK or NOK.
3. OK: the OK count of the current step increases by 1. When the step's “Batch Count” is reached, the screen switches to the next step automatically.
4. NOK: the record is still saved and the NOK count increases by 1, but the step does not advance. Retighten until you get OK.
5. When all steps are complete, the batch either restarts for the next round or stops and returns to the settings screen, according to the “After batch completion” setting (see Section 9.2).

After each tightening, the OK and NOK counts of every step are saved immediately. If you leave the work screen and come back, you continue from the same step (see “Interruption and resumption” in Section 9.2).

> **Note** Batch jobs do not judge REHIT (repeated tightening).

9.2 Batch work screen

Path: Navigation menu → “Rotary Sensor” → “Batch Jobs”.

Runs all steps of the batch in order on one screen and shows the current step, progress and judgement result in real time; the curve and the torque during tightening are viewed in the chart dialog. If the batch has not been set up yet, clicking “Batch Jobs” opens the settings screen first (see Section 9.3).

Opening the work screen requires the “Run · Work” permission; the “Settings” button at the top right requires the “View · Work Settings” permission and is not shown without it; the “Work Records” button requires the “View · Work Records” permission. By default roles A, B and C all have these permissions, and an administrator can adjust them per user (see Chapter 15). For an account that has “Run · Work” but not “View · Work Settings”, when no batch has been completely set up, the screen shows “Failed to load batch work data.” without the “Reload settings” button; for an account that has “View · Work Settings” but not “Run · Work”, clicking “Batch Jobs” only opens the settings screen.

Before you start, make sure that the sensor of every step is paired and switched on, and that the RF receiver is connected (see Chapter 12). While RF is not connected, live values are not updated and no records are created.

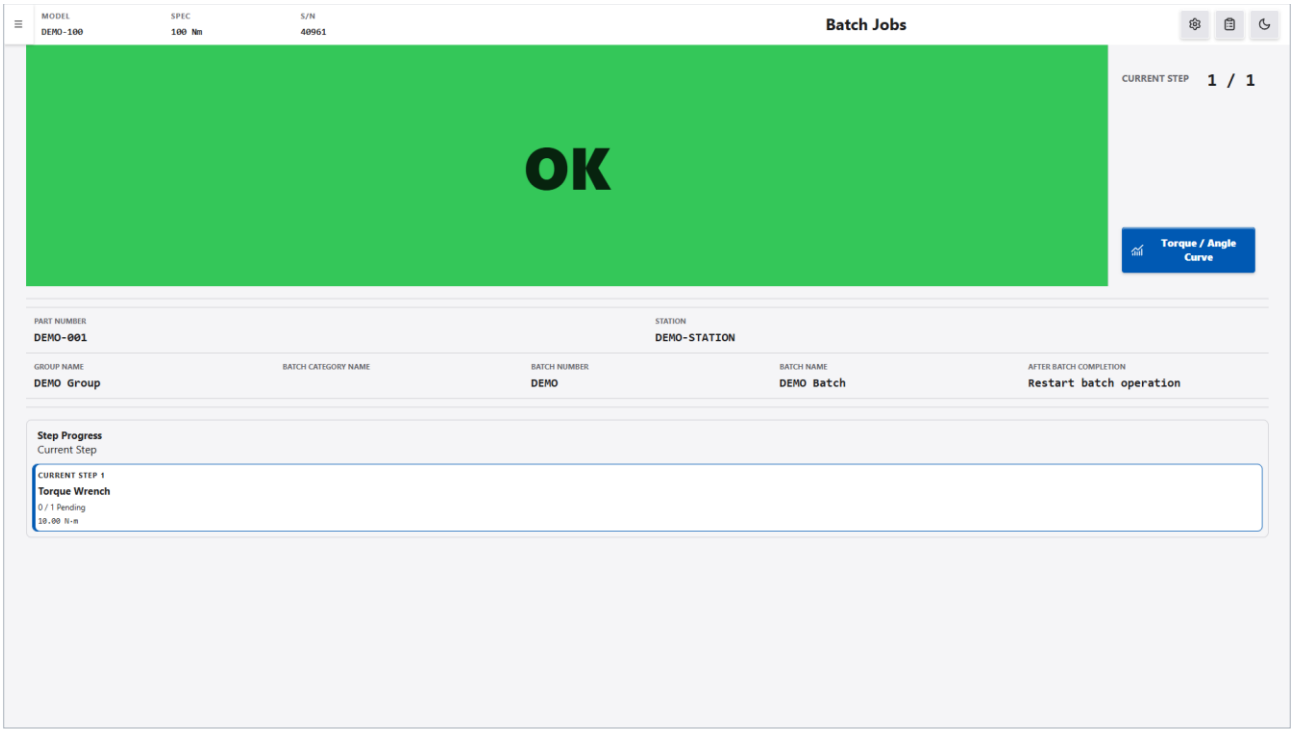

Figure 9-1 Batch job work screen

9.2.1 Screen layout

Area/button	Description
Header	On the left, the “Model”, “Spec” and “S/N” of the sensor used by the current step (the battery level is not shown); they change when the step changes. In the center, the page title “Batch Jobs”.
“Settings” (gear icon)	Switches to the batch settings screen (see Section 9.3). Leaving this screen stops work; a tightening whose torque has not returned to 0 is not recorded. This button is not shown when the account does not have the “View · Work Settings” permission.
“Work Records” (list icon)	Opens the records page with batch job records selected (see Chapter 11). Leaving this screen stops work.
Toggle light/dark mode (moon icon)	Switches the screen color scheme.
Verdict banner	“Pending”, “OK” or “NOK”; the background color changes with the judgement (see Section 5.2.5). Torque Wrench and Power Tool steps have no large reading, so the verdict banner fills the whole main area.
“Final Angle”	Shown only for Torque & Angle and Torque Inspection steps; it is the only large reading on this screen, and it shows “--” when there is no reading yet. The range bar below it: for Torque & Angle steps, the marks follow the angle tolerance standard; for Torque Inspection steps, only “Target Angle” is marked. This screen shows no large torque reading and no torque range bar; view the torque during tightening under “Real-time Torque” in the chart dialog.
Statistics panel (right)	Only “Current Step”: current step number / total number of steps.

Area/button	Description
Chart button (bottom of the statistics panel)	The button shows “Torque / Angle Curve” for every step type. Click it to open the chart dialog (see Section 9.2.2).
Mode information row (below the result panel)	Appears only for Torque Inspection and Power Tool steps and shows the values of that step type (see Section 9.2.2).
Current work information (first row)	“Part Number” and “Station”, both read-only text.
Current work information (second row)	“Group Name”, “Batch Category Name”, “Batch Number”, “Batch Name”, “After batch completion”, plus extra fields depending on the step type (see Section 9.2.2). In certain situations “Batch Name” is a drop-down list (see “The “Batch Name” drop-down list” below).
Step progress (bottom)	The label on the right shows “Step Progress” (running), “Current Step” (last step) or “Batch Complete”. Each step has one card showing “Current Step N”, the mode name, “OK count / Batch Count”, status (“Pending”, “Step Progress” or “Batch Complete”) and target value; the card of the current step is outlined.
Error messages	Shown in red at the bottom of the screen (see “Error messages” in this section).

This screen has no “Start” or “Stop” button: work starts automatically when you open the screen and stops automatically when you leave it. When the batch moves to the next step, the system automatically switches to that step's sensor and settings.

After the batch moves to the next step with angle, the range bar of “Final Angle” switches to the marks of the new step and shows no pointer until tightening starts in the new step. This prevents the reading of the previous step from being compared with the specification of the new step.

Step parameters other than the target torque (tolerance, torque unit, torque multiplier, seating torque, control mode, tool type and so on) are not shown on the work screen; view them on the settings screen (see Section 9.3).

> **Tip** Batch jobs have no input fields for station and part number. Batch records store the station as “WS-01” and the part number as “AUTO-BATCH”; the “Part Number” and “Station” fields show the values of the latest record of the current step; when there is no record yet, “Part Number” is blank and “Station” shows “--”.

The “Batch Name” drop-down list

“Batch Name” is normally text. In the following two situations it becomes a drop-down list; each option has the format “Pset ID · Batch Name”, and only batches that are completely set up are listed:

- The account does not have the “View · Work Settings” permission (there is no “Settings” button in the header) and more than one batch is completely set up: select another batch from the list; the system first stops the current work, then loads and starts the selected batch. While a tightening is in progress (the torque has not returned to 0) or a result is being saved, the list is temporarily

disabled. Switching does not change the settings of any batch. An account with the “View · Work Settings” permission sees text; to change the batch, go to the settings screen.

- The batch to be run is no longer available (for example, its setup has become incomplete): “This batch recipe is no longer available. Select an available recipe before starting work.” is shown in red at the top of the screen, and the list defaults to “--”. Select an available batch, then click “Start work” next to the list; work starts only then. Even if only one batch is available, you must select it manually; the system does not switch to another batch automatically. This situation does not depend on the account's permissions.

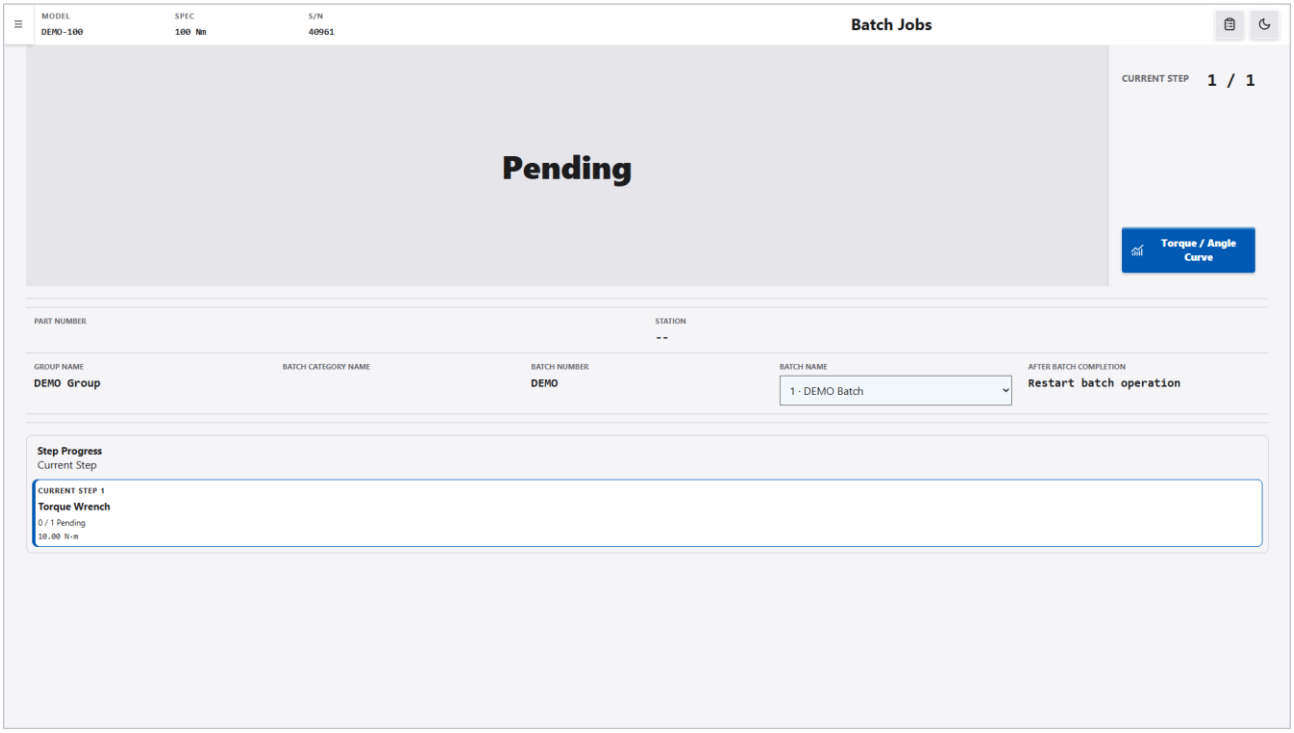

Figure 9-2 Batch job work screen: the “Batch Name” drop-down list

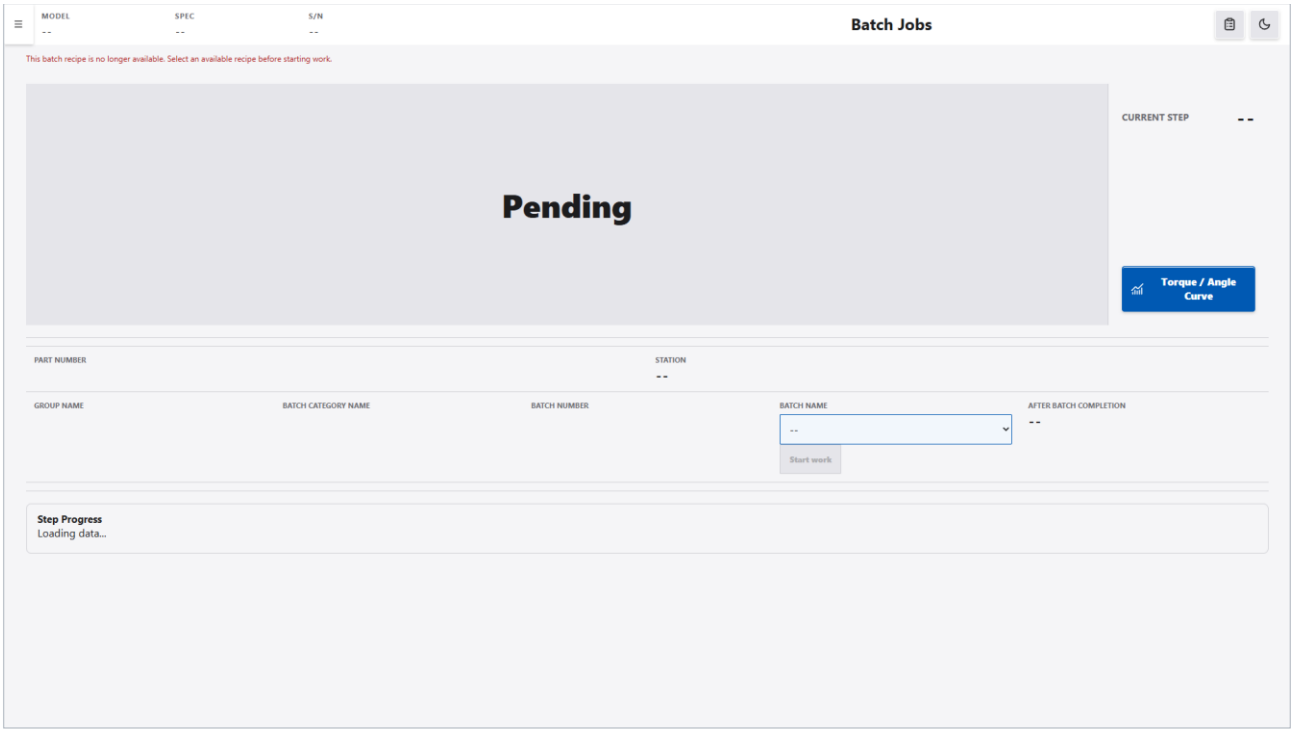

Figure 9-3 Batch job work screen: the batch to be run is no longer available

9.2.2 Extra information by step type

For Torque & Angle and Torque Inspection steps, the reading area shows “Final Angle”; Torque Wrench and Power Tool steps have no large reading.

Step type	Mode information row	Extra fields in the second row of the current work information	Chart button
Torque Wrench	Not shown	None	“Torque / Angle Curve”
Torque & Angle	Not shown	“Final Angle”	“Torque / Angle Curve”
Torque Inspection	“Angle Torque”, “Live Angle”	“Angle Torque”, “Live Angle”	“Torque / Angle Curve”
Power Tool (Impact, Pulse)	“Pulse Count”	“Pulse Count”, “Target Work Time”, “Detect Work Time”	“Torque / Angle Curve”
Power Tool (Clutch)	“Detect Work Time” (seconds)	“Target Work Time”, “Work Time”, “Detect Work Time”	“Torque / Angle Curve”

For Power Tool steps, “Detect Work Time” in the current work information shows the configured “On” or “Off”, and “Target Work Time” shows the configured number of seconds. For a Clutch step, “Detect Work Time” in the mode information row and “Work Time” in the current work information are the same measured value (seconds).

The angle is counted only after the torque reaches the “Initial Torque”; when the initial torque is 0, the sensor angle is used directly. When the torque multiplier is on, the angle is converted with the torque

multiplier parameter set. “Angle Torque” is the torque at the moment the target angle is reached; it shows “--” when the target angle was not reached.

> **Note** For Torque Inspection steps, the OK/NOK judgement and the actual torque in the record are both the “Angle Torque”, not the peak of the current tightening. “Real-time Torque” in the chart dialog can be higher than the angle torque, and even beyond the torque upper limit, while the judgement is still “OK”. Go by the verdict banner for the judgement.

Chart dialog

Click the chart button at the bottom of the statistics panel to open the chart dialog. The dialog title is the same as the button text; for shared operations such as closing the dialog, the smoothed curve and the cursor readout, see Section 5.2.6.

- Above the chart, the current mode name and the step label are shown: “Torque Wrench”, “Torque & Angle”, “Torque Inspection” or “Clutch Work Mode” (a Power Tool step whose tool type is not Clutch shows “Pending”), together with “Real-time Torque”.
- Every step plots the “Real-time Torque” line, and the “Torque Upper Limit”, “Target Torque” and “Torque Lower Limit” dashed lines drawn according to the target torque and tolerance of the current step.
- Torque & Angle steps also plot “Live Angle”, plus the “Target Angle”, “Angle Lower Limit” and “Angle Upper Limit” dashed lines drawn according to the control mode and angle tolerance standard (only lines that have a value are drawn).
- Torque Inspection steps also plot “Live Angle”, but draw only the “Target Angle” line and no angle limit lines.
- Torque Wrench and Power Tool steps plot torque only.
- When the tool is released, the batch job curve does not make the vertical drop to zero described in Section 5.2.6.

9.2.3 Progress and status

Status	What the screen shows
Not loaded	“Current Step” shows “--”, and the mode name in the chart dialog shows “Loading data...”.
Waiting for tightening	The verdict banner shows “Pending”. Step card status: “Pending” when there is no OK yet, “Step Progress” when there are OK results but the Batch Count is not reached, “Batch Complete” when the Batch Count is reached.
Tightening	For steps with angle, “Final Angle” and the range bar pointer update in real time; while the chart dialog is open, the curve and “Real-time Torque” update in real time.
This tightening OK	The verdict banner shows “OK”; the OK count on the current step card increases by 1.
This tightening NOK	The verdict banner shows “NOK”; the step does not advance, and the count on the step card does not change.

Status	What the screen shows
Step complete	The step card shows “Batch Complete”, the outline moves to the next card, “Current Step” increases by 1, and the header shows the sensor of the new step. For steps with angle, the range bar switches to the marks of the new step and shows no pointer until tightening starts in the new step.
Batch complete	A tone plays and “Batch Complete” appears in the middle of the screen for about 1 second; then the screen acts according to the “After batch completion” setting (see “Actions after batch completion” below).
Re-entering after completion	The label of “Step Progress” at the bottom shows “Batch Complete”, and both the mode name and the label in the chart dialog show “Batch Complete”; work does not start automatically.

9.2.4 Actions after batch completion

“After batch completion” setting	When all steps are complete
Restart batch operation	The OK and NOK counts of all steps are reset to zero, and the next round starts automatically from step 1. Suitable for continuous production where every part goes through the same procedure.
Stop batch operation and return to settings	Work stops and the batch settings screen opens. The progress stays complete; when you open the work screen again, the label of “Step Progress” at the bottom shows “Batch Complete”. To run another round, save again on the settings screen with “Save Job” or “Work”; the counts of all steps are reset to zero.

9.2.5 Interruption and resumption

- Clicking “Settings” or “Work Records”, switching to another page from the navigation menu, or logging out stops work. A tightening in progress whose torque has not returned to 0 is not recorded.
- Completed tightenings are saved after each judgement. When you return to the work screen by clicking “Batch Jobs” in the navigation menu, work continues from the first step that is not complete, and the OK and NOK counts are kept.
- If the RF connection is lost, the tightening in progress is not recorded. After the connection is restored, simply tighten again; the completed progress is not affected.

Warning On the batch settings screen, clicking “Save Job”, “Work” or “Back” (←, at the top right) saves the batch and resets the OK and NOK counts of all steps to zero, so the batch starts again from step 1. If you only want to view the settings without interrupting the progress, do not click any of these three buttons; instead, switch to another page from the navigation menu (for example “Torque Wrench”), then click “Batch Jobs” to return to the work screen. Records already created are not affected.

9.2.6 Procedure

1. Click “Batch Jobs” in the navigation menu. If the settings screen opens, first complete the settings in Section 9.3 and click “Work”. The screen shows “Batch Jobs”, and the current work information at the bottom shows the batch number and batch name.
2. Check “Current Step” in the statistics panel and the outlined step card at the bottom, and prepare the matching tool; make sure that “Model” and “S/N” in the header match the sensor in your hand.
3. Check the target value on the step card (target torque; steps with angle also have a target angle). View the other parameters, such as the tolerance, on the settings screen; if you need to change them, note the warning in “Interruption and resumption”.
4. Start tightening. For steps with angle, “Final Angle” and the range bar pointer update with it; after you release the tool and the torque returns to 0, the verdict banner shows “OK” or “NOK”.
5. On OK, the OK count on the current step card increases by 1; on NOK, retighten at the same position. To check the curve, click the chart button at the bottom of the statistics panel; when you have finished, press Esc or click “×” to close the dialog.
6. When the current step reaches its Batch Count, the screen switches to the next step automatically. Change the tool or position according to the new step card and repeat steps 4 to 5.
7. When all steps are complete, “Batch Complete” appears in the middle of the screen, and the batch restarts or returns to the settings screen according to the “After batch completion” setting.
8. Click “Work Records” at the top right to view the details of each tightening (see Chapter 11).

Every tightening (OK or NOK) creates one batch record with the group, batch, step number, target values, actual values and judgement. For a complete example of creating and running a batch, see Section 9.3.

9.2.7 Error messages

On-screen message	Cause and action
“Failed to load batch work data.”	Reading the batch or records failed; a reason may be shown as well, for example “You do not have permission to perform this operation.”. If a “Reload settings” button is shown next to the message, click it to read the data again; after it is read successfully, work does not start automatically, so click “Work” on the screen. If it still fails, check the login status and permissions, then open the screen again.
“Failed to start work.”	Starting work failed; the screen shows an RF-related reason. Check the RF receiver and sensor (see Chapter 16), then open “Batch Jobs” again from the navigation menu.
“Failed to save the measurement result.”	This result was not written. Switch to another page from the navigation menu, return to “Batch Jobs” and try again.

On-screen message	Cause and action
"Failed to save the measurement result." (cause: the result belongs to a batch step that is no longer the current step)	The result belongs to a step that is no longer the current step. Open "Batch Jobs" again from the navigation menu and try again.
"The record was saved, but the records could not be refreshed."	The result was saved, but the progress on screen was not updated. Open "Batch Jobs" again and check the records page.
"Realtime torque monitoring is unavailable." or "Invalid binary realtime data format."	The screen is not receiving valid live data. Check the receiver connection and open the screen again; if it still fails, restart the program.
"Unsupported torque unit: (unit)"	The step's torque unit cannot be recognized. On the settings screen, select the step's "Torque Unit" again and save.
"You do not have permission to perform this operation."	The account lacks the "Run · Work" permission. Ask an administrator to adjust the permissions (see Chapter 15).
"Failed to load batch work data." (without the "Reload settings" button)	The account does not have the "View · Work Settings" permission and no batch is completely set up. Ask a person with the settings permission to complete the batch settings first (see Section 9.3), or ask an administrator to adjust the permissions (see Chapter 15).
"This batch recipe is no longer available. Select an available recipe before starting work."	The batch to be run is no longer available, for example because its setup has become incomplete. Select an available batch in the "Batch Name" drop-down list, then click "Start work" (see Section 9.2.1); if the list contains no available batch, ask a person with the settings permission to complete the batch settings first.
No result and no message after tightening in a Torque Inspection step	This tightening did not reach the "Target Angle", so the system could not obtain the angle torque; this tightening is not recorded and is not counted as NOK. Make sure you turn past the target angle before releasing the tool; if necessary, check whether "Seating Torque" is set too high.

9.3 Batch settings overview

Path: Navigation menu → "Rotary Sensor" → "Batch Jobs" → "Settings" at the top right.

Create, select and modify batches: set the group, category, batch number and name, and the action after all steps are complete; add, reorder and delete steps in the "Job Steps" list, and set up each step one by one. After saving, the screen switches directly to the work screen (see Section 9.2).

Opening this screen requires the "View · Work Settings" permission; saving a batch or adding a group or category requires the "Edit · Work Parameters, Pairing and Calibration" permission. By default roles A and B have the edit permission and role C does not. Without the edit permission you can open the screen and change fields, but saving shows "Unable to connect to the local service. Open the desktop application to continue." and the batch does not change.

Before you start, pair the torque sensors in System Settings and make sure each sensor has a spec (see Chapter 12). If a step will use a torque multiplier, first complete the torque multiplier parameters in System Settings (see Chapter 12).

On a new installation, the system contains one built-in batch that is not yet set up. It belongs to the built-in default group and already contains four steps (one each of Torque Wrench, Torque & Angle, Power Tool and Torque Inspection). The first time you open it, the group name, batch number and batch name, as well as “Target Torque” and “Target Angle” of each step, are blank, and you must enter them before you can save.

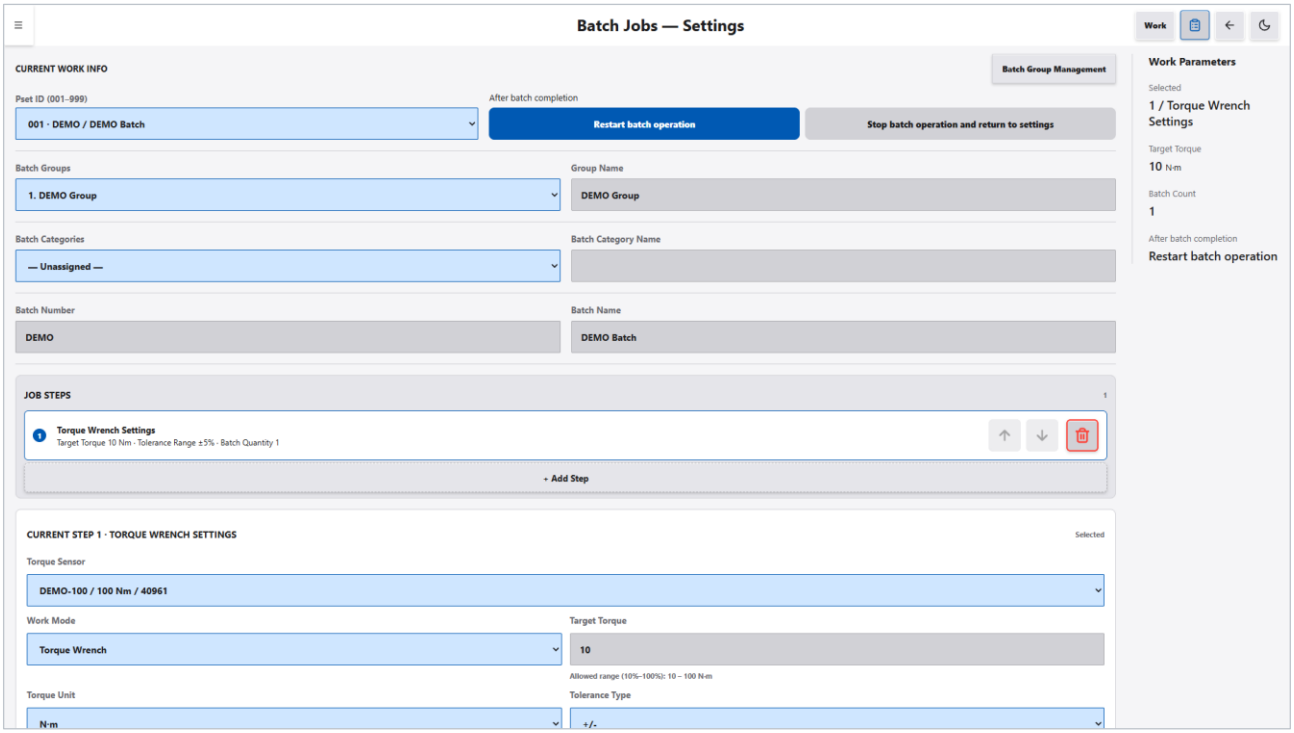

Figure 9-4 Batch job settings screen

9.3.1 Screen layout

Area/button	Description
“Work” (top right)	Validates and saves the batch; on success, plays a tone and switches to the work screen. The counts of all steps are reset to zero.
“Work Records” (list icon)	Opens the records page with batch job records selected. Unsaved changes are discarded without a prompt.
“Back” (← icon)	Same as “Save Job”: validates and saves, then switches to the work screen on success. It does not mean “discard changes”.
Basic batch data (“Current Work Info”)	“Pset ID (001–999)”, “After batch completion”, “Batch Groups” and “Group Name”, “Batch Categories” and “Batch Category Name”, “Batch Number”, “Batch Name”. “Batch Group Management” at the top right expands the quick-add area (see Section 9.5).

Area/button	Description
Job steps	Step list; the number on the right is the total number of steps. Each row shows the step number, step type (for example "Torque Wrench Settings") and a one-line summary, with move up (↑), move down (↓) and delete (red trash can) buttons on the right. The step being edited is outlined in blue. "+ Add Step" is at the bottom of the list.
Step details	Title "Current Step N · (type) Settings", with "Selected" on the right. The fields depend on the work mode (see Section 9.4). When no step is selected, the area shows "No step selected. Click a step in the list on the left to edit its settings." Steps have many fields; scroll down to see all of them.
Current parameters (right, "Work Parameters")	"Selected", "Target Torque", "Batch Count" and "After batch completion", reflecting unsaved content in real time.
"Reset"	Discards the current changes and restores the batch as last loaded or saved. Does not save.
"Save Job"	Validates and saves the batch, then switches to the work screen on success. The counts of all steps are reset to zero.

Summary format in the step list:

Step type	Summary format
Torque Wrench, Torque Inspection	Target Torque 60 Nm · Tolerance Range ±10% · Batch Quantity 5
Torque & Angle	Target Torque 120 Nm / Target Angle 90 ° · Tolerance Range ±10%
Power Tool	Tool Type Impact · Target Torque 300 Nm · Tolerance Range +15%

When "Tolerance Type" is "+", the "±" in the summary becomes "+"; when the target, angle or tolerance is not filled in, "Not set" is shown.

9.3.2 Basic batch data fields

Field	Description	Range and default
Pset ID (001–999)	Selects the batch to edit; options are shown as "ID · Batch Number / Batch Name". Select "Add Job" to create a new batch.	The batch currently in use is selected by default. A new batch gets the smallest unused number from 001 to 999.
After batch completion	Action after all steps are complete (see Section 9.2).	"Restart batch operation" or "Stop batch operation and return to settings"; "Restart batch operation" for a new batch.
Batch Groups	Selects the group the batch belongs to; options are shown as "Group No. Group Name". The selection fills in "Group Name" on the right.	"— Unassigned —" for a new batch.

Field	Description	Range and default
Group Name	Name of the selected group. Editing this field renames the group itself (see the warning below).	Required; cannot be blank.
Batch Categories	Selects an existing category; the selection fills in "Batch Category Name" on the right.	"— Unassigned —" for a new batch.
Batch Category Name	Category name. Select "— Unassigned —" in the drop-down list and type a new name; the category is created automatically when you save.	Optional; blank means no category.
Batch Number	Identification number of the batch, shown on the work screen and in records. Each record keeps the batch number at the time of tightening; changing the batch number later does not change saved records.	Required.
Batch Name	Name of the batch.	Required.

Warning The "Group Name" text field changes the name of the group itself; after saving, all batches in the same group show the new name. If you type a name and save while the group is set to "— Unassigned —", the batch is assigned to the group with the smallest group number, and that group is renamed to the name you typed. To create a new group, first use "Add Group" (see Section 9.5), then select it.

Note Once a category is selected, editing the "Batch Category Name" text field has no effect; the originally selected category is still used when you save. To use a new category, first select "— Unassigned —" in the drop-down list and then type the name, or use "Add Category". To rename an existing category, go to "Batch Group Management" (see Section 9.6).

9.3.3 Fields common to all steps

Every step type has the following fields; for the extra fields of each type, see Section 9.4.

Field	Description	Range and default
Torque Sensor	Sensor used by this step, in the format "Model / Spec Nm / S/N". When you select a different sensor, only "Target Torque" of this step is cleared and must be entered again; for steps with angle, "Seating Torque" is reset to 20% of the spec.	Required; only paired sensors are listed. A new step automatically selects the first sensor in the list.
Work Mode	Step type: "Torque Wrench", "Torque & Angle", "Power Tool", "Torque Inspection". Changing it resets some fields (see Section 9.4).	A step created with "+ Add Step" is "Torque Wrench".
Target Torque	Target value for the judgement, in the "Torque Unit". After you select a sensor, "Allowed range (10%–100%): lower limit – upper limit unit" is shown below the field.	Required; 10% to 100% of the sensor spec (converted to the current unit). Blank for a new step. Up to two decimal places are shown.

Field	Description	Range and default
Torque Unit	Torque unit of this step. When you change it, the target torque and seating torque are converted automatically.	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; default N·m.
Tolerance Type	"+/-": symmetric above and below the target; "+": only values above the target are allowed.	Default "+/-".
Tolerance Range	Allowed deviation as a percentage.	0 or more; 10 for a new step. If you clear it and save, 5 is used.
Enable torque multiplier	Whether this step uses a torque multiplier.	"Off", "On"; default "Off".
Stage	Which torque multiplier parameter set from System Settings is used.	"Stage 1", "Stage 2", "Stage 3"; selectable only when the torque multiplier is on; default Stage 1.
Torque Ratio	Torque ratio of the selected parameter set, filled in automatically from System Settings; cannot be edited. The torque on the work screen is multiplied by this ratio.	Shown as "x.xx : 1"; 1.00 : 1 when the torque multiplier is off.
Batch Count	How many OK results this step needs; the denominator of "Step Progress" on the work screen.	Required; an integer greater than 0; 1 for a new step.

9.3.4 Procedure: creating a batch

1. Click "Batch Jobs" in the navigation menu, then click "Settings" at the top right of the work screen. The screen shows "Batch Jobs — Settings".
2. In "Pset ID (001–999)", select "Add Job". The basic data is cleared, the step list is pre-filled with four steps, and step 1 is selected. If there are unsaved changes, the confirmation "Switching or creating a batch discards your unsaved changes. Continue?" appears; click "Discard Changes" to continue, or "Cancel" to keep the current content.
3. If you need a new group or category, click "Batch Group Management" to add it (see Section 9.5). It is selected automatically after it is added.
4. Select "Batch Groups" and "Batch Categories", enter "Batch Number" and "Batch Name", and select the "After batch completion" action.
5. Delete unneeded steps with the red trash can, or click "+ Add Step" to add steps. Deletion does not ask for confirmation; if you delete a step by mistake, click "Reset" to return to the content as last loaded or saved.
6. Click a step in the step list. The detail area below shows the fields of that step; select "Torque Sensor" and "Work Mode", then fill in the fields as described in Section 9.4. The summary in the list and the "Work Parameters" panel on the right update at the same time.

7. Repeat step 6 for each step. Use the move up and move down buttons or drag to change the order; after reordering, the detail area returns to the unselected state, so click the step again. The work screen runs the steps from top to bottom in list order.
8. Click “Save Job” (or “Work” at the top right). When validation passes, a tone plays, the screen switches to “Batch Jobs” and starts automatically from step 1 (see Section 9.2).
9. If validation fails, the screen stays here and shows the error in red. An error belonging to a step is prefixed with “Step N:”, and the detail area switches to that step automatically. Correct it and save again.

After saving, the steps are renumbered in list order and the OK and NOK counts of all steps are reset to zero; records already created are not affected.

Tip This screen has no button for deleting a whole batch, group or category. There can be at most 999 batch IDs, so reuse existing batches instead of creating a new batch for a small change.

9.3.5 Complete example: creating and running a 3-step batch

Example A wheel hub has 5 bolts. The procedure is to pre-tighten to 60 N·m with the torque wrench, then turn 90° by torque and angle, and finally re-check by torque inspection. Every vehicle goes through the same procedure.
Preparation: one paired torque wrench sensor with a 200 N·m spec that can measure angle (allowed target torque input range 20.00 to 200.00 N·m). Set the actual values according to the tightening specification of the part.
① Navigation menu “Batch Jobs” → “Settings” at the top right → in “Pset ID (001–999)” select “Add Job”.
② Click “Batch Group Management”, enter “Wheel Hub Assembly” in “Add Group” → click “Add Group”; enter “Chassis” in “Add Category” → click “Add Category”. Both drop-down lists select the new items automatically.
③ Enter HUB-5 in “Batch Number” and “Hub bolts 5 pcs” in “Batch Name”, and select “Restart batch operation” in “After batch completion”.
④ In the step list, click the red trash can of step 3 (Power Tool Settings) to delete it, leaving three steps: Torque Wrench, Torque & Angle and Torque Inspection.
⑤ Click step 1 “Torque Wrench Settings”: “Torque Sensor” the 200 N·m sensor, “Work Mode” Torque Wrench, “Target Torque” 60, “Torque Unit” N·m, “Tolerance Type” +/-, “Tolerance Range” 10, “Enable torque multiplier” Off, “Batch Count” 5. OK range 60 × 0.9 = 54.00 to 60 × 1.1 = 66.00 N·m. The summary shows “Target Torque 60 Nm · Tolerance Range ±10% · Batch Quantity 5”.
⑥ Click step 2 “Torque & Angle Settings”: “Torque Sensor” the same sensor, “Seating Torque” 60, “Target Torque” 120 (curve reference line), “Torque Unit” N·m, “Tolerance Type” +/-, “Tolerance Range” 10, “Target Angle” 90, “Control mode” Angle, “Angle tolerance standard” ≥, “Enable torque multiplier” Off, “Batch Count” 5. OK condition: final torque ≥ 60 N·m and final angle ≥ 90°.

⑦ Click step 3 “Torque Inspection Settings”: “Torque Sensor” the same sensor, “Seating Torque” 100, “Target Torque” 140, “Torque Unit” N·m, “Tolerance Type” +/-, “Tolerance Range” 15, “Target Angle” 5, “Enable torque multiplier” Off, “Batch Count” 5. OK condition: the angle torque at the moment 5° is reached is between 140 × 0.85 = 119.00 and 140 × 1.15 = 161.00 N·m.
⑧ Click “Save Job”. A tone sounds and the screen switches to “Batch Jobs”: “Current Step” 1 / 3, the step 1 card at the bottom is outlined and shows “0 / 5 Pending”, chart button “Torque / Angle Curve”. Step 1 is a Torque Wrench step, so the screen has no large reading and the verdict banner shows “Pending”.
⑨ Pre-tighten bolt 1, peak torque 61.20 N·m → “OK”, the step 1 card changes to “1 / 5 Step Progress”. Bolt 2 67.00 N·m → “NOK” (above 66.00), the count on the card does not change; handle it according to factory rules and retighten until you get OK.
⑩ After 5 OK results in step 1, the step 1 card shows “5 / 5 Batch Complete” and the screen switches to step 2 automatically: “Current Step” 2 / 3, the step 2 card shows “0 / 5 Pending”, and “Final Angle” appears in the reading area.
⑪ Angle-tighten bolt 1, final angle 92.5° → “OK”; if the final angle is only 85.0° → “NOK”, the progress does not change; handle it according to factory rules and retighten.
⑫ After 5 OK results in step 2, the screen switches to step 3: “Current Step” 3 / 3, the label at the bottom shows “Current Step” (last step), the reading area shows “Final Angle”, and “Angle Torque” and “Live Angle” appear in the mode information row. Re-check bolt 1, angle torque 138.60 N·m → “OK”; the peak of this tightening may be higher than the angle torque, but only the angle torque is judged. If you release before reaching 5°, that tightening is not recorded.
⑬ After 5 OK results in step 3, a tone plays, “Batch Complete” appears in the middle of the screen for about 1 second, all counts are reset to zero, and the batch returns to step 1 for the next vehicle.

9.3.6 Error messages

On-screen message	Cause and action
“Please fill in all fields”	“Group Name”, “Batch Number” or “Batch Name” is blank, or a numeric field cannot be recognized. Fill them in and save again.
“Step N: Unsupported torque unit: (unit)”	The torque unit of that step cannot be recognized. Select the “Torque Unit” of that step again.
“Step N: Select a torque sensor.”	No sensor is selected for that step. Select a paired sensor.
“Step N: Select a torque sensor with a valid capacity.”	The selected sensor is not in the paired list or has no spec. Check the sensor spec in System Settings (see Chapter 12), then select it again.
“Step N: Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is blank or out of range. Correct it to the range in the message.
“Step N: Target angle must be between 1 and 360 degrees.”	The “Target Angle” of a step with angle is blank or out of range. Enter 1 to 360.
“Batch quantity must be an integer greater than 0.”	The “Batch Count” of a step is 0, negative or a decimal. Change it to a positive integer.

On-screen message	Cause and action
“Initial torque must be 0 or greater.”	The “Seating Torque” of a step with angle is blank or negative. Enter a value of 0 or more.
“Angle range must be 0 or greater.”	In a Torque & Angle step with control mode “Torque”, “Angle Range” is blank or negative. Enter a value of 0 or more.
“Tolerance range must be 0 or greater.”	“Tolerance Range” is negative. Enter a value of 0 or more.
“Work time must be 0 or greater.”	The “Work Time” of a Power Tool step is negative. Enter a value of 0 or more.
“Torque Ratio > 0”	The “Torque Ratio” is invalid. Check the torque multiplier parameters in System Settings (see Chapter 12).
“Stage: 1-3”	The torque multiplier is on, but “Stage” is not Stage 1 to 3. Select the parameter set again.
“Failed to load the paired torque sensor list.”	Reading the sensor list failed. Open this screen again and check the sensor settings.
“Unable to connect to the local service. Open the desktop application to continue.”	Loading or saving failed. When saving, this also covers: the account lacks the “Edit · Work Parameters, Pairing and Calibration” permission, the step list is empty, or batch IDs 001 to 999 are all used. Check the permissions, keep at least one step, and save again.

> **Tip** When loading fails, the editing area is locked. Switch to another page from the navigation menu and click “Batch Jobs” to open it again; if it still fails, restart the program.

9.4 Step types

Path: Navigation menu → “Rotary Sensor” → “Batch Jobs” → “Settings” at the top right → click a step in the “Job Steps” list → select the type in “Work Mode” in the detail area.

All four step types are set up in the step detail area described in Section 9.3, with the same permissions and buttons as in Section 9.3. For the common fields (Torque Sensor, Work Mode, Target Torque, Torque Unit, Tolerance Type, Tolerance Range, Enable torque multiplier, Stage, Torque Ratio, Batch Count), see Section 9.3; this section covers only the extra fields and the judgement of each type. Types with angle (Torque & Angle, Torque Inspection) require a sensor that can measure angle.

When you change “Work Mode”, “Torque Sensor”, “Target Torque”, “Torque Unit”, “Tolerance Type” and “Batch Count” are kept, and the following fields are reset:

Field	Value after reset
Tolerance Range	10
Seating Torque	Torque & Angle, Torque Inspection: 20% of the spec of the sensor selected for this step, in the step's current torque unit; other types: cleared

Field	Value after reset
Target Angle	Cleared; must be entered again for Torque & Angle and Torque Inspection
Control mode, Angle tolerance standard, Angle Range	Torque & Angle: Angle, ≥, 10; other types: cleared
Tool Type, Detect Work Time, Work Time	Power Tool: Impact, Off, 0; other types: cleared
Enable torque multiplier	Off

Note After changing to Torque & Angle or Torque Inspection, “Target Angle” is blank and must be entered before you can save. If the sensor of this step has no valid spec, “Seating Torque” is also blank; enter it yourself.

9.4.1 Torque Wrench

A tightening step with a manual torque wrench. For each tightening, the peak torque is compared with the target torque and tolerance to judge OK or NOK. The detail area of this type is shown in Figure 9-4; it has only the common fields.

Judgement: OK when the peak torque (already multiplied by the torque factor and torque multiplier ratio) is within “Target Torque ± Tolerance Range%”; when “Tolerance Type” is “+”, only deviation above the target is allowed.

On the work screen there is no large reading, and the verdict banner fills the main area. The chart button is “Torque / Angle Curve”, both the mode name and the label in the chart dialog are “Torque Wrench”, and the curve plots torque only.

Example Pre-tightening step, target 60 N·m ±10%, Batch Count 5: OK range 54.00 to 66.00 N·m; 5 OK results are needed before the next step (for the complete flow, see example steps ⑤ and ⑨ in Section 9.3).

9.4.2 Torque & Angle

A tightening step that measures torque and angle together. You can select “Torque” or “Angle” as the control mode; the angle is counted after the torque reaches the “Seating Torque”. For the general concept of control modes, see Chapter 6.

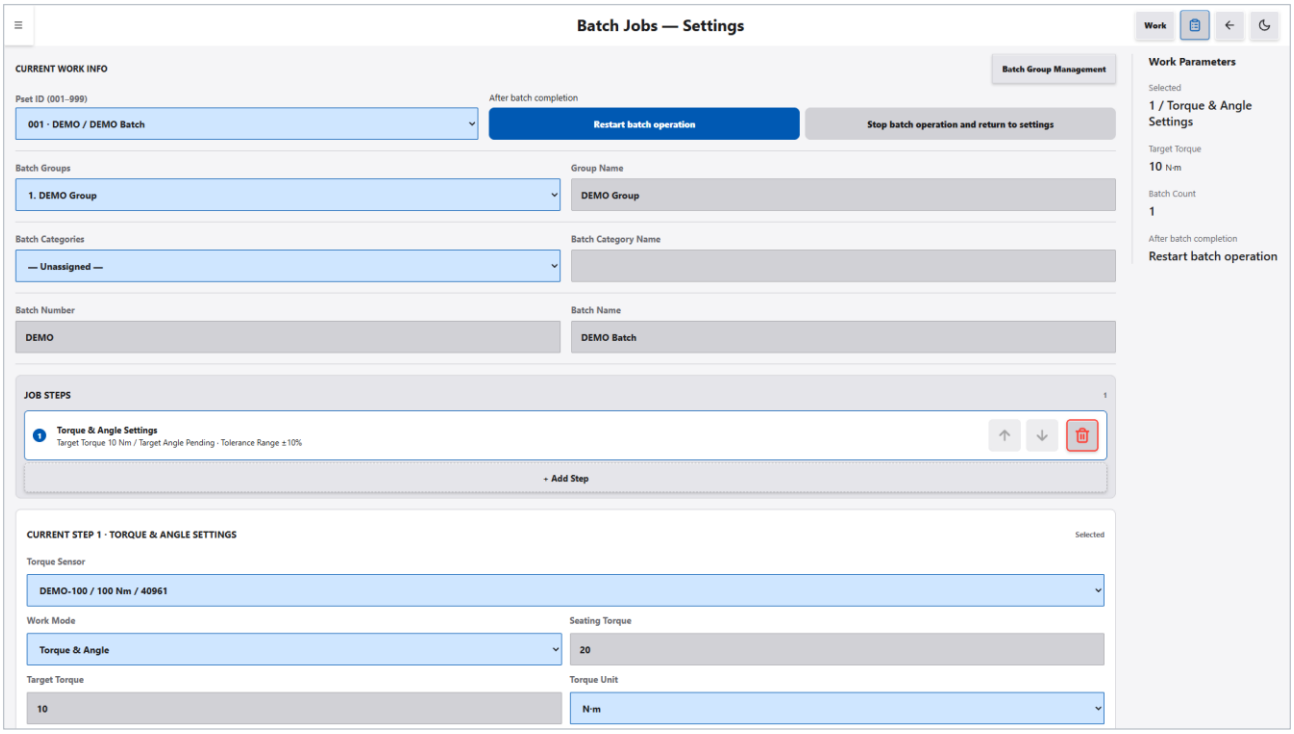

Figure 9-5 Batch job settings: Torque & Angle step

From top to bottom, the detail area contains “Torque Sensor”, “Work Mode”, “Seating Torque”, “Target Torque”, “Torque Unit”, “Tolerance Type”, “Tolerance Range”, “Target Angle”, “Control mode” and “Angle tolerance standard”; when the control mode is “Torque”, there is an extra “Angle Range”, followed by the torque multiplier fields and “Batch Count”.

Field	Description	Range and default
Seating Torque	The angle is counted only after the torque reaches this value. With control mode “Angle”, this is also the minimum torque for an OK judgement.	Required; 0 or more; 0 means the sensor angle is used directly. When you select a sensor, 20% of the spec is filled in.
Target Angle	Target for the angle judgement.	Required; 1 to 360 degrees; blank for a new step.
Control mode	Uses “Torque” or “Angle” as the basis of judgement. When you change it, “Angle tolerance standard” is reset to the first option of that mode.	“Angle” for a new step.
Angle tolerance standard	How the angle is compared.	Control mode “Angle”: “≥”, “≤”; control mode “Torque”: “±”, “+”.
Angle Range	Allowed angle deviation (degrees). Shown only with control mode “Torque”.	Required; 0 or more; 10 for a new step.

Judgement:

- Control mode “Angle”: OK when the final torque reaches the “Seating Torque” and the “Final Angle” meets the angle tolerance standard (≥ or ≤ the “Target Angle”). “Target Torque” and “Tolerance Range” do not take part in the judgement, but they must still be within the valid range before you can save, and they are shown as reference lines on the curve.
- Control mode “Torque”: judged only by whether the final torque is within “Target Torque ± Tolerance Range%”. “Angle tolerance standard” and “Angle Range” are recorded and shown but do not affect OK or NOK.

On the work screen, the reading area shows “Final Angle”, and the range bar below it is marked according to the control mode and angle tolerance standard: with control mode “Angle”, “≥” marks “Angle Lower Limit” and “≤” marks “Angle Upper Limit”, both equal to the “Target Angle”; with control mode “Torque”, the lower and upper limits are marked according to the “Angle tolerance standard” and “Angle Range”. The label in the chart dialog is “Torque & Angle”; the curve shows both torque and angle, with the same angle dashed lines as the range bar.

Note After you select a sensor, only the seating torque is filled in (20% of the spec); the target torque is blank and must be entered yourself. With control mode “Angle”, the torque must reach the seating torque before an OK is possible, so set both values again for the actual part.

Example Control mode “Angle”: seating torque 60 N·m, target angle 90, angle tolerance standard “≥”. Final torque 98.40 N·m, final angle 92.5° → OK; final angle 85.0° → NOK (for the complete flow, see example steps ⑥ and ⑪ in Section 9.3).
Control mode “Torque”: target torque 80 N·m, tolerance type “+/-”, tolerance range 5. OK range 80 × 0.95 = 76.00 to 80 × 1.05 = 84.00 N·m; final torque 82.30 N·m → OK, regardless of the final angle.

9.4.3 Power Tool

A tightening step with a power tool such as an impact, pulse or clutch tool, judged by peak torque. For how to choose the tool type, see Section 8.1.

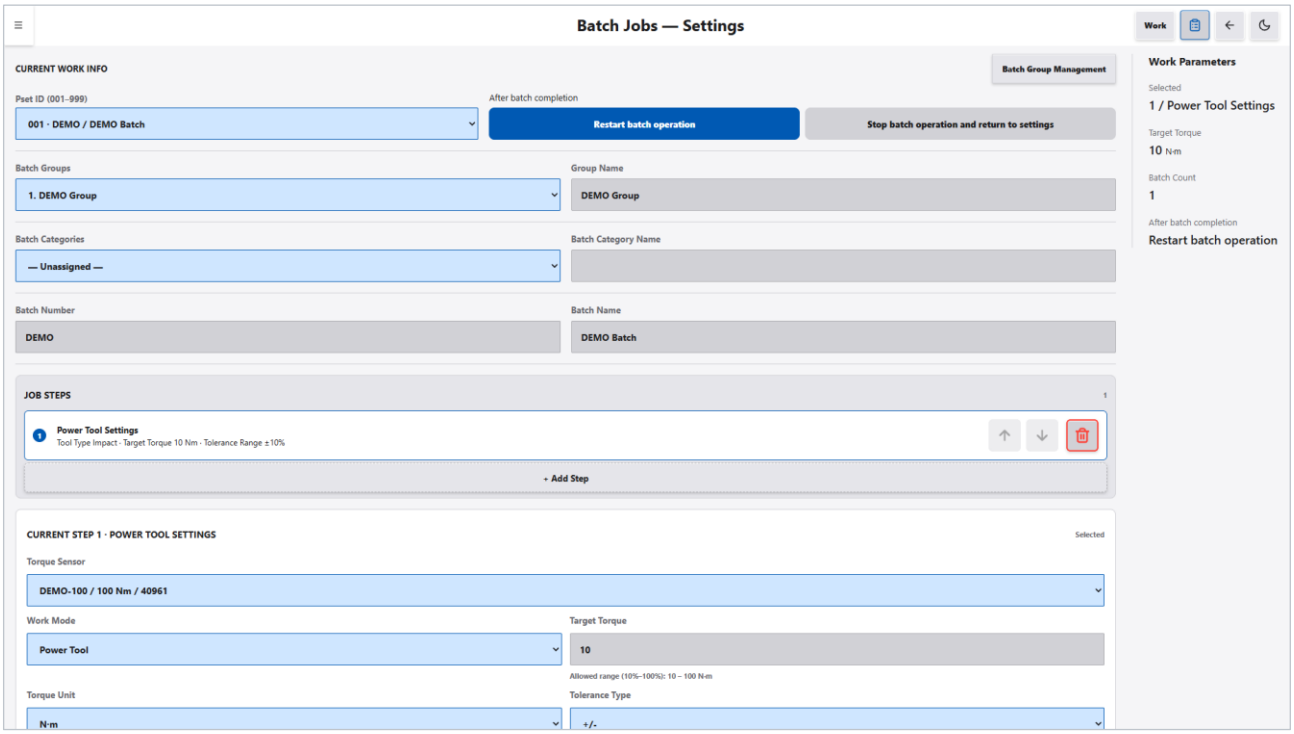

Figure 9-6 Batch job settings: Power Tool step

From top to bottom, the detail area contains “Torque Sensor”, “Work Mode”, “Target Torque”, “Torque Unit”, “Tolerance Type”, “Tolerance Range”, “Tool Type”, “Detect Work Time” and “Work Time”, followed by the torque multiplier fields and “Batch Count”.

Field	Description	Range and default
Tool Type	Kind of power tool. Impact, Pulse: the work screen shows “Pulse Count”; Clutch: the work screen shows “Detect Work Time” and the mode name in the chart dialog shows “Power Tool - Clutch”.	“Impact”, “Clutch”, “Pulse”; “Impact” for a new step.
Detect Work Time	Work time switch, shown in the information rows of the work screen.	“Off”, “On”; default “Off”.
Work Time	Target work time (seconds), shown on the work screen as “Target Work Time”. It can be entered even when Detect Work Time is “Off”.	0 or more, up to 3 decimal places; default 0.

Judgement: based only on whether the peak torque is within “Target Torque ± Tolerance Range%”. “Tool Type”, “Detect Work Time” and “Work Time” do not affect OK or NOK. Power Tool steps in a batch do not have the “Work time reminder” function.

The chart button on the work screen shows “Torque / Angle Curve” for every tool type, including Clutch. The curve plots torque only.

> **Example** Tightening 4 frame bolts with an impact wrench, allowing only values above the target: “Torque Sensor” a sensor with a 500 N·m spec, “Work Mode” Power Tool, “Tool Type” Impact, “Target Torque” 300, “Tolerance Type” +, “Tolerance Range” 15, “Batch Count” 4.
> OK range 300.00 to 300 × 1.15 = 345.00 N·m. The summary shows “Tool Type Impact · Target Torque 300 Nm · Tolerance Range +15%”. The mode information row on the work screen shows “Pulse Count”, and the chart button is “Torque / Angle Curve”; in the chart dialog, the “Torque Lower Limit” and “Target Torque” dashed lines are both at 300 N·m and the “Torque Upper Limit” dashed line is at 345 N·m.

9.4.4 Torque Inspection

Judges OK or NOK by the torque at the moment the tightening reaches the “Target Angle” (angle torque). Commonly used to re-check bolts that are already tightened.

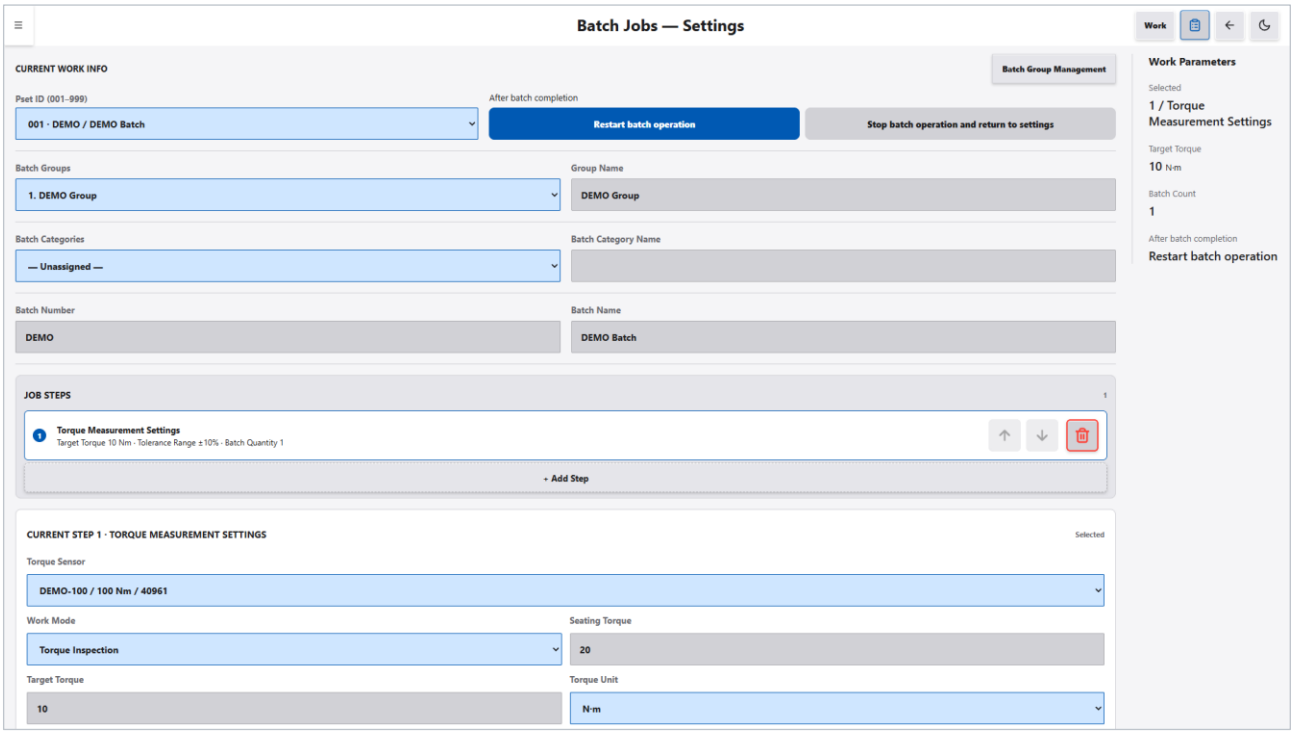

Figure 9-7 Batch job settings: Torque Inspection step

From top to bottom, the detail area contains “Torque Sensor”, “Work Mode”, “Seating Torque”, “Target Torque”, “Torque Unit”, “Tolerance Type”, “Tolerance Range” and “Target Angle”, followed by the torque multiplier fields and “Batch Count”. There is no control mode or angle tolerance standard.

Field	Description	Range and default
Seating Torque	The angle is counted only after the torque reaches this value; this determines where angle measurement starts.	Required; 0 or more; 0 means the sensor angle is used directly. When you select a sensor, 20% of the spec is filled in.
Target Angle	Angle position at which the torque is taken.	Required; 1 to 360 degrees; blank for a new step.

Judgement: when the angle reaches the “Target Angle”, the system takes the “Angle Torque” at that moment and judges by whether the angle torque is within “Target Torque ± Tolerance Range%”. If a tightening does not reach the target angle, it is not recorded and is not counted as NOK.

On the work screen, the reading area shows “Final Angle”, and the range bar marks only “Target Angle”; the mode information row shows “Angle Torque” and “Live Angle”. The judgement and the actual torque in the record are both the angle torque, not the peak of this tightening (see the note in Section 9.2). The label in the chart dialog is “Torque Inspection”; the curve shows both torque and angle, but only the “Target Angle” line is drawn, without angle limit lines.

> **Note** After you select a sensor, only the seating torque is filled in (20% of the spec); the target torque is blank and must be entered yourself. The angle is counted only after the torque exceeds the seating torque, so the angle torque obtained is usually also higher than the seating torque; keeping the filled-in values easily leads to off-target judgements. Set them again according to the actual inspection conditions.

> **Example** Re-check step: seating torque 100 N·m, target angle 5, target torque 140 N·m, tolerance range 15. OK range 119.00 to 161.00 N·m; angle torque 138.60 N·m at 5° → OK (for the complete flow, see example steps ⑦ and ⑫ in Section 9.3).

9.5 Group and category management

Path: Navigation menu → “Rotary Sensor” → “Batch Jobs” → “Settings” at the top right → “Batch Group Management” at the top right of the basic batch data area. Click the same button again to collapse the area.

Quickly add a group or category inside the batch settings screen and apply it directly to the batch being edited, without leaving the settings screen. To change the code or name of an existing group, or to rename a category, use advanced group management (see Section 9.6).

“Add Group” and “Add Category” save immediately and require the “Edit · Work Parameters, Pairing and Calibration” permission; without it, the screen shows “Unable to save the batch group.” or “Unable to save the batch category.”. While the batch settings are loading or saving, the inputs and buttons in this area are temporarily disabled.

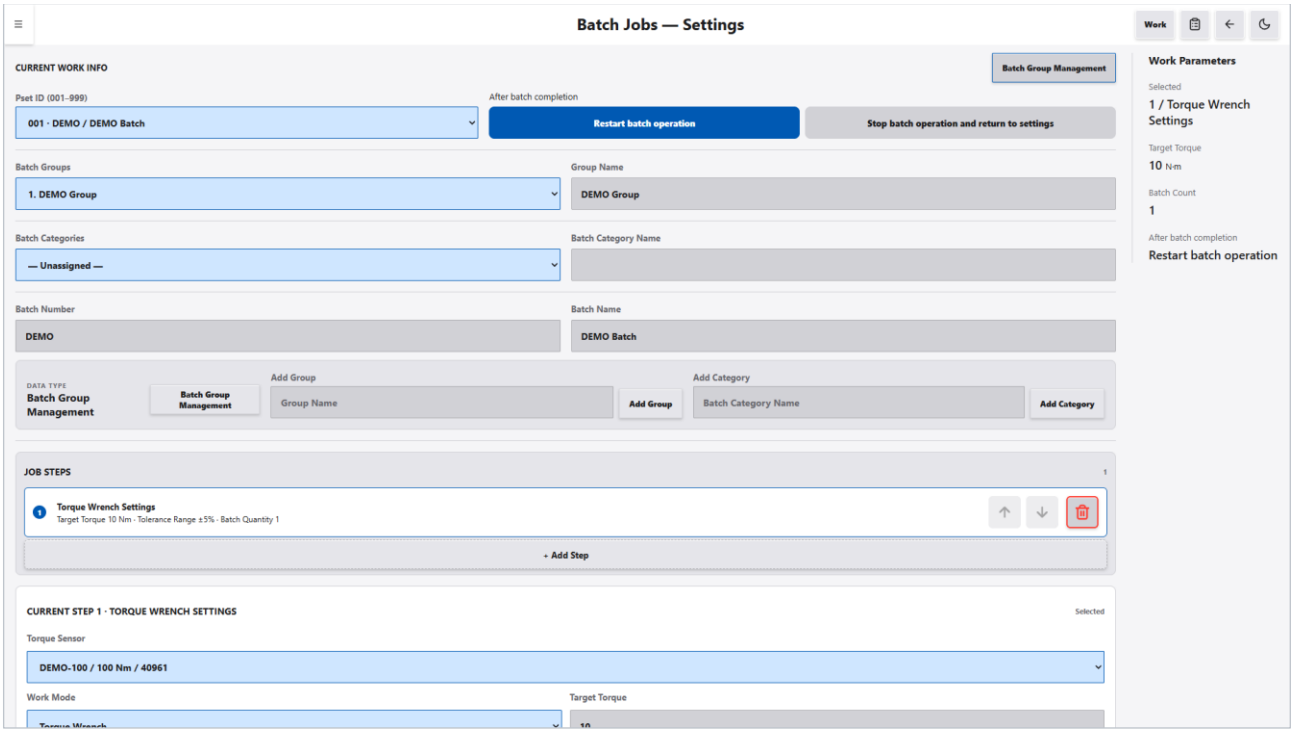

Figure 9-8 Batch job settings: group and category management

9.5.1 Screen layout

Area/button	Description
Title	Small text “Data Type”, large text “Batch Group Management”.
“Batch Group Management” (in this area)	Switches to the “Batch Group Management” screen (see Section 9.6). Unsaved batch changes are kept, and you can continue editing after you return.
“Add Group” field and “Add Group” button	Type a name and click “Add Group” to create the group immediately and switch the current batch's group to the new group.
“Add Category” field and “Add Category” button	Type a name and click “Add Category” to create the category immediately and switch the current batch's category to the new category.

Success and failure messages for adding appear in the message line at the bottom of the settings screen.

9.5.2 Fields

Field	Description	Range and default
Add Group	Name of the group to create. The “Group Code” of the new group is set to the same text as the name, and the “Group No.” is the current highest number plus 1.	Required when you click “Add Group”; may have the same name as an existing group. Cleared automatically after it is added.
Add Category	Name of the category to create. If you type the name of an existing category, that category is selected and no duplicate is created.	Required when you click “Add Category”; category names must be unique. Cleared automatically after it is added.

9.5.3 Procedure

1. On the batch settings screen, click “Batch Group Management”. The “Add Group” and “Add Category” fields appear below.
2. Add a group: type a name in “Add Group” and click “Add Group”. The input field is cleared, “Batch Groups” switches to the new group, and “Group Name” on the right shows the same name.
3. Add a category: type a name in “Add Category” and click “Add Category”. The input field is cleared and “Batch Categories” switches to the new category.
4. Check the other batch fields and click “Save Job”; only then are the new group and category applied to the batch (see Section 9.3).

New groups and categories appear in the drop-down lists and in the advanced group management lists as soon as they are created. If you leave without clicking “Save Job”, the batch stays in its original group and category, but the newly created group and category remain in the lists. Groups and categories cannot be deleted on screen once created.

> **Tip** A quickly added group has the same code and name. If the group code needs separate coding (for example a production line code), change “Group Code” in advanced group management after adding it.

9.5.4 Error messages

On-screen message	Cause and action
“Enter a batch group name.”	“Add Group” was clicked while the “Add Group” field was blank. Type a name and click again.
“Enter a batch category name.”	“Add Category” was clicked while the “Add Category” field was blank. Type a name and click again.
“Unable to save the batch group.”	Creating the group failed, for example because the account lacks the “Edit · Work Parameters, Pairing and Calibration” permission. Check the permissions (see Chapter 15) and try again.
“Unable to save the batch category.”	Creating the category failed, for example because of missing permissions. Check the permissions and try again.
“Unable to connect to the local service. Open the desktop application to continue.”	The group or category was created, but reloading the list failed. Open the batch settings screen again and check that the new item is in the list.

9.6 Advanced group management

Path: Navigation menu → “Rotary Sensor” → “Batch Jobs” → “Settings” at the top right → “Batch Group Management” → “Batch Group Management” in the expanded area.

Maintain batch groups and batch categories centrally on the “Batch Group Management” screen: add groups, change group codes and names, add categories and rename categories. This screen has no delete function.

Opening this screen requires the “View · Work Settings” permission; “Save Group” and “Save Category” require the “Edit · Work Parameters, Pairing and Calibration” permission (by default roles A and B have it and role C does not). Without the permission, the screen shows “Unable to save the batch group.” or “Unable to save the batch category.”.

When the screen opens, the group and category lists are loaded automatically, and the first group and first category in the lists are preselected.

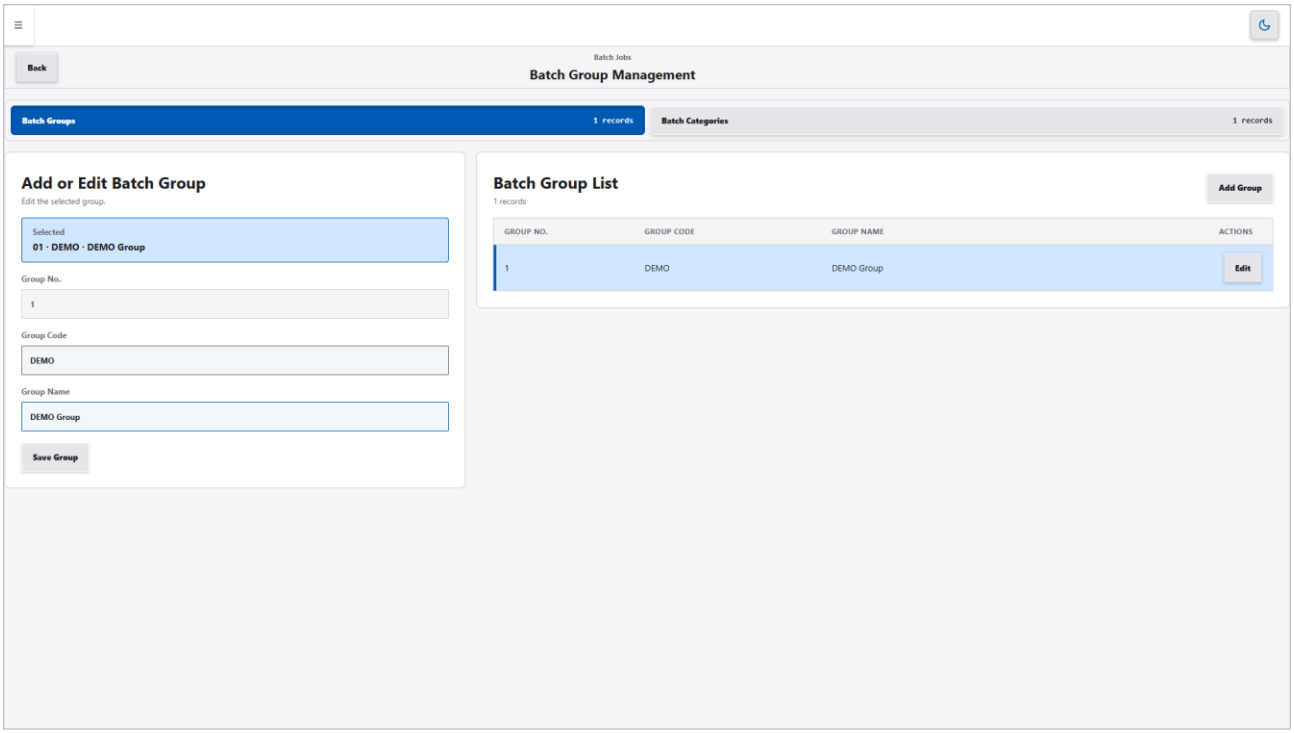

Figure 9-9 Batch Group Management: Batch Groups tab

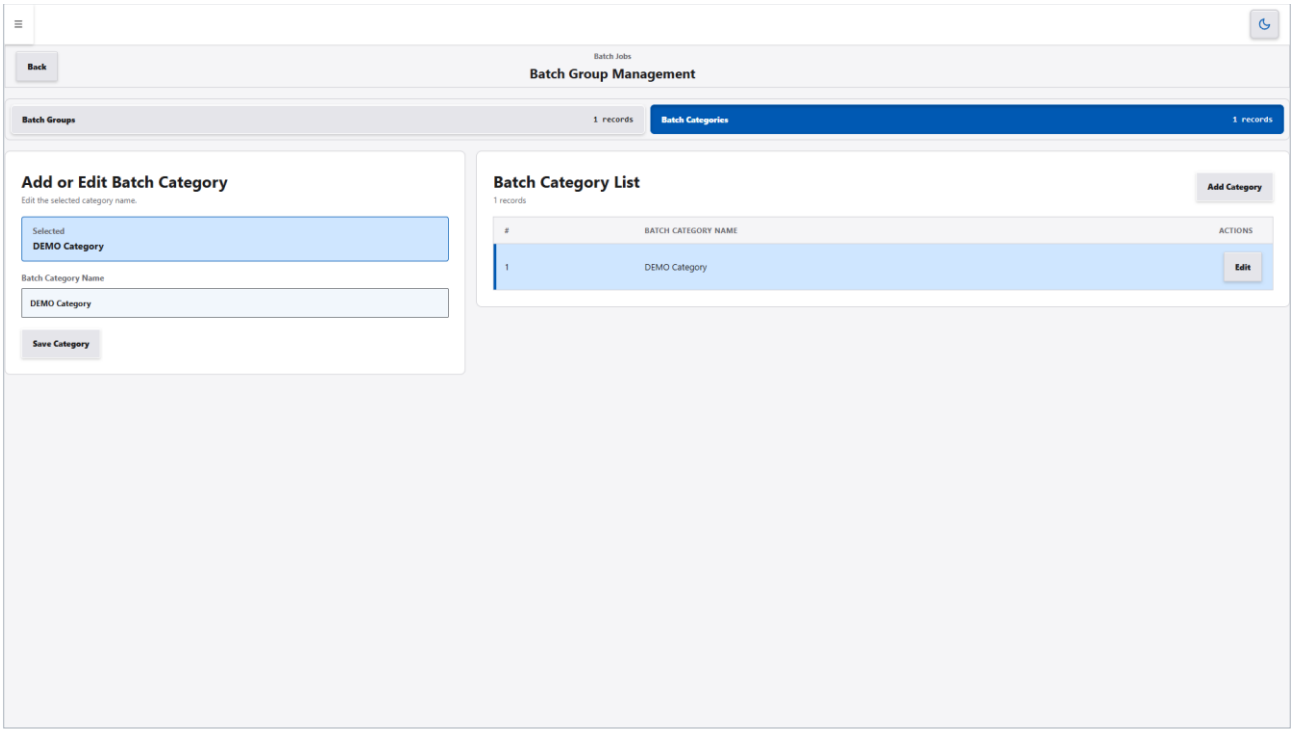

Figure 9-10 Batch Group Management: Batch Categories tab

9.6.1 Screen layout

Area/button	Description
“Back” (top left)	Returns to the batch settings screen. Unsaved input on this screen is discarded; unsaved changes in the batch settings are still kept.
Title	Small text “Batch Jobs”, large text “Batch Group Management”. Only the light/dark toggle is at the top right.
Tabs	“Batch Groups” and “Batch Categories”, each with its count on the right (for example “3 records”). The selected tab has a blue background.
Add or edit batch group (left side of the group tab)	Title “Add or Edit Batch Group”. The blue box shows “Selected” and “Group No. · Group Code · Group Name”; in add mode it shows “Add Mode” and “Creating a new batch group”. Below are “Group No.”, “Group Code”, “Group Name” and “Save Group”.
Batch group list (right side of the group tab)	Title “Batch Group List” with the description “N records”, and “Add Group” at the top right. The columns are “Group No.”, “Group Code”, “Group Name” and “Actions” (“Edit” button); the selected row has a blue background. When there is no data, “No records found” is shown.
Add or edit batch category (left side of the category tab)	Title “Add or Edit Batch Category”. The blue box shows “Selected” and the category name, or “Add Mode” and “Creating a new batch category”. Below are “Batch Category Name” and “Save Category”.
Batch category list (right side of the category tab)	Title “Batch Category List” with the description “N records”, and “Add Category” at the top right. The columns are “#”, “Batch Category Name” and “Actions” (“Edit” button), sorted by name.

Area/button	Description
“Add Group” / “Add Category”	Clears the form on the left and enters add mode. Does not save.
“Edit”	Loads that row into the form on the left for editing. Does not save.
“Save Group”	In add mode, creates a group; in edit mode, updates the code and name of the selected group. While saving, the button text changes to “Save Settings...”. On success, “Batch group saved locally” is shown.
“Save Category”	In add mode, creates a category (if a category with the same name exists, it is selected instead); in edit mode, renames the selected category. On success, “Batch category saved locally” is shown. Category changes are included in synchronization (see Chapter 14).

9.6.2 Fields

Field	Description	Range and default
Group No.	Sequential number of the group, used for sorting and in the drop-down list of the batch settings (shown as “No. Name”).	Read-only, assigned by the system (current highest number plus 1); blank in add mode and generated when saved.
Group Code	Code of the group, for example a production line code.	Required; leading and trailing spaces are removed; may duplicate other groups.
Group Name	Display name of the group. After renaming, all batches in the group show the new name.	Required; may duplicate other groups.
Batch Category Name	Category name. After renaming, all batches using this category change to the new name.	Required; must not be the same as another category.

9.6.3 Procedure

1. On the batch settings screen, click “Batch Group Management”, then click “Batch Group Management” in the expanded area. The screen switches to “Batch Group Management”, opens on the “Batch Groups” tab, and the first group is loaded on the left.
2. Add a group: click “Add Group” at the top right; the left side shows “Add Mode”. Enter “Group Code” and “Group Name”, and click “Save Group”. The screen shows “Batch group saved locally”, and the new group appears in the list with a group number assigned.
3. Change a group: click “Edit” in that row of the list; “Selected” on the left shows the group. Change “Group Code” or “Group Name” and click “Save Group”.
4. Add or rename a category: switch to the “Batch Categories” tab. To add, click “Add Category”, enter “Batch Category Name” and click “Save Category”; to rename, click “Edit” in that row, change the name and click “Save Category”. The screen shows “Batch category saved locally”.

5. Click “Back” at the top left to return to the batch settings screen, check the selections in “Batch Groups” and “Batch Categories”, then click “Save Job” (see Section 9.3).

Groups and categories are saved as soon as you click “Save Group” or “Save Category”, and the batch does not need to be saved again for them; however, to change which group or category the current batch uses, you must return to the batch settings and click “Save Job”.

Note After “Save Group” succeeds on this screen, “Batch Groups” on the batch settings screen automatically switches to the group you just saved. Even if you only changed the data of another group, check that the current batch's group is correct after returning, before you click “Save Job”.

Example Set a production line code for the “Wheel Hub Assembly” group created in the example in Section 9.3.
① On the “Batch Groups” tab, click “Edit” in the “Wheel Hub Assembly” row of the list. “Selected” on the left shows the group, and “Group Code” is currently “Wheel Hub Assembly”.
② Change “Group Code” to L2-HUB and click “Save Group”. The screen shows “Batch group saved locally”, and the group code in the list is updated to L2-HUB.
③ Click “Back”, check that “Batch Groups” is still “Wheel Hub Assembly”, and click “Save Job”.

9.6.4 Error messages

On-screen message	Cause and action
“Unable to load batch groups.” or “Unable to load batch categories.”	Reading the list failed. Click “Back” and open the screen again; if it still fails, restart the program.
“Enter a batch group code.”	“Group Code” is blank. Enter a code and save again.
“Enter a batch group name.”	“Group Name” is blank. Enter a name and save again.
“Unable to save the batch group.”	Saving failed, for example because the “Edit · Work Parameters, Pairing and Calibration” permission is missing or the group no longer exists. Check the permissions (see Chapter 15), open this screen again and try again.
“Enter a batch category name.”	“Batch Category Name” is blank. Enter a name and save again.
“Unable to save the batch category.”	Saving failed, for example because of missing permissions or because the new name already exists as a category. Check the permissions or use another name; if a category still cannot be renamed, click “Add Category” to create one with the name you want, then select it.

Chapter 10 Capability Index

This chapter describes “Tool Inspection”, the capability index test: you capture a series of torque samples against one set of specifications, and the system automatically calculates indices such as Cp, Cpk, Cm and Cmk to evaluate the repeatability of a tightening tool.

10.1 Overview and the three modes

Path: Navigation menu → “Tool Capability” → “Tool Inspection”.

“Tool Inspection” evaluates whether a tightening tool (impact, pulse, torque wrench, clutch) is stable. You set the upper and lower specification limits and tighten repeatedly. For every captured sample, TMS judges OK/NOK and calculates the mean, standard deviation and capability indices, then shows “Pass”, “Marginal” or “Fail” according to the acceptance thresholds you set. Every capture is saved as one capability test record (see Chapter 11).

10.1.1 The three test modes

The work screen title identifies the current test mode. The three modes use exactly the same statistics and judgement; they differ in what is measured and in the screen content:

Mode	What is measured	Typical use	Equipment required
Torque sensor mode	The peak torque measured by the torque sensor each time the tool under test tightens	Evaluating the repeatability of the power tool or wrench itself (machine capability)	A paired rotary torque sensor with a spec; RF 2.4G receiver
Residual torque mode	Torque measured with an RF 2.4G measuring device (called “Torque tension meter device” on screen); swing torque, reference torque and angle can also be recorded by manual input	Residual torque audits on joints that are already tightened, recording torque factor, angle factor and combination information	A paired RF 2.4G sensor with a spec; RF 2.4G receiver
Residual torque + torque sensor mode	Torque captured by the torque sensor (used for judgement and statistics); residual torque measured with another instrument is recorded by manual input	One record keeps both the tool tightening torque and the residual torque for easy comparison	A paired torque sensor; RF 2.4G receiver; an instrument for measuring residual torque (for example a torque wrench)

- A new installation uses torque sensor mode.
- The “Mode” field on the settings screen always shows “Torque Sensor” and cannot be switched on screen. Residual torque mode and residual torque + torque sensor mode appear only when the local data is already set to that mode; contact your supplier if you need to change it.

- To check the actual mode, look at the work screen title: torque sensor mode shows “Tool Inspection Work”, residual torque mode shows “Tool Inspection / Residual Torque”, and residual torque + torque sensor mode shows “Tool Inspection / Residual Torque + Torque Sensor”.
- All three modes share one set of capability test settings; the last saved settings apply.
- The work screens of all three modes show only torque readings, not angles; in the residual torque modes, angles are only entered manually in the “Manual reference” fields.

10.1.2 Opening the screen and first use

1. In the navigation menu, click “Tool Capability” → “Tool Inspection”.
2. If capability test settings have never been saved, the settings screen opens first (see Section 10.3). After saving successfully, the screen switches to the work screen automatically.
3. If settings have been saved before, the work screen opens directly. To change the settings, click “Settings” (gear icon) at the top right.

When you open the work screen, TMS automatically sends a start-work command to the sensor; when you leave the screen, work stops automatically. This page has no separate “Start” or “Stop” button. For RF connection, battery level and offline status in general, see Section 5.2.

10.1.3 Permissions

The table below lists the permissions used by the capability index test, with the same names as on the “User Management” screen. Each one can be adjusted per user (see Section 15.4).

Action	Required permission	Default template
Open the work screen	Run · Work, and Run · Tool Inspection	Allowed for A, B, C
Open the settings screen (the “Settings” button in the header of the work screen)	View · Work Settings	Allowed for A, B, C
Capture samples (automatically or with “Confirm capability capture”)	Run · Tool Inspection	Allowed for A, B, C
Save capability test settings	Edit · Tool Inspection	Allowed for A, B; denied for C
Click “Start collecting data” to start a new statistics round	Clear All · Tool Inspection	Allowed for A, B; denied for C
Open “Work Records”	View · Work Records	Allowed for A, B, C

- An account that has “Run · Work” and “Run · Tool Inspection” but not “View · Work Settings”: if settings have already been saved, the work screen opens directly and the header has no “Settings” button; if no settings have been saved yet, the screen shows “Failed to load capability test settings.” without the “Reload settings” button; ask a person with the settings permission to complete the settings first.

- An account that lacks either “Run · Work” or “Run · Tool Inspection” but has “View · Work Settings”: clicking “Tool Inspection” only opens the settings screen; the work screen does not open.

> **Note** The “Clear All · Tool Inspection” permission controls the “Start collecting data” button. The “Clear All” button at the top of the work screen requires no permission and only clears the screen display (see Section 10.2).

10.2 Common statistical indices

The sampling, judgement and statistics rules in this section apply to all three modes. TMS calculates in N·m and converts the results to the torque unit you set for display.

10.2.1 How samples are created

- **Automatic capture**: after the torque starts rising from 0, TMS keeps the peak value of this tightening; when the torque returns to 0, one sample is captured automatically with this peak value.
- **Manual capture**: click “Confirm capability capture” to capture one sample with the current real-time torque. If there is no torque greater than 0 at that moment, the screen shows “No positive sensor torque has been received. Capability capture cannot be confirmed.” and nothing is captured.
- Before a sample is saved, it is multiplied by the factor from “Torque Factor Settings” and the ratio from “Torque Multiplier Settings” (1 when not enabled), and then judged and included in the statistics (see Sections 12.4 and 12.5). The large torque value on the work screen (for example “Final Torque”) is multiplied by the same factors.
- If the configured torque unit is invalid, no samples are captured and the screen shows “Unsupported torque unit: (unit)”. Go to the settings screen, select the torque unit again and save.

10.2.2 OK/NOK judgement

A sample between the LSL (lower specification limit) and the USL (upper specification limit), including values equal to the limits, is OK; otherwise it is NOK. The judgement depends only on the limits, not on the target torque. Before any sample is captured, the verdict banner on the work screen shows “Waiting”.

10.2.3 Statistical indices and formulas

In the formulas, USL and LSL are the upper and lower limits from the settings screen; M is the mean; S is the sample standard deviation; n is the number of samples.

Index	Formula	Calculation range and display
M mean	Sum of samples ÷ n	Samples accumulated on this page
S standard deviation	$\sqrt{[\Sigma(\text{sample} - M)^2 \div (n - 1)]}$	Samples accumulated on this page; “--” with fewer than 2 samples
Cp (potential process capability)	(USL − LSL) ÷ (6 × S)	Latest 20 samples of the same round; saved in records only, not shown on screen

Index	Formula	Calculation range and display
Cpk (process capability index)	min[(USL − M) ÷ (3 × S), (M − LSL) ÷ (3 × S)]	Latest 20 samples of the same round; shown as "CPK" with 2 decimal places
Cm (potential machine capability)	(USL − LSL) ÷ (6 × S)	Latest N samples of the same round (N = target sample count); saved in records only
Cmk (machine capability index)	min[(USL − M) ÷ (3 × S), (M − LSL) ÷ (3 × S)]	Latest N samples of the same round; shown as "CMK" with 2 decimal places
CMU	(USL − M) ÷ (3 × S)	Samples accumulated on this page; shown only in the residual-torque-related modes, 3 decimal places
CML	(M − LSL) ÷ (3 × S)	Same as CMU
In-spec percentage	Number of OK ÷ n × 100%	Samples accumulated on this page; 1 decimal place

- Cpk and Cmk use the same formula; they differ only in the number of samples: CPK uses the latest 20 samples, CMK uses the latest N samples (30, 50 or 100).
- While the window is not yet full, the index shows "--". For example, with a target sample count of 30, CPK appears after 20 samples and CMK after 30 samples.
- If all samples in the window are identical (standard deviation 0), the index cannot be calculated and shows "--".
- When each sample is saved, the Cp, Cpk, Cm and Cmk calculated at that moment are recorded. Samples captured later do not change the values in earlier records.
- N, M, S and the in-spec percentage in the statistics summary are calculated from the samples currently accumulated on this page; CPK and CMK are the values calculated and saved at the last capture. Therefore, with fewer than 20 accumulated samples, the mean already has a value while CPK is still "--".

10.2.4 Calculation examples

Example Calculating Cpk in N·m.

Conditions: target torque 50, LSL 45, USL 55; for the latest 20 samples of the same round, mean M = 50.4 and standard deviation S = 0.8.

1. 3 × S = 3 × 0.8 = 2.4.
2. Upper side: (USL − M) ÷ (3 × S) = (55 − 50.4) ÷ 2.4 = 4.6 ÷ 2.4 = 1.9167.
3. Lower side: (M − LSL) ÷ (3 × S) = (50.4 − 45) ÷ 2.4 = 5.4 ÷ 2.4 = 2.2500.
4. Cpk is the smaller of the two = 1.9167; "CPK" on the screen shows 1.92.
5. Cp = (USL − LSL) ÷ (6 × S) = 10 ÷ 4.8 = 2.0833, saved in the record.
6. CPK acceptance threshold 1.33: 1.92 ≥ 1.33, so "Pass" is shown.

Cp (2.08) is larger than Cpk (1.92) because the mean is 0.4 N·m away from the specification center of 50. When the mean returns to 50, Cpk equals Cp.

If the target sample count is 30 and the latest 30 samples have the same M and S as above, the same calculation gives Cmk 1.92 and Cm 2.08.

Example Same specifications, but with S = 1.5:
1. 3 × S = 4.5; upper side 4.6 ÷ 4.5 = 1.0222; lower side 5.4 ÷ 4.5 = 1.2000.
2. Cpk = 1.0222, shown as 1.02.
3. CPK acceptance threshold 1.33: the threshold is not reached, but the value is ≥ 1.00, so “Marginal” is shown.
4. If CMK is also 1.02: it is below 1.33, so “Fail” is shown.

10.2.5 Judgement levels and interpretation

CPK and CMK show the judgement text according to the table below. You enter the acceptance thresholds on the settings screen; the lower bound for “Marginal” is fixed and cannot be changed.

Condition	CPK display	CMK display
Index ≥ acceptance threshold	Pass	Pass
Below the acceptance threshold, but CPK ≥ 1.00 / CMK ≥ 1.33	Marginal	Marginal
Below the lower bound above	Fail	Fail
No value yet	--	--

- The judgement uses the unrounded value. For example, when Cpk is 1.329 the screen shows 1.33, but with a threshold of 1.33 the judgement is still “Marginal”.
- When the CMK acceptance threshold is set to 1.33 or lower, CMK never shows “Marginal”, only “Pass” or “Fail”.

Interpretation guidelines (the following are common industry reference values; set the actual acceptance criteria in the “CPK” and “CMK” acceptance thresholds according to your company's or customer's standards):

- Cpk ≥ 1.33: process capability is generally considered sufficient. The distance from the mean to the nearest specification limit is at least 4 standard deviations.
- 1.00 ≤ Cpk < 1.33: capability is marginal; tighter control or reducing variation is recommended.
- Cpk < 1.00: capability is insufficient and out-of-spec samples may keep occurring; find the cause before using the tool.
- Machine capability (Cmk) often uses a stricter standard; some industries require Cmk ≥ 1.67.
- When Cp is clearly larger than Cpk, the mean is off the specification center; adjust the tool setting first to bring the mean back to the target. When Cp itself is low, the variation is too large; check the tool, the joint or the working method.

10.2.6 Collection rounds: “Start collecting data” and “Clear All”

A collection round is a series of consecutive samples taken under the same conditions. CPK and CMK are calculated only from samples of the same round.

- **Clicking “Start collecting data”**: ends the current round; the next capture starts a new round, CPK and CMK are accumulated from the beginning, and the statistics on this page are reset to zero. Saved records are not deleted. Requires the “Clear All · Tool Inspection” permission.
- **Automatic new round when conditions change**: when any of the following changes, the next capture automatically starts a new round: work station, tool number, torque sensor (including model, serial number and spec), torque unit, test mode, target sample count, specification limits, operator, torque factor or torque multiplier ratio.
- **Clicking “Clear All”**: clears only the real-time reading, last result and accumulated samples shown on this page; it does not end the current round and does not delete records. Samples captured afterward are still in the same round as the samples before clearing, so CPK and CMK still include the samples from before the clearing.

> **Note** To formally restart a capability evaluation, click “Start collecting data”; do not just click “Clear All”.

10.2.7 Torque distribution histogram

On the work screen, click “Normal Distribution Histogram” at the bottom of the statistics panel to open the histogram dialog. The dialog title is “Normal Distribution Histogram”; it is closed in the same way as the chart dialog (see Section 5.2.6). All three modes use this dialog.

- The histogram is drawn only after 2 or more samples have accumulated; before that, the screen shows “At least 2 samples are needed to generate the distribution chart”.
- The horizontal axis is torque, covering the LSL, the USL and all samples; the vertical axis is the number of samples. The number of bins is the square root of the number of samples (rounded up), with a minimum of 5 and a maximum of 12 bins.
- Green bars are “In Spec” samples; red bars are “Out of Spec” samples.
- The bar below the chart shows, from left to right, the lower limit, the specification center (equal to the target torque) and the upper limit.

> **Example** With 4 accumulated samples, $\sqrt{4} = 2$, which is below the minimum number of bins, so 5 bins are drawn; with 30 accumulated samples, $\sqrt{30} \approx 5.48$, rounded up to 6 bins.

10.3 Torque sensor mode

Torque sensor mode captures samples continuously with a paired rotary torque sensor, so you can follow the sampling progress, CPK, CMK and distribution in real time. First fill in the specifications on the settings screen, then capture samples on the work screen.

10.3.1 Settings screen

Path: Navigation menu → “Tool Capability” → “Tool Inspection” → “Settings” at the top right. On first use, this screen opens directly when you open the page.

Set the identification data, torque sensor, tool type, specification limits, target sample count and acceptance thresholds for the capability test. All three test modes share these settings. Opening the screen requires the “View · Work Settings” permission; saving requires the “Edit · Tool Inspection” permission. Without it, you can open the screen but cannot save.

Prerequisite: at least one torque sensor with a spec is paired (see Section 12.3).

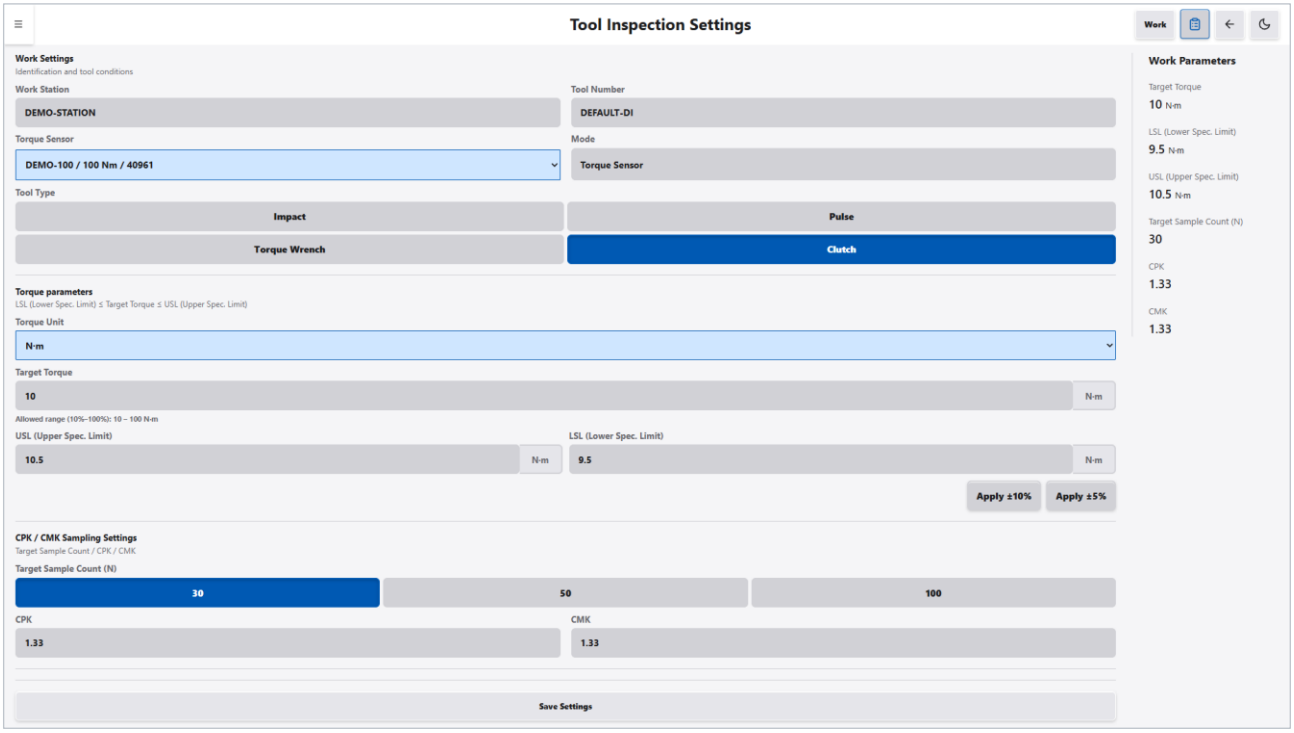

Figure 10-1 Tool Inspection settings screen

Screen layout

Area/button	Description
Header	Title in the center: “Tool Inspection Settings”; on the right: “Work”, “Work Records” (clipboard icon), “←” (back) and “Toggle light / dark mode”
Work settings (identification and tool conditions)	“Work Station”, “Tool Number”, “Torque Sensor”, “Mode”, and four “Tool Type” buttons
Torque parameters (lower limit ≤ target torque ≤ upper limit)	“Torque Unit”, “Target Torque”, “USL (Upper Spec. Limit)”, “LSL (Lower Spec. Limit)”, plus “Apply ±10%” and “Apply ±5%”

Area/button	Description
CPK / CMK Sampling Settings (target sample count and acceptance thresholds)	"Target Sample Count (N)" with three buttons (30, 50, 100), and the "CPK" and "CMK" acceptance thresholds
Save Settings	Full-width button at the bottom of the form; on success, "Capability test settings were saved locally." is shown briefly
Current parameters	Right column ("Work Parameters") showing in real time the target torque, lower limit, upper limit, target sample count (N) and both acceptance thresholds being entered in the form (including unsaved changes)

Fields

Field	Description	Range and default
Work Station	Station where this evaluation takes place; recorded in every record	Optional; can be left blank; blank on first use; when left blank, no code is filled in automatically
Tool Number	Number of the tool under test	Required; cannot contain only spaces; blank on first use
Torque Sensor	Sensor used to capture samples; options are shown as "Model / Spec / S/N"	Required; only paired sensors are listed; when you select another sensor, "Target Torque" is cleared and must be entered again, and "LSL (Lower Spec. Limit)" and "USL (Upper Spec. Limit)" keep their values
Mode	For display only; cannot be changed	Always shows "Torque Sensor" (see Section 10.1)
Tool Type	Type of the tool under test; recorded only, does not affect the judgement	Impact, Pulse, Torque Wrench, Clutch; the selected one has a blue background
Torque Unit	Torque unit for the settings screen and the work screen	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; N·m on a new installation; values already entered are converted automatically when you change it
Target Torque	Specification center, and also the basis for "Apply ±10%" and "Apply ±5%"; does not take part in the OK/NOK judgement. After you select a sensor, "Allowed range (10%–100%): lower limit – upper limit unit" is shown below the field	Required; 10% to 100% of the selected sensor's spec; up to two decimal places are shown
USL (Upper Spec. Limit)	USL, the upper bound of the OK judgement (inclusive)	Required; must be greater than the lower limit
LSL (Lower Spec. Limit)	LSL, the lower bound of the OK judgement (inclusive)	Required; must be less than the upper limit
Target Sample Count (N)	Number of samples for the CMK calculation, and also the target of "Data Collection Progress"	30, 50, 100; default 30

Field	Description	Range and default
CPK acceptance threshold (“CPK”)	When CPK reaches this value, “Pass” is shown	A number of 0 or more; default 1.33
CMK acceptance threshold (“CMK”)	When CMK reaches this value, “Pass” is shown	A number of 0 or more; default 1.33

Buttons

Button	Description
Impact / Pulse / Torque Wrench / Clutch	Selects the tool type; takes effect only after you click “Save Settings”
Apply ±10%	Lower limit = target × 0.9, upper limit = target × 1.1 (to 3 decimal places), overwriting the existing limits; does not save; available only when the target torque is positive
Apply ±5%	Lower limit = target × 0.95, upper limit = target × 1.05; otherwise the same as above
30 / 50 / 100	Selects the target sample count; does not save
Save Settings	Validates and saves the settings; on success, switches to the work screen; if validation fails, stays on this page and shows the reason
Work	Same as “Save Settings”: saves first, then switches to the work screen on success
← (back)	Same as “Save Settings”: saves first, then switches to the work screen on success; it does not discard changes
Work Records	Opens the capability index records (see Section 11.9); unsaved changes are lost
Toggle light / dark mode	Switches the screen theme

> **Note** “←” saves the settings first; it does not cancel. If you only want to discard your changes, switch to another screen from the navigation menu.

Procedure

1. On the work screen, click “Settings” (on first use you see this screen directly). The screen title is “Tool Inspection Settings”.
2. Enter “Tool Number” (required); if needed, enter “Work Station” (can be left blank).
3. In “Torque Sensor”, select the sensor used for the test. “Target Torque” becomes blank and the settable range is shown below the field; “LSL (Lower Spec. Limit)” and “USL (Upper Spec. Limit)” keep their values.
4. Click a “Tool Type”.
5. If necessary, change “Torque Unit”; values already entered are converted automatically.

6. Enter “Target Torque”, then click “Apply ±10%” or “Apply ±5%”, or enter “LSL (Lower Spec. Limit)” and “USL (Upper Spec. Limit)” directly.
7. Click a “Target Sample Count (N)” and enter the “CPK” and “CMK” acceptance thresholds.
8. Click “Save Settings”. The screen briefly shows “Capability test settings were saved locally.” and switches to the work screen.

Example Evaluating a pulse wrench with a 100 N·m torque sensor:
1. Enter “ST-01” as the work station and “PT-0123” as the tool number.
2. Select the torque sensor “TTES / 100 Nm / 16909060”: “Target Torque” is blank, and “Allowed range (10%–100%): 10 – 100 N·m” is shown below the field.
3. Click “Pulse” as the tool type.
4. Enter 50 as the target torque (between 10 and 100) and click “Apply ±10%”: lower limit 45, upper limit 55.
5. Click “30” as the target sample count; CPK acceptance threshold 1.33; enter 1.67 as the CMK acceptance threshold according to the customer's standard.
6. Click “Save Settings”; the screen switches to the work screen.

Tip On first use, the target torque and limits are blank. Select a sensor first, enter the target torque and click “Apply ±10%” or “Apply ±5%”, or enter the lower and upper limits directly. After selecting another sensor, check that the lower and upper limits that were kept still suit the new target torque.

Tip After you change and save the work station, tool number, sensor, unit, target sample count or limits, the next capture automatically starts a new statistics round (see Section 10.2).

Error messages

On-screen message	Cause and action
“Enter the tool number.”	“Tool Number” is blank or contains only spaces. Enter the tool number and save again; “Work Station” can be left blank
“Select a torque sensor.”	No sensor is selected. Select a paired sensor
“Select a torque sensor with a valid capacity.”	The selected sensor has no valid spec. Check the spec in sensor pairing, or select another sensor (see Section 12.3)
“Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is blank or out of range. Correct it to the range in the message
“The lower limit must be a valid number.” / “The upper limit must be a valid number.”	The lower or upper limit is blank. Enter a value
“The target value must be a valid number.” / “The specification center must be a valid number.”	The target torque is blank. Enter the target torque
“Sample count must be 30, 50, or 100.”	The target sample count is not an allowed value. Click 30, 50 or 100

On-screen message	Cause and action
“Failed to save capability test settings.”	The lower limit is greater than or equal to the upper limit. Correct the limits
“Unsupported torque unit: (unit)”	The unit in the settings is not supported. Select it again in “Torque Unit” and save
“Failed to load the paired torque sensor list.”	Reading the sensor list failed. Leave and open this page again
“Failed to load capability test settings.”	Reading the settings failed, or the “View · Work Settings” permission is missing. Open this page again; if it still fails, ask an administrator to check the permissions
“Failed to save capability test settings.”	Saving was rejected or writing failed, for example because of insufficient permissions; the message does not include the reason. Check the permissions and the entered values, then save again; for insufficient permissions, contact an administrator

10.3.2 Work screen

Path: Navigation menu → “Tool Capability” → “Tool Inspection”.

Captures samples continuously with the torque sensor and shows the sampling progress, CPK, CMK and distribution in real time. Opening this screen and capturing samples require the “Run · Work” and “Run · Tool Inspection” permissions; clicking “Start collecting data” requires the “Clear All · Tool Inspection” permission.

Prerequisites: a torque sensor is paired (see Section 12.3) and the capability test settings are saved (see Section 10.3).

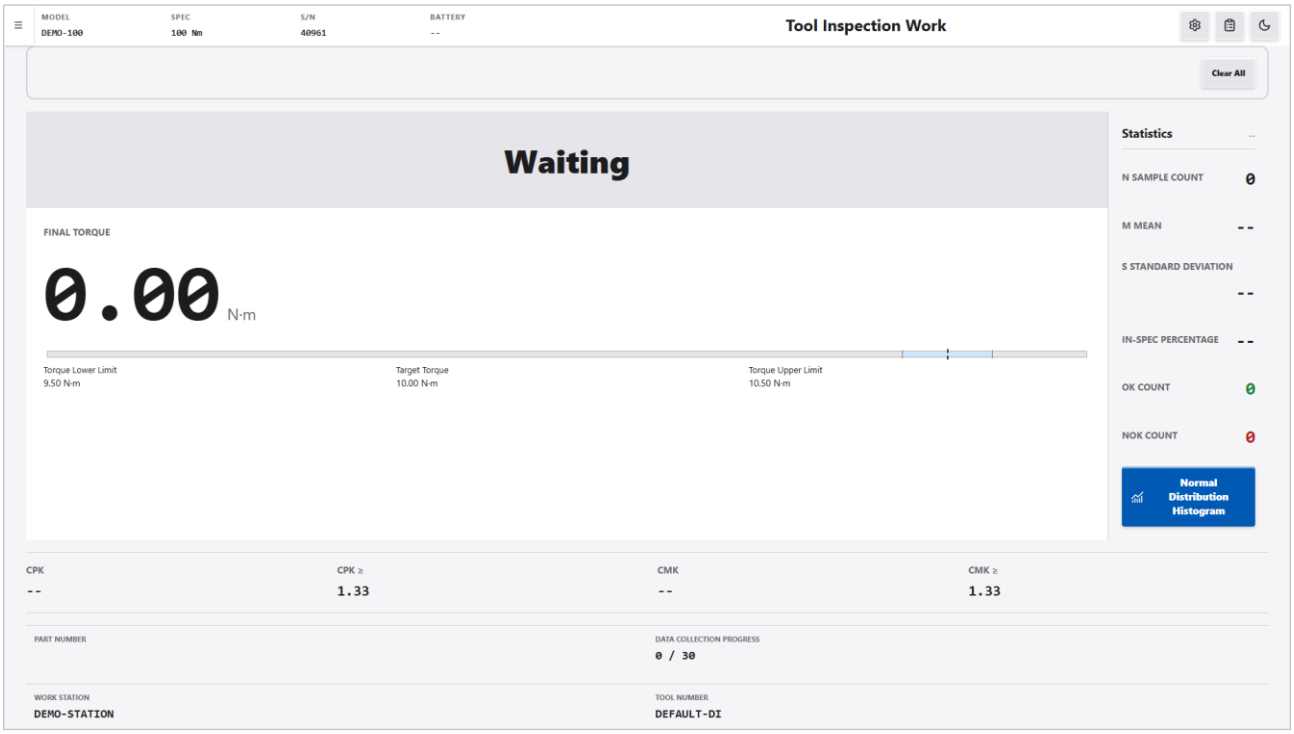

Figure 10-2 Tool Inspection work screen (torque sensor mode)

Screen layout

Area/button	Description
Header	At the far left, “Toggle navigation menu”; the sensor's “Model”, “Spec”, “S/N” and “Battery”; title in the center: “Tool Inspection Work”; on the right: “Settings” (gear), “Work Records” (clipboard) and “Toggle light / dark mode”
Clear All	Button on the right above the result panel; clears only the display on this page (see Section 10.2)
Verdict banner	Judgement of the last capture: “Waiting”, “OK” or “NOK”; the background color changes with the judgement (see Section 5.2.5)
“Final Torque”	The large torque value (see “Display fields” below). On the range bar below it, “Torque Lower Limit”, “Target Torque” and “Torque Upper Limit” are the configured lower limit, target torque and upper limit; the range between the lower and upper limits is the acceptable range. The range bar is not shown while the settings are incomplete. This mode does not show angles
“Statistics” (statistics panel on the right)	The CPK judgement is shown to the right of the title (“Pass”, “Marginal” or “Fail”; “--” when there is no value yet); below it, “N Sample Count”, “M Mean”, “S Standard deviation”, “In-spec percentage”, “OK Count” (green) and “NOK Count” (red)
“Normal Distribution Histogram”	Button at the bottom of the statistics panel; opens the histogram dialog, which contains the target torque, the “Out of Spec” and “In Spec” legend, the histogram and, below it, the lower limit, specification center and upper limit (see Section 10.2)
Mode information row	Below the result panel, from left to right: “Cpk”, “Cpk ≥” (acceptance threshold), “Cmk” and “Cmk ≥” (acceptance threshold)
Work settings strip	Two rows of read-only data at the bottom. First row: “Part Number” (the capability index test does not use a part number, so this field is blank) and “Data Collection Progress” (samples accumulated on this page / target sample count); second row: “Work Station” and “Tool Number”. The torque unit, tool type and target sample count are not shown on the work screen; for the lower limit, target torque and upper limit, see the range bar
Measurement Data History	Scroll down to see it; the title row has “Start collecting data” and “Confirm capability capture”; the table lists only the last capture: “Time”, “Result”, “Final Torque”, “USL (Upper Spec. Limit)”, “Target Torque”, “LSL (Lower Spec. Limit)”, “CPK”, “CMK”, “OK Count”, “NOK Count”; before any capture it shows “No measurement history yet”

Display fields

Field	Description	Shown when there is no data
Model / Spec / S/N / Battery	Information on the sensor selected in the settings, and its current battery level	--
Verdict banner	Judgement of the last capture	Waiting

Field	Description	Shown when there is no data
Final Torque	When this page already has captures, the torque of the latest capture; when there is no capture yet (or after “Clear All” or “Start collecting data”), the peak torque of the latest tightening. Already multiplied by the torque factor and torque multiplier ratio	0.00
Data Collection Progress	Samples accumulated on this page / target sample count; this page keeps at most the latest N samples	0 / N
CPK / CMK	Capability indices calculated at the last capture (see Section 10.2)	--
N Sample Count / M Mean / S Standard deviation / In-spec percentage	Statistics of the samples accumulated on this page	0 or --
OK Count / NOK Count	Number of OK and NOK results accumulated on this page	0

Note When this page already has capture results, “Final Torque” and the range bar pointer stay at the value of the previous capture during tightening; they are updated to the new torque only after the torque returns to 0 and the new capture is complete. The judgement and statistics are always based on the captured values.

Buttons

Button	Description
Toggle navigation menu	Expands or collapses the navigation menu on the left
Settings (gear)	Switches to the settings screen (see Section 10.3)
Normal Distribution Histogram	Opens the histogram dialog; press Esc or click “×” to close it (see Section 10.2)
Work Records (clipboard)	Opens the capability index records (see Section 11.9); requires the “View · Work Records” permission
Clear All	Clears the real-time reading, last result and accumulated samples on this page; does not delete records and does not end the current round
Start collecting data	Ends the current round; the next capture starts a new round, and the statistics on this page are cleared; does not delete records; unavailable without the permission or while processing
Confirm capability capture	Captures one sample with the current real-time torque and saves it as a record; nothing is captured when there is no real-time torque greater than 0; repeated clicks are ignored while the previous manual capture is still being processed

Procedure

1. Open “Tool Inspection” from the navigation menu. The screen title is “Tool Inspection Work” and the verdict banner shows “Waiting”.
2. Check the work station, the tool number and the target sample count in the sampling progress in the work settings strip at the bottom, and the torque lower limit, target torque and torque upper limit on the range bar. If anything is wrong, click “Settings” to change it.
3. Make sure the model and serial number of the sensor in the header are correct and that “Battery” shows a value (meaning that sensor data is being received).
4. Scroll down to “Measurement Data History” and click “Start collecting data”. “Data Collection Progress” is reset to zero.
5. Tighten with the tool under test. When the torque returns to 0, one sample is captured automatically; the verdict banner changes to OK or NOK, “Final Torque” shows the torque of this sample, the range bar pointer marks its position between the limits, and “Data Collection Progress” increases by 1.
6. Repeat the tightening. CPK appears after 20 samples, and the CPK judgement text is shown to the right of “Statistics”; CMK appears when the target sample count is reached. Once 2 or more samples have accumulated, you can click “Normal Distribution Histogram” to view the distribution; when you have finished, press Esc or click “×” to close the dialog.
7. To record the current reading while the sensor is still under load, click “Confirm capability capture”. Each click adds one record, so do not click repeatedly.
8. When finished, click “Work Records” to view the captures of this round (see Section 11.9).

Example Continuing the settings example above (target 50 N·m, lower limit 45, upper limit 55, target sample count 30, CPK threshold 1.33, CMK threshold 1.67):
1. Click “Start collecting data”; the sampling progress shows “0 / 30”.
2. The 1st tightening measures 50.6 N·m; the verdict banner shows “OK”, “Final Torque” shows 50.60, and the sampling progress is “1 / 30”.
3. After the 2nd tightening, click “Normal Distribution Histogram” to see the histogram; CPK shows a value after the 20th tightening.
4. CMK shows a value after the 30th tightening. If the latest 30 samples have M = 50.4 and S = 0.8, CMK = 1.92 (for the calculation, see Section 10.2); 1.92 ≥ 1.67, so the CMK acceptance threshold is reached.
5. As you continue tightening, CPK is updated on a rolling basis from the latest 20 samples and CMK from the latest 30 samples.

Error messages

On-screen message	Cause and action
"No positive sensor torque has been received. Capability capture cannot be confirmed."	There was no real-time torque greater than 0 when you clicked "Confirm capability capture". Make sure the sensor is connected and under load, then click again
"Failed to confirm capability capture."	Saving the capture failed for an unidentified reason. When the reason is known, a message about it appears instead of this one (see the rows below; some are shown in Chinese even in English). Correct the settings according to that message and capture again
"能力檢測擷取需要大於 0 的扭矩。" (shown in Chinese even in English: capability capture requires a torque greater than 0)	A torque of 0 or an invalid torque was received. Make sure the sensor is under load and capture again
"You do not have permission to perform this operation."	The account lacks the corresponding permission. Ask an administrator to adjust the permissions (see Section 15.4)
"Failed to reset capability data collection."	"Start collecting data" failed. Check the permissions and try again
"Failed to load capability test settings."	Reading the settings failed. If a "Reload settings" button is shown next to the message, click it to read the settings again; after they are read successfully, work does not start automatically, so click "Work" on the screen. If it still fails, open this page again and check the permissions
"Failed to load capability test settings." (without the "Reload settings" button)	The account does not have the "View · Work Settings" permission and no capability test settings have been saved yet. Ask a person with the settings permission to complete the settings first (see Section 10.3), or ask an administrator to adjust the permissions (see Section 15.4)
"Unsupported torque unit: (unit)"	The configured torque unit is not supported. Select it again on the settings screen and save
"Failed to start work."	The start-work command was not sent successfully. Check the RF receiver and sensor connection (see Section 16.4), then open this page again
"Realtime torque monitoring is unavailable."	Real-time data cannot be received. Open this page again; if it still fails, restart TMS

10.4 Residual torque mode

In addition to the real-time reading, sampling progress and capability indices, the work screen in residual torque mode has capability metrics, device torque readings, CMU/CML and the "Manual reference" input fields. The sampling, judgement and statistics rules are the same as in torque sensor mode (see Section 10.2).

Samples are taken from the RF 2.4G sensor selected in the settings (called "Torque tension meter device" on screen). The "Manual reference" fields let you record the swing torque, reference torque and

angle measured with other instruments, together with the combination, head group and wrench numbers, in every record.

10.4.1 Work screen

Path: Navigation menu → “Tool Capability” → “Tool Inspection” (this screen appears automatically when the local data is in residual torque mode).

Captures samples in residual torque mode and records manual reference data at the same time. The permissions are the same as in torque sensor mode: opening this screen and capturing samples require the “Run · Work” and “Run · Tool Inspection” permissions; clicking “Start collecting data” requires the “Clear All · Tool Inspection” permission.

Prerequisites: an RF 2.4G sensor with a spec is paired (see Section 12.3) and the capability test settings are saved (see the settings screen in this section).

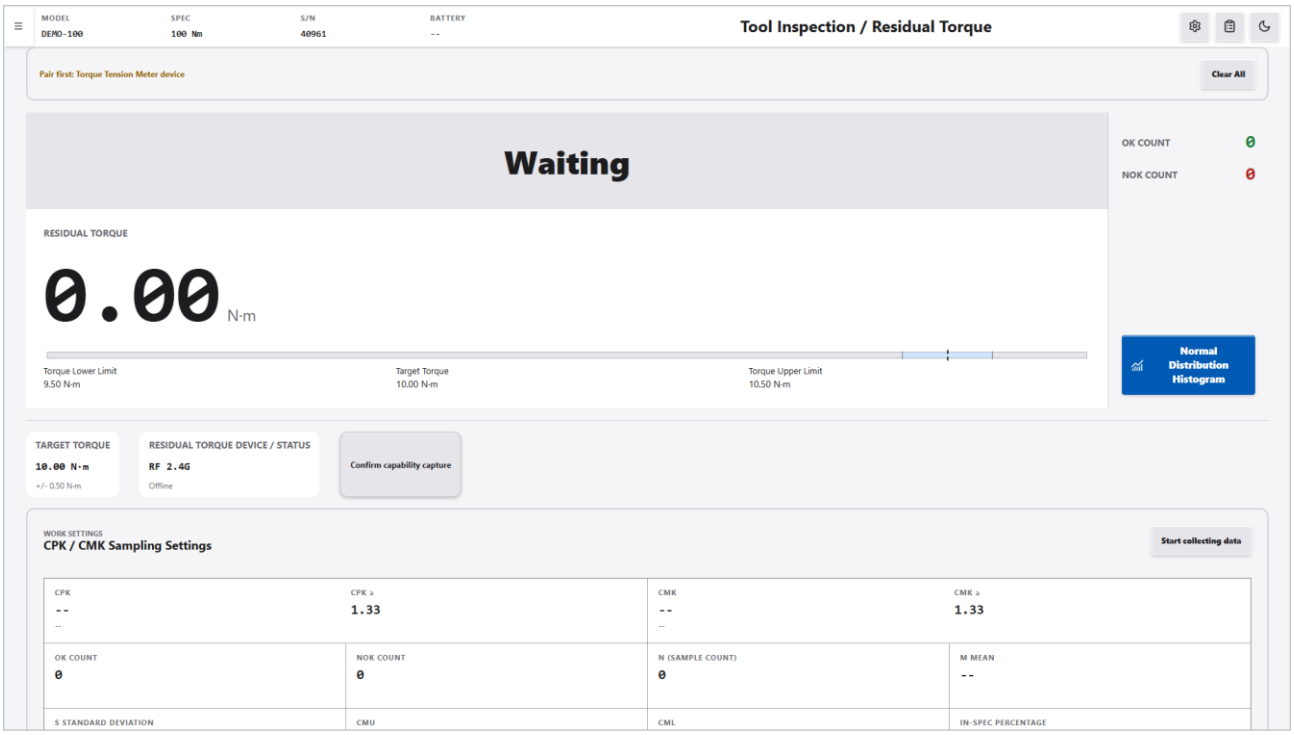

Figure 10-3 Tool Inspection work screen (residual torque mode)

Screen layout

The upper half of the screen is shown in the figure above; scroll down to see the lower half of the sampling settings area and the areas from the work settings strip onward.

Area/button	Description
Header	Title in the center: “Tool Inspection / Residual Torque”; otherwise the same as in torque sensor mode (see Section 10.3)
Action bar	The hint “Pair first: Torque Tension Meter device” on the left; “Clear All” on the right. The hint is always shown and does not mean that the device is currently unpaired; whether data is being received is shown by the “Residual Torque Device / Status” card

Area/button	Description
Verdict banner	Judgement of the last capture: “Waiting”, “OK” or “NOK” (see Section 5.2.5)
“Residual Torque”	The large torque value: when this page already has captures, the torque of the latest capture; otherwise the peak torque of the latest tightening; already multiplied by the torque factor and torque multiplier ratio. The range bar below it is the same as in torque sensor mode (see Section 10.3)
Statistics panel (right)	“OK Count” (green) and “NOK Count” (red)
“Normal Distribution Histogram”	Button at the bottom of the statistics panel; opens the histogram dialog. The chart title in the dialog is “Torque Curve Chart”; it shows the distribution histogram of the captured samples (see Section 10.2), not a curve over time
Target Torque (mode information row)	The configured target torque; the small “+/-” tolerance text below it is for reference only; OK/NOK is always judged by the configured lower and upper limits (“Torque Lower Limit” and “Torque Upper Limit” on the range bar)
Residual Torque Device / Status (mode information row)	Shows “RF 2.4G”; below it, “N% battery” when a battery level is received, “-- battery” when data is received without a battery level, and “Offline” when no data has been received yet
Confirm capability capture (mode information row)	Manually captures one sample with the current real-time torque
CPK / CMK Sampling Settings	Below the mode information row; “Start collecting data” on the right; below it “Cpk” and “Cmk” (with judgement text; to the right of each is its acceptance threshold cell, “Cpk ≥” or “Cmk ≥”), “OK Count”, “NOK Count”, “N (Sample Count)”, “M Mean”, “S Standard deviation”, “CMU”, “CML” and “In-spec percentage”
Work settings strip	Same fields as in torque sensor mode: “Part Number”, “Data Collection Progress”, “Work Station” and “Tool Number”
RF 2.4G Sensor Pairing	Shows the sensor ID of the “Torque tension meter device”; for viewing only; to pair, go to the sensor pairing screen (see Section 12.3)
Capability metrics	“Torque Factor”, “Angle factor”, “Pulse Count”, “Time at peak torque”
Device torque readings	“Sensor torque” and “Residual Torque”; in this mode both cards show the same value
Manual reference	Title “Rotary sensor / Torque-angle sensor”; eight input fields (see the table below)
Latest capability detail	Appears after at least one capture: “Source mode” (“Residual Torque” in this mode), “Last measured torque”, “Last result”, “Combination No.”
Measurement Data History	Lists only the last capture, with the same columns as in torque sensor mode; before any capture it shows “No measurement history yet”

Manual reference fields

None of these fields take part in the OK/NOK judgement or the CPK/CMK calculation; they are only saved in the record together with each capture (automatic or manual).

Field	Description	Range and default
Swing torque	Swing torque measured with another instrument, in the configured torque unit	Optional; blank when the screen opens; when blank, the value is not stored in the record
Rotation angle	Rotation angle during the swing	Optional; uses the same unit as “Reference angle”
Reference torque	Torque value from the reference instrument, in the configured torque unit; the denominator of the torque factor	Optional; when 0 or blank, the torque factor is not calculated
Reference angle	Angle value from the reference instrument; the denominator of the angle factor	Optional; when 0 or blank, the angle factor is not calculated
Combination No.	Number of the combination that this tightening belongs to; shown in “Latest capability detail”	Optional; leading and trailing spaces are removed
Job Name	Combination name	Optional
Head group no.	Number of the head group (socket, adapter)	Optional
Torque wrench no.	Number of the reference torque wrench	Optional

- Torque factor = swing torque ÷ reference torque; angle factor = rotation angle ÷ reference angle. When both fields have values, the result is shown immediately in the “Capability metrics” area (4 decimal places). This torque factor is recorded only in the capability test record and is unrelated to the factor in “Torque Factor Settings”.
- The fields are not cleared automatically after a capture; they stay in use until you change them or leave this screen. When you leave and open the screen again, all of them are blank.
- Neither “Clear All” nor “Start collecting data” clears the manual reference fields.

Display fields

For the fields that are the same as in torque sensor mode, see Section 10.3. Only the fields specific to this screen are listed below.

Field	Description	Shown when there is no data
Torque Factor / Angle factor	Calculated in real time from the manual reference fields; when the fields are incomplete, the values stored in the last record are shown	--
Pulse Count	Maximum number of pulses received in the current tightening; reset to zero after each capture	--
Time at peak torque	Time from the start of the current tightening until the peak torque, in seconds (S), 2 decimal places; reset to zero after each capture	--
Sensor torque / Residual Torque	Same as the large torque value: torque of the last capture; before any capture, the peak torque of the latest tightening	0.00
CMU / CML	Upper-side and lower-side capability values (for the formulas, see Section 10.2), 3 decimal places	--

Buttons

Button	Description
Settings (gear) / Work Records (clipboard)	Same as in torque sensor mode; “Work Records” opens the capability index records of residual torque mode (see Section 11.9)
Normal Distribution Histogram	Opens the histogram dialog; press Esc or click “×” to close it (see Section 10.2)
Clear All	Clears the real-time reading, last result and accumulated samples on this page; does not delete records, does not end the current round and does not clear the manual reference fields
Confirm capability capture	Captures one sample with the current real-time torque and saves it together with the manual reference fields; nothing is captured when there is no real-time torque greater than 0
Start collecting data	Ends the current round; the next capture starts a new round, and the statistics on this page are cleared; does not delete records

Procedure

1. Open “Tool Inspection” from the navigation menu. The screen title is “Tool Inspection / Residual Torque” and the verdict banner shows “Waiting”.
2. Check the torque lower limit, target torque and torque upper limit on the range bar, and the work station, the tool number and the target sample count in the sampling progress in the work settings strip. Click “Settings” if you need to change anything.

3. Make sure that the “Residual Torque Device / Status” card changes from “Offline” to showing a battery level, which means that sensor data is being received. If it still shows “Offline”, check the sensor power, pairing and RF receiver (see Section 16.4).
4. Scroll down to “Manual reference” and enter the swing torque, rotation angle, reference torque, reference angle and the various numbers to be recorded this time (fields you do not need can be left blank). The “Capability metrics” area immediately shows the torque factor and angle factor.
5. In the “CPK / CMK Sampling Settings” area below the result panel, click “Start collecting data”. The sampling progress is reset to zero.
6. Measure once. When the torque returns to 0, one sample is captured automatically; “Latest capability detail” appears with “Source mode” “Residual Torque”, the verdict banner changes to OK or NOK, and the sampling progress increases by 1.
7. If the next sample needs different reference values, change the manual reference fields before measuring.
8. Repeat the measurement until the sampling progress reaches the target sample count and Cpk, Cmk, CMU and CML all have values.
9. Click “Work Records” to view the captures and manual reference data of this round (see Section 11.9).

Example Manual reference and factor calculation (torque unit N·m):
1. Enter 52.0 in “Swing torque” and 50.0 in “Reference torque”: torque factor = 52.0 ÷ 50.0 = 1.0400.
2. Enter 31.5 in “Rotation angle” and 30.0 in “Reference angle”: angle factor = 31.5 ÷ 30.0 = 1.0500.
3. Enter “C-01” in “Combination No.” and measure once to get 50.8 N·m (LSL 45, USL 55): the verdict banner shows “OK”; “Latest capability detail” shows source mode “Residual Torque”, last measured torque 50.80 N·m and combination number “C-01”.
4. This record stores both the torque factor 1.0400 and the angle factor 1.0500.

Example CMU and CML (torque unit N·m): LSL 45, USL 55, samples accumulated on this page M = 50.4, S = 0.8.
1. CMU = (55 − 50.4) ÷ (3 × 0.8) = 4.6 ÷ 2.4 = 1.917.
2. CML = (50.4 − 45) ÷ (3 × 0.8) = 5.4 ÷ 2.4 = 2.250.
3. The smaller side (CMU) is closer to its specification limit, which means the samples lean toward the upper limit.

Error messages

The error messages are the same as in torque sensor mode (see Section 10.3). Also note:

On-screen message	Cause and action
The “Residual Torque Device / Status” card keeps showing “Offline”	No sensor data has been received yet. Check the sensor power, pairing and RF receiver connection (see Sections 12.3 and 16.4), then open this page again
Torque factor or angle factor shows “--”	The swing value or reference value is blank, or the reference value is 0. Enter valid values in both fields; the reference value must not be 0
The tolerance on the “Target Torque” card does not match the torque lower limit and torque upper limit on the range bar	The tolerance is for reference only. OK/NOK is judged by the configured lower and upper limits

10.4.2 Settings screen

Path: Work screen in residual torque mode → “Settings” at the top right.

The fields, buttons, validation rules and error messages of the settings screen are exactly the same as in torque sensor mode; follow the settings screen in Section 10.3. The permission requirements are also the same: saving requires the “Edit · Tool Inspection” permission.

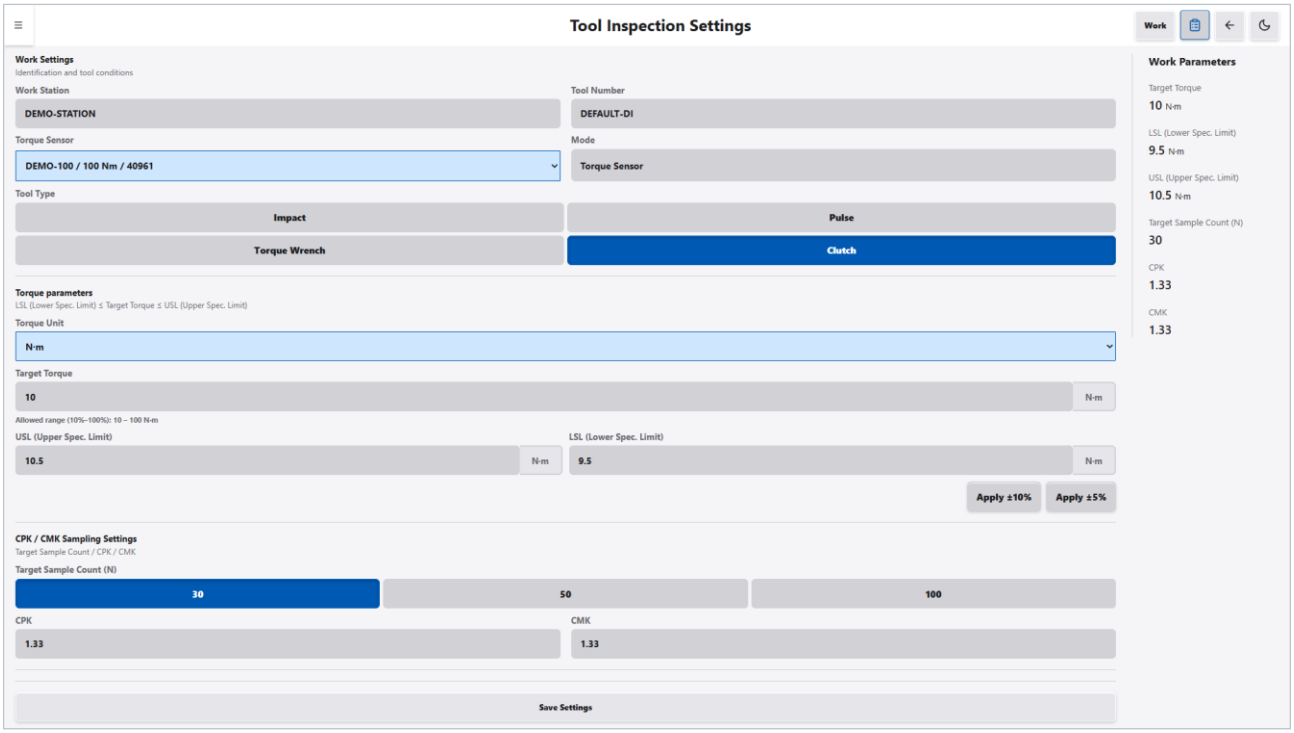

Figure 10-4 Tool Inspection settings screen (residual torque mode)

- The “Mode” field still shows “Torque Sensor”. When you save, the current residual torque mode is kept and is not changed to torque sensor mode. Use the work screen title to identify the actual mode.
- This screen has no manual reference fields; they are only on the work screen.

- Both “Work” and “←” save first and then return to the work screen of residual torque mode on success.

Procedure

1. On the work screen in residual torque mode, click “Settings”.
2. Fill in or change the settings as in steps 2 to 7 of the settings screen procedure in Section 10.3.
3. Click “Save Settings”. The screen briefly shows “Capability test settings were saved locally.” and returns to the “Tool Inspection / Residual Torque” work screen.

10.5 Residual torque + torque sensor mode

Residual torque + torque sensor mode uses the same screen layout as residual torque mode. The differences are: the OK/NOK judgement and all statistics use only the torque captured by the torque sensor; the residual torque is measured by you with another instrument and entered in “Reference torque” under “Manual reference”, and it is saved with the record. For the sampling, judgement and statistics rules, see Section 10.2.

10.5.1 Work screen

Path: Navigation menu → “Tool Capability” → “Tool Inspection” (this screen appears automatically when the local data is in residual torque + torque sensor mode).

Saves the torque captured by the torque sensor together with the manually entered residual torque and factors in the same record. The permissions are the same as in the other modes (see Section 10.1).

Prerequisites: a torque sensor is paired (see Section 12.3) and the capability test settings are saved; you also need an instrument for measuring residual torque.

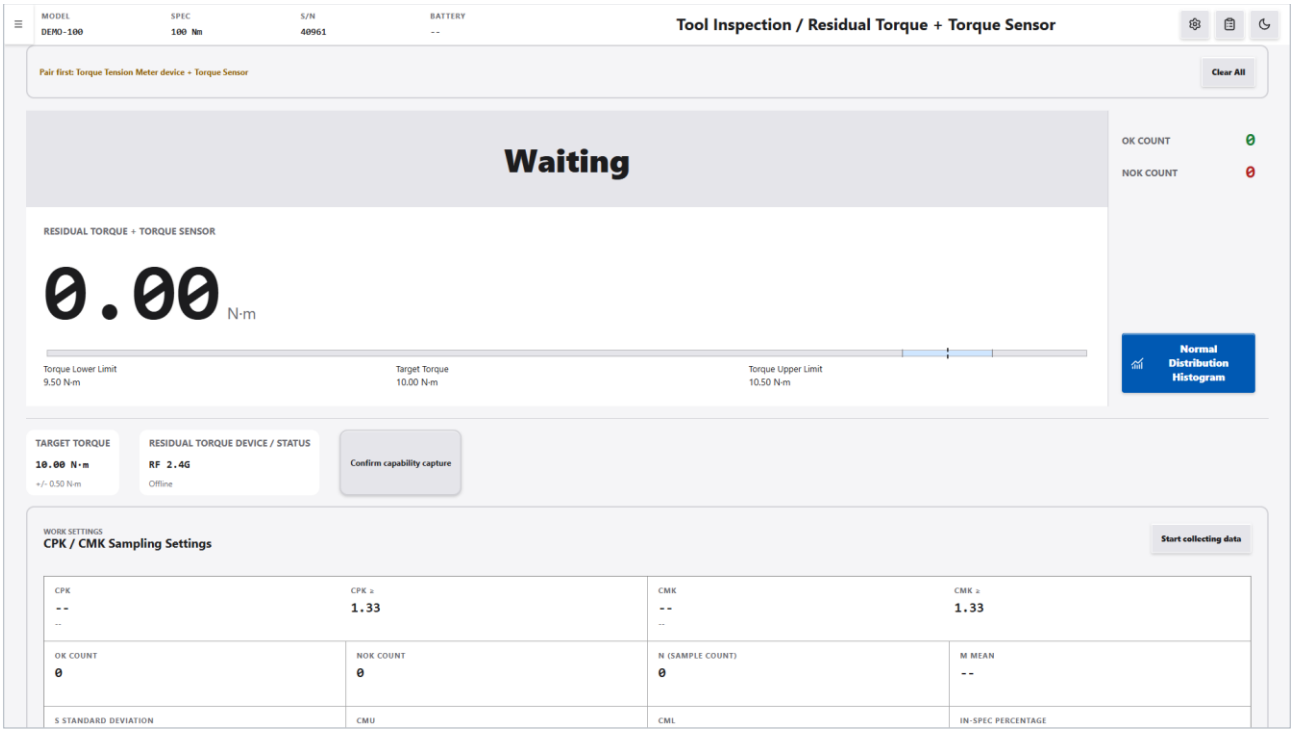

Figure 10-5 Tool Inspection work screen (residual torque + torque sensor mode)

Screen layout

Only the differences from residual torque mode (see Section 10.4) are listed below; all other areas, positions and operations are the same.

Area/button	Description
Header title	“Tool Inspection / Residual Torque + Torque Sensor”
Action bar hint	“Pair first: Torque Tension Meter device + Torque Sensor”; always shown and does not indicate the current pairing status
Large torque value	The label is “Residual Torque + Torque Sensor”; the value is the torque of the torque sensor: when this page already has captures, the torque of the latest capture; otherwise the peak torque of the latest tightening
“Normal Distribution Histogram”	The chart title in the dialog is “Residual Torque + Torque Sensor / Torque Curve Chart”; it shows the distribution histogram of the captured samples (torque sensor torque), without the residual torque
RF 2.4G Sensor Pairing	“Torque tension meter device” always shows “--”; another field, “Torque Sensor”, shows the ID of the selected sensor
Device torque readings	Three cards: “Sensor torque” (same as the large torque value: torque of the last capture; before any capture, the peak torque of the latest tightening), “Residual Torque” (the reference torque entered at the last capture; “--” if none), “Torque Sensor” (the peak torque of the latest tightening)
Latest capability detail	“Source mode” shows “Residual Torque + Torque Sensor”

The eight manual reference fields are the same as in residual torque mode (see Section 10.4). In this mode, “Reference torque” has one additional role: after a capture, it is shown on the “Residual Torque” card under “Device torque readings”. To record the residual torque, enter the measured residual torque in “Reference torque” before each capture.

> **Tip** “Reference torque” is also the denominator of the torque factor. If you enter the residual torque in “Reference torque” and also fill in “Swing torque”, the torque factor in the record is swing torque ÷ residual torque. Decide whether to use it this way according to your organization's inspection standards.

Procedure

1. Open “Tool Inspection” from the navigation menu. The screen title is “Tool Inspection / Residual Torque + Torque Sensor”.
2. Check the range bar and the work settings strip (see Section 10.4). Click “Settings” if you need to change the settings.
3. Make sure the “Residual Torque Device / Status” card shows a battery level, which means that torque sensor data is being received.
4. In the sampling settings area, click “Start collecting data” to start a new round.
5. After measuring the residual torque with another instrument, scroll down to “Manual reference”, enter the residual torque in “Reference torque”, and fill in other fields as needed.
6. Tighten with the tool under test on the torque sensor. When the torque returns to 0, one sample is captured automatically; the “Residual Torque” card shows the reference torque you just entered, and the source mode in “Latest capability detail” is “Residual Torque + Torque Sensor”.
7. Update “Reference torque” before each capture, and repeat until the sampling progress reaches the target sample count.
8. Click “Work Records” to view the results (see Section 11.9).

> **Example** Settings: target 50 N·m, LSL 45, USL 55:
> 1. Measure the residual torque of the joint with a torque wrench: 48.6 N·m. Enter 48.6 in “Reference torque”.
> 2. Tighten with the tool under test on the torque sensor and capture 50.3 N·m: 45 ≤ 50.3 ≤ 55, so the verdict banner shows “OK”.
> 3. “Sensor torque” shows 50.30 N·m and “Residual Torque” shows 48.60 N·m.
> 4. This record stores both 50.3 (used for the judgement and for CPK and CMK) and 48.6 (reference torque). The residual torque does not affect the judgement or statistics.

Error messages

The error messages are the same as in Sections 10.3 and 10.4. Also note:

On-screen message	Cause and action
The “Residual Torque” card shows “--”	“Reference torque” was blank at the last capture, or nothing has been captured yet. Enter the reference torque before capturing; records already captured are not filled in afterward
“Torque tension meter device” shows “--”	In this mode this field always shows “--”; this is normal. The sensor actually used is shown in the “Torque Sensor” field in the same area

10.5.2 Settings screen

Path: Work screen in residual torque + torque sensor mode → “Settings” at the top right.

The settings screen is exactly the same as in torque sensor mode; follow the settings screen in Section 10.3. Saving requires the “Edit · Tool Inspection” permission.

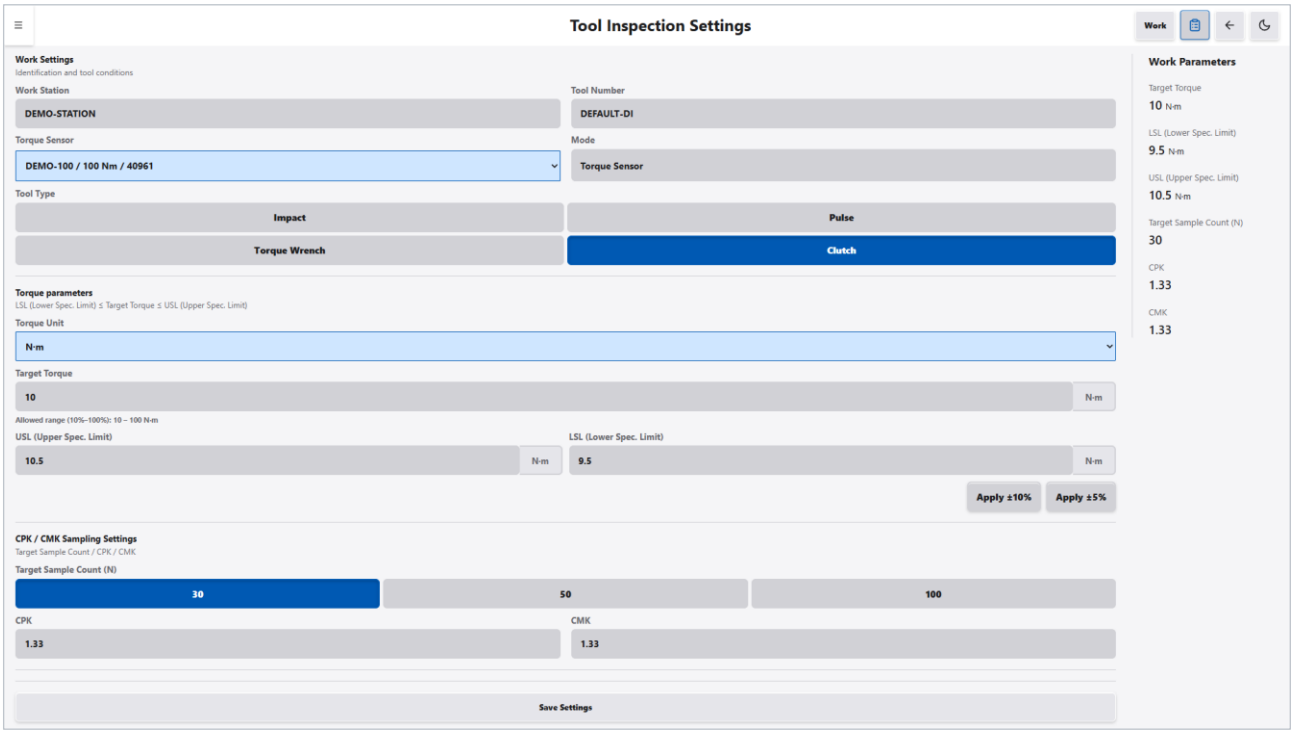

Figure 10-6 Tool Inspection settings screen (residual torque + torque sensor mode)

- The “Mode” field also shows “Torque Sensor”; saving keeps the residual torque + torque sensor mode.
- This screen has no residual torque fields; enter it on the work screen as “Reference torque”.

Procedure

1. On the work screen in this mode, click “Settings”.
2. Fill in or change the settings as in steps 2 to 7 of the settings screen procedure in Section 10.3.
3. Click “Save Settings”; on success, the screen returns to the work screen of this mode.

Chapter 11 Records and Export

Each time a job is completed and judged, TMS saves the result as a local record. This chapter first describes the operations that all records share: querying, reading the list, opening the detail, exporting and deleting (Sections 11.1 to 11.3). It then describes the fields and detail content specific to each work mode (Sections 11.4 to 11.9).

11.1 Record types and how to open them

11.1.1 Record types

TMS keeps records separately for each work mode. The “Work mode filter” on the records page offers “All work modes” and the 8 record types in the table below.

“Work mode filter” option	List title	Chart and raw samples in the detail page	Related chapters
Torque Wrench	Torque Wrench — Records	“Torque chart” + “Data Points”	Chapter 5; Section 11.4
Power Tool	Power Tool Work Records	“Torque chart” + “Data Points”	Chapter 8; Section 11.7
Torque & Angle	Torque & Angle — Records	“Torque / Angle Curve” + “Sample Data Detail”	Chapter 6; Section 11.5
Torque Inspection	Torque Inspection — Records	“Torque / Angle Curve” + “Sample Data Detail”	Chapter 7; Section 11.6
Batch Jobs	Batch Jobs — Records	Depends on whether the step has a target angle; same as Torque Wrench or Torque & Angle	Chapter 9; Section 11.8
Tool Inspection / Torque Sensor	Tool Inspection / Torque Sensor Records	None	Chapter 10; Section 11.9
Tool Inspection / Residual Torque	Tool Inspection / Residual Torque Records	None	Chapter 10; Section 11.9
Tool Inspection / Residual Torque + Torque Sensor	Tool Inspection / Residual Torque + Torque Sensor Records	None	Chapter 10; Section 11.9

Note The three capability index record types have only a list and a detail page. They have no chart, data points or curve samples, and their detail export contains only one row of field values.

11.1.2 Two ways to open records

- **From a work mode**: On the work screen, click “Work Records” (clipboard icon) in the header. Only the records of that mode are shown, and the page title is the list title of that mode, for example “Torque Wrench — Records”. When you open records from the capability index test, the records page for the current test mode opens (see Section 11.9).
- **From System Settings**: Path: Navigation menu → “System Settings” → “Data management” on the left → “Records & export”. The page title is “Records & export”. “All work modes” is shown by default, and you can switch to any record type.

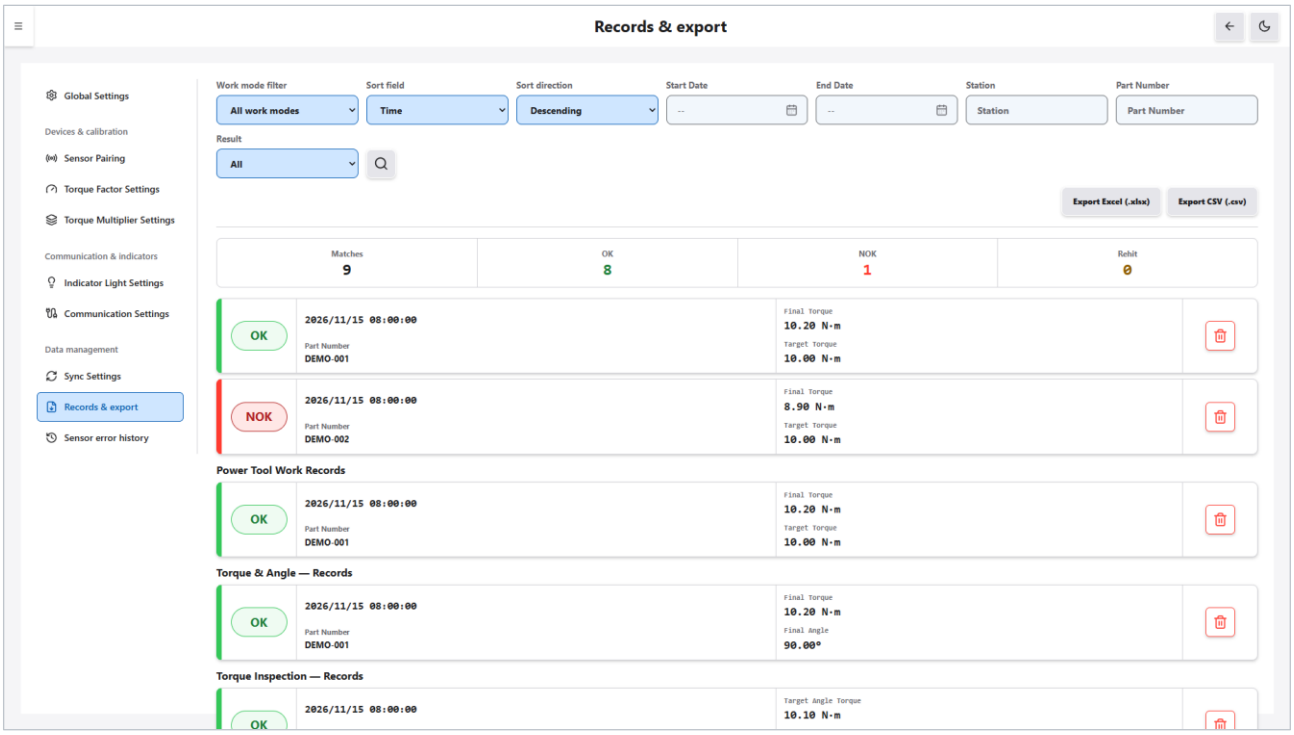

Figure 11-1 System Settings: Records & export

Querying, the detail page, exporting and deleting work the same way from both entry points. The differences are:

Item	Click “Work Records” in a work mode	“System Settings” → “Records & export”
Page title	List title of that mode	Records & export
“Work mode filter”, “Sort field”, “Sort direction”	Not shown; fixed to that mode, sorted by time from newest to oldest	Shown; can be changed
Header buttons	“Work” and “←” both return to the work screen of that mode	“←” returns to the System Settings home page
Mode-specific filters	Shown depending on the mode (see Sections 11.7, 11.8, 11.9)	Only when “Batch Jobs” is selected: “Batch Number” and “Batch Name” are added

11.1.3 Permissions

The records function is controlled by the following permissions. A, B and C are the default templates. An administrator can change each permission to “Allow” or “Deny” per user in “User Management” (see Chapter 15).

Permission name	What it controls	A/B/C default
View · Work Records	Opening the records page, querying, opening the detail and the chart	Allowed for all
Export · Work Records (CSV / Excel)	“Export Excel (.xlsx)” and “Export CSV (.csv)” in the list, and “Excel” and “CSV” in the detail page; also requires “View · Work Records”	Allowed for all
Edit · File Management	Deleting records	Allowed for A and B; denied for C
View · System Settings	Opening “Records & export” from “System Settings”	Allowed for all

Without “Export · Work Records (CSV / Excel)”, the export buttons are gray and cannot be clicked. Viewing and exporting are two separate permissions, so you can let a user view records without being able to export them.

> **Note** The red trash can button (tooltip “Delete”) is shown to everyone. If a user without “Edit · File Management” clicks it and confirms, “Failed to delete record” appears and the record is not deleted.

11.1.4 How time, numbers and units are displayed

- **Time**: Shown in the time zone of this computer's Windows and in the date and time format of the Windows “Region” setting (including custom formats). It does not follow the interface language. For example, if the interface is in English and the Windows region is Taiwan, dates are still shown in the Taiwan format.
- **Numbers**: The decimal point and thousands separator follow the interface language.
- **Torque unit**: Torque in the list, the detail page, the chart and the export files is always converted to the torque unit currently selected in “Global Settings” (see Chapter 12). Changing the unit only changes the display; it does not change the record itself.
- **Torque decimal places**: Values below 100 are shown with two decimal places; 100 to 999 with one; 1000 and above with none. This is only rounding for display; the value saved in the record is not truncated.
- **Sensor spec**: “Sensor Spec” is always shown in Nm and is not converted to the torque unit.
- **Station, part number**: The record keeps the values entered during the job. In the torque wrench, torque & angle, torque inspection and power tool modes, a blank field is recorded as blank. Batch job records always record the station as “WS-01” and the part number as “AUTO-BATCH” (see Section 9.2). In versions before 1.4.2, a blank part number in the torque & angle, torque inspection

and power tool modes was recorded as “AUTO-TORQUE-ANGLE”, “AUTO-TORQUE-TEST” and “AUTO-DYNAMIC” respectively; after an upgrade, these older records keep their original values.

> **Example** The “Final Torque” of a record is saved as 10.20 N·m. Change the torque unit in “Global Settings” to kgf·cm and open the record again:
> 10.20 ÷ 0.0980665 = 104.01 kgf·cm. The value is between 100 and 999, so only one decimal place is shown: the screen and the export file show “104.0 kgf·cm”.
> Change the unit back to N·m and “10.20 N·m” is shown again. The record itself has not changed.

11.2 All work records and the “Records & export” page

Path: Navigation menu → “System Settings” → “Data management” on the left → “Records & export”.

On this page you can view the records of all work modes at once and export the query result to Excel or CSV. The querying, list, detail, export and delete operations described in this section are the same on all records pages; Sections 11.4 to 11.9 describe only what differs in each mode. Requires the “View · Work Records” permission; exporting also requires “Export · Work Records (CSV / Excel)”, and deleting also requires “Edit · File Management” (see Section 11.1).

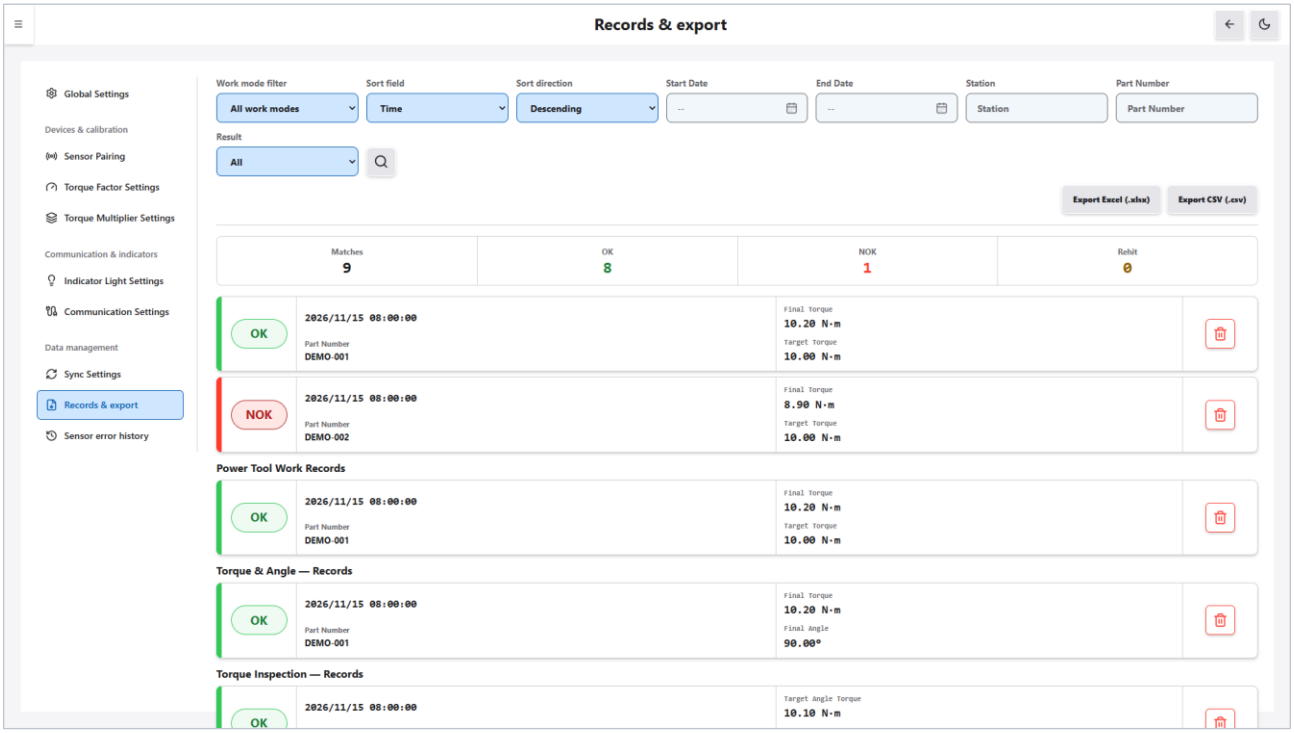

Figure 11-2 Records & export: All work modes

11.2.1 Screen description

Area/button	Description
Header	"Toggle navigation menu" at the top left expands or collapses the navigation menu; the page title is in the center; "←" at the top right returns to the System Settings home page; the moon icon switches between light and dark mode.
System Settings menu on the left	The current item "Records & export" is highlighted in blue; for the other items, see Chapters 12 to 14.
Filter bar	"Work mode filter", "Sort field", "Sort direction", "Start Date", "End Date", "Station", "Part Number", "Result" and the magnifier "Query". See "Querying records" below.
"Export Excel (.xlsx)", "Export CSV (.csv)"	Save the current query result to a file without leaving the screen; gray without the export permission, while a query is running, after a query has failed, or when the dates are reversed. See "Exporting to Excel and CSV" below.
Statistics bar	Four counts: "Matches", "OK", "NOK", "Rehit".
Record list	One record card per record, grouped by work mode. Click anywhere on a card (or move to the card with Tab and press Enter or the space bar) to open the detail.
Red trash can	Deletes the record (tooltip "Delete"). A confirmation dialog appears first; see "Deleting records" below.
Pagination	When a group has more than 50 records, "Previous page", "Page N of M" and "Next page" appear below it; each group is paged separately.
Footer	"N records" at the bottom right, the same as "Matches".

11.2.2 Querying records

Field	Description	Range and default
Work mode filter	Selects the record type to view; also determines the columns of the export file	"All work modes" and the 8 record types (see Section 11.1); default "All work modes"
Sort field	Sorts by "Time" or "#" (local sequence number)	Default "Time"; capability index records are always sorted by time
Sort direction	"Descending" shows the newest on top; "Ascending" shows the oldest on top; the row order of the export file is the same	Default "Descending"
Start Date	Lists only records from this day (inclusive) onward; click the field to open the date picker	Blank shows "--", meaning no limit
End Date	Lists only records up to this day (inclusive)	Blank means no limit; it must not be earlier than the start date; if the dates are reversed, a message is shown and no query can be run (see the Note below)
Station	Matches on part of the text; not case-sensitive for English letters; placeholder text "Station"	Blank means no limit

Field	Description	Range and default
Part Number	Same as “Station”; placeholder text “Part Number”	Blank means no limit
Result	Filters by judgement result	“All”, “OK”, “NOK”, “Rehit”; default “All”

Steps:

1. In “Work mode filter”, select the record type. Only records of that type remain in the list, and the filter fields specific to that mode (if any) appear.
2. Click “Start Date” and select a date in the date picker; set “End Date” the same way. To remove a date condition, open the date picker and select “Clear” (the button text may vary slightly with the Windows language).
3. Enter “Station” and “Part Number” and select “Result” as needed.
4. Each time you change a condition, the query runs again automatically and returns to page 1 (for text fields, the query runs a moment after you stop typing): the statistics bar first shows “--” and the list shows “Loading records...”, then both are updated.
5. To read the latest data again with the same conditions, click the magnifier “Query”. While a query is running, this button is temporarily unavailable.

Note “Start Date” and “End Date” are compared using the date in Coordinated Universal Time (UTC), while the list shows local time. In Taiwan (UTC+8), records completed between 00:00 and 07:59 local time are counted as the previous day. To query a complete day, set “Start Date” one day earlier, then exclude the records you do not need by “Time”.

Note When “End Date” is earlier than “Start Date”, the filter bar shows “The end date is before the start date. Change either date.” in red, the magnifier “Query” and the export buttons cannot be clicked, and the statistics bar, the list and the footer are not shown. After you correct either date, the screen is restored automatically and the query runs again.

Tip Once you enter any text in “Station” or “Part Number”, records with that field blank no longer appear. If you enter a “Part Number” under “All work modes”, capability index records (which have no part number) do not appear in the list, but “Matches” still counts them.

11.2.3 List and statistics

Item	Description
Matches	Total number of records under the current conditions, not affected by the 2000-record loading limit; shows "--" while loading or when the query fails.
OK/NOK	Number of records judged OK or NOK.
Rehit	Number of records judged "Rehit".
Record card	Color bar and result badge on the left (OK green, NOK red); time and the main identifier in the middle ("Part Number" in most modes); two main values on the right (different for each mode, see Sections 11.4 to 11.9); the red trash can at the far right. Other fields are visible only in the detail page or in an export.

Under "All work modes", the list is grouped by mode: torque wrench records come first without a group title, followed by "Power Tool Work Records", "Torque & Angle — Records", "Torque Inspection — Records", "Batch Jobs — Records" and "Tool Inspection Records". Modes without records have no group. The three capability index record types are combined here into one group, "Tool Inspection Records"; to see the residual torque fields, switch "Work mode filter" to that record type.

For each record type, at most the newest 2000 records are loaded each time. If there are more, the top of the page shows "More than 2000 records match this filter. Only the newest 2000 are shown and exported -- narrow the date range to see the rest." In this case "Matches" still shows the real total, but the list, OK/NOK/Rehit and the export file contain only the newest 2000 records. Query and export in parts by date range.

11.2.4 Opening the record detail

Click any record card in the list to switch to "Record Detail". The figure below uses a torque wrench record as an example; the details of torque & angle, torque inspection, power tool and batch job records have the same layout. Capability index details have no chart and no samples (see Section 11.9).

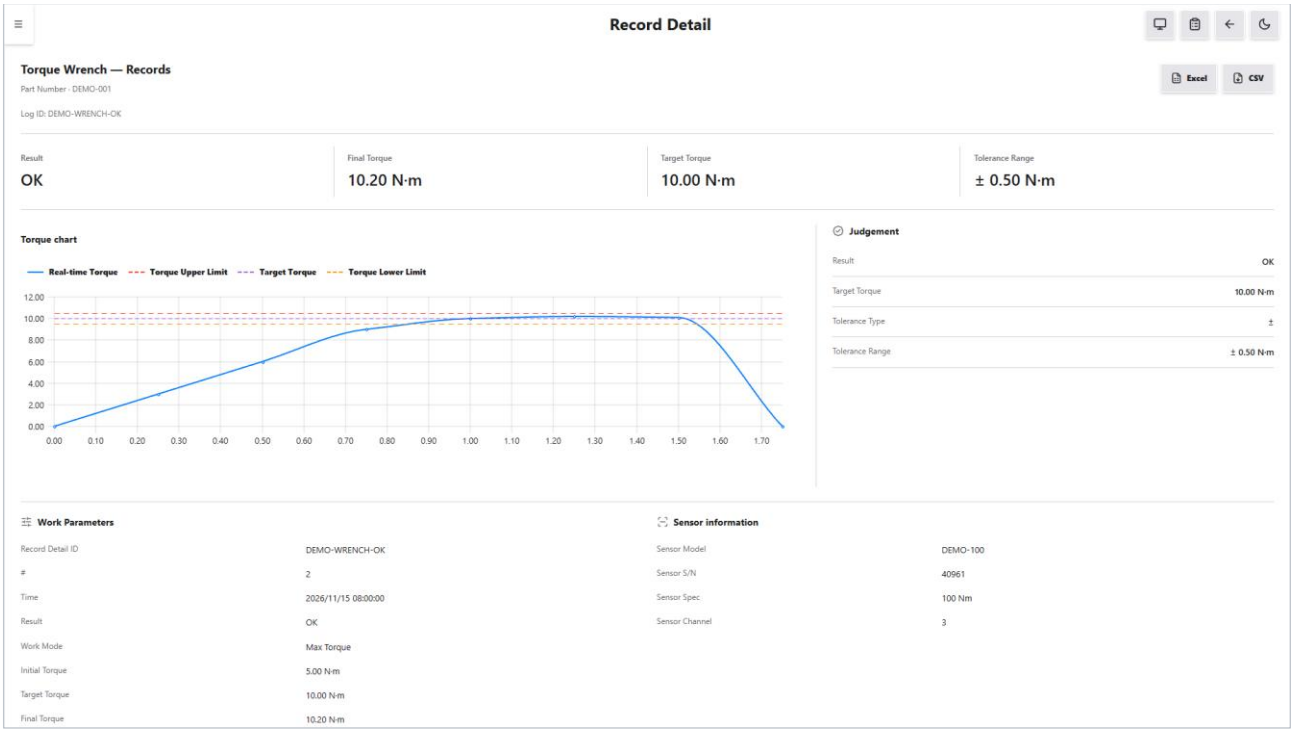

Figure 11-3 Record Detail (torque wrench record)

Area/button	Description
Header	The screen icon “Work” returns to the work screen of that mode (shown only when you opened records from a work mode); the clipboard icon “Work Records” and “←” (back to the record list) return to the list, keeping the previous filter conditions and page number; the moon icon switches the color scheme.
Title area	Record type name and “Part Number · …”; “Excel” and “CSV” on the right export only this record (including samples); see “Exporting to Excel and CSV” below.
Summary cards	The 3 to 4 most important values of this record, for example “Result”, “Final Torque”, “Target Torque”, “Tolerance Range”; the result is colored according to OK/NOK.
Chart area	The chart saved with this record; it is no longer updated. The solid line is “Real-time Torque”; the dashed lines are “Torque Upper Limit”, “Target Torque” and “Torque Lower Limit”. If the target or tolerance is missing, the corresponding dashed line is not drawn. The horizontal axis is in seconds, counted from the first sample. The curve is drawn as a smooth line through every sample point; the smoothing affects only how it is drawn and does not change the values saved or exported (see Section 5.2.6). Move the mouse over the chart to show the time and torque of that point.
Judgement	The conditions the judgement is based on, for example “Target Torque”, “Tolerance Type”, “Tolerance Range”.
Work Parameters	All fields of this record; for each mode, see Sections 11.4 to 11.9.
Sensor information	“Sensor Model”, “Sensor S/N”, “Sensor Spec” and “Sensor Channel” of the torque sensor used during the job. Later changes to the sensor settings do not change old records.
Data points/curve samples	At the very bottom, collapsed by default; see below.

The detail page has no delete button; to delete, go back to the list.

Viewing data points (raw samples)

"Data Points" are the curve samples saved with the record during the job, that is, every point on the chart. For records with angle, they are called curve samples ("Sample Data Detail").

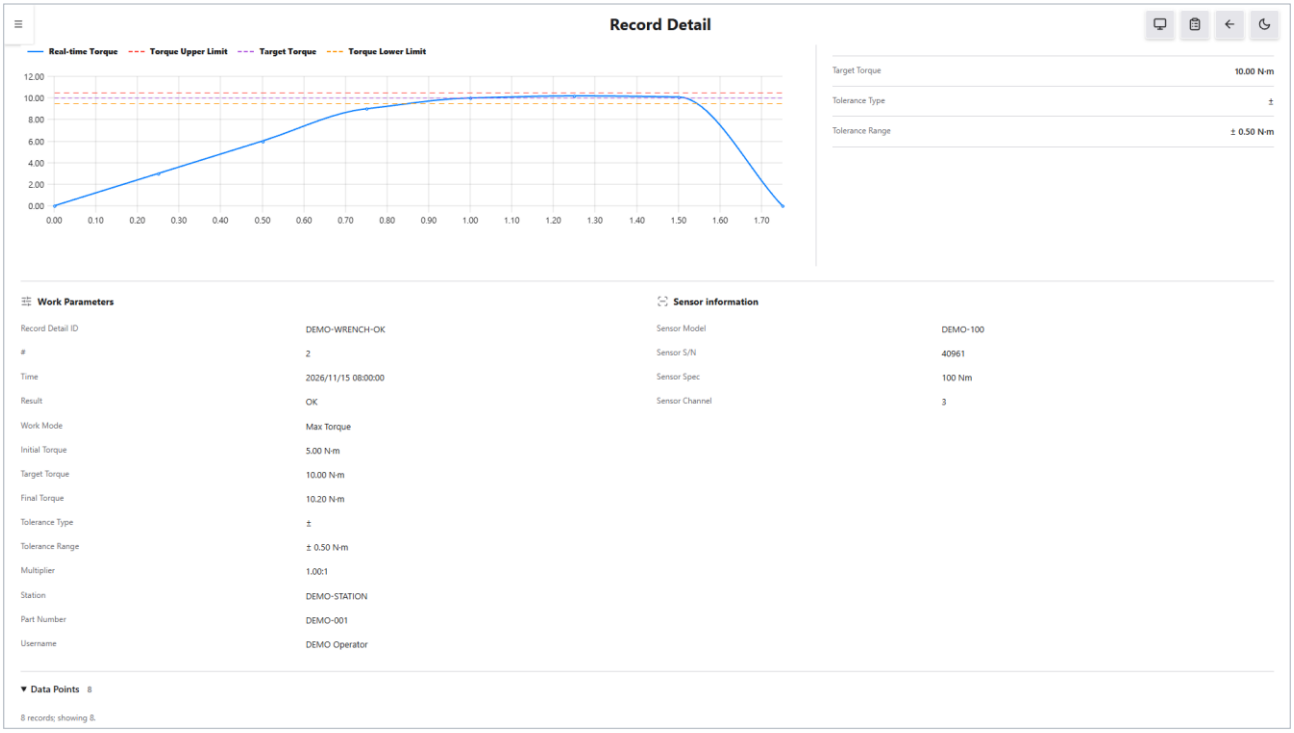

Figure 11-4 Record Detail: data points expanded

1. Scroll to the bottom of the detail page and click "▶ Data Points N" (N is the total number of samples). The table expands.
2. Above the table, "N records; showing M." is shown. By default only the first 12 are listed.
3. If there are more than 12, click "List all data points" to see all of them; click "Show first 12 only" to collapse again. With 12 or fewer, these two buttons are not shown.
4. The table is view-only and cannot be edited. To save it to a file, use "Excel" or "CSV" in the detail page.

Column	Description
Sample No.	Sample sequence number, in ascending order.
Time (s)	Seconds from the first sample, two decimal places.
Torque (unit)	Real-time torque at that point in time; the current torque unit is in parentheses, for example "Torque (N·m)".
Angle	Angle at that point in time (degrees); torque wrench and power tool do not measure angle and always show 0.00.

The chart area can show the following states:

Chart area shows	Meaning and action
“Loading data...”	Samples are being read; “Excel” and “CSV” in the detail page are temporarily unavailable.
“No data points”	This record has no saved samples. This is not an error. The field data is still valid and can be exported (the sample columns are blank).
“Failed to load chart samples” and “Reload”	Reading failed. Click “Reload”; until it succeeds, “Excel” and “CSV” in the detail page are unavailable. If it still fails, go back to the list and open the record again, or log in again.

Finding out why a record is NOK

1. In the list, set “Result” to “NOK” and click the record card you want to check.
2. Look at the final value in the summary cards (for example “Final Torque”) and at “Target Torque” and “Tolerance Range”.
3. Look at “Tolerance Type” in the “Judgement” area: “±” means there is tolerance both above and below; “≥” means only values above the target torque are allowed (the “+” on the settings screen).
4. Calculate the allowed range and see on which side of the range the final value falls.
5. Look at the chart: whether the highest point did not reach the “Torque Lower Limit” dashed line, or went above the “Torque Upper Limit” dashed line.
6. Look at “Multiplier” in “Work Parameters” and at “Sensor information” to confirm that the correct torque multiplier settings and sensor were used at the time.

The judgement conditions differ by mode: for torque & angle, see Section 11.5; for torque inspection, see Section 11.6; for capability index, see Section 11.9.

> **Example** Reading a torque wrench NOK record
> Summary cards: “Result” NOK, “Final Torque” 8.90 N·m, “Target Torque” 10.00 N·m, “Tolerance Range” ± 0.50 N·m; in the “Judgement” area, “Tolerance Type” is “±”.
> Tolerance range = target torque × tolerance percentage = 10.00 × 5% = 0.50 N·m.
> Allowed range: lower limit 10.00 − 0.50 = 9.50 N·m; upper limit 10.00 + 0.50 = 10.50 N·m.
> 8.90 N·m is below the lower limit of 9.50 N·m, so the result is NOK because of insufficient torque; the highest point of the chart is also below the “Torque Lower Limit” dashed line.
> Action: After confirming that “Multiplier” matches the torque multiplier used at the time, retighten the workpiece according to the work instructions.

11.2.5 Exporting to Excel and CSV

TMS has two ways to export:

Export type	Button location	Export content	Default file name
List export	"Export Excel (.xlsx)" and "Export CSV (.csv)" above the list	All records under the current conditions (not only the current page; at most 2000 per record type), in the current sort order, one row per record; no samples	"Mode name-export date", for example "Torque Wrench-20261115.xlsx"; for "All work modes", "All-20261115.xlsx"
Detail export	"Excel" and "CSV" at the top right of the detail page	Only this record; includes data points or curve samples (except capability index records)	"Mode name-record date", for example "Torque Wrench-20261110.csv"

Steps:

1. Set the conditions as described in "Querying records" and check that "Matches" and the list content are correct. If the statistics bar shows "--" and a red frame appears, the query has failed and the old list on the screen is not up to date, and the export buttons are gray and cannot be clicked; click "Reload" first, and export after the query succeeds.
2. Click "Export Excel (.xlsx)" or "Export CSV (.csv)" (in the detail page, click "Excel" or "CSV"). The Windows "Save As" dialog appears with the title "Save exported file". The default file name is filled in, and the only file type is "Excel" or "CSV". Until the file is saved or you cancel, all export buttons are temporarily unavailable.
3. Go to the folder where you want to save the file (the folder shown first is chosen by Windows), change the file name if needed, and click "Save". After the file is written, no success message is shown.
4. Click "Cancel" to not write a file; no message is shown.

5. If “Export failed” appears on the screen, see the error message table at the end of this section.

Item	Excel (.xlsx)	CSV (.csv)
File structure	One worksheet named after the mode; the first row contains the column names (frozen, bold, gray background)	UTF-8 text file, comma-separated; the first row contains the column names
Cell content	All text; torque includes the unit, for example “10.20 N·m”	Plain text; non-numeric content that starts with =, +, - or @ is prefixed with a single quote so that spreadsheets do not treat it as a formula
Column names and time	Column names follow the interface language; time follows the Windows time zone and region format	Same as left
Additional content in the detail export	A second worksheet “Sample Data Detail”: the numeric columns “Time (s)” and “Torque (unit)” (records with angle also have “Angle (°)”) and a chart; without samples, only the first worksheet	One row per sample; each row repeats the field values of this record, followed by “Sample No.”, “Time (s)”, “Torque (unit)”, “Angle”; the first column “Category” is the mode name
File size limit	64 MiB	64 MiB

For the columns exported in each mode, see Sections 11.4 to 11.9. No export file contains “Record Detail ID” or “#” (local sequence number), nor the “Work Mode” field of the detail page.

> **Note** The “Work Mode” (“Max Torque” or “Real-time Torque”) in the detail page of torque wrench and torque & angle records is shown only in the detail page; neither the list export nor the detail export contains this column. If you need this information, check it in the detail page.

Content of the “All work modes” export: The columns are “Detection Mode”, “#”, “Part Number”, “Target Torque”, “Measured Torque”, “QC”, “Time”. All modes are in the same sheet, without sensor columns and without the username. For batch job rows, “Part Number” contains the batch name; for capability index rows, it contains the combination number and “#” is the export order; for torque inspection rows, “Measured Torque” is the target angle torque.

> **Note** The “All work modes” export file has no column that shows which work mode each row belongs to. If you need statistics per mode or traceability for quality control, select each mode in turn in “Work mode filter” and export them separately.

> **Example** Querying this week's NOK records and exporting them for quality control (this week is 2026/11/09 (Mon) to 2026/11/15 (Sun))
> (1) Navigation menu → “System Settings” → “Records & export”.
> (2) In “Work mode filter”, select “Torque Wrench”.
> (3) For “Start Date”, select 2026/11/08 (one day earlier, so that records from 00:00–07:59 on 11/09 are included); for “End Date”, select 2026/11/15.
> (4) In “Result”, select “NOK”. The statistics bar shows, for example, “Matches 6” and “NOK 6”, and 6 red NOK record cards appear in the list.

(5) Click “Export Excel (.xlsx)”. In the “Save exported file” dialog, go to the shared quality control folder, change the default file name “Torque Wrench-20261115.xlsx” to “Torque Wrench-NOK-20261109-20261115.xlsx” and click “Save”.
(6) Open the file in Excel and delete the rows whose “Time” is earlier than 2026/11/09 00:00 (if you export next week, also delete the rows later than 2026/11/15 23:59).
(7) In “Work mode filter”, select “Power Tool”, “Torque & Angle”, “Torque Inspection” and “Batch Jobs” in turn, leave the dates and “Result” unchanged, and export each once as in steps (5) to (6). Modes whose “Matches” is 0 do not need to be exported.
(8) If you need to attach the chart, click that record in the list and click “Excel” in the detail page to export this record separately (with the “Sample Data Detail” worksheet and the chart).

11.2.6 Deleting records

1. In the list, click the red trash can at the far right of the record card.
2. The confirmation dialog “Delete this record? This marks it deleted and queues it for sync.” appears, with the buttons “Delete” and “Cancel”.
3. Click “Cancel” to do nothing. After you click “Delete”, the list refreshes automatically, the record no longer appears, and the page shows “Record marked deleted, pending sync.”
4. If “Failed to delete record” appears, check that you have the “Edit · File Management” permission, then click “Query” to refresh.

After deletion, the record no longer appears in the list, the statistics or the export files, and it is queued for sync: the sync function sends the deletion to the remote database (see Chapter 14). When you delete a capability index record, the Cpk/Cmk statistics of that test are recalculated. There is no function on the screen to undo a deletion.

Warning A deletion cannot be undone on the screen. It is also synced to the remote database and affects the statistics of the capability index test. Before you delete, make sure it is the correct record, and export a backup first if needed.

11.2.7 Error messages

Message on the screen	Cause and action
“Failed to load records. Displayed data has not been updated.” (red frame, with “Reload”)	Reading the records failed, for example because of a missing “View · Work Records” permission, an expired login or a busy database. Click “Reload”; if it still fails, log in again or ask the administrator to check the permissions. The old list left on the screen is not up to date, and you cannot export until a reload succeeds.
“The end date is before the start date. Change either date.” (red text)	“End Date” is earlier than “Start Date”. Correct either date; until then, you cannot query or export, and the statistics bar and the list are not shown.

Message on the screen	Cause and action
“Time: Failed to load records. Displayed data has not been updated.”	The time cannot be displayed according to the Windows region setting. Switch to another window and back to TMS (it retries automatically), or open this page again; if it still appears, check that the Windows “Region” setting is correct.
“More than 2000 records match this filter. Only the newest 2000 are shown and exported -- narrow the date range to see the rest.”	The single loading limit is exceeded. Narrow the date range and query and export in parts.
“Export failed”	The file cannot be created or written, for example because of a missing export permission, a save folder that cannot be written to, or a file larger than 64 MiB. Save to another folder, or narrow the query and try again.
“Failed to delete record”	Missing “Edit · File Management” permission, an expired login, or the record has already been deleted. Click “Query” to refresh and check again.
“Failed to load chart samples”	Reading the samples in the detail page failed. Click “Reload” next to it; if it still fails, go back to the list and open the record again.

11.3 Empty record list

Path: Same as Section 11.2. After a new installation, before any job has been completed, “Records & export” opens with this screen.

When the list has no record cards, the cause can be “no measurements yet”, “no query results” or “query failed”. The three are handled in completely different ways. First tell them apart by the text on the screen, and do not mistake a failed query for missing data.

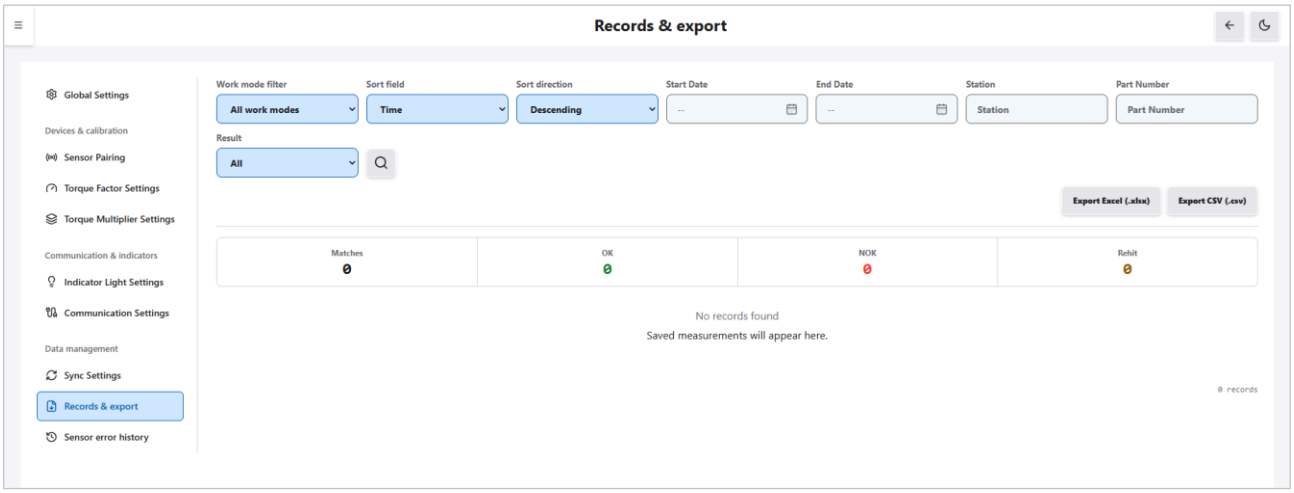

Figure 11-5 Records & export: No records found

11.3.1 Telling the causes of an empty list apart

State	What the screen shows	What it means	Action
No measurements yet	All four counts in the statistics bar are 0; the list area shows “No records found” and “Saved measurements will appear here.”; footer “0 records”	There is not a single record of this type on this computer (never measured, or all deleted)	Complete a job in the corresponding work mode, then query again
No query results	“Matches” is 0; the list area shows “No records match these filters.” and the “Clear filters” button; footer “0 records”	There are records on this computer, but none matches the current conditions	Click “Clear filters” to clear the dates and all text and menu conditions at once and set “Result” back to “All” (work mode and sorting are kept); or widen individual conditions yourself
Dates reversed	The filter bar shows “The end date is before the start date. Change either date.” in red; the statistics bar, the list and the footer are not shown	“End Date” is earlier than “Start Date”; no query is run	Correct either date
Query failed	All four counts in the statistics bar are “--”; below the filter bar, the red frame “Failed to load records. Displayed data has not been updated.” and “Reload” appear; the footer shows the same message	No data was read; this does not mean there are no records. The old list loaded earlier may still be on the screen	Click “Reload”; if it still fails, log in again or ask the administrator to check the “View · Work Records” permission
Loading	All four counts in the statistics bar are “--”; the list area shows “Loading records...”; footer “Loading...”	The query is running	Wait; the “Query” button and the export buttons are temporarily unavailable

When you open records by clicking “Work Records” in a work mode, “no measurements yet” refers only to the records of that mode. For example, if there are torque wrench records but no power tool records, opening records from the power tool still shows “No records found”.

In the “no measurements yet” state, the export buttons can still be clicked, but the export file contains only the column name row.

11.3.2 Steps

1. Look at the statistics bar: does it show the number 0 or “--”?
2. If it shows “--” and a red frame appears, the query failed. Click “Reload”; if it still fails, check the login status and the “View · Work Records” permission (see Chapter 15).

3. If it shows 0 and the list area shows “No records match these filters.”, click “Clear filters”, or clear “Start Date”, “End Date”, “Station” and “Part Number”, and set “Result” back to “All”.
4. If it shows 0 and the list area shows “No records found”, complete a job in the corresponding work mode, then come back and query again.

Example An operator reports that “yesterday's records are gone”
The administrator opens “Records & export”. The statistics bar shows “Matches 0” and the list area shows “No records match these filters.” This means the data is still there but is hidden by the conditions.
Checking the filter bar shows that “Result” is set to “NOK” and “Station” contains “ST-02”. After clicking “Clear filters” (or setting “Result” back to “All” and clearing “Station”), yesterday's records appear in the list.
If the statistics bar shows “--” and a red frame appears, the query has failed: click “Reload” first instead of adjusting the conditions.

11.4 Torque wrench records

Path: Navigation menu → “Rotary Sensor” → “Torque Wrench” → “Work Records” in the header. You can also select “Torque Wrench” in “Work mode filter” on “Records & export”.

View the result of each tightening in the torque wrench mode (Chapter 5). For querying, opening the detail, exporting and deleting, see Section 11.2; this section describes only what is specific to torque wrench records. Requires the “View · Work Records” permission.

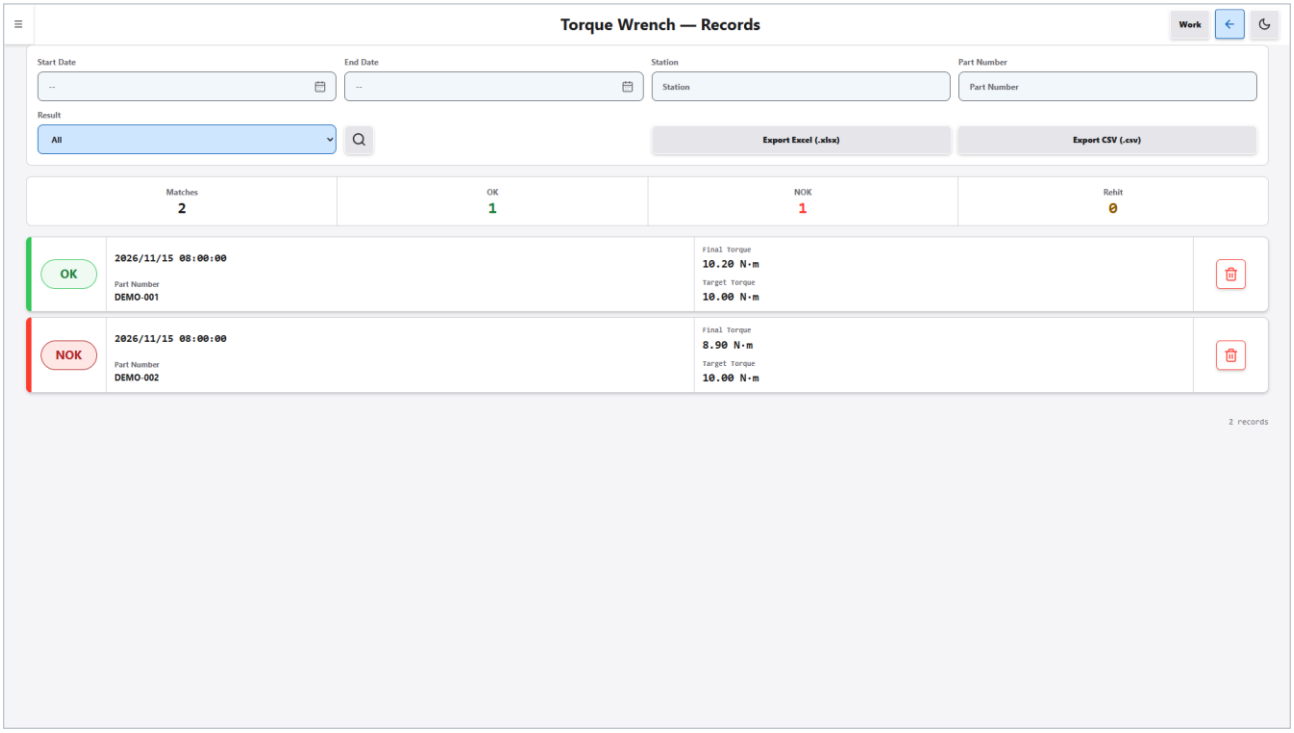

Figure 11-6 Torque wrench record list

11.4.1 List

- The page title is “Torque Wrench — Records”. At the top right of the header are “Work”, “←” and the moon icon; “Work” and “←” both return to the torque wrench work screen.
- The only filter fields are “Start Date”, “End Date”, “Station”, “Part Number” and “Result”; there are no mode-specific filters.
- The middle of the record card shows “Part Number”; on the right, “Final Torque” is at the top and “Target Torque” below it.

11.4.2 Detail

For the detail layout, see Figure 11-3 and Figure 11-4 (Section 11.2). Features of torque wrench records:

- The title area shows “Torque Wrench — Records” with an additional line “Log ID: (record ID)” below it. Only torque wrench records have this line.
- The summary cards are “Result”, “Final Torque”, “Target Torque”, “Tolerance Range”.
- The chart is “Torque chart”, with torque only; the collapsed area at the bottom is “Data Points”, and the “Angle” column is always 0.00.
- The “Judgement” area lists “Result”, “Target Torque”, “Tolerance Type”, “Tolerance Range”.

“Work Parameters” fields:

Field	Description
Record Detail ID/#	ID generated by the system and the local sequence number; not exported.
Time	Time the job was completed.
Result	OK, NOK or “Rehit”.
Work Mode	How torque was read at the time: “Max Torque” or “Real-time Torque”; shown only in the detail page, not included in export files.
Initial Torque	The torque threshold at which calculation starts.
Target Torque	The target torque set for the job.
Final Torque	The torque used for the judgement.
Tolerance Type	“±” or “≥” (“≥” is the “+” on the settings screen).
Tolerance Range	Target torque × tolerance percentage, shown as “± value unit”.
Multiplier	The torque multiplier torque ratio during the job; “1.00:1” when no torque multiplier is enabled.
Station/Part Number	The values entered during the job; blank if left empty, except for batch jobs and records from versions before 1.4.2 (see Section 11.1).
Username	The login account that performed the job.

Note When “Tolerance Type” is “≥”, “Tolerance Range” is still shown as “± value”. In this case the allowed range is from “Target Torque” to “Target Torque + Tolerance Range value”. Read the result according to “Tolerance Type”.

11.4.3 Export columns

- **List export**: Time, Result, Initial Torque (CSV only), Target Torque, Final Torque, Tolerance Type, Tolerance Range, Multiplier, Station, Part Number, Username, Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel.
- **Detail export**: The first column is “Category” (Torque Wrench), followed by the columns above, then the sample columns “Sample No.”, “Time (s)”, “Torque (unit)”, “Angle”.
- The torque wrench Excel files (list and detail) **do not include** “Initial Torque”; only CSV has it. If you need the initial torque, use CSV.

Example Reading a NOK record with tolerance type “≥”
Detail: “Target Torque” 10.00 N·m, “Tolerance Type” ≥, “Tolerance Range” ± 0.50 N·m, “Final Torque” 10.62 N·m, “Result” NOK.
Allowed range for “≥”: lower limit = target torque 10.00 N·m; upper limit = 10.00 + 0.50 = 10.50 N·m. 10.62 N·m exceeds the upper limit of 10.50 N·m, so the result is NOK because the torque is too high. Although “Tolerance Range” shows “±”, the lower limit is still the target torque of 10.00 N·m, not 9.50 N·m.

11.5 Torque and angle records

Path: Navigation menu → “Rotary Sensor” → “Torque & Angle” → “Work Records” in the header. You can also select “Torque & Angle” in “Work mode filter” on “Records & export”.

View the tightening results of the torque & angle mode (Chapter 6), including both the torque and the angle judgement. Requires the “View · Work Records” permission. For the common operations, see Section 11.2; this section describes only what differs from torque wrench records.

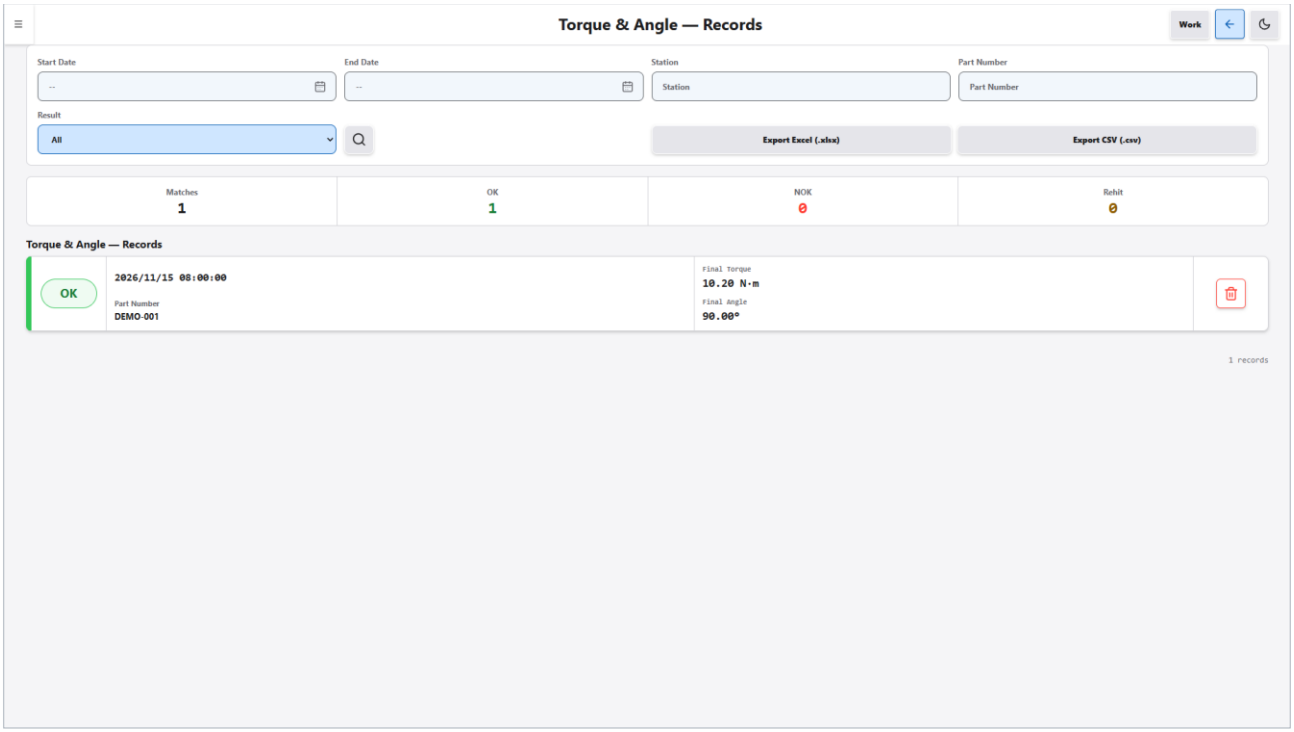

Figure 11-7 Torque & angle record list

11.5.1 List

- The page title is “Torque & Angle — Records”, and there is also a group title with the same name above the list.
- The filter fields are the same as for the torque wrench.
- On the right of the record card, “Final Torque” is at the top and “Final Angle” below it (degrees, two decimal places, for example “90.00°”).

11.5.2 Detail

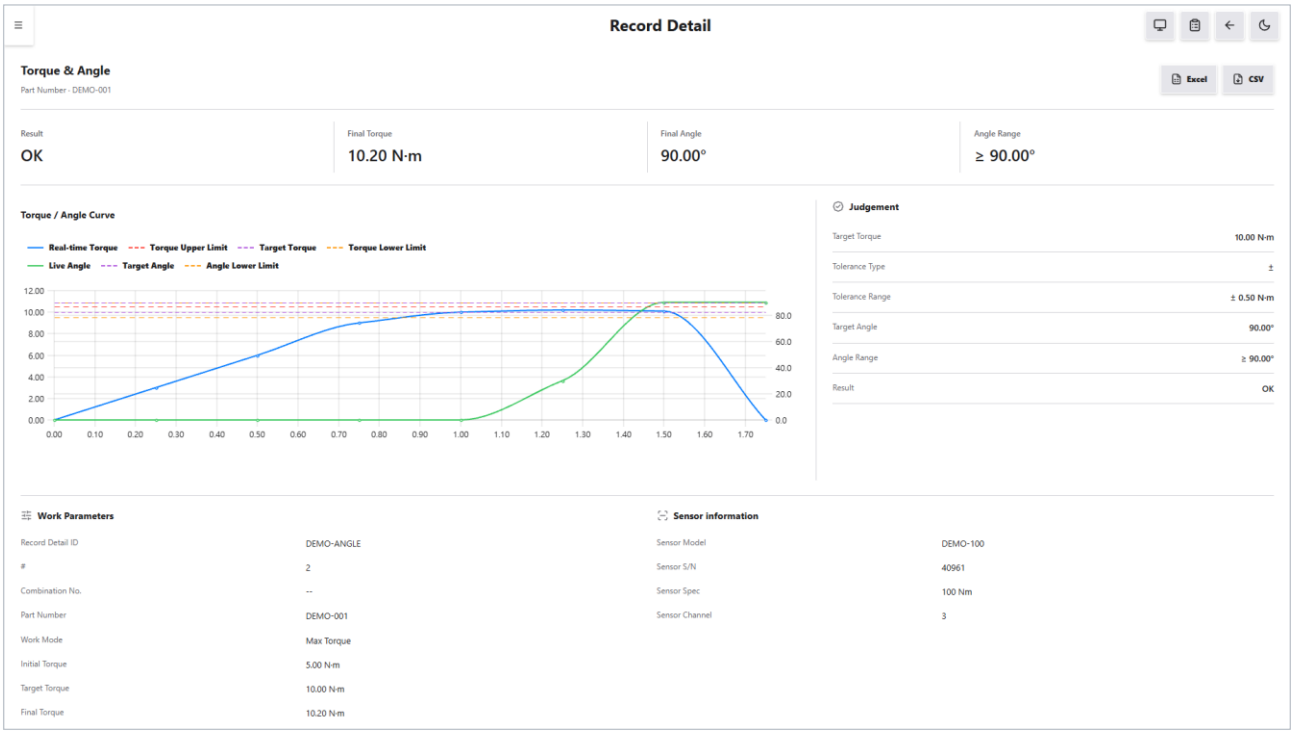

Figure 11-8 Torque & angle record detail

- The title area shows “Torque & Angle” and “Part Number · …”; there is no “Log ID” line.
- The summary cards are “Result”, “Final Torque”, “Final Angle”, “Angle Range”.
- The chart is “Torque / Angle Curve”: the left vertical axis is torque and the right vertical axis is angle. In addition to the solid and dashed torque lines, there is a green solid line “Live Angle” and the dashed lines “Target Angle”, “Angle Upper Limit” and “Angle Lower Limit” (only the lines the record has are drawn). The mouse tooltip has the additional item “Live Angle”.
- The “Judgement” area lists “Target Torque”, “Tolerance Type”, “Tolerance Range”, “Target Angle”, “Angle Range”, “Result”.
- “Work Parameters” are, in order: Record Detail ID, #, Combination No., Part Number, Work Mode, Initial Torque, Target Torque, Final Torque, Tolerance Type, Tolerance Range, Target Angle, Angle Range, Final Angle, Multiplier, Gear Ratio, Result, Time. There is no “Station” and no “Username”.

Fields that differ from or are added to the torque wrench:

Field	Description
Combination No.	The torque & angle combination number used for the job.
Initial Torque	The torque at which angle counting starts; under angle control, it is also the minimum torque required for OK.
Target Angle	The set target angle (degrees, two decimal places).
Angle Range	The angle judgement range. If it shows “≥ target°” or “≤ target°”, angle control was used at the time; if it shows “lower° ~ upper°”, torque control was used.

Field	Description
Final Angle	The angle at the end of tightening (degrees, two decimal places).
Gear Ratio	The torque multiplier gear ratio during the job; “1.00:1” when no torque multiplier is enabled.

The judgement depends on the control mode at the time (see Chapter 6):

- Angle control: OK only if “Final Torque” ≥ “Initial Torque” and “Final Angle” is within “Angle Range”; the target torque and tolerance are not used for the judgement.
- Torque control: OK only if “Final Torque” is within the tolerance of the target torque; the angle does not affect the judgement.

11.5.3 Curve samples

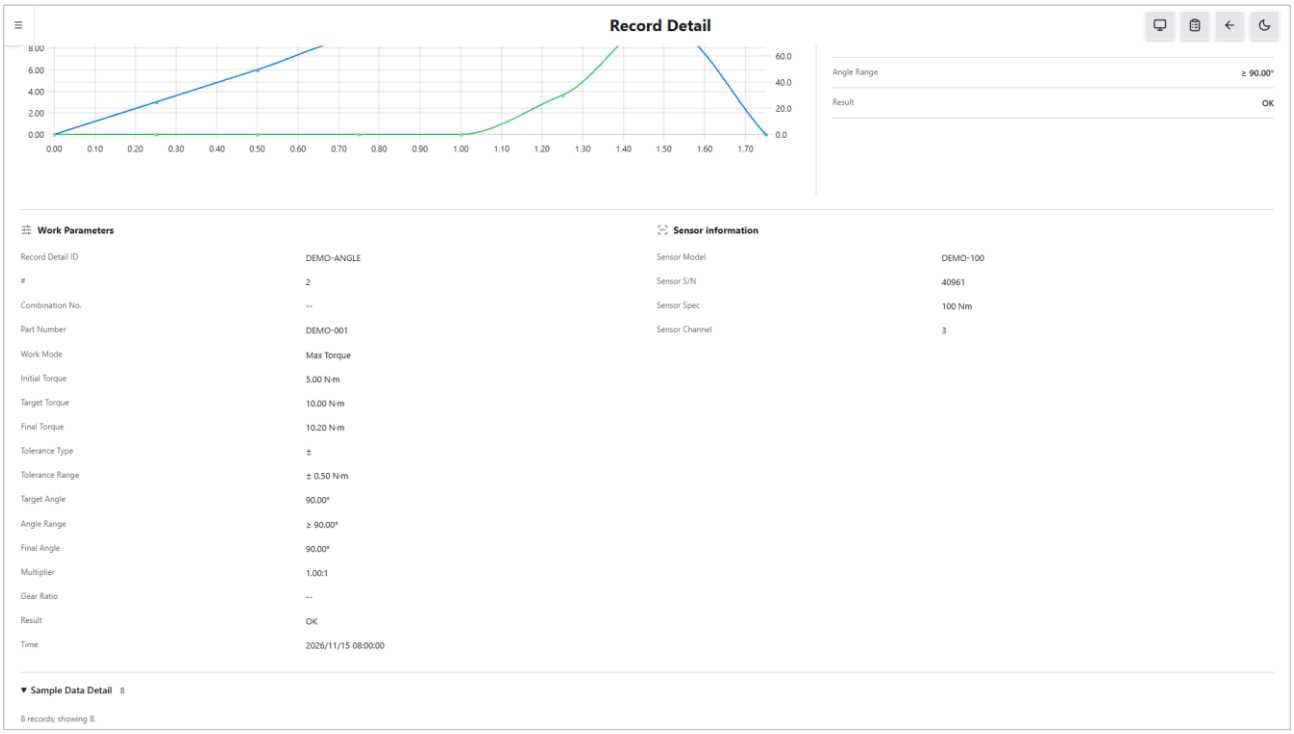

Figure 11-9 Torque & angle record detail: curve samples expanded

The collapsed area at the bottom of the detail is named “Sample Data Detail” and works the same way as “Data Points” (see Section 11.2). The “Angle” column is the actual angle at that point in time.

11.5.4 Export columns

- **List export**: Time, Result, Initial Torque, Target Torque, Final Torque, Tolerance Type, Tolerance Range, Target Angle, Angle Range, Final Angle, Multiplier, Gear Ratio, Station, Part Number, Combination No., Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel.
- **Detail export**: “Category”, the work parameter fields (without Record Detail ID, # and Work Mode), the four torque sensor columns, then “Sample No.”, “Time (s)”, “Torque (unit)”, “Angle”. The detail export does not include “Station”.

- Both Excel and CSV include “Initial Torque”.
- In the detail Excel, the “Sample Data Detail” worksheet has the additional column “Angle (°)”, the chart title is “Torque / Angle Curve”, and the angle uses the right axis.

Note Neither the detail nor the export files of torque & angle records show “Username”; “Station” appears only in the list export file. To trace the operator, compare the time and station with the shift schedule.

Example Reading a NOK record with insufficient angle
Summary cards: “Result” NOK, “Final Torque” 10.20 N·m, “Final Angle” 85.30°, “Angle Range” ≥ 90.00°.
“Angle Range” starts with “≥”, which means angle control was used: “Final Torque” must be ≥ “Initial Torque”, and “Final Angle” must be ≥ the target angle of 90.00°.
“Initial Torque” in “Work Parameters” is 5.00 N·m; 10.20 ≥ 5.00, so the torque condition is met.
85.30° < 90.00°, the angle is 4.70° short, so the result is NOK. On the “Torque / Angle Curve”, the green “Live Angle” line also does not reach the “Target Angle” dashed line.

11.6 Torque inspection records

Path: Navigation menu → “Rotary Sensor” → “Torque Inspection” → “Work Records” in the header. You can also select “Torque Inspection” in “Work mode filter” on “Records & export”.

View the results of the torque inspection mode (Chapter 7): the torque when the target angle is reached, and the angle and torque at loosening. Requires the “View · Work Records” permission. For the common operations, see Section 11.2; this section describes only what is specific to this mode.

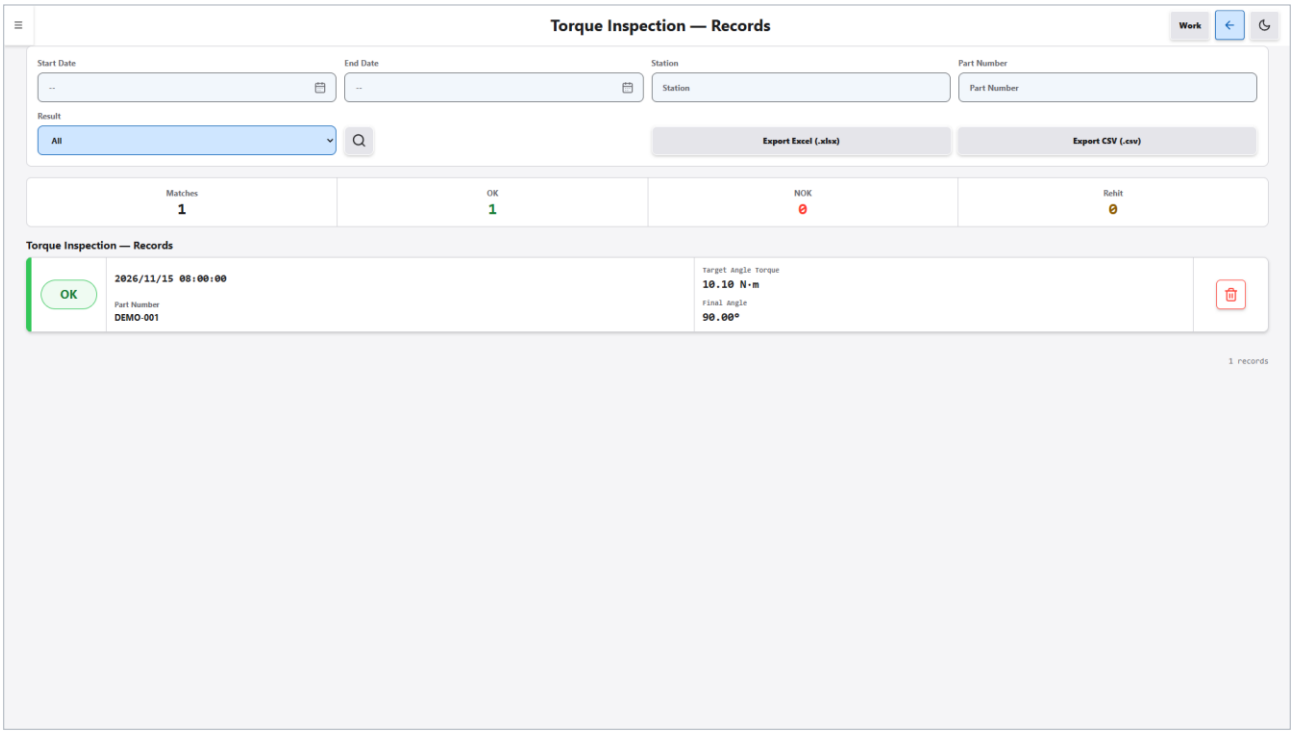

Figure 11-10 Torque inspection record list

11.6.1 List

- The page title is “Torque Inspection — Records”, and there is also a group title with the same name above the list.
- The filter fields are the same as for the torque wrench.
- On the right of the record card, “Target Angle Torque” is at the top and “Final Angle” below it. The “Final Angle” in the list is the loosening angle; the detail shows the same value, also labeled “Final Angle”.

11.6.2 Detail

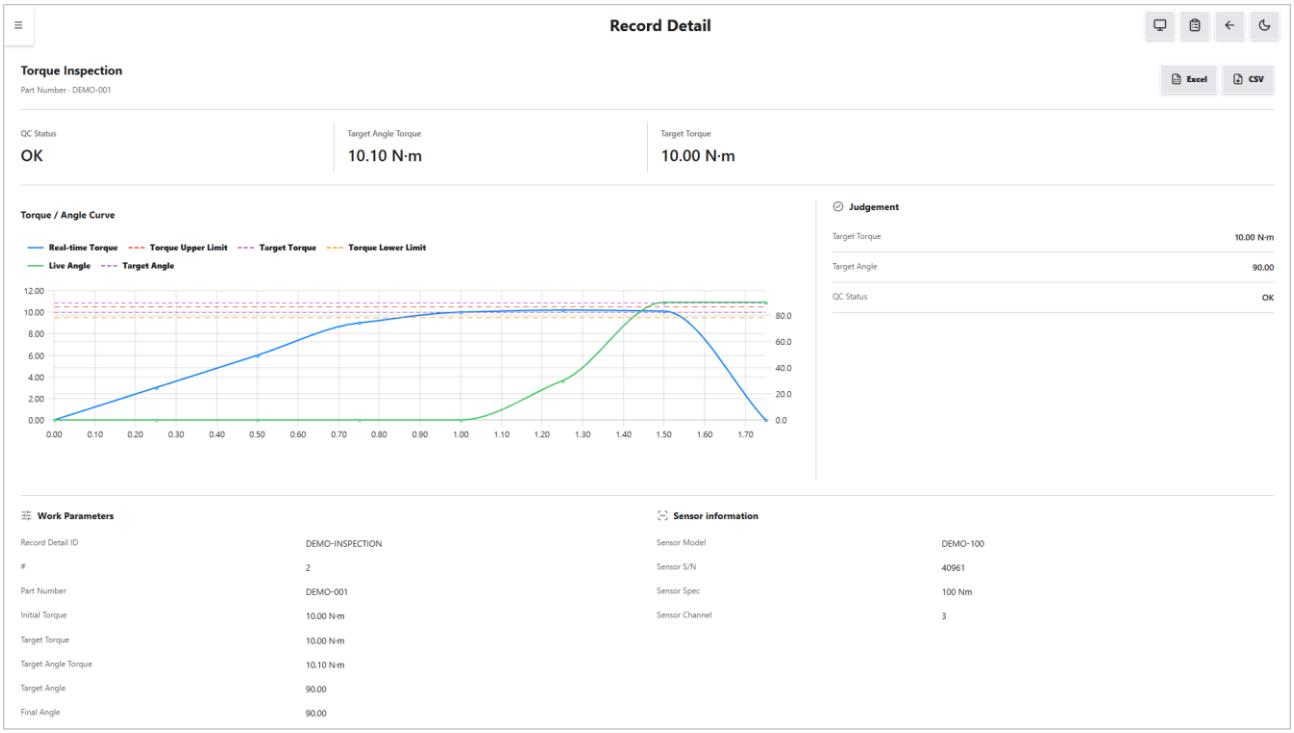

Figure 11-11 Torque inspection record detail

- The title area shows “Torque Inspection” and “Part Number · …”; there is no “Log ID” line.
- There are only three summary cards: “QC Status”, “Target Angle Torque”, “Target Torque”. The result field is named “QC Status”.
- The chart is “Torque / Angle Curve” with a right angle axis; for angle, only “Live Angle” and “Target Angle” are drawn, without angle limit lines.
- The “Judgement” area lists “Target Torque”, “Target Angle”, “QC Status”.
- “Work Parameters” are, in order: Record Detail ID, #, Part Number, Initial Torque, Target Torque, Target Angle Torque, Target Angle, Final Angle (loosening angle), Final Torque (loosening torque), Multiplier, Gear Ratio, QC Status, Time. There is no “Station”, “Tolerance Type”, “Tolerance Range”, “Batch Quantity” or “Username”; the station, tolerance and batch quantity are available in the list export file.

Field	Description
Initial Torque/Target Torque	The torque at which angle counting starts; also the center value of the judgement. The settings screen has only one starting value, “Target Torque (Angle Start)”, which is written to both fields when saved, so the two are usually the same (see Chapter 7).
Target Angle Torque	The torque at the moment the target angle is reached; OK/NOK is judged on this value.
Target Angle	The set target angle; the detail page shows only the number, without “°”.
Final Angle (loosening angle)	The angle at loosening; shows only the number. The list and export files also call it “Final Angle”.
Final Torque (loosening torque)	The torque at loosening; appears only in the detail page and the detail export, not in the list export.
QC Status	OK, NOK or “Rehit”.

11.6.3 Curve samples

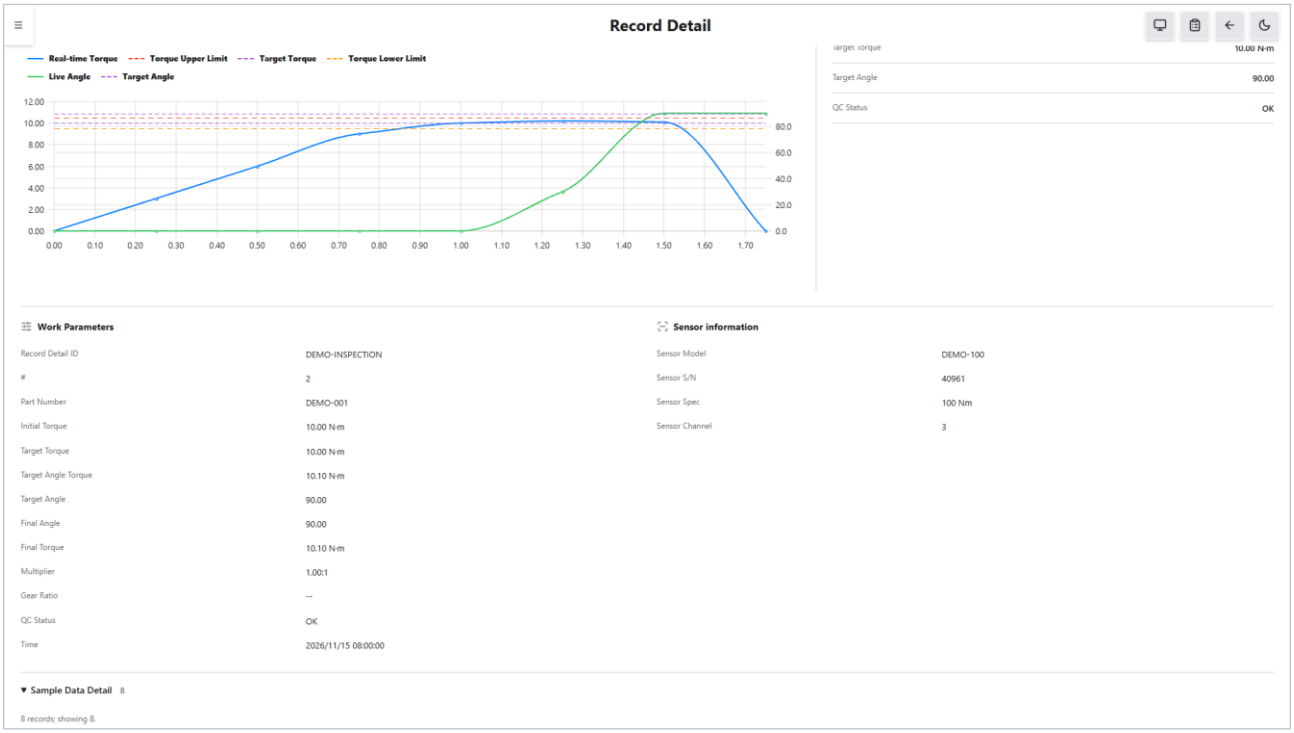

Figure 11-12 Torque inspection record detail: curve samples expanded

The collapsed area at the bottom of the detail is named “Sample Data Detail” and works the same way as “Data Points” (see Section 11.2). The “Angle” column is the actual angle at that point in time.

11.6.4 Export columns

- **List export**: Time, Result, Initial Torque, Target Torque, Tolerance Type, Tolerance Range, Target Angle Torque, Target Angle, Final Angle, Sensor Model, Sensor S/N, Multiplier, Gear Ratio, Station, Part Number, Batch Quantity, Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel. The two “Sensor Model/Sensor S/N” column pairs have the same content.

- **Detail export**: “Category”, the work parameter fields (without Record Detail ID and #), the four torque sensor columns, then the four sample columns. It includes the loosening torque, but not the station, tolerance or batch quantity.
- In the detail Excel, the “Sample Data Detail” worksheet includes the angle column, and the chart title is “Torque / Angle Curve”.
- Neither the detail nor the export files of torque inspection records show “Username”.

Example Reading a torque inspection NOK record
Detail: “Target Torque” 10.00 N·m, “Target Angle” 90.00, “Target Angle Torque” 10.62 N·m, “QC Status” NOK. The detail page has no tolerance fields.
Click “Export Excel (.xlsx)” in the list and find the row with the same time in the file: “Tolerance Type” ±, “Tolerance Range” ± 0.50 N·m.
Allowed range: 10.00 − 0.50 = 9.50 N·m to 10.00 + 0.50 = 10.50 N·m.
The target angle torque of 10.62 N·m exceeds the upper limit of 10.50 N·m, so the result is NOK: the torque was already too high when 90° was reached.

11.7 Power tool records

Path: Navigation menu → “Rotary Sensor” → “Power Tool” → “Work Records” in the header. You can also select “Power Tool” in “Work mode filter” on “Records & export”.

View the final torque, work time and pulse count of each operation in the power tool mode (Chapter 8). Records use one of two column sets: general (impact, pulse, etc.) and clutch. Requires the “View · Work Records” permission. For the common operations, see Section 11.2; this section describes only what is specific to this mode.

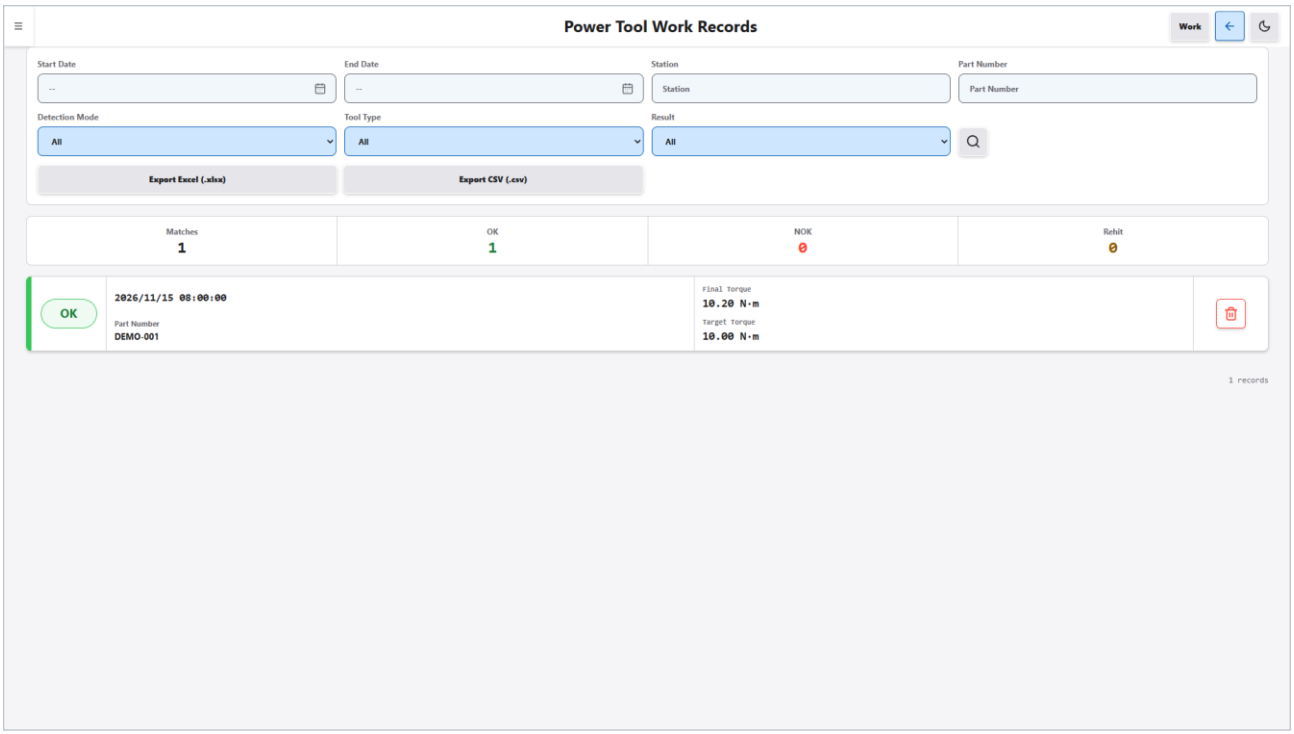

Figure 11-13 Power tool record list

11.7.1 List and mode-specific filters

- The page title is “Power Tool Work Records”. When **all** records found are clutch records, the title changes to “Power Tool Clutch Work Records”, and the export also uses the clutch columns.
- On the right of the record card, “Final Torque” is at the top and “Target Torque” below it.
- When you open records by clicking “Work Records” on the power tool work screen, two more drop-down menus appear to the left of “Result” in the filter bar; when you select “Power Tool” in “Records & export”, these two menus are not shown.

Field	Description	Range and default
Detection Mode	Filters by the torque detection method used during the operation; clutch records have no detection mode and do not appear when “Max Torque” or “Real-time Torque” is selected	“All”, “Max Torque”, “Real-time Torque”; default “All”
Tool Type	Filters by tool type; for types not in the menu (for example “Hydraulic”), use “All”	“All”, “Impact”, “Pulse”, “Clutch”; default “All”

Note When you select “Clutch” in “Tool Type” and all records found are clutch records, the page switches to “Power Tool Clutch Work Records”, and the two menus “Detection Mode” and “Tool Type” are hidden while the filter stays at “Clutch”. To return to all power tool records, click “Work” to go back to the work screen, then click “Work Records” to open the records again.

11.7.2 Detail

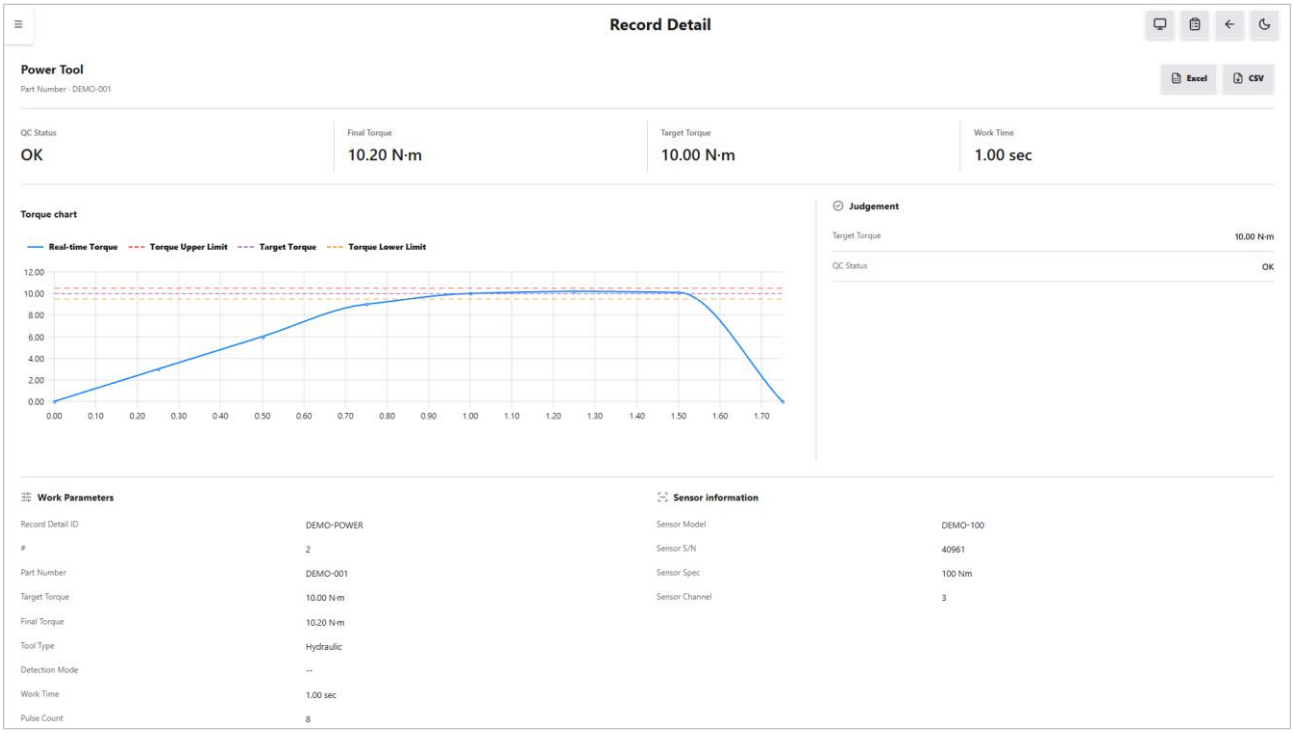

Figure 11-14 Power tool record detail

- The title area shows “Power Tool” and “Part Number · …”; there is no “Log ID” line.

- Summary cards: general records have “QC Status”, “Final Torque”, “Target Torque”, “Work Time”; clutch records have no “Work Time”, only the first three cards.
- The chart is “Torque chart”, with torque only.
- The “Judgement” area lists “Target Torque”, “QC Status”.
- “Work Parameters”: general records have, in order, Record Detail ID, #, Part Number, Target Torque, Final Torque, Tool Type, Detection Mode, Work Time, Pulse Count, QC Status, Username, Time; clutch records have, in order, Record Detail ID, #, Part Number, Target Torque, Final Torque, Tool Type, Target Work Time, Detect Work Time, Detection Mode, Batch Quantity, QC Status, Username, Time.
- The detail has no “Tolerance Type”, “Tolerance Range”, “Multiplier” or “Station”; these fields are available in the list export file.

Field	Description
Tool Type	Tool type during the operation, for example “Impact”, “Pulse”, “Clutch”, “Hydraulic”.
Detection Mode	“Max Torque” or “Real-time Torque”; “--” for clutch records.
Work Time	For general records, the time detected for this operation (seconds, two decimal places); for its meaning, see Chapter 8.
Pulse Count	For general records, the number of pulses detected for this operation.
Target Work Time	The target work time in the clutch work settings (seconds, two decimal places).
Detect Work Time	For clutch operations, the time from the start to the highest torque (seconds, two decimal places); for its meaning, see Chapter 8.
Batch Quantity	The batch quantity setting of the clutch operation.
QC Status	OK, NOK or “Rehit”.

11.7.3 Data points

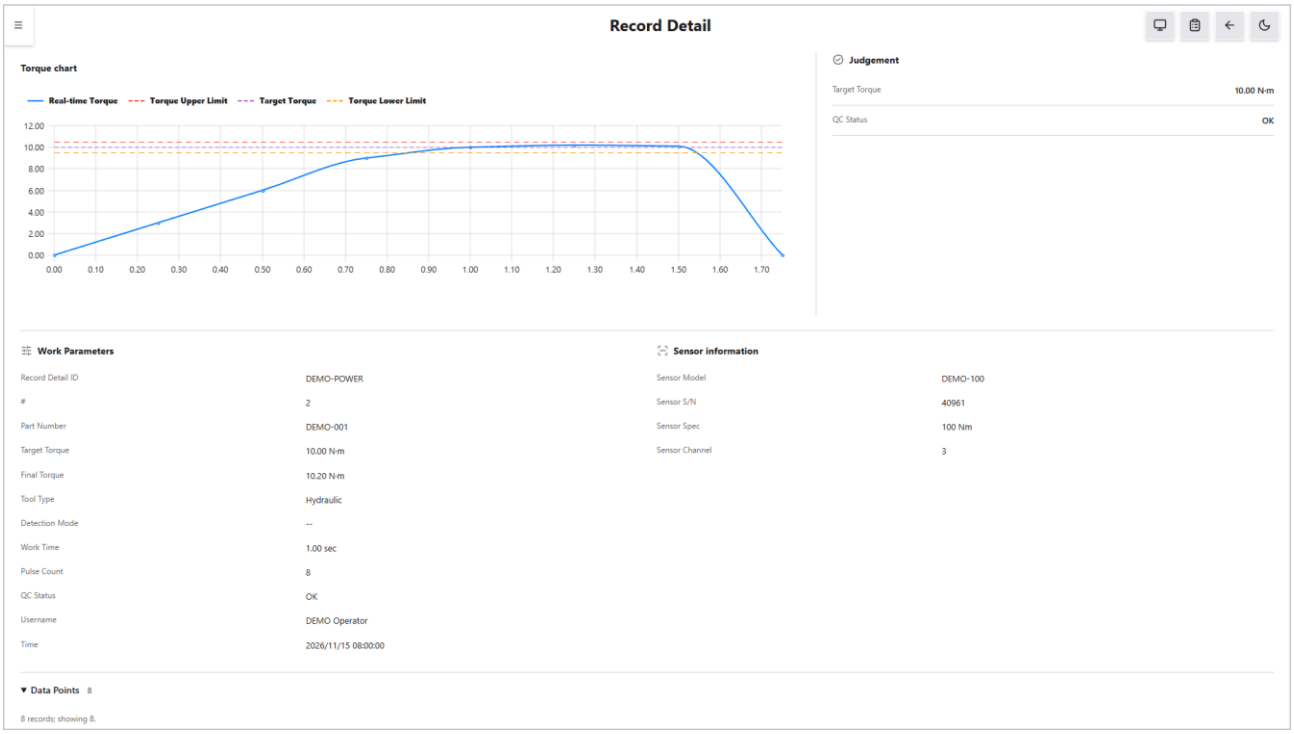

Figure 11-15 Power tool record detail: data points expanded

"Data Points" is at the bottom of the detail; see Section 11.2. Power tools do not measure angle, so the "Angle" column is always 0.00.

11.7.4 Export columns

- **List export (general columns)**: Time, Result, Final Torque, Target Torque, Tolerance Type, Tolerance Range, Work Time, Pulse Count, Multiplier, Tool Type, Detection Mode, Station, Part Number, Username, Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel.
- **List export (clutch columns)**: Used when all records found are clutch records. The columns are Time, Result, Final Torque, Target Torque, Tolerance Type, Tolerance Range, Target Work Time, Detect Work Time, Tool Type, Detection Mode, Station, Part Number, Batch Quantity, Username and the four torque sensor columns.
- When general and clutch records are exported together, the general columns are used: the "Work Time" column of clutch records contains the detect work time, and "Target Work Time" and "Batch Quantity" are not output.
- **Detail export**: "Category", the work parameter fields (without Record Detail ID and #), the four torque sensor columns, then the four sample columns. The chart title in the detail Excel is "Torque chart".

Example Exporting clutch records with “Target Work Time”

(1) On the power tool work screen, click “Work Records”. “Power Tool Work Records” appears.

(2) In “Tool Type”, select “Clutch”. When all records found are clutch records, the title changes to “Power Tool Clutch Work Records” and the two drop-down menus are hidden.

(3) Set the dates and “Result” as needed, click “Export Excel (.xlsx)” and save the file (the default file name is, for example, “Power Tool-20261115.xlsx”).

(4) Open the file. You can see the columns “Target Work Time”, “Detect Work Time” and “Batch Quantity”. For example, if “Detect Work Time” in a row is 1.42, the operation took about 1.42 seconds from the start to the highest torque.

(5) To return to all power tool records, click “Work” to go back to the work screen, then click “Work Records”.

11.8 Batch job records

Path: Navigation menu → “Rotary Sensor” → “Batch Jobs” → “Work Records” in the header. You can also select “Batch Jobs” in “Work mode filter” on “Records & export”.

View the result of each step of a batch job (Chapter 9), and trace the steps of the same batch by batch number and batch name. Each record is “one step in a batch”, not the whole batch. Requires the “View · Work Records” permission. For the common operations, see Section 11.2; this section describes only what is specific to this mode.

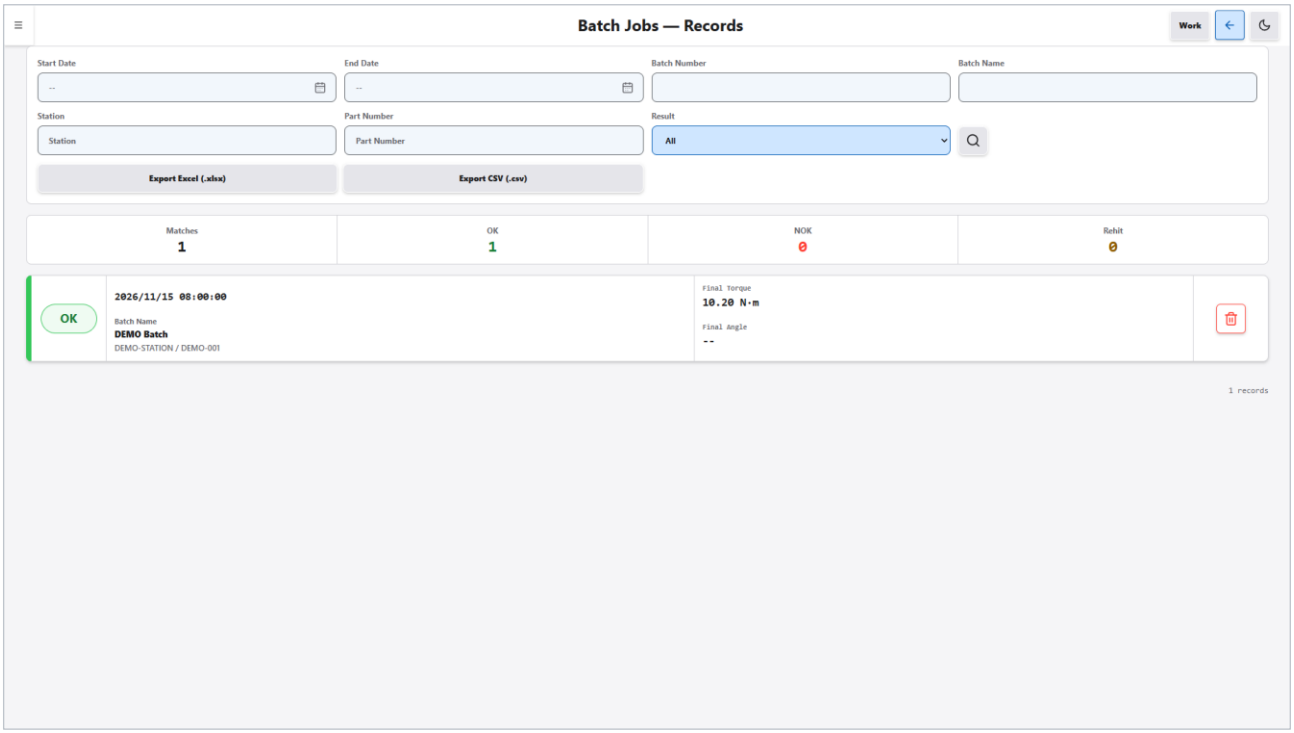

Figure 11-16 Batch job record list

11.8.1 List and mode-specific filters

- The page title is “Batch Jobs — Records”.
- The first row of the filter bar has two additional text fields, “Batch Number” and “Batch Name” (they also appear when you select “Batch Jobs” in “Records & export”); “Station”, “Part Number” and “Result” move to the second row.
- The main identifier in the middle of the record card is “Batch Name” (bold), with “Station / Part Number” in small text below it; if the station is blank, the part before “ / ” is empty, and if the part number is blank, “--” is shown.
- On the right of the record card, “Final Torque” is at the top and “Final Angle” below it; steps without angle (for example torque wrench steps) show “--”.

Field	Description	Range and default
Batch Number	Matches on part of the text; not case-sensitive for English letters; leading and trailing spaces are ignored; also affects “Matches” and the export file	Blank means no limit
Batch Name	Matches on part of the text; also affects “Matches” and the export file	Blank means no limit

> **Note** Each batch record keeps the batch number that the batch had when the record was saved; changing the batch number in the batch settings later does not change saved records. After an upgrade from version 1.7.3 or earlier, the batch records saved before the upgrade have no batch number: the “Batch Number” column of the export file contains “--”, and these records do not appear once you filter by “Batch Number”. To find these records, filter by “Batch Name” instead.

11.8.2 Detail

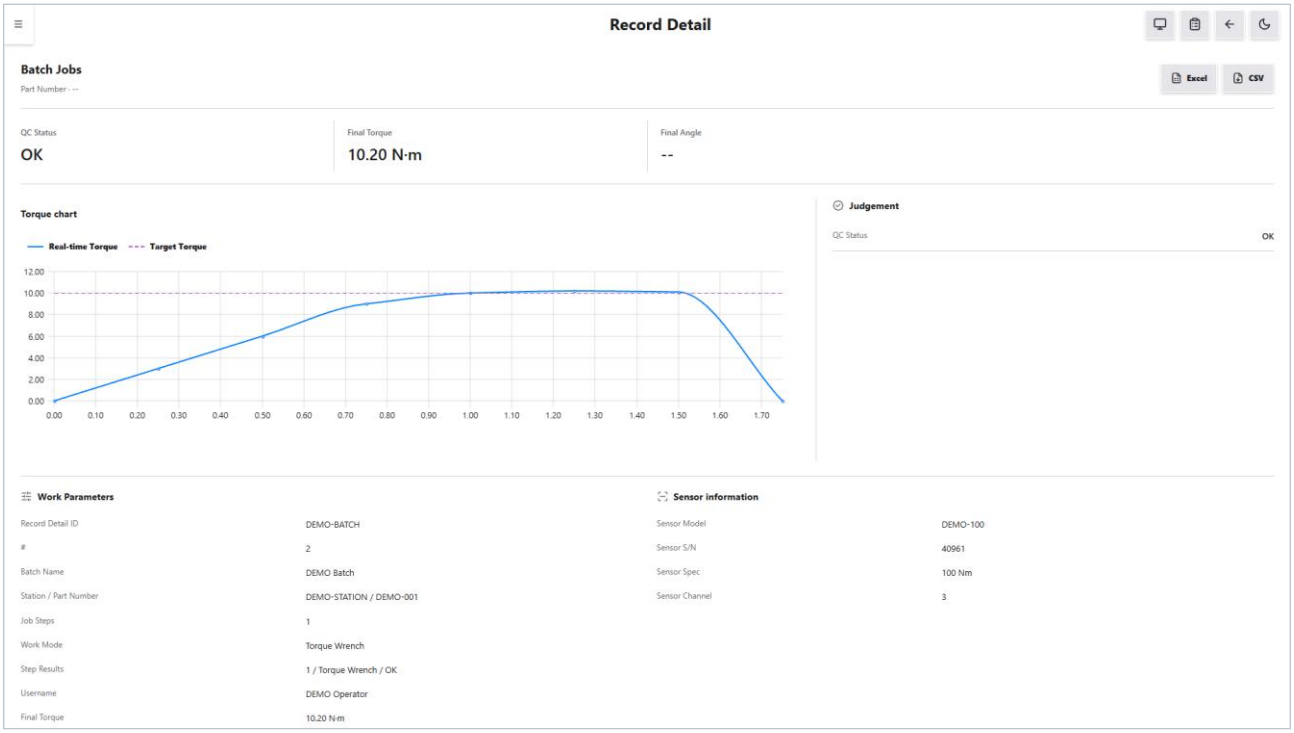

Figure 11-17 Batch job record detail

- The title area shows “Batch Jobs”. Below the title, “Part Number · --” is always shown, because batch records combine the station and part number in the single field “Station / Part Number”; use that field in “Work Parameters”.
- There are only three summary cards: “QC Status”, “Final Torque”, “Final Angle”.
- The chart depends on whether the step has a target angle: without a target angle, “Torque chart” and “Data Points”; with a target angle, “Torque / Angle Curve” and “Sample Data Detail”. If tolerance data is missing, only “Real-time Torque” and “Target Torque” are drawn.
- The “Judgement” area has only “QC Status”.
- “Work Parameters” are, in order: Record Detail ID, #, Batch Name, Station / Part Number, Job Steps, Work Mode, Step Results, Username, Final Torque, Final Angle, On Completion, Completed Steps, Cycle Count, Data Source Record Detail, QC Status, Time. There is no “Target Torque”, “Target Angle”, “Category”, “Group” or “Batch Number”; these fields are available in the list export file.

Field	Description
Batch Name	The name of the batch the step belongs to.
Station / Part Number	Station and part number shown together; if the station is blank, the first part is empty, and if the part number is blank, “--” is shown.
Job Steps	The step number of this record within the batch.
Work Mode	The work mode used by the step, for example “Torque Wrench”, “Torque & Angle”; not “Max Torque/Real-time Torque”.
Step Results	“Step / work mode / result” shown together, for example “1 / Torque Wrench / OK”.
Final Angle	The final angle of the step; the detail page shows only the number, without “°”.
On Completion	The action after the step is completed, shown as the raw system code, for example “cycle”.
Completed Steps/Cycle Count	The number of completed steps, and the number of times the batch has cycled.
Data Source Record Detail	The original record that produced this step, shown as “record type code / record ID”, for example “static_torque / …”.
QC Status	OK, NOK or “Rehit”.

11.8.3 Data points or curve samples

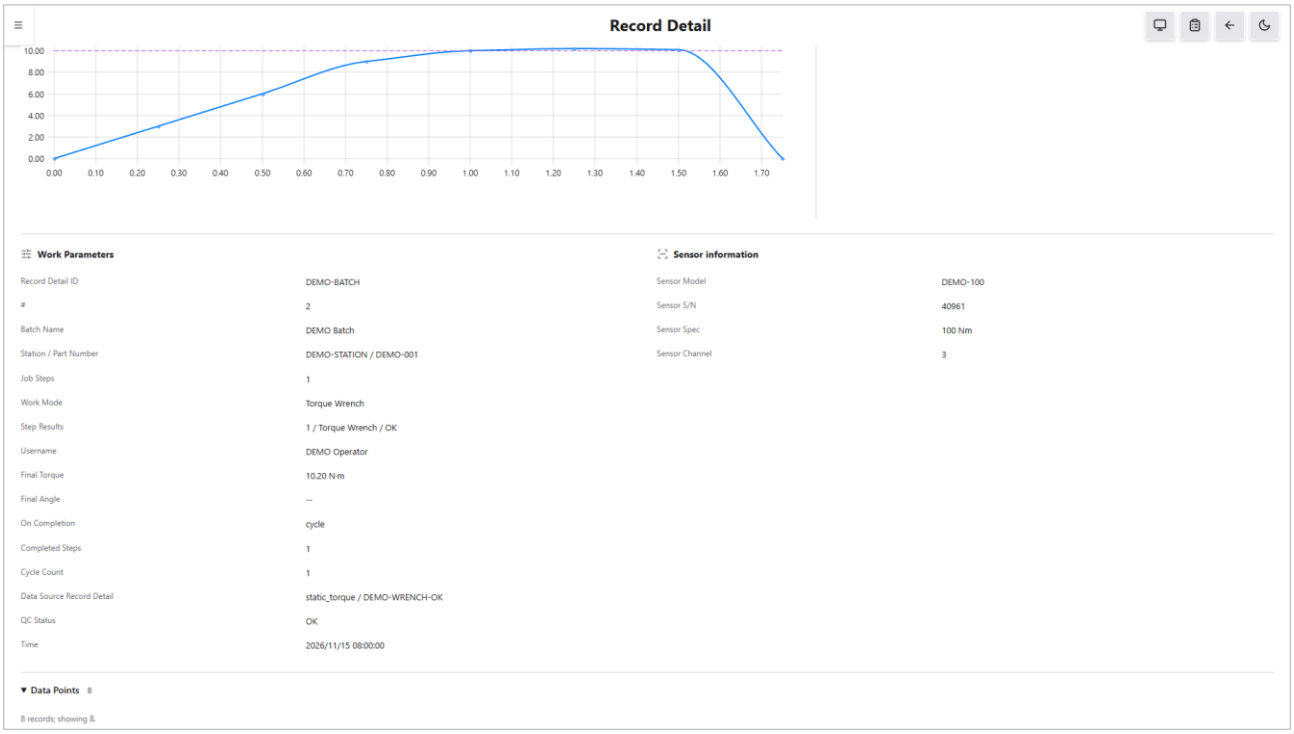

Figure 11-18 Batch job record detail: data points expanded

Steps without a target angle have “Data Points” (the “Angle” column is always 0.00); steps with a target angle have “Sample Data Detail” (the “Angle” column is the actual angle). For the operation, see Section 11.2.

11.8.4 Export columns

- **List export**: Time, Result, Target Torque, Final Torque, Target Angle, Final Angle, Category, Group, Batch Number, Batch Name, Station, Part Number, Username, On Completion, Completed Steps, Cycle Count, Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel. If “Part Number” is blank, “--” is filled in; if “Station” is blank, it is left empty; if a record has no saved batch number, “--” is filled in for “Batch Number” (see Section 11.8.1).
- The list export does **not** include the “Work Mode” of each step (Torque Wrench, Torque & Angle, etc.). If you need to analyze by step mode, check it in the detail page, or tell the steps apart by whether “Target Angle” has a value.
- **Detail export**: “Category” (Batch Jobs), the work parameter fields (without Record Detail ID, # and Work Mode), the four torque sensor columns, then the four sample columns. Chart in the detail Excel: steps without a target angle have “Torque chart”; steps with a target angle have “Torque / Angle Curve” and include the angle column.

Example Tracing which step in a batch is NOK
(1) In “Batch Name” on “Batch Jobs — Records”, enter part of the batch name, for example “LINE-A”, and set “Result” to “NOK”.
(2) One record remains in the list; open its detail. “Step Results” shows “2 / Torque & Angle / NOK”, which means step 2 was judged NOK in the torque & angle mode.
(3) “Final Torque” is 10.20 N·m and “Final Angle” is 85.30; note the “Time”.
(4) Go to “Torque & Angle — Records”, query with the same date, find the record with the same time, and use the example in Section 11.5 to determine whether the torque or the angle did not meet the requirement.

11.9 Capability index records

Each sample captured in the capability index test (Chapter 10) is saved as one record. Depending on the test mode at the time of capture, records are divided into three records pages: torque sensor mode, residual torque mode, and residual torque + torque sensor mode. Requires the “View · Work Records” permission; for the permissions needed to export and delete, see Section 11.1. For querying, exporting, deleting and pagination, see Section 11.2; this section describes only the fields specific to each page.

Note Capability index records have only two levels, list and detail. They have **no** chart, data points or curve samples. The detail export has only one row of field values, without sample data, and the Excel file has no chart. Do not apply the “Viewing data points” procedure of Section 11.2.

11.9.1 Common information

Path: Navigation menu → “Tool Capability” → “Tool Inspection” → “Work Records” at the top right (clipboard icon).

TMS opens the records page that matches the test mode of the current capability test settings:

Current test mode	Records page opened	Screens
Torque sensor mode	Tool Inspection / Torque Sensor Records	Figure 11-19, Figure 11-20
Residual torque mode	Tool Inspection / Residual Torque Records	Figure 11-21, Figure 11-22
Residual torque + torque sensor mode	Tool Inspection / Residual Torque + Torque Sensor Records	Figure 11-23, Figure 11-24

You can also select “Tool Inspection / Torque Sensor”, “Tool Inspection / Residual Torque” or “Tool Inspection / Residual Torque + Torque Sensor” in “Work mode filter” on “Records & export”.

- The page a record belongs to depends on the test mode used at capture. The three pages are independent: when the current mode is torque sensor mode, records captured earlier in residual torque mode do not appear on this page; go to “Records & export” and select the corresponding type.

- The judgement is only OK or NOK, so “Rehit” in the statistics bar and the “Rehit” option of “Result” always show 0 records.
- The “Tool Model” on the records page is the “Tool Number” of the capability test settings.
- Capability index records have no part number; below the detail title, “Part Number · --” is always shown.
- “Work” and “←” in the header both return to the “Tool Inspection” work screen, which shows the **current** test mode, not necessarily the mode of the records page you were just viewing.
- After you delete a capability index record, the Cpk/Cmk statistics of that test are recalculated and queued for sync (see “Deleting records” in Section 11.2).
- “Excel” and “CSV” in the detail export only this record: one row of column names plus one row of values, with “Category” as the first column. The default file name is “mode name-capture date”, for example “Tool Inspection - Torque Sensor-20261115.csv”.

11.9.2 Torque sensor mode records

Path: When the test mode is torque sensor mode, click “Work Records” on the capability index test work screen.

View each sample captured in torque sensor mode, together with the CPK and CMK calculated at the time of capture.

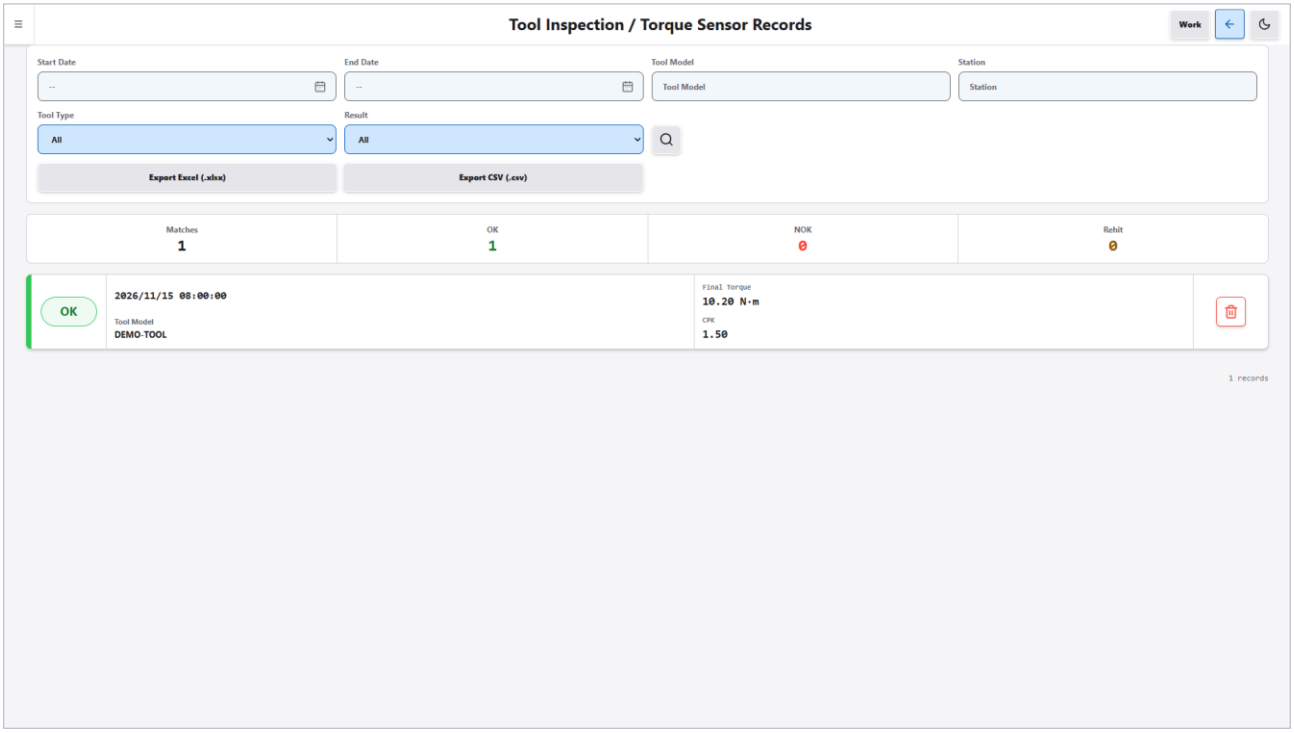

Figure 11-19 Capability index record list (torque sensor mode)

List

Field	Description	Range and default
Start Date/End Date	Capture date range; for how dates are compared, see Section 11.2	Blank means no limit
Tool Model	Matches the tool number on part of the text; placeholder text “Tool Model”	Blank means no limit
Station	Matches the station on part of the text; placeholder text “Station”	Blank means no limit
Tool Type	Filters by tool type; only this page has this filter	“All”, “Impact”, “Pulse”, “Torque Wrench”, “Clutch”; default “All”
Result	Filters by judgement	“All”, “OK”, “NOK”, “Rehit”; default “All”

From left to right, the record card shows the judgement badge, the time and “Tool Model”, “Final Torque” and “CPK”, and the red trash can. “CPK” shows “--” while the statistics window is not yet full (see Section 10.2).

List export columns (default file name “Tool Inspection - Torque Sensor-YYYYMMDD”, worksheet name “Tool Inspection - Torque Sensor”):

Export column	Content
Time, Result	Capture time; OK or NOK.
Final Torque, USL (Upper Spec. Limit), Target Torque, LSL (Lower Spec. Limit)	The captured torque and the specifications at that time, converted to the current torque unit with the unit attached.
Station, Tool Model, Tool Type	The capability test settings at capture.
Sensor Model, Sensor S/N	The sensor used for the capture.
Target Sample Count	The target sample count N at capture.
Sample No.	Row number in the export file, starting from 1; changes with filtering and sorting, and does not indicate the order of the sample within the collection round.
CP, CPK, CM, CMK	Capability indices at the time of capture; CPK and CMK with two decimal places, CP and CM output as raw unrounded values.
Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel	Sensor information at the time of capture.

Detail

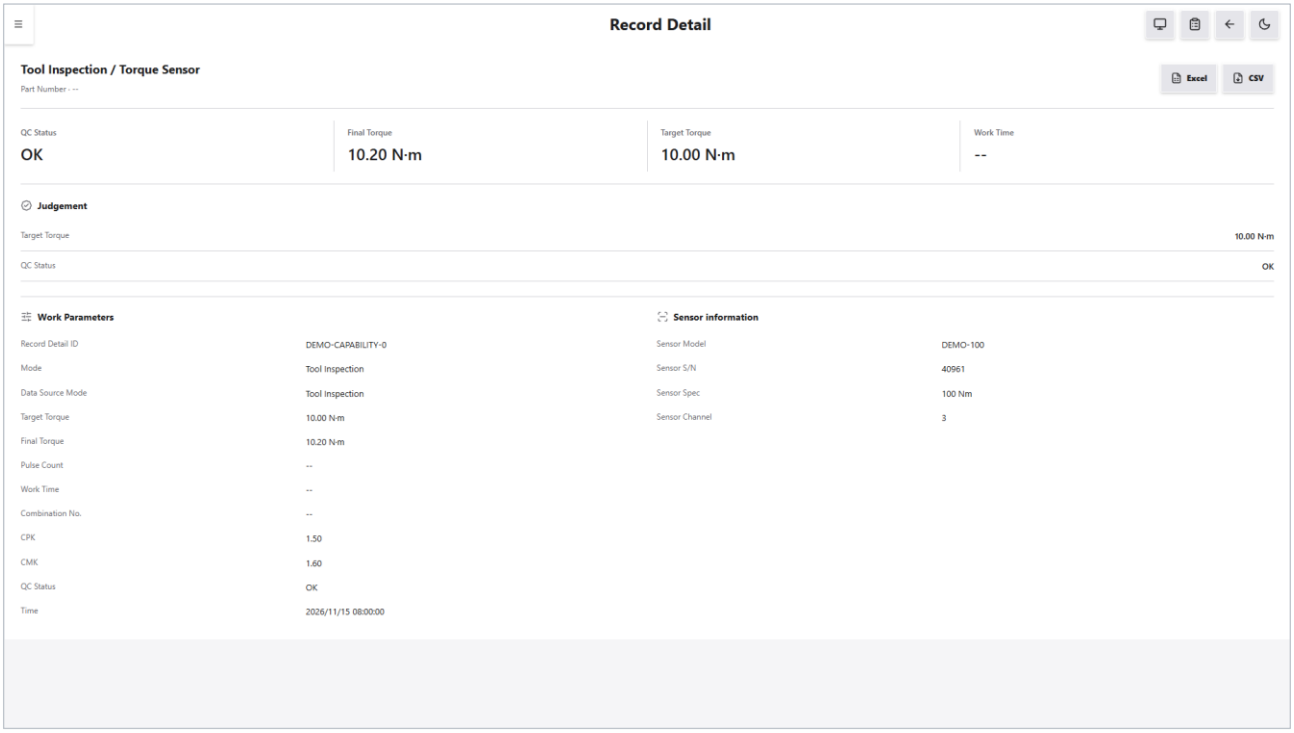

Figure 11-20 Capability index record detail (torque sensor mode)

- The title area shows “Tool Inspection / Torque Sensor” and “Part Number · --”, with “Excel” and “CSV” on the right.
- The summary cards are “QC Status”, “Final Torque”, “Target Torque”, “Work Time”; the “Judgement” area shows “Target Torque”, “QC Status”.
- Below are “Work Parameters” and “Sensor information”; there is no chart area.

Field	Description
Mode	The test mode at capture; this page shows “Tool Inspection”.
Data Source Mode	The capture source of this sample, for example “Tool Inspection”, “Manual Reference”.
Target Torque/Final Torque	The target torque at capture; the captured torque (with the global torque factor and multiplier applied, see Section 10.2).
Pulse Count	The maximum pulse count received in that tightening.
Work Time	Time from the start of that tightening to the maximum torque (seconds), that is, “Time at peak torque” on the work screen.
Combination No.	The combination number recorded at capture; “--” if there is none.
CPK/CMK	Cpk and Cmk calculated at the time of capture; they do not change when samples are added or deleted later.
QC Status/Time	Judgement result and capture time.

Tip The detail does not show the station, tool model, upper limit, lower limit, CP or CM. If you need these fields, use “Export Excel (.xlsx)” or “Export CSV (.csv)” in the list.

> **Example** Checking why a capability test sample is NOK
> Detail: “QC Status” NOK, “Final Torque” 10.62 N·m, “Target Torque” 10.00 N·m. The detail has no upper or lower limit.
> Go back to the list, click “Export Excel (.xlsx)”, and find the row with the same time in the file: “LSL (Lower Spec. Limit)” 9.50 N·m, “USL (Upper Spec. Limit)” 10.50 N·m.
> The capability test judges only by the upper and lower limits: 9.50 ≤ final torque ≤ 10.50 is OK. 10.62 > 10.50, which exceeds the upper limit by 0.12 N·m, so the result is NOK.

11.9.3 Residual torque mode records

Path: When the test mode is residual torque mode, click “Work Records” on the capability index test work screen.

View the samples captured in residual torque mode, and use the statistics cards and trend chart to follow the average and variation of the residual torque.

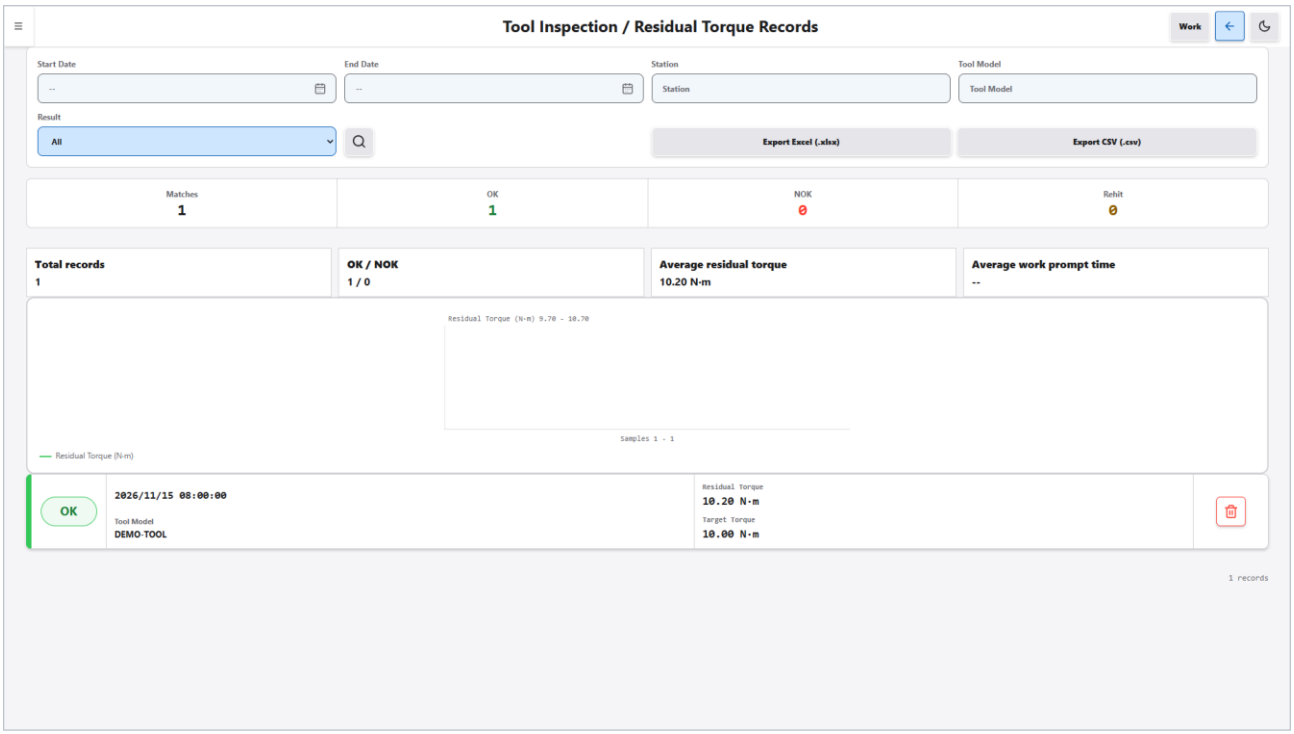

Figure 11-21 Capability index record list (residual torque mode)

List

- The filter fields are “Start Date”, “End Date”, “Station”, “Tool Model”, “Result”; there is **no** “Tool Type”. The rules are the same as in torque sensor mode.
- Below the statistics bar, this mode adds “Residual torque statistics” and a trend chart. Both are calculated from all records in the current filter result (not only the current page; at most 2000 records). If no records remain after filtering, neither is shown.

- On the right of the record card are “Residual Torque” and “Target Torque”.

Item	Description
Total records	Number of records in the current filter result.
OK / NOK	OK count / NOK count.
Average residual torque	Average of “Residual Torque” over all records (current torque unit).
Average work prompt time	Average of “Prompt Time (sec)” over all records; only records with a value are averaged; “--” if none has a value.
Trend chart	Residual torque of each record from oldest to newest; with only 1 record there is only one point and no line.
Residual Torque	The captured torque (with the global torque factor and multiplier applied, see Section 10.2).

List export columns (default file name “Tool Inspection - Residual Torque-YYYYMMDD”): Time, Result, Target Torque, Tolerance Type, Tolerance Range, Torque Factor, Residual Torque, Prompt Time (sec), Residual Torque Device Model, Residual Torque Device S/N, Station, Tool Model, OK Count, NOK Count, Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel.

- “Tolerance Range” = target torque × tolerance percentage saved in the record; it is not converted from the upper and lower limits. For the judgement, see Section 10.2.
- “Torque Factor” is the swing torque ÷ reference torque of the manual reference at capture, output as a raw value; “--” if not entered.
- “Residual Torque Device Model” and “Residual Torque Device S/N” are the torque sensor used for the capture.
- “OK Count” and “NOK Count” are always “--”. If you need the counts, look at “OK / NOK” above the list, or count by the “Result” column in the spreadsheet.

Detail

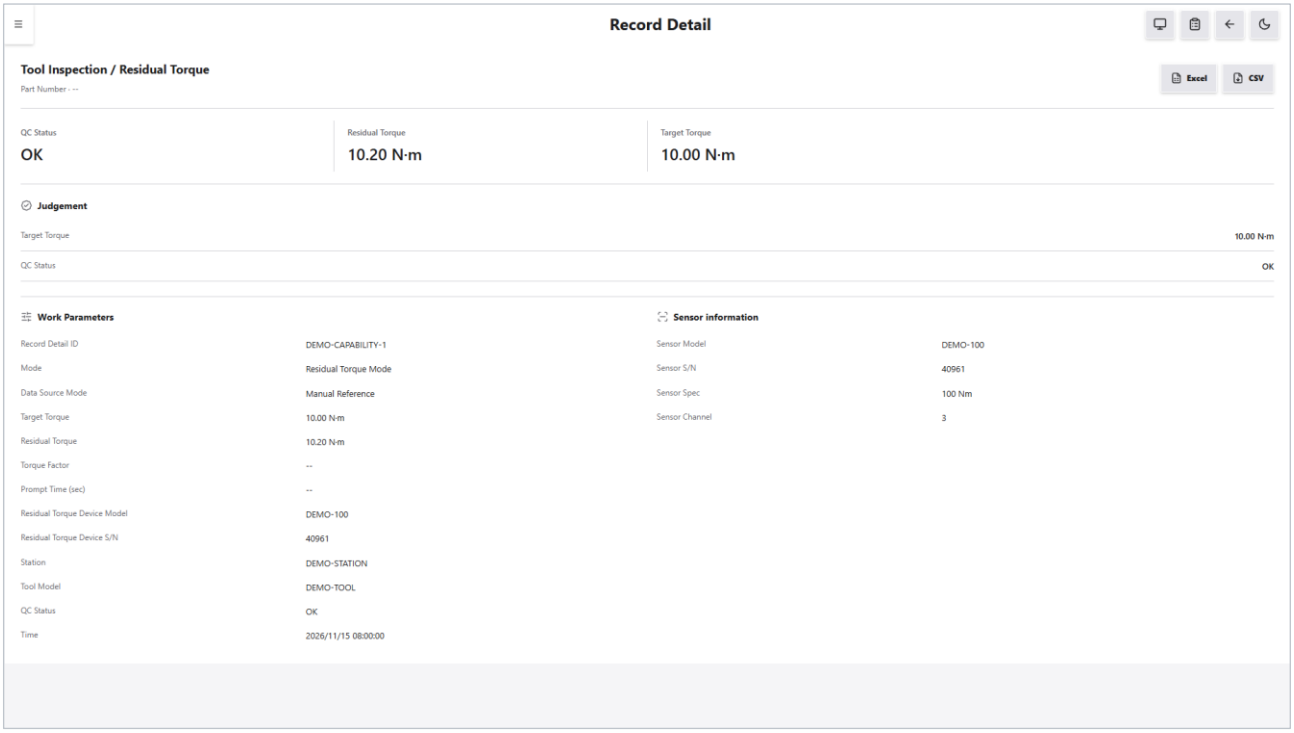

Figure 11-22 Capability index record detail (residual torque mode)

- The title area shows “Tool Inspection / Residual Torque” and “Part Number · --”.
- There are only three summary cards: “QC Status”, “Residual Torque”, “Target Torque”; the “Judgement” area shows “Target Torque”, “QC Status”.
- “Work Parameters”: Record Detail ID, Mode (“Residual Torque Mode”), Data Source Mode (for example “Residual Torque”, “Manual Reference”), Target Torque, Residual Torque, Torque Factor, Prompt Time (sec), Residual Torque Device Model, Residual Torque Device S/N, Station, Tool Model, QC Status, Time.
- The detail and export of this mode do not include CPK, CMK, the upper and lower limits or the combination number. The swing torque, rotation angle, reference torque, reference angle and other values entered in “Manual reference” on the work screen are neither shown nor exported on the records page, except as converted into “Torque Factor”.

Example Understanding “Average residual torque”
After filtering there are 3 records, with “Residual Torque” of 10.10, 10.30 and 9.90 N·m.
Average residual torque = (10.10 + 10.30 + 9.90) ÷ 3 = 30.30 ÷ 3 = 10.10 N·m; the statistics card shows “10.10 N·m”.
After you change “Result” to “NOK”, the statistics cards and the trend chart are recalculated from the NOK records only.

11.9.4 Residual torque + torque sensor mode records

Path: When the test mode is residual torque + torque sensor mode, click “Work Records” on the capability index test work screen.

Compare the torque measured by the torque sensor with the residual torque (reference torque) entered at capture.

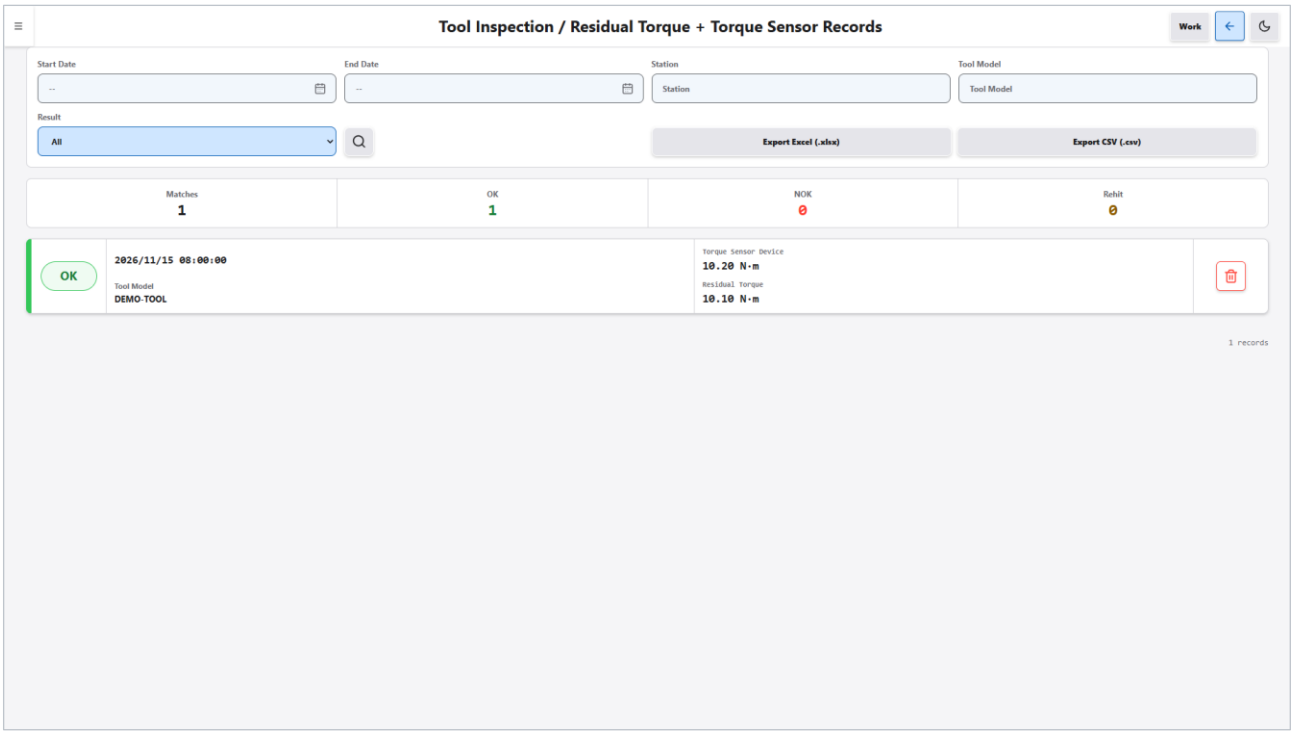

Figure 11-23 Capability index record list (residual torque + torque sensor mode)

List

- The filter fields are the same as in residual torque mode, without “Tool Type”.
- There are no residual torque statistics cards and no trend chart.
- On the right of the record card are “Torque Sensor Device” and “Residual Torque”.

Field	Description
Torque Sensor Device	The captured torque (with the global torque factor and multiplier applied); also the value used for the judgement and the statistics.
Residual Torque	The “Reference torque” entered in “Manual reference” at capture; not used for the judgement; “--” if nothing was entered at capture.

List export columns (default file name “Tool Inspection - Residual Torque + Torque Sensor-YYYYMMDD”): Time, Result, Torque Sensor Device, Residual Torque, Station, Tool Model, Residual Torque Device Model, Residual Torque Device S/N, Residual Torque Device Torque Factor, Torque Sensor Device Model, Torque Sensor Device S/N, Sensor Factor, OK Count, NOK Count, Sensor Model, Sensor S/N, Sensor Spec, Sensor Channel.

- “Residual Torque Device Torque Factor” is the swing torque ÷ reference torque, output as a raw value; “--” if not entered.
- “Residual Torque Device Model” and “Residual Torque Device S/N” are always blank; “Sensor Factor”, “OK Count” and “NOK Count” are always “--”.
- If a sensor column name is repeated, “(2)” is added to it automatically; both sets of sensor columns come from the same torque sensor.
- The list, detail and export of this mode do not include CPK, CMK or the upper and lower limits. To evaluate the capability indices, rely on the values on the work screen (see Chapter 10), or calculate them yourself from the “Torque Sensor Device” column of the export file.

Detail

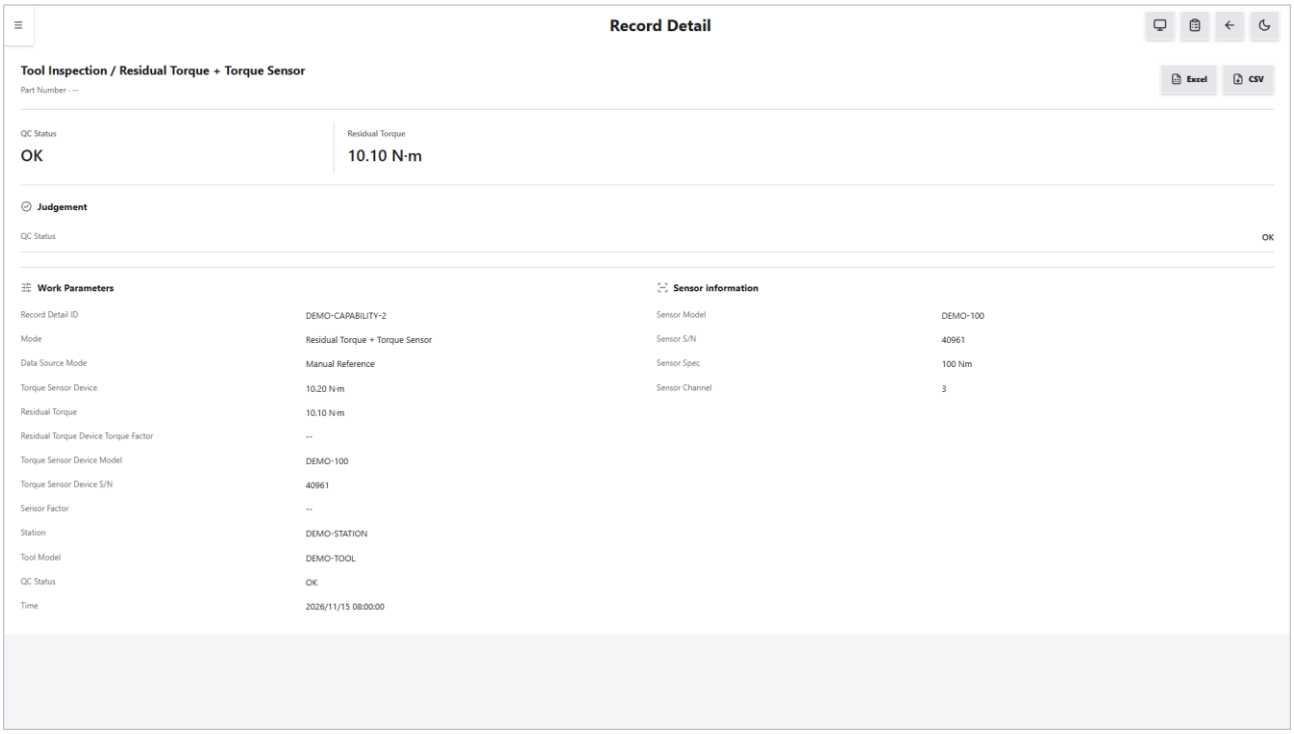

Figure 11-24 Capability index record detail (residual torque + torque sensor mode)

- The title area shows “Tool Inspection / Residual Torque + Torque Sensor” and “Part Number · --”.
- There are only two summary cards: “QC Status”, “Residual Torque”. The torque of the torque sensor is not in the summary cards; see “Torque Sensor Device” in “Work Parameters”.
- The “Judgement” area has only “QC Status”.
- “Work Parameters”: Record Detail ID, Mode (“Residual Torque + Torque Sensor”), Data Source Mode (for example “Residual Torque + Torque Sensor”, “Manual Reference”), Torque Sensor Device, Residual Torque, Residual Torque Device Torque Factor, Torque Sensor Device Model, Torque Sensor Device S/N, Sensor Factor, Station, Tool Model, QC Status, Time. “Torque Sensor Device Model” and “Torque Sensor Device S/N” in “Work Parameters” have the same content as “Sensor Model” and “Sensor S/N” in “Sensor information”.

Example "Residual Torque" shows "--"

A record shows "Torque Sensor Device" 10.20 N·m, "Residual Torque" --, "QC Status" OK.

"--" means that no "Reference torque" was entered in "Manual reference" before the capture. The judgement uses only "Torque Sensor Device", so the result is not affected.

A saved record cannot be filled in afterwards; before future captures, enter the reference torque first (see Chapter 10).

Chapter 12 System Settings: Global, Sensor and Auxiliary Settings

This chapter describes the settings in “System Settings” that relate to measuring devices: torque unit and language, RF sensor pairing, torque factor, torque multiplier, indicator light, and sensor error history.

12.1 System Settings Overview and Subpage Navigation

Path: Navigation menu → “System Settings”.

“System Settings” gathers all settings that are not work settings. The subpage list is on the left, and the content of the current subpage is on the right. Each time you enter System Settings, the “Global Settings” subpage is shown first.

Requires the “View · System Settings” permission; all three default templates A, B and C include it. Changing and saving on each subpage has its own permission requirements, described in each section; for how to set permissions, see Chapter 15.

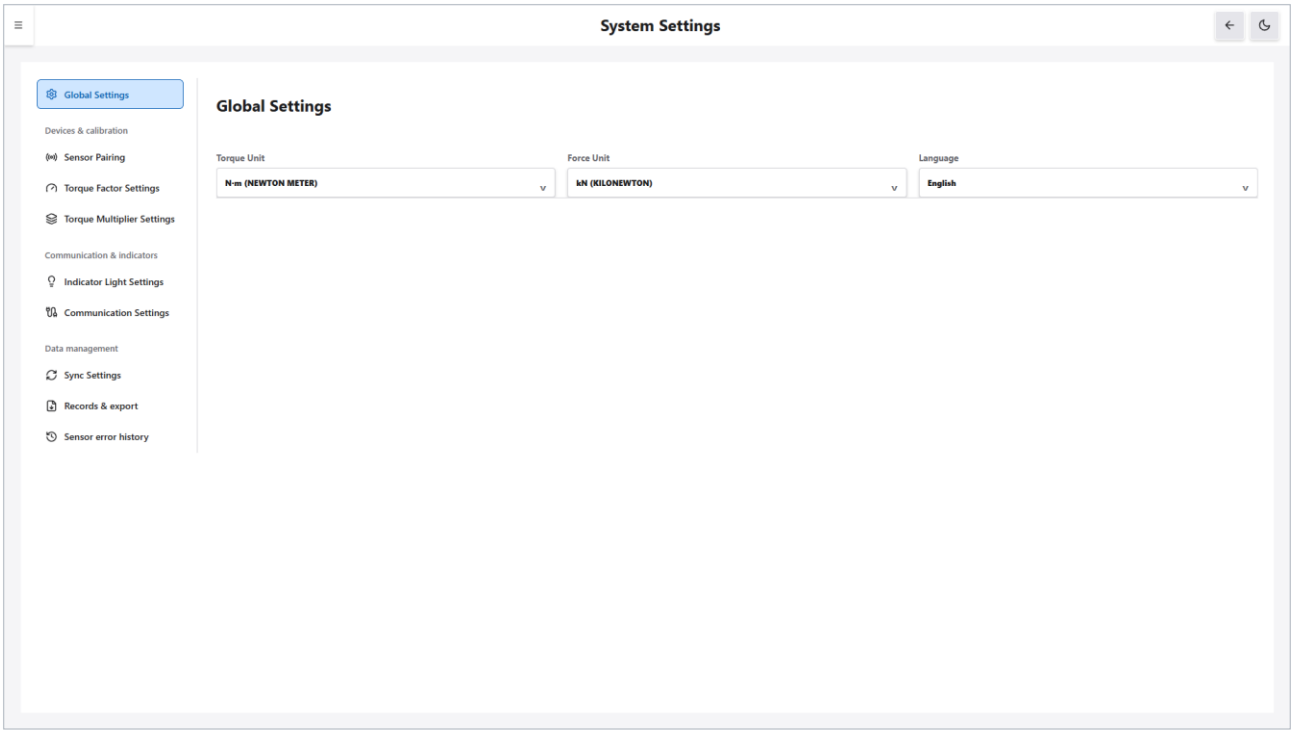

Figure 12-1 System Settings: Global Settings subpage

12.1.1 Screen Description

Area / button	Description
“Toggle navigation menu”	Expands or collapses the navigation menu.
Page title	On the “Global Settings” subpage it shows “System Settings”; when you switch to another subpage it changes to that subpage's title, for example “Torque Factor Settings”, “Torque Multiplier Settings” or “Indicator Light Settings”.
← (back)	On the “Global Settings” subpage: leaves System Settings and returns to the work screen you came from (to “Torque Wrench” if there was no previous work screen). On other subpages: returns to the “Global Settings” subpage. Nothing is saved.
Moon/sun icon (Toggle light / dark mode)	Switches the screen colors; does not affect any setting.
Subpage list on the left	Divided into four groups: “Global Settings”, “Devices & calibration”, “Communication & indicators” and “Data management”. Click a subpage name to switch to it; the current subpage is highlighted in blue. Hover the mouse over a subpage name to see a short description.
Content area on the right	Shows the content of the current subpage.

12.1.2 Subpage Overview

Subpage	Purpose	See
Global Settings	Torque unit, force unit, interface language	Section 12.2
Sensor Pairing	Connect the RF receiver; pair, switch and delete sensors	Section 12.3
Torque Factor Settings	Correct sensor readings with values measured by a reference instrument	Section 12.4
Torque Multiplier Settings	Set the torque ratio and gear ratio of each stage of the torque multiplier	Section 12.5
Indicator Light Settings	COM port and light tests for an external three-color light and buzzer	Section 12.6
Communication Settings	Modbus TCP, Modbus RTU, Open Protocol	Chapter 13
Sync Settings	Database sync and the read API	Chapter 14
Records & export	Search and export work records	Chapter 11
Sensor error history	View errors reported by sensors	Section 12.7
User Management (opened from the navigation menu; not in this page's list)	Accounts, roles and permissions	Chapter 15

12.1.3 Operating Steps

1. Click “Toggle navigation menu” at the top left to open the navigation menu, then click “System Settings”. The screen in Figure 12-1 appears, with “Global Settings” selected on the left.
2. Click the subpage you want to set on the left. The content on the right and the title at the top change together.
3. After making changes, click that subpage's own save button.
4. Click “Back” (←) at the top: on a subpage, you return to “Global Settings”; on “Global Settings”, you leave System Settings.

> **Note** Switching subpages or clicking “Back” does not save for you; unsaved changes are discarded. Click the subpage's save button first, then switch subpages.

> **Tip** When a sensor error appears on a work screen, click “Go to sensor pairing” in the error message to open the “Sensor Pairing” subpage directly. If the account does not have the “View · System Settings” permission, the error message shows a “Log Out” button instead.

12.1.4 Troubleshooting

Situation	Cause and solution
You cannot enter “System Settings” from the navigation menu	The account's “View · System Settings” permission is turned off. Ask an administrator to turn it on in “User Management” (see Chapter 15).
After switching subpages, the changes you just made are gone	Switching subpages does not keep unsaved content. Return to that subpage, enter the values again and save.

12.2 Global Settings

Path: Navigation menu → “System Settings” → “Global Settings” on the left (the default subpage when you enter System Settings).

Sets the torque unit, force unit and interface language. All three fields take effect as soon as you select a value; there is no save button.

Any account with the “View · System Settings” permission can change them. These choices are stored on this computer (for the current Windows user) and do not follow the login account: after anyone changes them, the next person who logs in sees the same settings.

For the screen, see Figure 12-1.

12.2.1 Fields

Field	Description	Range and default
Torque Unit	The unit in which “Records & export” shows torque, and the unit in which the read API returns torque. It does not change the unit on the work mode screens and does not rewrite saved records.	kgf·cm, kgf·m, N·m, ozf·in, lbf·in, lbf·ft; default N·m
Force Unit	Force unit options. The selection is not saved and does not affect any screen.	kN, N, lbf, kgf; kN is shown every time you open System Settings
Language	Interface display language. When you select one, the whole interface switches immediately; no restart is needed.	16 languages; at first startup it is applied automatically from the Windows display language, and English is used for unsupported languages

12.2.2 How the Torque Unit Affects Screens and Records

Location	Torque unit used
Settings screens and work screens of each work mode (target torque, final torque, range bar, curve)	The “Torque Unit” in that mode's settings screen (see Chapters 5 to 9)
Record list, record details, CSV/Excel export	The global “Torque Unit” (see Chapter 11)
Torque returned by the read API	The global “Torque Unit” (see Chapter 14)
The sensor's “Spec”	Always shown in Nm

Records are always stored in N·m and converted to the global torque unit for display. Values below 100 are shown with 2 decimal places, values from 100 to 999 with 1 decimal place, and values of 1000 or more as integers.

Unit	Value of 1 unit in N·m	50 N·m shown in records as
kgf·cm	0.0980665	509.9 kgf·cm
kgf·m	9.80665	5.10 kgf·m
N·m	1	50.00 N·m
ozf·in	0.00706155	7081 ozf·in
lbf·in	0.112985	442.5 lbf·in
lbf·ft	1.355818	36.88 lbf·ft

Example In the torque wrench settings, “Torque Unit” is N·m and “Target Torque” is 50. After you change the global “Torque Unit” to lbf·ft:
On the torque wrench settings screen and work screen, the target torque is still shown as 50 N·m (it follows the mode's own unit).
In “Records & export”, the target torque of the same record changes to 36.88 lbf·ft (50 ÷ 1.355818 ≈ 36.88).
Torque that external systems obtain through the read API is also calculated in lbf·ft.
After you change back to N·m, the record shows 50.00 N·m again; the saved data does not change at all.

12.2.3 Selection Windows

Click the “Torque Unit”, “Force Unit” or “Language” selection field to open the matching selection window. The checked, highlighted option is the current selection.

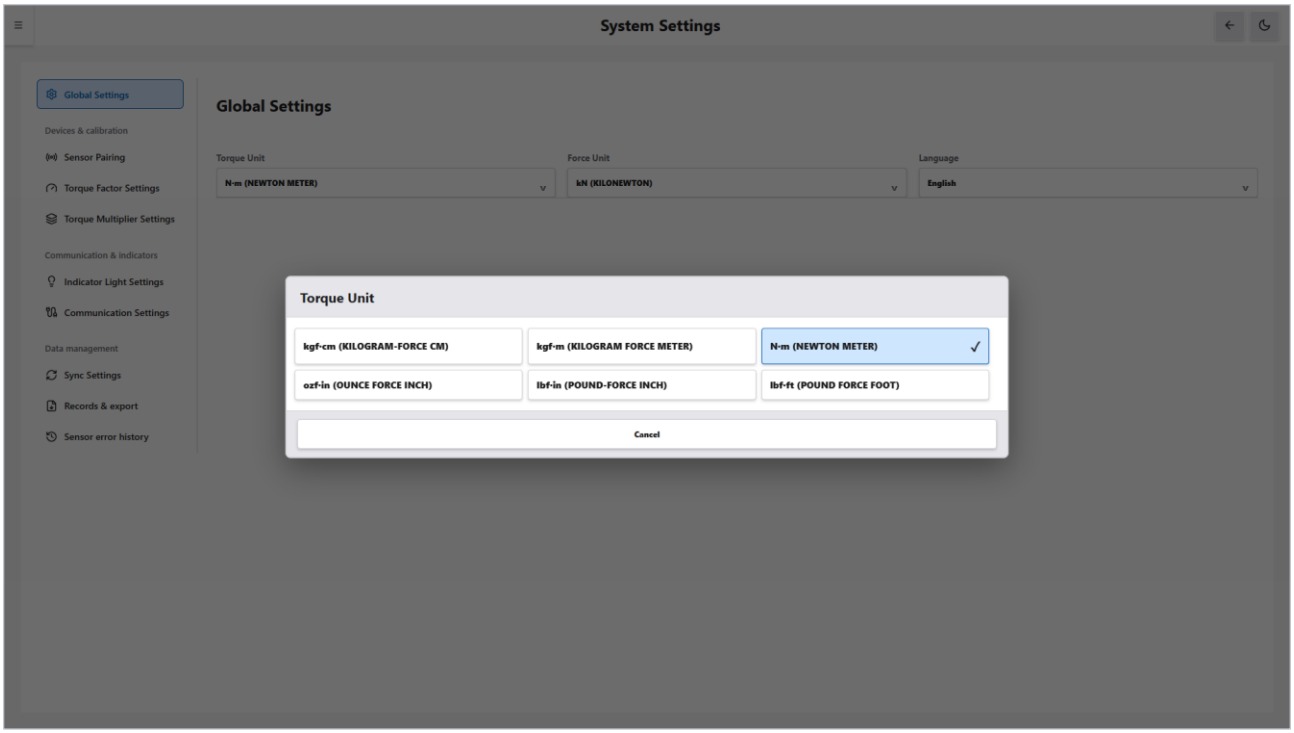

Figure 12-2 Torque unit selection window

The torque unit window shows the six units in three columns: “kgf·cm (KILOGRAM-FORCE CM)”, “kgf·m (KILOGRAM FORCE METER)”, “N·m (NEWTON METER)”, “ozf·in (OUNCE FORCE INCH)”, “lbf·in (POUND-FORCE INCH)”, “lbf·ft (POUND FORCE FOOT)”, with “Cancel” at the bottom.

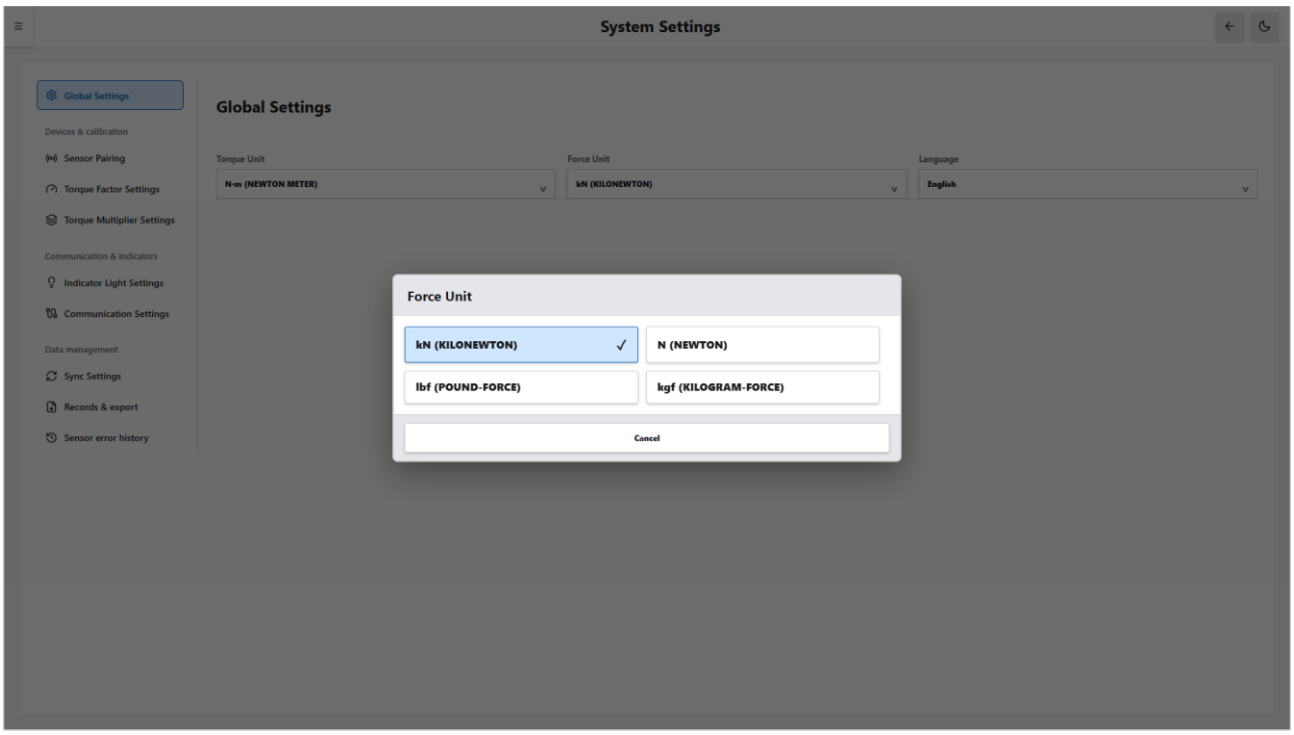

Figure 12-3 Force unit selection window

The force unit window shows the four options in two columns: “kN (KILONEWTON)”, “N (NEWTON)”, “lbf (POUND-FORCE)”, “kgf (KILOGRAM-FORCE)”, with “Cancel” at the bottom.

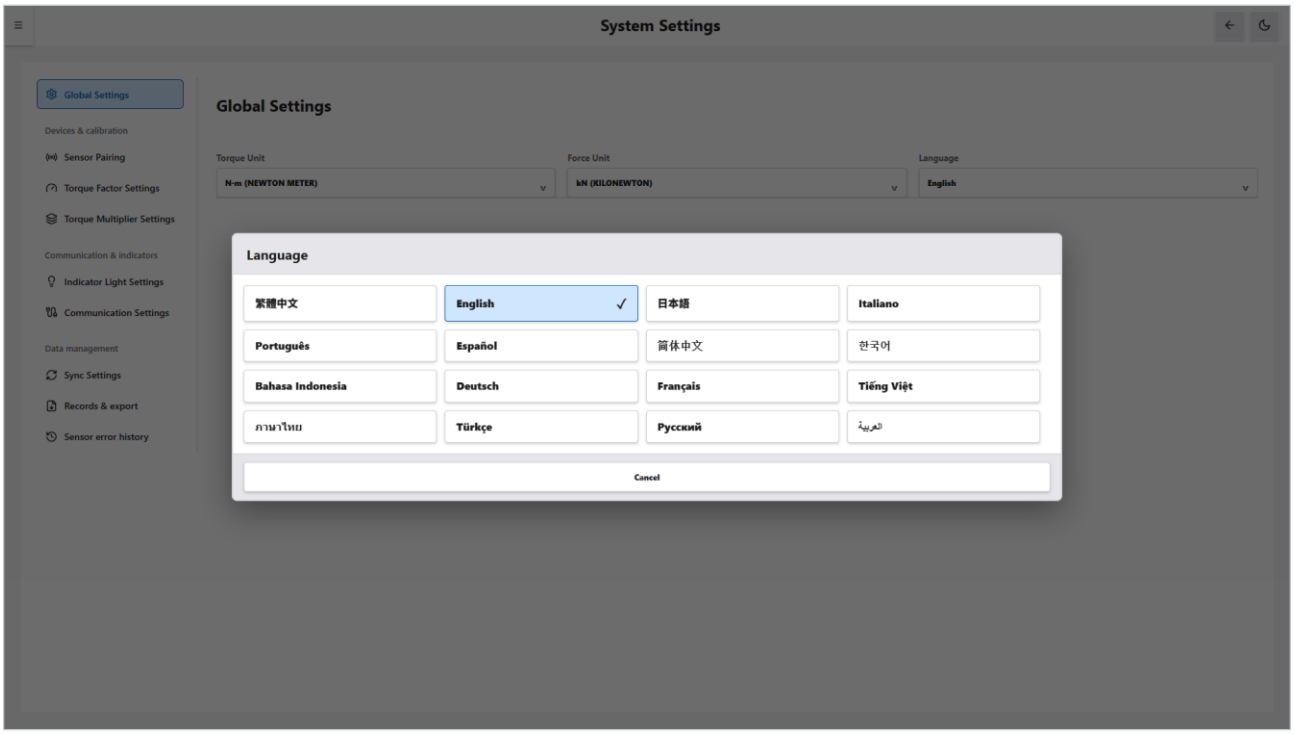

Figure 12-4 Language selection window

The language window shows the 16 languages in four columns, each written in its own language: 繁體中文 (Traditional Chinese), English, 日本語 (Japanese), Italiano (Italian), Português (Portuguese), Español (Spanish), 简体中文 (Simplified Chinese), 한국어 (Korean), Bahasa Indonesia (Indonesian),

Deutsch (German), Français (French), Tiếng Việt (Vietnamese), ภาษาไทย (Thai), Türkçe (Turkish), Русский (Russian), العربية (Arabic). “Cancel” is at the bottom.

Button	Description
“Torque Unit”, “Force Unit”, “Language” selection fields	Open the matching selection window.
Any option	Applies that option and closes the window. The torque unit and language are saved immediately; the force unit is not saved.
“Cancel”, the Esc key, or clicking the gray area outside the window	Closes the window without changing the current selection.
Arrow keys, Home, End	Move between options; press Enter or the Space bar to select.

12.2.4 Language and Date Format

- At first startup, the language is applied automatically from the Windows display language: Traditional Chinese Windows systems get “繁體中文”, other Chinese systems get “简体中文”; if the language is one of the 16 languages, that language is used; other languages get “English”.
- Once you have selected a language in the language window, your choice is always used from then on and no longer follows Windows.
- When you select “العربية”, the interface is laid out from right to left.
- The date and time format follows the Windows “Regional format”, not the interface language. To change the date format, go to Windows “Settings” → “Time & language” → “Language & region” → “Regional format”. The actual names may differ slightly depending on the Windows version.

> **Example** The interface language is set to “English” and the Windows regional format is “Chinese (Traditional, Taiwan)”. The times in records and in the error history are still shown in the Chinese (Taiwan) date format, while the interface text is in English.

12.2.5 Operating Steps

To change the torque unit:

1. Navigation menu → “System Settings”, and check that “Global Settings” is selected on the left (Figure 12-1).
2. Click the “Torque Unit” selection field. The window in Figure 12-2 appears, with the current unit checked.
3. Click the unit you want to use. The window closes and the selection field shows the new unit.
4. Go to “Records & export” and check that torque is now shown in the new unit (see Chapter 11).

To change the interface language:

1. In “Global Settings”, click the “Language” selection field. The window in Figure 12-4 appears.

2. Click the language you want to use. The whole interface changes to that language immediately; the choice is kept after you close and reopen the program.

12.2.6 Error Messages

Message on screen	Cause and solution
"API display unit is not synchronized."	After you changed the torque unit, the read API unit was not updated successfully, so external systems still receive the old unit. Click the refresh icon to the right of the message to retry; if it still fails, see Chapter 14.
You selected a language you cannot read	Click the third selection field (Language) in "Global Settings", and in the window find your language, which is always written in its own script (for example "English").
You changed the language, but the date format did not change	This is normal. The date format follows the Windows regional format; see the description above.

12.3 Sensors and RF Pairing

Path: Navigation menu → "System Settings" → "Sensor Pairing" on the left. The page title at the top is "Sensor Pairing".

Here you connect the RF 2.4G receiver (a wireless receiver that plugs into a USB port of the computer and appears as a COM port), pair torque sensors to a specified RF channel, and manage saved sensors. All work modes need pairing to be completed here first before they can get real-time readings.

To use the buttons and channel buttons on this page, including starting a pairing and deleting a saved sensor, you need the "Edit · Work Parameters, Pairing and Calibration" permission; detecting the receiver, connecting and switching sensors also require the "Run · Work" permission (templates A and B have both by default; template C does not have the former by default). Without these permissions you can open this page and view the saved list, but the buttons and channel buttons are grayed out, and the receiver is not detected automatically when you enter this page.

After a fresh installation the sensor list is empty, and you must complete the first pairing.

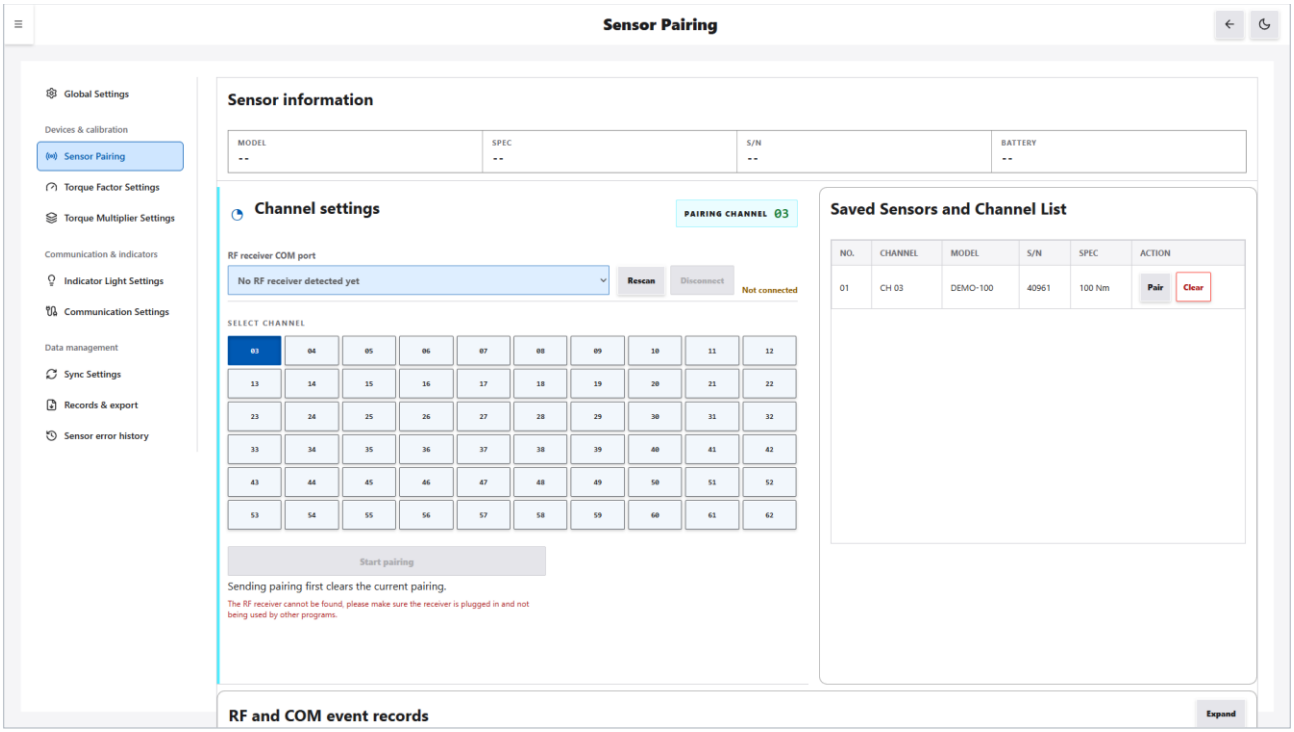

Figure 12-5 Sensor Pairing screen

Figure 12-5 shows the state where one sensor is already in the list but the computer has not detected a receiver: the COM field shows “No RF receiver detected yet”, the status is “Not connected”, and “Start pairing” is grayed out.

12.3.1 Screen Description

Area / button	Description
“Sensor information”	“Model”, “Spec”, “S/N” and “Battery” of the currently connected sensor. Shown only when the receiver is connected and data from this sensor has been received; otherwise “--”. While connected, the status is updated every 3 seconds.
“Pairing channel”	The currently selected channel (two digits). It only shows the channel you are about to use; it does not mean that pairing succeeded.
“RF receiver COM port”	The COM port of the receiver. If none is detected, it shows “No RF receiver detected yet” and cannot be selected. Selecting another port switches the connection immediately.
“Rescan”	Scans for and connects to the first available receiver (the port that last worked is tried first). Runs once automatically when you enter this page and no receiver is connected. Clicking it interrupts the current real-time readings.
“Disconnect”	Ends the connection to the receiver; saved sensors are not deleted. Can be clicked only while connected.
Connection status	“Not connected”, “Detecting RF receiver...” or “Connected COMx”.
“Select channel”	60 channel buttons from 03 to 62; the dark one is currently selected. It only changes the selection and does not send any packet.

Area / button	Description
“Start pairing”	First clears the current pairing, then sends the pairing packet and waits for the sensor to respond (about 1 second). Can be clicked only when the receiver is “Connected”. Below the button: “Sending pairing first clears the current pairing.”
“Saved Sensors and Channel List”	Lists up to 3 entries, sorted by channel in ascending order; each row has “Pair” and “Clear”. When there are more than 3, “View all (N)” appears at the top right (Figure 12-7).
“RF and COM event records”	Collapsed by default. Click “Expand” to show the latest 6 receiver events; you can click “pause” and “continue”, and “clear history” only clears the screen. Use it for troubleshooting.
← (back)	Returns to the “Global Settings” subpage.

12.3.2 Fields

Field	Description	Range and default
Model	Model reported by the sensor, for example “TTES” or “TTAS”	“--” when there is no data
Spec	Torque capacity (full scale) of the sensor; the target torque range in work settings is based on it	Shown in Nm; integers without decimals, other values with 2 decimal places; “--” when there is no data
S/N	Serial number of the sensor, used to identify the same sensor	Decimal digits; “--” when there is no data
Battery	Remaining battery charge of the sensor	0–100 %; updated only when it differs from the displayed value by 10 percentage points or more, so that the number does not jump; “--” when there is no data
Select channel / Pairing channel	RF channel used for this pairing	03–62; when saved sensors exist, the default is the channel of the first entry in the list, otherwise 03
No. (list)	Order in the list	01, 02, 03; not a property of the sensor
Channel (list)	Channel saved for that sensor	“CH 03” format

12.3.3 Connection and Pairing States

State	On the screen	Meaning
Not connected	Status “Not connected”; “Start pairing” and “Disconnect” are grayed out	Not yet connected to the RF receiver
Detecting	Status “Detecting RF receiver...”; buttons temporarily disabled	Scanning or switching COM ports

State	On the screen	Meaning
Connected	Status “Connected COMx”	You can start pairing or select a saved sensor
Pairing	All buttons temporarily disabled	Pairing has been sent; waiting for the sensor to respond
Pairing successful	Shows “Packet sent”, “Pairing result”, “Sent NN; tool reported NN” and “Channels match. The torque sensor reported the target pairing channel.”	The sensor responded on that channel
Channel mismatch	“Channels do not match. Make sure the tool is in pairing mode, then start pairing again.”	The channel reported by the sensor differs from the channel sent
List empty	“No saved torque sensor information is available yet.”	No sensor has been saved yet

12.3.4 Connecting the RF Receiver

1. Plug the RF 2.4G receiver into a USB port of the computer. Close programs that may occupy the COM port (for example, serial port monitoring tools).
2. Open “Sensor Pairing”. The program detects the receiver automatically; on success, the status shows “Connected COMx”.
3. If “Not connected” or an error message is shown, check that the receiver is plugged in properly and click “Rescan”.
4. If several receivers are connected to the computer, select the correct port in the “RF receiver COM port” menu.

12.3.5 Pairing a New Sensor

Before you start, check that the receiver is “Connected”, the sensor is powered on, and no work is in progress.

1. Put the sensor into pairing mode as described in the sensor's manual.
2. Click a channel in “Select channel”. If there are several sensors at the same site, use a different channel for each one. “Pairing channel” at the top right shows the selected channel.
3. Click “Start pairing”. After about 1 second, the screen shows “Packet sent” and “Pairing result”.
4. Check that “Pairing result” shows “Channels match. The torque sensor reported the target pairing channel.”. “Sensor information” shows the model, spec, serial number and battery, and the sensor appears in the list on the right.
5. Click “Back” and select this sensor on each work settings page (see Chapters 5 to 10).

Example Pair a sensor with a capacity of 100 N·m on channel 15.
Plug in the receiver; the status shows “Connected COM5” (the port number depends on the computer).
Put the sensor into pairing mode and click channel “15”; “Pairing channel” at the top right shows 15.
Click “Start pairing”; “Pairing result” shows “Sent 15; tool reported 15” and “Channels match. The torque sensor reported the target pairing channel.”.
“Spec” in “Sensor information” shows 100 Nm, and a new row “CH 15” is added to the list.

12.3.6 Switching to a Saved Sensor

“Pair” in the list reconnects that sensor using its saved data without sending a pairing packet again, and switches the channel to that sensor's channel.

1. End any work in progress. You cannot switch sensors while work is in progress.
2. Check that the status is “Connected COMx” and that the sensor you want to use is powered on.
3. In the list, click “Pair” for that sensor. If the list has more than 3 entries, click “View all (N)” and then click “Select” in that row of the window.
4. “Pairing channel” at the top right switches to that sensor's channel; once a response is received, “Sensor information” shows its model, serial number and battery.

12.3.7 Deleting a Saved Sensor

Deleting does not require a receiver connection.

1. In the list (or in the “All saved sensors” window), click “Clear” for that sensor.
2. The confirmation dialog “Clear this saved sensor pairing record? This cannot be undone.” appears. Click “Clear” to delete it; click “Cancel” to keep it.
3. The row disappears from the list.
4. Go back to each work settings page that uses this sensor, confirm the sensor again and save.

Warning “Clear” deletes the saved data of this sensor and cannot be undone. All work settings that use it (Torque Wrench, Torque & Angle, Torque Inspection, Power Tool, Batch Jobs, Tool Inspection) become not set up; if other saved sensors exist, these settings are re-bound to the currently active sensor (or to the most recently added sensor if no sensor is active). Check the serial number before you delete. Completed work records are not affected.

12.3.8 Fresh Installation: Empty Sensor List

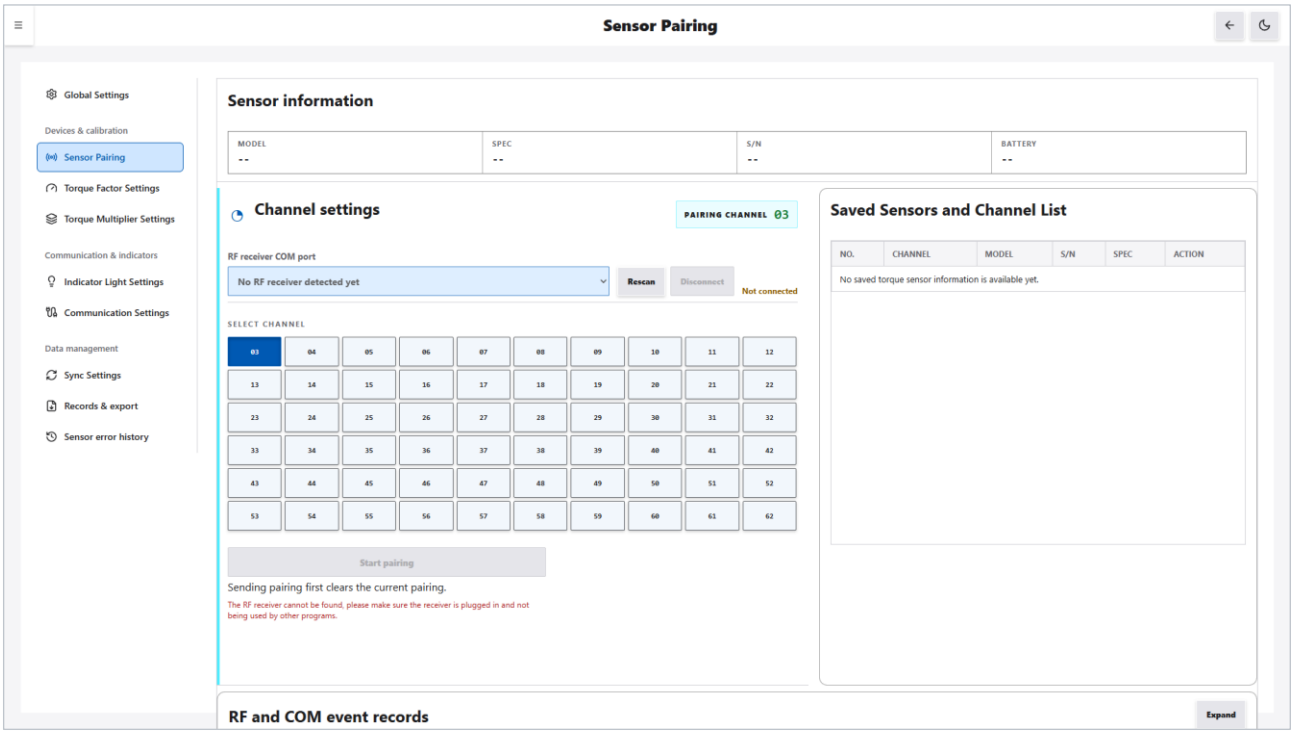

Figure 12-6 Sensor Pairing screen: empty list

After a fresh installation, before any sensor has been paired, the list area shows “No saved torque sensor information is available yet.”, all four boxes of “Sensor information” show “--”, and “Pairing channel” is 03. If no receiver is connected to the computer, “The RF receiver cannot be found, please make sure the receiver is plugged in and not being used by other programs.” is shown below.

- Complete the first pairing by following “Pairing a New Sensor” in this section.
- An empty list is different from a read failure: when reading fails, the red text “Unable to read torque sensor information.” is also shown.

12.3.9 All Saved Sensors Window

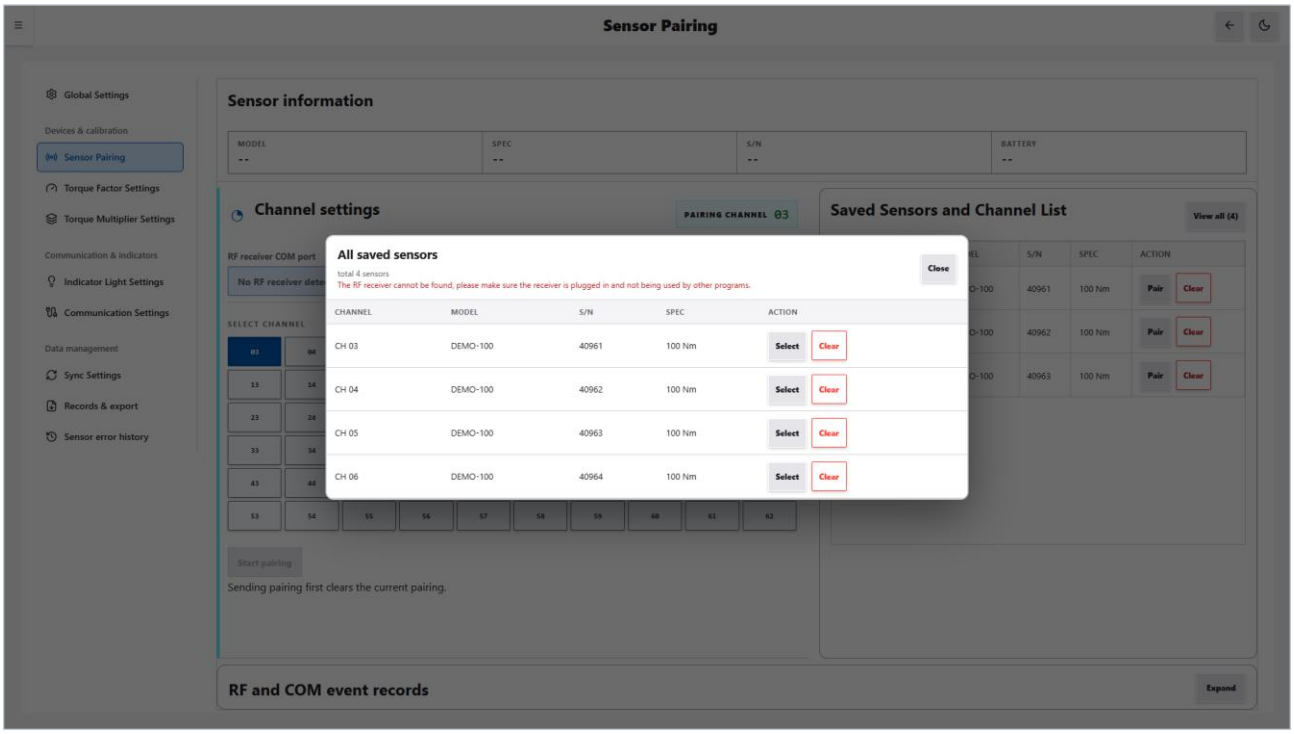

Figure 12-7 All saved sensors window

When more than 3 sensors are saved, click “View all (N)” at the top right of the list to open this window.

Area / button	Description
“All saved sensors” and “total N sensors”	Window title and total count. If an error occurs, the error message is shown below the title.
Table	“Channel”, “Model”, “S/N”, “Spec”, “Action”; lists all sensors sorted by channel in ascending order.
“Select”	Closes the window and reconnects that sensor using its saved data (same as “Pair” in the list). If the receiver is not connected, the main screen shows “Please connect to the RF receiver first.”
“Clear”	Deletes the sensor after confirmation (see “Deleting a Saved Sensor” in this section). The window stays open, the row disappears, and “total N sensors” decreases accordingly.
“Close”, the Esc key, or clicking the gray area outside the window	Closes the window.

Without the “Edit · Work Parameters, Pairing and Calibration” permission, “Select” and “Clear” are grayed out, and you can only view.

12.3.10 Error Messages

Message on screen	Cause and solution
“The RF receiver cannot be found, please make sure the receiver is plugged in and not being used by other programs.”	No receiver was found by the scan. Unplug and replug the receiver, close programs that may occupy the COM port, then click “Rescan”.
“RF receiver detection failed.”	An error occurred during detection. Same solution as above; if it still fails, expand “RF and COM event records”, write down the content and report it as described in Chapter 16.
“Failed to write to the RF receiver. Make sure the COM port is not in use, then run detection again.”	Cannot write to the COM port. Close the program that occupies the port, then click “Rescan”.
“The RF receiver timed out. Make sure the torque sensor is powered on and in pairing mode.”	No response was received within about 1 second after pairing was sent. Check that the sensor is powered on and in pairing mode, then click “Start pairing”.
“Channels do not match. Make sure the tool is in pairing mode, then start pairing again.”	The channel reported by the sensor differs from the channel sent. Put the sensor into pairing mode again and send again.
“Please connect to the RF receiver first.”	“Pair”, “Select” or “Start pairing” was clicked while the receiver was not connected. Click “Rescan” first until “Connected COMx” is shown.
“The selected channel must be between 03 and 62.”	The channel is out of range. Click a channel from 03 to 62 again.
“Failed to send the pairing command.”	Sending the pairing command or receiving the response failed. Check that the receiver is connected and try again.
“Unable to switch to the selected RF receiver COM port.”	The port selected in the menu cannot be connected; the menu automatically returns to the original port. Check the receiver on that port and try again.
“Unable to disconnect the RF receiver.”	Disconnecting failed. Wait a moment and click again; if it still fails, restart the program.
“Unable to read torque sensor information.”	Reading the list, updating the status or selecting a sensor failed, including when a sensor switch is rejected because work is in progress. End the work first, check that the receiver is connected, then click “Pair” again.
“Failed to delete the saved sensor.”	Deletion failed; the data was not deleted. Try again; if it still fails, restart the program.

12.4 Torque Factor

Path: Navigation menu → “System Settings” → “Torque Factor Settings” on the left. The page title at the top is “Torque Factor Settings”.

Uses values measured by an external reference instrument (for example, a torque meter used for calibration) to correct the ratio difference between the sensor reading and the actual torque. The program reads the “Displayed Torque” of the selected sensor automatically, you enter the “Measured Torque” measured by the reference instrument, and the program calculates:

Torque Factor = Measured Torque ÷ Displayed Torque

After saving, torque during work = sensor reading × torque factor; when the torque multiplier is turned on in the work settings, it is also multiplied by the torque ratio (see Section 12.5).

Viewing this page requires the “View · Work Settings” permission (all three templates have it by default); changing and saving require the “Edit · Work Parameters, Pairing and Calibration” permission (templates A and B have it by default, template C does not). Without the edit permission, you can still load saved configurations to view them, but the fields, “Add Configuration” and “Save Configuration” are grayed out.

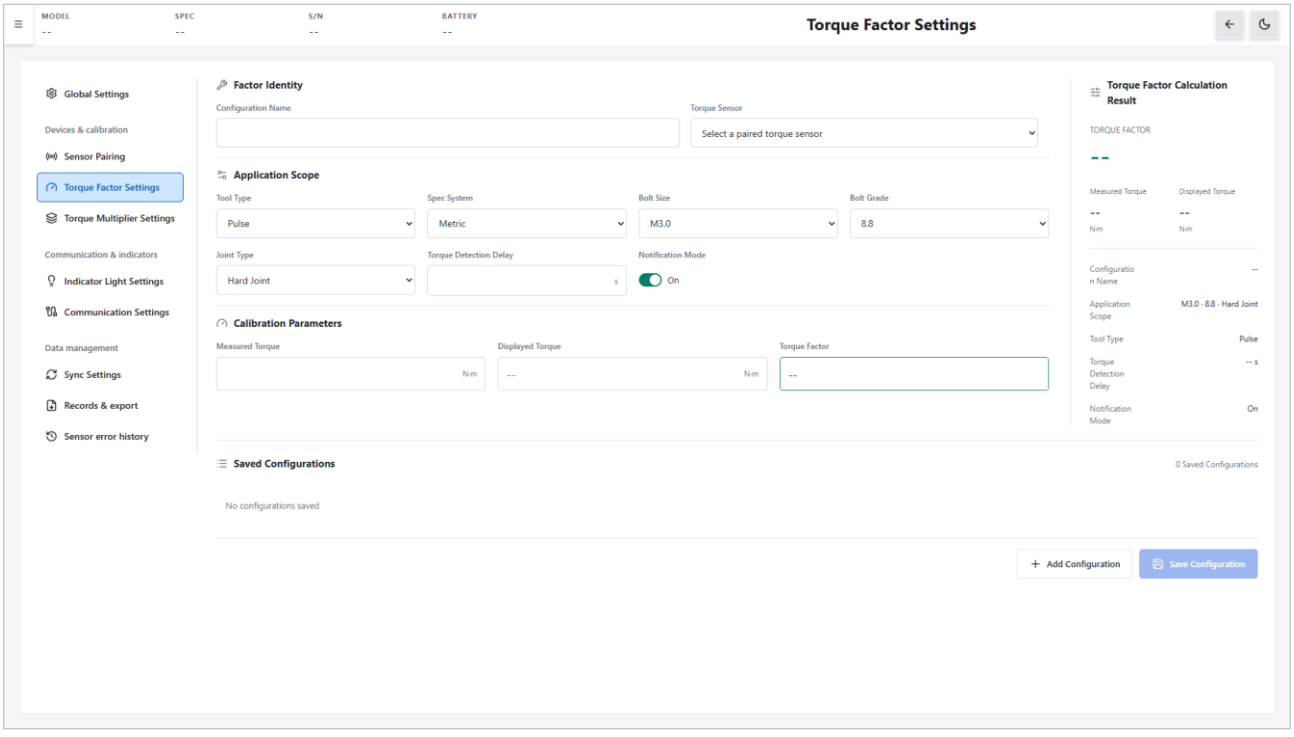

Figure 12-8 Torque Factor Settings screen

Figure 12-8 shows the state where no sensor is selected and there are no saved configurations: “Displayed Torque” and “Torque Factor” show “--”, “Saved Configurations” shows “0 Saved Configurations” and “No configurations saved”, and “Save Configuration” is grayed out.

12.4.1 Screen Description

Area / button	Description
“Model”, “Spec”, “S/N”, “Battery” at the top	Data of the sensor selected in “Torque Sensor”; “--” when none is selected.
“Factor Identity”	“Configuration Name” and “Torque Sensor”.
“Application Scope”	Records the situation this factor applies to: “Tool Type”, “Spec System”, “Bolt Size”, “Bolt Grade”, “Joint Type”, “Torque Detection Delay” and “Notification Mode”. These fields are for reference only and do not change work judgements.
“Calibration Parameters”	“Measured Torque” (entered), “Displayed Torque” (read automatically), “Torque Factor” (calculated automatically).
“Torque Factor Calculation Result” (right side)	Shows the currently calculated torque factor in large text and lists the measured torque, displayed torque, configuration name and application scope, so that you can check them before saving.
“Saved Configurations”	Shows “N Saved Configurations” at the top right. The table lists configuration name, tool type, bolt size, joint type, measured torque, displayed torque and torque factor, sorted by save time from newest to oldest; the currently loaded row is highlighted. When there is no data, “No configurations saved” is shown.
Folder icon (load)	Fills the form with that configuration and waits again for a “Displayed Torque” reading. Loading alone does not apply it.
“Add Configuration”	Resets the form to the defaults (the “Torque Sensor” selection is kept); clicking “Save Configuration” afterwards adds a new entry. Unsaved changes are cleared without asking.
“Save Configuration”	Calculates and saves using the current “Measured Torque” and the “Displayed Torque” at the moment you click. If the form holds a loaded existing configuration, that entry is overwritten; after “Add Configuration”, a new entry is added. Grayed out when “Displayed Torque” has no valid reading.
← (back)	Returns to the “Global Settings” subpage; unsaved changes are not kept.

This page has no function for deleting saved configurations.

12.4.2 Fields

Field	Description	Range and default
Configuration Name	Identifies this factor	Required; leading and trailing spaces are removed; empty by default
Torque Sensor	Specifies which sensor “Displayed Torque” is read from; used only to read the calibration value and not saved with the factor	Required; a paired sensor; default “Select a paired torque sensor”, not selected automatically
Tool Type	Applicable tool	“Pulse”, “Clutch”; default “Pulse”
Spec System	Bolt specification system	“Metric”, “Imperial”; default “Metric”

Field	Description	Range and default
Bolt Size	Applicable bolt size	M1.6, M2.0, M3.0, M4.0; default M3.0
Bolt Grade	Bolt strength grade	4.6, 8.8, 10.9, 12.9; default 8.8
Joint Type	Joint characteristic	“Soft Joint”, “Hard Joint”; default “Hard Joint”
Torque Detection Delay	Seconds recorded for the application scope	Required; 0.5–5.0 s, step 0.1; empty by default
Notification Mode	Notification setting recorded for the application scope	“On”, “Off”; default “On”
Measured Torque	Actual torque measured by the external reference instrument (numerator of the formula)	Required; N·m, 0 or more, step 0.01, no upper limit; does not change with the global torque unit
Displayed Torque	Real-time reading of the selected sensor at the same moment (denominator of the formula), not multiplied by the torque factor or the torque multiplier; cannot be entered manually	N·m, shown with 2 decimal places; must be greater than 0 to save
Torque Factor	Measured Torque ÷ Displayed Torque, calculated as you type	0 or more, no upper limit; shown with 4 decimal places, the full unrounded value is saved; “--” when it cannot be calculated

12.4.3 How the Factor Is Applied to Work

- Work uses the factor of “the most recently saved configuration with a factor greater than 0”. It does not distinguish between sensors and does not choose by “Application Scope”.
- If no factor has ever been saved, work calculates with a factor of 1, that is, no correction.
- Configurations with a factor of 0 are skipped, and the previous factor greater than 0 is used instead; if there is none, 1 is used. Do not use 0 as a way to disable the factor.
- After you load an old configuration, you must click “Save Configuration” again while there is a real-time reading for it to become the factor used in work; when it is saved, it is recalculated with the displayed torque at that moment.
- A new factor affects only later work; completed records are not rewritten.

12.4.4 Operating Steps

Before you start, check that the receiver is “Connected”, the sensor to calibrate is the currently active sensor (see Section 12.3), and there is no sensor error that stops work; the external reference instrument must be able to take the load at the same time as the sensor and give a reading.

1. Open “Torque Factor Settings”. If configurations were saved before, the form first loads the most recently saved one.

2. To create a new factor, click “Add Configuration”; to update an existing factor, click the folder icon of that row in “Saved Configurations”.
3. Enter “Configuration Name” and select the sensor to calibrate in “Torque Sensor”. The top bar shows its model, spec and serial number.
4. Select each field of “Application Scope”, and enter a value between 0.5 and 5.0 in “Torque Detection Delay”.
5. Apply torque to the sensor and the reference instrument at the same time and hold it. “Displayed Torque” shows a reading greater than 0, and “Save Configuration” becomes available.
6. Enter the reference instrument's reading (N·m) in “Measured Torque”. “Torque Factor” and “Torque Factor Calculation Result” on the right show the result immediately.
7. While the torque is still held and “Displayed Torque” still has a reading, click “Save Configuration”. The screen shows “Torque factor settings saved.”, and the entry appears at the top of “Saved Configurations”, marked as currently loaded.
8. Measure on a work screen and check that the result uses the new factor (see Chapters 5 to 9).

Example The reference instrument measures 60.0 N·m, and at the same moment “Displayed Torque” is 57.00 N·m.
Torque factor = 60.0 ÷ 57.0 ≈ 1.0526 (the screen shows 4 decimal places; the full value 1.052631… is saved).
After saving, when the sensor reads 57.0 N·m, work torque = 57.0 × 1.0526 ≈ 60.0 N·m, which matches the reference instrument.
With the same factor, when the sensor reads 38.0 N·m, work torque = 38.0 × 1.0526 ≈ 40.0 N·m.

Tip Saving uses the “Displayed Torque” at the moment you click “Save Configuration”. If the torque changes while you are typing, the displayed torque and the factor change with it; check “Torque Factor Calculation Result” on the right before you click.

Note “Displayed Torque” reads only the currently active sensor. If no sensor is selected, the reading is 0, there has been no new reading for more than 3 seconds, the receiver is disconnected, or the sensor has an error that stops work, “Displayed Torque” returns to “--” and you cannot save.

12.4.5 Error Messages

Message on screen	Cause and solution
“Save Configuration” stays grayed out	No edit permission, still loading, or “Displayed Torque” is “--”. Check the permission; in “Sensor Pairing”, check that the receiver is connected and the sensor is selected; apply a torque greater than 0 to the sensor.
“Torque detection delay must be between 0.5 and 5.0 seconds.”	The seconds value is empty or out of range. Enter a value from 0.5 to 5.0.
“Measured torque must be zero or greater.”	The measured torque is empty or negative. Enter the reading of the reference instrument.

Message on screen	Cause and solution
“Realtime torque monitoring is unavailable.”	When you clicked save, no sensor was selected, the reading had not been updated for more than 3 seconds, or reading the sensor list failed. Select the sensor again, keep applying torque, then click “Save Configuration”; if it still fails, check the connection in “Sensor Pairing”.
“Torque factor must be zero or greater.”	A valid factor cannot be calculated. Check that both “Measured Torque” and “Displayed Torque” have values, then try again.
“Failed to save torque factor settings.” (cause: “Configuration Name” or another required field is empty)	“Configuration Name” or another required option is empty. Fill it in and save again.
“Failed to save torque factor settings.” (cause: the loaded configuration no longer exists)	The loaded configuration no longer exists. Click “Add Configuration” to create it again.
“Failed to save torque factor settings.”	Another save error. Try again later; if it still fails, report it as described in Chapter 16.
“Failed to load torque factor settings.”	Reading the saved list failed. Switch to another subpage and come back to reload it. If “Torque factor settings saved.” is also shown, the settings were saved; only the list was not updated.

12.5 Torque Multiplier

Path: Navigation menu → “System Settings” → “Torque Multiplier Settings” on the left. The page title at the top is “Torque Multiplier Settings”.

When the sensor is mounted on the input side of a torque multiplier (torque intensifier), set the “Gear Ratio” and “Torque Ratio” of each stage of the multiplier on this page. The program multiplies the stages in use to get the “Total Torque Ratio” and the “Total Gear Ratio”, and converts as follows:

- Output torque = sensor torque × total torque ratio
- Output angle = sensor angle ÷ total gear ratio

This page holds one set of settings shared by the whole computer. Each work setting has its own “Enable torque multiplier” switch, and only work with the switch set to “On” applies the torque multiplier ratios; each step of a batch job has its own torque multiplier option (see Chapter 9).

The settings screens of Torque Wrench, Torque & Angle and Torque Inspection can also take the mode's own “Torque Ratio” (Torque & Angle and Torque Inspection also have a “Gear Ratio”):

- As long as no ratio has ever been entered on the mode's settings screen, the mode uses the total torque ratio and total gear ratio from this page.
- Once a ratio is entered and saved on the settings screen, the mode uses its own ratios, and later changes on this page no longer affect that mode; a ratio changed on that settings screen does not change this page or the other modes either (see Chapters 5 to 7).

Viewing this page requires the “View · Work Settings” permission; changing and saving require the “Edit · Work Parameters, Pairing and Calibration” permission (templates A and B have it by default, template C does not). Without the edit permission, all fields and “Save Settings” are grayed out.

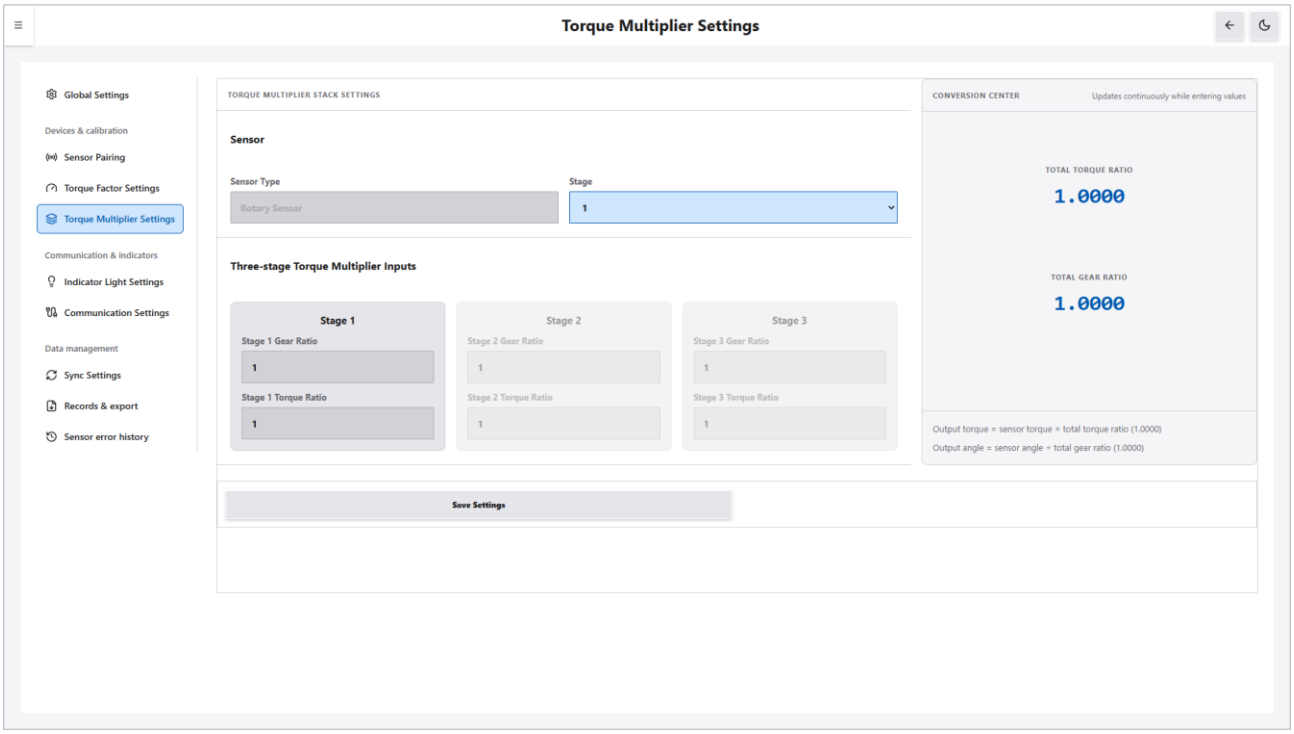

Figure 12-9 Torque Multiplier Settings screen

Figure 12-9 shows “Stage” set to 1 and all six ratios set to 1; “Total Torque Ratio” and “Total Gear Ratio” are both 1.0000, and the stage 2 and stage 3 cards are shown faded.

12.5.1 Screen Description

Area / button	Description
“Torque Multiplier Stack Settings” → “Sensor”	“Sensor Type” always shows “Rotary Sensor”; “Stage” selects how many stages the torque multiplier actually uses.
“Three-stage Torque Multiplier Inputs”	Three cards, “Stage 1”, “Stage 2” and “Stage 3”, each with “Stage N Gear Ratio” and “Stage N Torque Ratio”. Cards beyond the number of stages are shown faded and are not included in the total ratios.
“Conversion Center”	Shows “Total Torque Ratio” and “Total Gear Ratio” in large text, with the two conversion formulas; the note “Updates continuously while entering values” at the top right means that the values update as you type.
“Save Settings”	Checks the six ratios, then saves and enables the torque multiplier settings. On success, “Torque multiplier settings saved locally.” is shown.
↻ (refresh)	Appears only when loading fails; reads the settings again.
← (back)	Returns to the “Global Settings” subpage; unsaved changes are not kept.

12.5.2 Fields

Field	Description	Range and default
Sensor Type	Sensor category this setting applies to	Always “Rotary Sensor”; cannot be changed
Stage	Number of stages the torque multiplier actually uses; only the ratios of the first N stages are multiplied	1, 2, 3; default 1
Stage 1/2/3 Gear Ratio	Reduction gear ratio of that stage; the product of the first N stages = total gear ratio, used to convert the angle	Greater than 0, step 0.0001; default 1; all three stages must have a value, including unused stages
Stage 1/2/3 Torque Ratio	Torque amplification of that stage; the product of the first N stages = total torque ratio, used to convert the torque	Greater than 0, step 0.0001; default 1; all three stages must have a value, including unused stages
Total Torque Ratio	Calculated automatically	Shown with 4 decimal places
Total Gear Ratio	Calculated automatically	Shown with 4 decimal places

12.5.3 Meaning of Torque Ratio and Gear Ratio

- **Torque ratio**: how many times the input torque the torque at the output side (bolt side) of the multiplier is. A torque ratio of 3 means that an input of 100 N·m gives an output of 300 N·m.
- **Gear ratio**: how many degrees the input side must turn for the output side to turn 1 degree. A gear ratio of 3 means that when the input side turns 90°, the output side turns 30°.
- The sensor measures the input side. The program multiplies the sensor torque by the total torque ratio and divides the angle by the total gear ratio to get the torque and angle at the bolt; work screens, judgements and records all use the converted values.
- When a torque factor is also used, work torque = sensor reading × torque factor × total torque ratio (for the torque factor, see Section 12.4).

Example A single-stage torque multiplier rated at a torque ratio of 3 and a gear ratio of 3.
Set “Stage” to 1, “Stage 1 Torque Ratio” to 3 and “Stage 1 Gear Ratio” to 3; leave “Stage 2” and “Stage 3” at 1. “Conversion Center” shows “Total Torque Ratio” 3.0000 and “Total Gear Ratio” 3.0000.
In the torque wrench settings, switch “Enable torque multiplier” to “On”, check that “Torque Ratio” shows 3, and save.
When the sensor measures 100 N·m, bolt torque = 100 × 3 = 300 N·m; when the sensor turns 90°, bolt angle = 90 ÷ 3 = 30°.

Example Two stages in series, stage 1 torque ratio 3.5 and stage 2 torque ratio 4; select 2 in “Stage”. Total torque ratio = 3.5 × 4 = 14.0000. When the sensor measures 50 N·m, bolt torque = 50 × 14 = 700 N·m.

Example A torque factor of 1.0526 (see Section 12.4) plus a total torque ratio of 3.
When the sensor reads 57.0 N·m, work torque = 57.0 × 1.0526 × 3 ≈ 180.0 N·m.

12.5.4 Operating Steps

Before you start, have the gear ratio and torque ratio of each stage ready, taken from the torque multiplier manufacturer's specifications or calibration report.

1. Open “Torque Multiplier Settings”. The screen in Figure 12-9 appears, and the fields show the currently saved values.
2. In “Stage”, select the number of stages of the torque multiplier. Cards beyond the number of stages become faded.
3. On each stage card, enter the “Gear Ratio” and “Torque Ratio”. Keep unused stages at a value greater than 0, for example 1.
4. Check “Total Torque Ratio”, “Total Gear Ratio” and the formulas in “Conversion Center”.
5. Click “Save Settings”. The screen shows “Torque multiplier settings saved locally.”
6. Go to each work settings page that needs the torque multiplier, switch “Enable torque multiplier” to “On” and save (see Chapters 5 to 9). The settings screens of Torque Wrench, Torque & Angle and Torque Inspection show the ratios from this page; if the mode has ever had its own ratios entered, they show and use its own ratios.

Note After a fresh installation, the torque multiplier settings are not yet enabled. Until you click “Save Settings” on this page once, the torque ratio is calculated as 1, even if “Enable torque multiplier” is turned on in the work settings. This page has no disable option; if you do not use a torque multiplier, simply keep “Enable torque multiplier” in the work settings set to “Off”.

Note After saving, work that has “Enable torque multiplier” set to “On” and no ratios of its own immediately uses the new ratios to calculate torque and judgements. Torque Wrench, Torque & Angle and Torque Inspection with their own ratios entered on the settings screen are not affected; to use the new ratios there, change “Torque Ratio” and “Gear Ratio” on that settings screen. Incorrect ratios lead to incorrect judgements; check “Conversion Center” again before saving.

12.5.5 Error Messages

Message on screen	Cause and solution
“Torque multiplier ratios must be finite values greater than zero.”	The torque ratio of a stage (including unused stages) is empty, 0 or negative. Change it to a value greater than 0; enter 1 for unused stages.
“Gear ratios must be finite values greater than zero.”	The gear ratio of a stage is empty, 0 or negative. Same solution as above.
“Failed to load torque multiplier settings.”	Reading the settings failed, and the fields stay grayed out. Click “↻” to refresh; if it still fails, switch to another subpage and come back.
“Failed to save torque multiplier settings.”	Another save error. Try again later; if it still fails, report it as described in Chapter 16.

12.6 Indicator Light

Path: Navigation menu → “System Settings” → “Indicator Light Settings” on the left.

Sets which COM port the external three-color indicator light (red, yellow and green lights plus a buzzer, connected through a USB serial port and controlled by Modbus RTU) uses, and lets you test the lights manually. After saving, the lights turn on automatically when a work screen shows a judgement such as OK/NOK.

Opening this page requires the “View · System Settings” permission. Selecting a COM port, “Reorganize communication ports”, “Connect”, each test button and “Save Settings” require both the “Edit · Work Parameters, Pairing and Calibration” and “Edit · Communication and Layout” permissions (templates A and B have both by default; template C has neither by default). Without these permissions, this page is view-only, and COM ports are not scanned automatically.

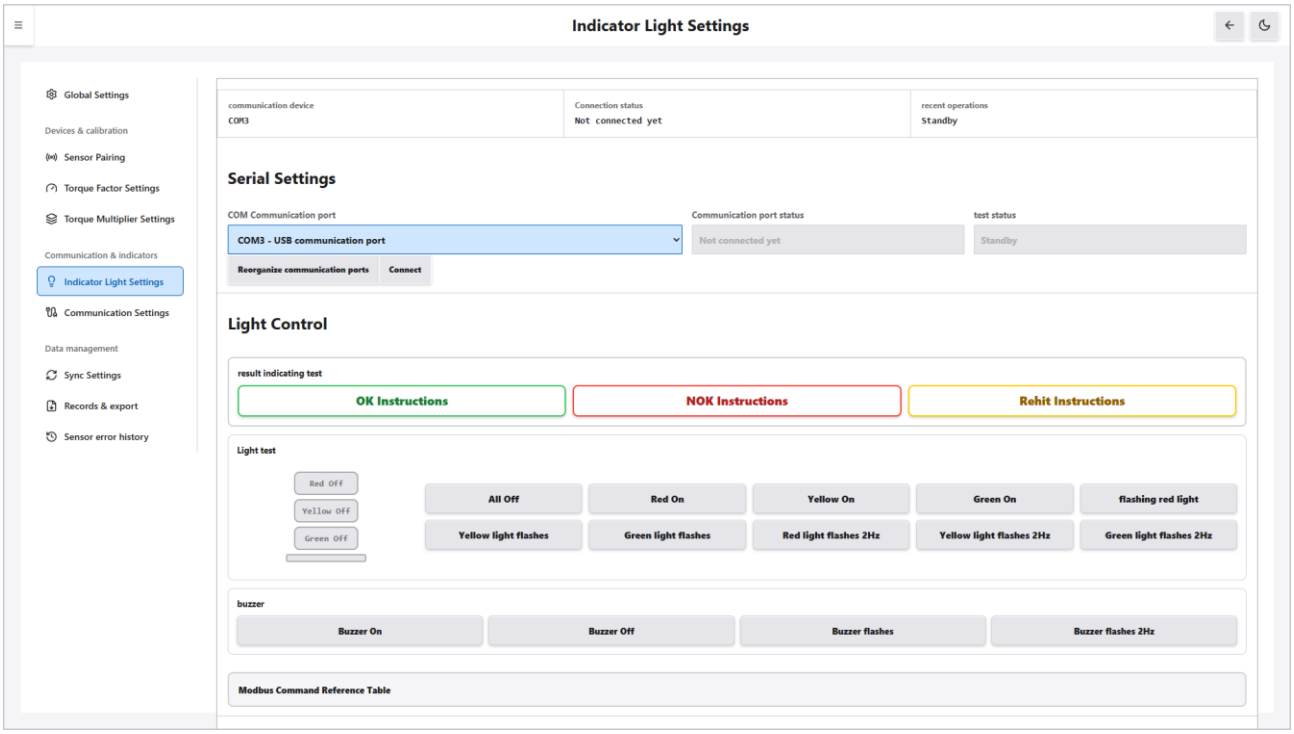

Figure 12-10 Indicator Light Settings screen

Figure 12-10 shows the state where the port is set to COM3 but that port cannot be found on the computer: “Connection status” and “Communication port status” both show “Not connected yet”, “recent operations” and “test status” show “Standby”, and the three lights of the light tower show “Red Off”, “Yellow Off” and “Green Off”. After a fresh installation no port is selected yet: “communication device” shows “Not selected yet”, the “COM Communication port” menu also stays at “Not selected yet”, and you must select the port of your controller.

12.6.1 Screen Description

Area / button	Description
Summary at the top	“communication device” (the currently selected COM port; “Not selected yet” if none is selected), “Connection status” (“Connected” or “Not connected yet”), “recent operations”.
“Serial Settings”	The “COM Communication port” menu (options in the format “COMx - USB communication port”), “Communication port status” (“Connected: COMx” or “Not connected yet”), “test status” (the most recent operation).
“Reorganize communication ports”	Scans the COM ports again and writes the result to “Operation Log”. With the required permissions, this page also scans automatically every 2 seconds.
“Connect”	Checks whether the selected COM port exists on this computer; if it does, the status changes to “Connected”. No command is sent. Grayed out while no COM port is selected.
“result indicating test”	“OK Instructions”, “NOK Instructions”, “Rehit Instructions”: send the matching result light combination. “Rehit Instructions” is a light signal kept for compatibility; new measurements in the work modes are judged only OK or NOK, and clicking this button does not make a measurement produce a Rehit.
“Light test”	The light tower icon on the left records the red, yellow and green on/off commands sent from this page (for example “Red Off”, “red light on”); it does not read the actual lights. On the right: “All Off”, “Red On”, “Yellow On”, “Green On”, plus each light's flashing and 2Hz flashing buttons (for example “Green light flashes” and “Green light flashes 2Hz”). After you click “Red On” and the light-on command is sent, the button text changes to “Red Off”; click it again to send the light-off command, and the text changes back to “Red On”. “Yellow On” and “Green On” work the same way; after you click “All Off”, all three buttons return to “… On”.
“buzzer”	“Buzzer On”, “Buzzer Off”, “Buzzer flashes”, “Buzzer flashes 2Hz”.
“Modbus Command Reference Table”	Click to expand; lists the name, code and Modbus frame of each command.
“Parameter Overview”	Click to expand; shows the fixed communication parameters.
“Operation Log”	Click to expand; shows “The last 20 indicator light communication events”, with times in the Windows regional format; “Clear Log” only clears the screen. All errors on this page are written here; no separate window pops up.
“Save Settings”	Saves the currently selected COM port for automatic lighting on work screens. Grayed out while no COM port is selected.
↻ (refresh)	Appears only when loading the settings fails; reads the settings again.
← (back)	Returns to the “Global Settings” subpage; an unsaved COM port selection is not kept.

12.6.2 Fields

Field	Description	Range and default
COM Communication port	Serial port of the indicator light controller. The work screens use it only after you click “Save Settings”.	COM ports that exist on this computer; empty after a fresh installation, shown as “Not selected yet”
Connection status / Communication port status	Whether the selected COM port exists on this computer. It only means that Windows can see this port, not that the controller responds.	“Connected”, “Connected: COMx” or “Not connected yet”
Recent operations / Test status	The most recent operation clicked on this page	Default “Standby”
Device ID, baud rate, data bits, stop bits, parity	Fixed communication parameters; the controller must be set to the same values	0x01, 9600, 8, 1, even parity; cannot be changed

12.6.3 OK/NOK and Light Signals

When the judgement on a work screen (Torque Wrench, Torque & Angle, Torque Inspection, Power Tool, Batch Jobs, Tool Inspection) changes, the program sends commands to the saved COM port according to the table below. The same judgement is not sent twice in a row.

Judgement	Commands sent (in order)	Afterwards
OK	Green light flashes 2Hz	Stays until the next judgement change
NOK	Red light + buzzer 2Hz	“Buzzer Off” is sent after 2 seconds
Rehit (repeated tightening)	All Off → Yellow light flashes 2Hz → Buzzer flashes 2Hz	“Buzzer Off” is sent after 2 seconds
Waiting (not yet judged)	All Off	—

If the judgement changes again before all commands have been sent, the commands not yet sent are skipped, so that an outdated light signal is not sent. If the screen has already returned to “Pending” while the NOK commands are still being sent, the program sends “All Off” once they have been sent. “Buzzer Off” after 2 seconds is sent only if the judgement has not changed.

Rehit is a light signal kept for compatibility. New measurements in the work modes are judged only OK or NOK, so Rehit does not occur.

The lights are also used when a sensor error occurs: an error that stops work sends “Red light + buzzer 2Hz”; a warning (for example low battery) sends “All Off” → “Yellow light flashes 2Hz” → “Buzzer flashes 2Hz”; “All Off” is sent after 2 seconds. These commands are sent as the currently logged-in account, and the account needs the “Edit · Communication and Layout” permission. For the error types, see Section 12.7.

Note Automatic lighting according to the judgement requires only the “Run · Work” permission, which all three templates have by default; an operator with template C needs no additional permission. If no COM port has been saved yet, work judgements do not turn on the lights, and the screen gives no warning.

12.6.4 Operating Steps

1. Connect the indicator light controller to the computer via USB, and check its COM port number under “Ports (COM & LPT)” in Windows “Device Manager”. The actual names may differ slightly depending on the Windows version.
2. Open “Indicator Light Settings”. The program scans automatically and shows the status of the currently set COM port.
3. Select the controller's COM port in “COM Communication port”. If you cannot find it, click “Reorganize communication ports”; expand “Operation Log” to see “Optional COM detected: …”.
4. Click “Connect”. “Connection status” changes to “Connected”, and “Communication port status” changes to “Connected: COMx”.
5. Click “All Off”, then click “OK Instructions”, and check visually that the green light flashes at 2Hz. “Operation Log” shows “Indicator command has been sent: …”.
6. Click “All Off”, then click “NOK Instructions”, and check that the red light flashes and the buzzer sounds at 2Hz; click “All Off” to stop.
7. Click “All Off”, then click “Rehit Instructions”, and check that the yellow light flashes and the buzzer sounds at 2Hz; click “All Off” to stop.
8. Click “Save Settings”. “Operation Log” shows “Indicator settings have been saved: COMx”.
9. Take one measurement on a work screen and check that the indicator light behaves as in the table above for OK/NOK (see Chapters 5 to 10).

Example The controller appears as COM6 in “Device Manager”.
In “COM Communication port”, select “COM6 - USB communication port” and click “Connect”; the status shows “Connected: COM6”.
Click “OK Instructions”; the green light flashes at 2Hz. Click “All Off” to turn it off. Click “Save Settings”; the log shows “Indicator settings have been saved: COM6”.
From then on, when the torque wrench judges OK, the green light flashes at 2Hz; when it judges NOK, the red light and the buzzer operate at 2Hz, and after 2 seconds the program sends “Buzzer Off”.

Tip The test buttons on this page do not turn the buzzer off automatically. After testing NOK, Rehit or “Buzzer On”, click “Buzzer Off” or “All Off”. The light tower icon only records the on/off commands sent from this page; check the actual lights visually.

12.6.5 Error Messages

Errors on this page are written to “Operation Log”; expand it to view them.

Message on screen	Cause and solution
“The saved indicator light port COMx is not connected yet”	The automatic scan cannot find the saved COM port. Check that the controller is connected; select the correct port and click “Save Settings”.
“Indicator port not found: COMx”	The port selected when you clicked “Connect” does not exist. Click “Reorganize communication ports” and select again.
“No available port COM detected”	There is no COM port on the computer. Check the USB connection and the controller's driver.
“Not connected yet, no indicator light command sent: …”	A test button was clicked while the status was “Not connected yet”. Click “Connect” first until “Connected” is shown.
“Failed to send indicator light command: …, 指示燈控制失敗，請檢查 COM 通訊埠與控制器連線。” (the part after the comma is shown in Chinese even in English: indicator light control failed; check the COM port and the controller connection)	The COM port cannot be opened or written to, for example because another program occupies it. Close the program that occupies the port, check the wiring and try again.
“Failed to send indicator light command: …, 找不到指示燈通訊埠 COMx，請確認裝置已連接。” (the part after the comma is shown in Chinese even in English: indicator light port COMx not found; make sure the device is connected)	The port disappeared at the moment of sending. Unplug and replug the controller, then click “Reorganize communication ports”.
“Failed to send indicator light command: …, You do not have permission to perform this operation.”	The account does not have the “Edit · Communication and Layout” permission. Ask an administrator to turn it on (see Chapter 15).
“Indicator COM Scan failed: …”, “Indicator connection check failed: …”	Reading the COM port list failed. Click “Reorganize communication ports” again later.
“Failed to load indicator light settings: …”	Reading the settings failed, and “Save Settings” stays grayed out. Click “↻” at the bottom to refresh.
“Failed to save indicator light settings: …”	Writing the settings failed, including because of insufficient permissions. Check the permissions and try again.

12.7 Sensor Error History

Path: Navigation menu → “System Settings” → “Sensor error history” on the left.

View the errors that sensors have reported, such as torque overload, zero-point drift and hardware damage, including when they occurred, whether work was stopped, and when they were cleared. QC and maintenance staff use it to trace the condition of tools. This page is for viewing only; events cannot be changed or deleted.

Requires the “View · System Settings” permission (all three templates have it by default). This page has no buttons that require an edit permission.

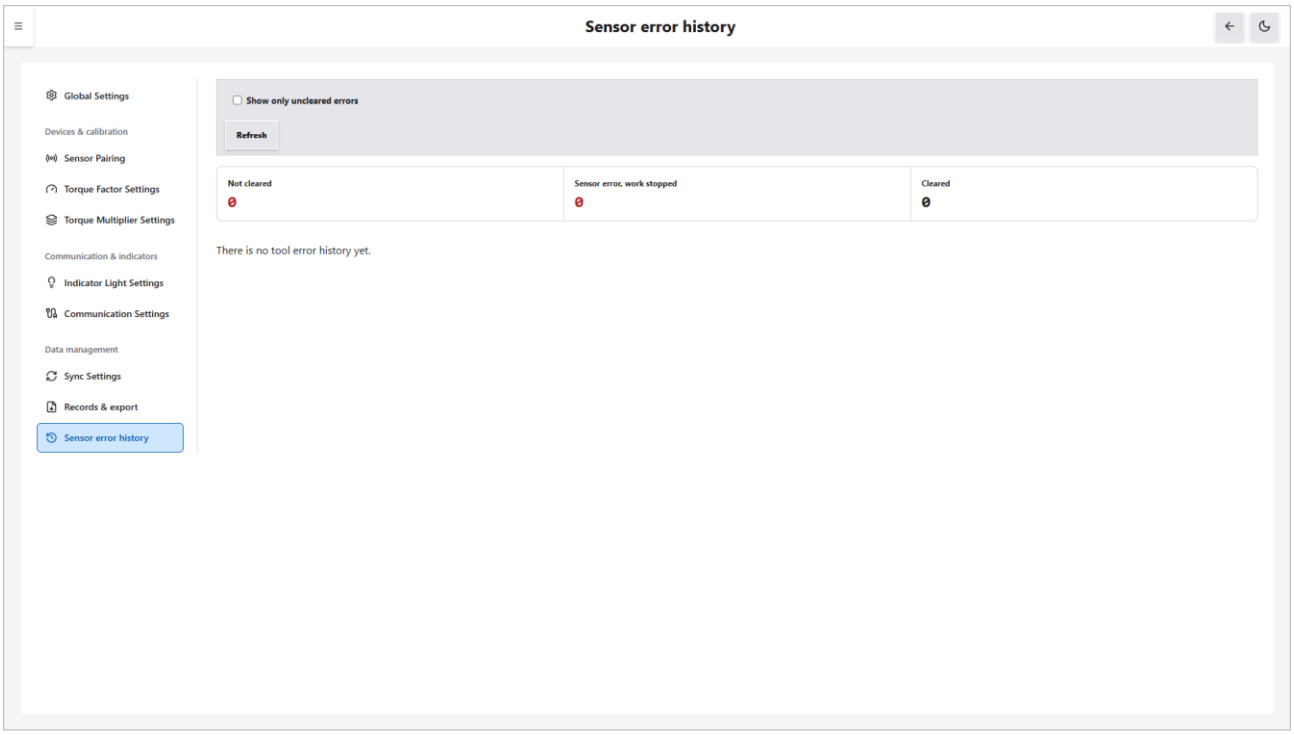

Figure 12-11 Sensor error history: no events

Figure 12-11 shows the state with no error events: all three statistics are 0, and “There is no tool error history yet.” is shown below.

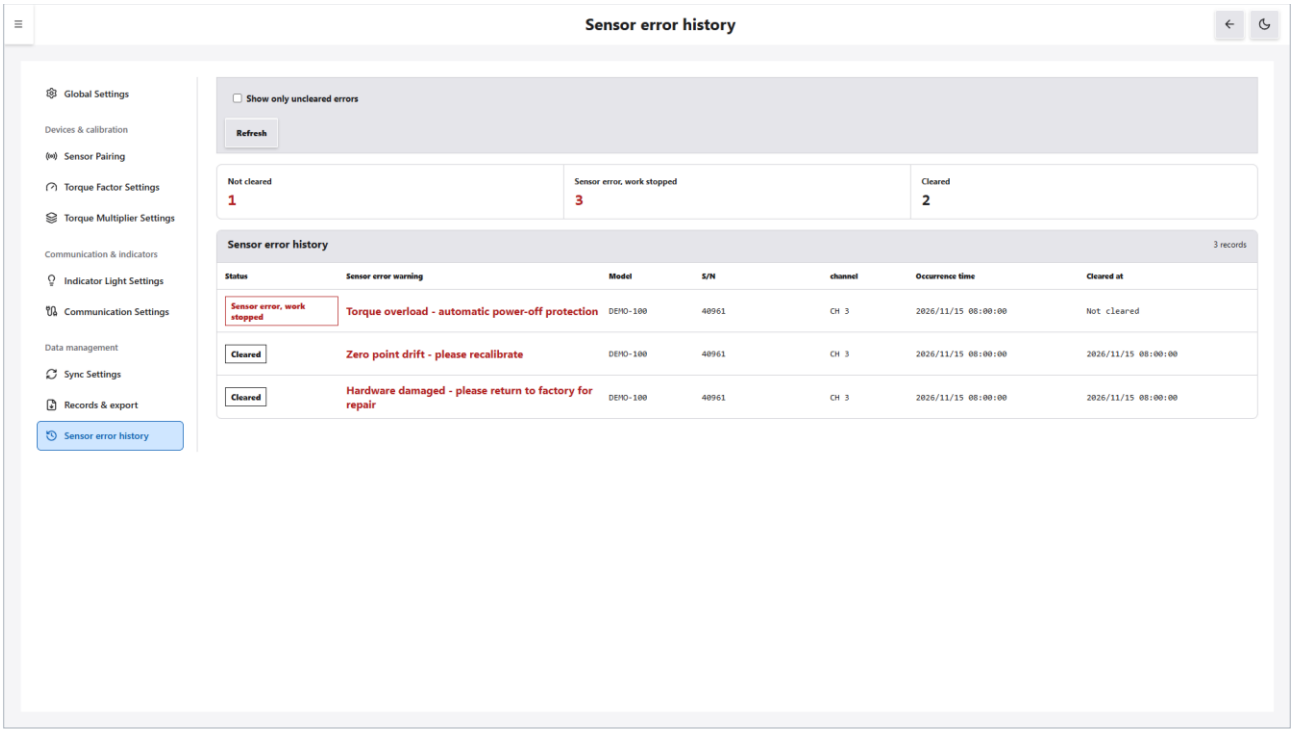

Figure 12-12 Sensor error history: with error events

Figure 12-12 shows the state with 3 events: “Not cleared” 1, “Sensor error, work stopped” 3, “Cleared” 2; the “Sensor error history” table shows “3 records” at the top right, and the event that has not been cleared shows “Not cleared” in the “Cleared at” column.

12.7.1 Screen Description

Area / button	Description
“Show only uncleared errors”	When checked, only events that have not been cleared are listed, and the list returns to page 1. Not checked by default.
“Refresh”	Reads the events again. This page does not update automatically; click this button to see the latest events.
Statistics row	Three numbers: “Not cleared”, “Sensor error, work stopped” and “Cleared”. “--” is shown while reading or if reading fails.
“Sensor error history” table	Shows “N records” at the top right. Sorted by occurrence time from newest to oldest, up to 100 per page. While reading, “Reading tool error in process...” is shown; when there are no events, “There is no tool error history yet.” is shown.
“‹”, “›” and page numbers	Appear when there are more than 100 events; switch to the previous or next page.
← (back)	Returns to the “Global Settings” subpage.

12.7.2 Fields

Field	Description	Range and default
Not cleared (statistic)	Number of events on the current page that have not been cleared	Counts only the current page (up to 100 events)
Sensor error, work stopped (statistic)	Number of events on the current page of the “stops work” type, including cleared ones	Counts only the current page
Cleared (statistic)	Number of cleared events on the current page	Counts only the current page
Status	Current status of the event	Cleared: “Cleared”; not cleared and stops work: “Sensor error, work stopped”; not cleared and does not stop work: “Not cleared”
Sensor error warning	Error content; errors that stop work are shown in red	See the error message table below
Model, S/N	Model and serial number of the sensor when the error occurred	“--” when there is no data
Channel	RF channel of the sensor when the error occurred	“CH N” format
Occurrence time	Time when the sensor reported the error	Shown in the Windows regional format, independent of the interface language
Cleared at	Time when the error was cleared	“Not cleared” while it has not been cleared

12.7.3 Error Message Reference

Error message	Meaning	Action
“Torque overload - automatic power-off protection”	The applied torque exceeded the sensor capacity, and the sensor powered off automatically for protection. Work stops, and the event is recorded on this page.	Stop applying torque and stop using the sensor immediately. Check that the target torque is within the sensor spec; send the sensor for calibration or repair before using it again.
“Zero point drift - please recalibrate”	The zero point of the sensor has drifted and recalibration is needed. Work stops, and the event is recorded on this page.	Stop using the sensor; recalibrate it as described in the sensor's manual or send it for calibration.
“Hardware damaged - please return to factory for repair”	The strain gauge, gyroscope or accelerometer inside the sensor is damaged (all three show the same message). Work stops, and the event is recorded on this page.	Stop using the sensor and return it to the factory for repair.
“Has been used for 5,000 cycles - recommended for use after verification”	The sensor has been used for 5,000 cycles; this is a warning. Work does not stop, but the event is recorded on this page.	Schedule a calibration.
“Low battery - please charge as soon as possible”	The sensor battery is low; this is a warning. Work does not stop; it is only shown on the work screen and is not recorded on this page.	Charge it as soon as possible.

12.7.4 What “Cleared” Means

“Cleared” and “Cleared at” mean that the sensor's later reports no longer include this error; the program records the clear time automatically. Neither this page nor any other part of the program has a button for clearing errors manually, and event records are never deleted. To actually fix the cause of an error (charging, recalibration, return to factory), follow the table above and Chapter 16.

12.7.5 Operating Steps

1. Open “Sensor error history”. The screen shows the statistics row and the event list (as in Figure 12-11 when there are no events).
2. To see only errors that still exist, check “Show only uncleared errors”.
3. Use “Model”, “S/N” and “channel” to identify the sensor with the error, and check “Sensor error warning”, “Occurrence time” and “Cleared at”.
4. After a new error occurs during work, click “Refresh” to get the latest list.
5. Fix the error according to the table above. After the sensor reports normally again, click “Refresh”; the status of that event changes to “Cleared” and the clear time is shown.

Example An operator reports that the torque wrench suddenly stopped working.
Open “Sensor error history” and check “Show only uncleared errors”. The top row of the list shows “Sensor error, work stopped” and “Torque overload - automatic power-off protection”, “channel” CH 15, and “Not cleared” in “Cleared at”.
Find the sensor by its serial number, stop using it and send it for repair. After the repair, the sensor is powered on and used again, and it no longer reports this error.
Back on this page, click “Refresh”: the row status changes to “Cleared”, “Cleared at” shows the time the error was cleared, and in the statistics row “Not cleared” decreases by 1 and “Cleared” increases by 1.

Tip The statistics count only the current page. When there are more than 100 events, check “Show only uncleared errors” to see the events that still need attention.

12.7.6 Error Messages

Message on screen	Cause and solution
“Unable to read tool error history: You do not have permission to view sensor error history.”	The account does not have the “View · System Settings” permission. Ask an administrator to turn it on (see Chapter 15).
“Unable to read tool error history: Your session has expired. Please sign in again.”	The login has expired. Log in again.
“Unable to read tool error history: Please sign in.”	You are not logged in, or the login is no longer valid. Log in again.
“Unable to read tool error history: Sensor error history is temporarily unavailable. Please try again.”	The data cannot be read at the moment. Click “Refresh” later; if it still fails, report it as described in Chapter 16.
“Time: Failed to load records. Displayed data has not been updated.”	Converting times to the Windows regional format failed; the time columns show “--”. Click “Refresh”; if it still fails, restart the program.

Chapter 13 Communication Settings

This chapter explains how a production-line PLC, MES or tightening management system can read TMS measurement results or send commands to TMS. TMS offers three types of communication: Modbus TCP, Modbus RTU and Open Protocol. In all three, TMS is “the side that accepts connections”: the external device connects, polls or sends commands on its own initiative, and TMS never connects to the PLC by itself.

Each type comes with setup steps you can follow and examples with real values: Modbus TCP in Section 13.2, Modbus RTU in Section 13.3, Open Protocol in Section 13.4, the full register map in Section 13.5, and connection testing and troubleshooting in Section 13.6.

13.1 Communication Settings Overview

Path: Navigation menu → “System Settings” → “Communication & indicators” group on the left → “Communication Settings”.

The “Communication Settings” page shows the status of all three communication services, the “Start” and “Stop” buttons, and the entry points to each service's settings window, the register map and the diagnostics window. For daily checks, this page alone tells you whether a service is running and whether an external device is reading.

Permissions: To change settings or start or stop a service, you need both the “Edit · Work Parameters, Pairing and Calibration” and “Edit · Communication and Layout” permissions (included by default in templates A and B). With only the “View · System Settings” permission (for example, template C), you can open this page and each window to view them, but the fields and buttons are disabled.

> **Tip** The screen uses “Edit · Work Parameters, Pairing and Calibration” to decide whether fields can be edited, and checks “Edit · Communication and Layout” when you press save, start or stop. When you adjust permissions user by user in “User Management”, set both together; otherwise a field may be editable but saving shows “You do not have permission to perform this operation.” (see Chapter 15).

13.1.1 Comparison of the Three Communication Methods

Method	TMS role	Connection medium	Typical counterpart
Modbus TCP	Server (slave); the external device is the master	Ethernet; default TCP port 1502	PLC, SCADA, a PC-based Modbus test tool or custom software
Modbus RTU	Slave; the external device is the master	RS-485 or RS-232 serial line (usually through a USB-to-RS-485 adapter); default COM3, 115200 bps	PLC or HMI that has only a serial port
Open Protocol	Server (acting as a tightening controller); the external device is the client	Ethernet; default TCP port 4545	Tightening management system, MES, or integration software that supports Open Protocol

- Modbus TCP and Modbus RTU read the same data at exactly the same addresses (see Section 13.5), and both can be enabled at the same time.
- Open Protocol settings are stored separately from Modbus, and Open Protocol can be enabled together with Modbus.
- After a fresh installation, all three are disabled and no communication port is opened.

Warning Modbus TCP and Open Protocol have no encryption and no username/password authentication. Any device on the same network can read TMS data and send commands that switch batches, lock the tool or reset batch progress. Use them only on a controlled production LAN, and do not let these ports be reached from the Internet or the office network. When not in use, clear the enable option and save. Before running write tests on equipment in production, get approval from the person in charge.

13.1.2 Screen Description

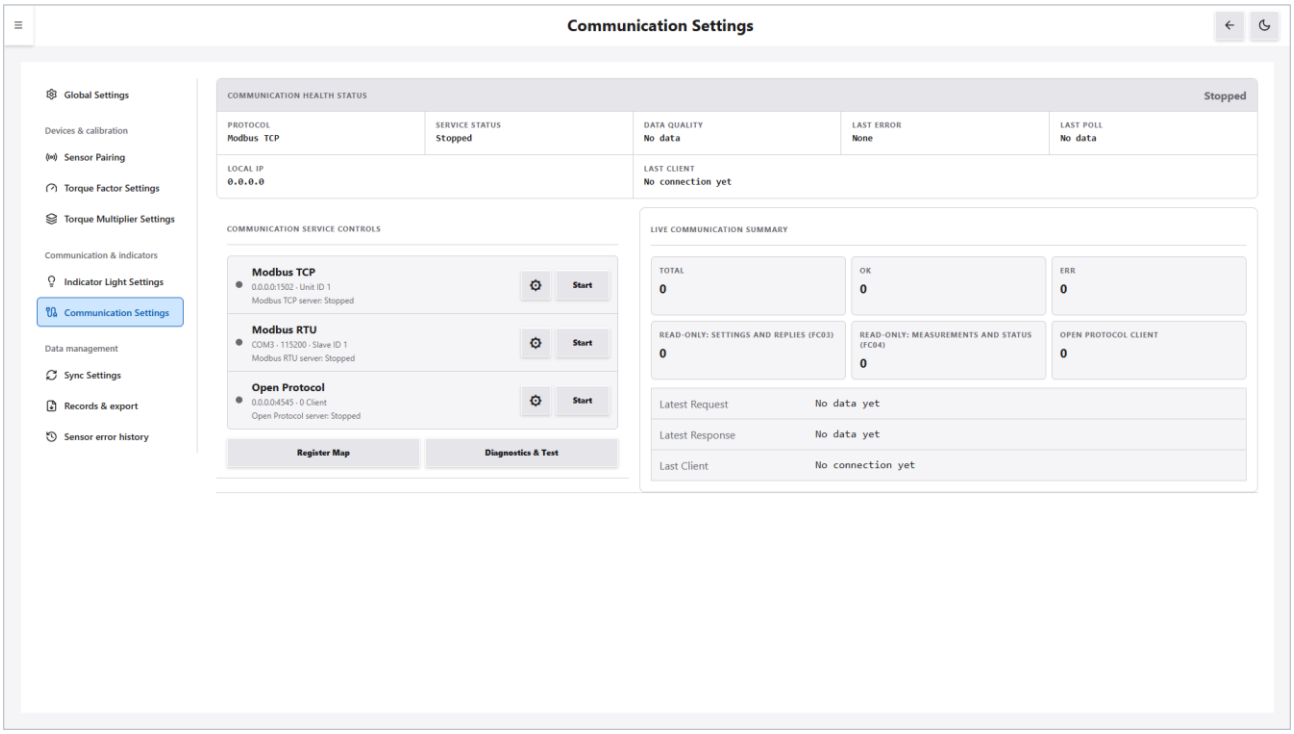

Figure 13-1 Communication Settings screen

Area / button	Description
Top bar	The page title “Communication Settings” in the center; “Back” (arrow) and “Toggle light / dark mode” at the top right.
System Settings menu on the left	Switches to other System Settings pages; the current page, “Communication Settings”, is highlighted.
Communication health status	The large text at the top right shows the overall status: error text when there is an error; “Stopped” when the service is not running; “Good” when the service is running and an external read occurred within the last 10 seconds; “No data” when the service is running but no read occurred within 10 seconds. Below it is a 7-field status summary (see “Status Fields” in this section).
Communication service controls	Three rows: Modbus TCP, Modbus RTU and Open Protocol. Each row shows the current settings (for example “0.0.0.0:1502 · Unit ID 1”, “COM3 · 115200 · Slave ID 1”, “0.0.0.0:4545 · 0 Client”) and “… server: Running / Stopped”. The dot on the left lights up while the service is running.
⚙ (Edit Modbus TCP, etc.)	Opens the settings window of that service (see Sections 13.2 to 13.4). Does not save or switch screens.
“Start”	Immediately starts the service with the **saved** settings. While the service is running, this button changes to a red “Stop” button. Not available without edit permission or while processing.
“Stop”	Shows the confirmation “Stopping the … server immediately disconnects all connected PLC/MES clients. Continue?” (for Open Protocol: “… disconnects all connected clients. …”). The service stops only when you press “Stop”; pressing “Cancel” changes nothing.

Area / button	Description
“Register Map”	Opens the Modbus register map window (see Section 13.5).
“Diagnostics & Test”	Opens the “Diagnostics & Test” window (see Section 13.6).
Live communication summary	Six counters (“Total”, “OK”, “ERR”, “Read-only: settings and replies (FC03)”, “Read-only: measurements and status (FC04)” and “Open Protocol Client”), plus “Latest Request”, “Latest Response” and “Last Client”. The screen refreshes automatically every second.

Note “Total”, “OK”, “ERR”, the FC03/FC04 counters, “Latest Request” and “Latest Response” count **Modbus TCP** only. Modbus RTU traffic does not increase these numbers; for Open Protocol, only the number of currently connected clients is shown.

13.1.3 Status Fields

Field	Description	When there is no data
Protocol	“Modbus RTU” when only Modbus RTU is enabled (TCP not enabled); “Modbus TCP” in all other cases	“Modbus TCP”
Service Status	Whether the service of the current protocol is running: “Listening” or “Stopped”; while Modbus RTU is waiting for its port, “Waiting for COMx; retrying every 2 seconds” is shown	“Stopped”
Data Quality	Modbus TCP: “Good” when the service is running and a read was received within 10 seconds, otherwise “No data”. Modbus RTU: “Good” whenever the service is running, which does not mean that the PLC is actually reading	“No data”
Last Error	The most recent start, stop, load or save error	“None”
Last Poll	Time of the last request received over Modbus TCP, in the format of the Windows regional settings	“No data”
Local IP	The saved Modbus TCP “Bind IP Address” setting, not the detected IP address of the computer; 0.0.0.0 means all network adapters	“0.0.0.0”
Last Client	Address of the last device that connected over Modbus TCP, for example “192.168.1.50:50312”	“No connection yet”

13.1.4 Start, Stop and Automatic Start

Whether a service runs automatically when TMS opens depends on the “Enable …” check box in the settings window, not on the “Start” and “Stop” buttons:

Action	Result
Select “Enable …” in the settings window and save	Starts the service immediately; from then on, it starts automatically every time TMS opens.
Clear “Enable …” in the settings window and save	Stops the service immediately (no confirmation); TMS does not start it the next time it opens.
Press “Start”	Starts the service for the current session only; does not select “Enable …”. After you close and reopen TMS, the service does not start automatically.
Press “Stop” and confirm	Stops the service for the current session only; does not clear “Enable …”. The service starts automatically again the next time TMS opens.

Steps:

1. From the navigation menu, click “System Settings”, then click “Communication Settings” on the left. You see “Communication health status” and the three service rows.
2. Make sure the service you want to use is configured and enabled (see Sections 13.2 to 13.4).
3. If the service is not running, press “Start” in its row. On success, the dot lights up, the row shows “server: Running”, and the health status changes to “No data”.
4. Ask the PLC/MES to start reading. When Modbus TCP receives requests, “Total” and “OK” increase, “Data Quality” changes to “Good”, and “Last Client” shows the address of the remote device.
5. To pause, press “Stop”, then press “Stop” in the confirmation window.

> **Tip** 10 seconds after the external device stops reading, the Modbus TCP status returns from “Good” to “No data”. This is not a fault.

Screen message	Cause and solution
“Unable to load communication settings.”	Reading the local settings failed or the login has timed out. Open this page again; if it still fails, log in again.
“Unable to load Modbus TCP server status.” (same format for RTU and Open Protocol)	The status query failed. The screen retries automatically every second; if the message persists, log in again or reopen TMS.
“Unable to start the Modbus TCP server.” followed by “Unable to start the ${protocol} server.” (the second part is shown exactly like this, including “${protocol}”)	The port is already used by another program, or the bind IP is not a network adapter of this computer. Use an unused port, set the bind IP to 0.0.0.0 or the local IP address, save, and press “Start” again.

Screen message	Cause and solution
“Unable to start the Modbus RTU server.” followed by “Unable to start the ${protocol} server.” (the second part is shown exactly like this, including “${protocol}”)	The serial parameters are invalid. Check the settings in Section 13.3, then press “Start” again. If the COM port is only temporarily unavailable, this message does not appear; TMS retries automatically instead (see Section 13.3).
“Unable to start the Modbus TCP server.” followed by “Modbus TCP 服務已在執行。” (the second part is shown in Chinese even in English: the Modbus TCP service is already running) / “Unable to start the Modbus RTU server.” followed by “Modbus RTU 服務已在執行。” (the second part is shown in Chinese even in English: the Modbus RTU service is already running)	The service is already running. Wait for the screen to refresh; to restart the service, press “Stop” and then “Start”.
“Unable to start the Open Protocol server.” or “Unable to save communication settings.”, followed by “Unable to complete the operation.” (cause: the System Settings service is temporarily unavailable)	Pressing “Start” for Open Protocol failed (for example, the port is in use), or access to the local settings failed. Make sure the port is not in use and try again; if it still fails, reopen TMS.
“You do not have permission to perform this operation.”	The account lacks the “Edit · Communication and Layout” permission. Ask an administrator to adjust the permissions (see Chapter 15).
“Your session has expired. Please sign in again.”	The login has timed out. Log in again, then retry.
“Unable to start the Modbus TCP server.” or “Unable to stop the Modbus TCP server.” followed by “Unable to load ${protocol} server status.” (same format for Modbus RTU; the second part is shown exactly like this, including “${protocol}”; cause: the Modbus service is temporarily unavailable)	Other start or stop errors. Wait a moment and try again; if it still fails, reopen TMS.

13.2 Modbus TCP

Path: “Communication Settings” → ⚙ (Edit Modbus TCP) on the right of the “Modbus TCP” row.

With Modbus TCP, TMS is the server (slave): TMS opens a TCP port on this computer and waits for connections, and a PLC, SCADA system or PC program (the master) connects to read measurement results or write commands. You need the “Edit · Work Parameters, Pairing and Calibration” and “Edit · Communication and Layout” permissions; with view permission only, you can open the window to view it, but you cannot change or save anything.

13.2.1 Screen Description

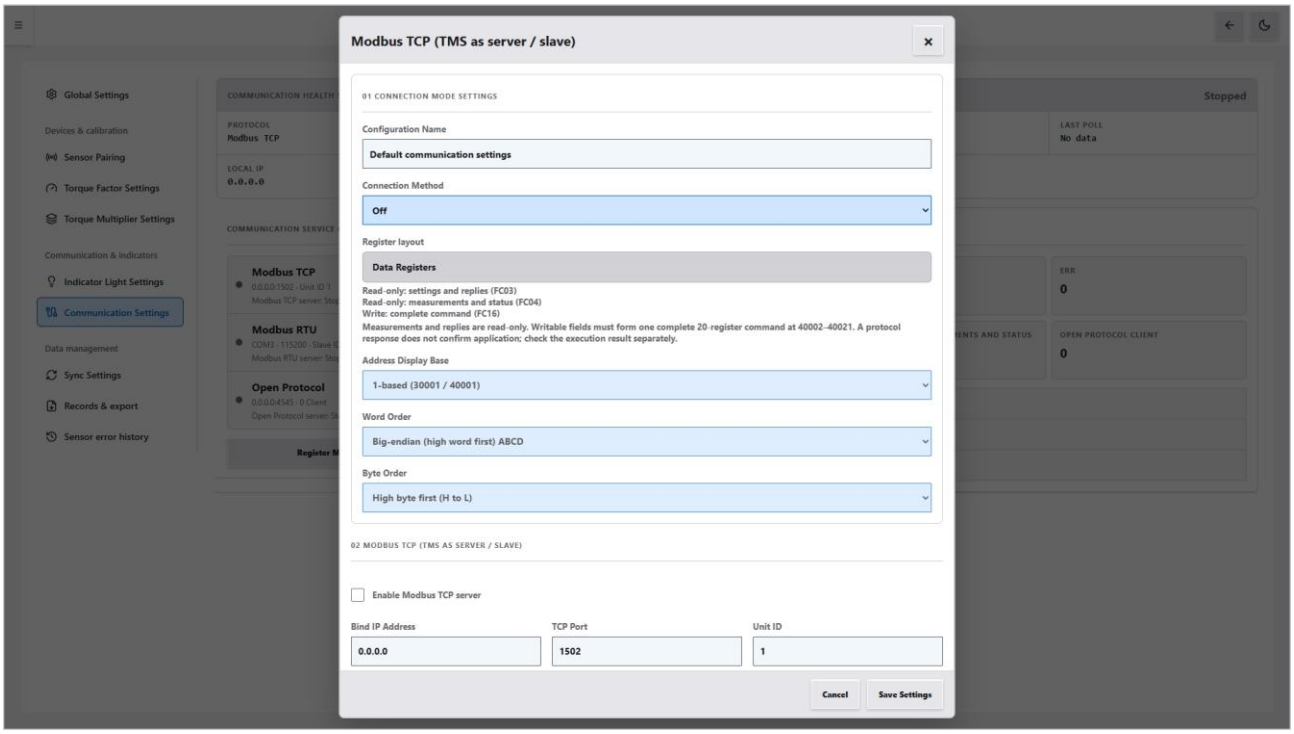

Figure 13-2 Modbus TCP settings window

Area / button	Description
“01 Connection Mode Settings”	Configuration name, connection method, and the fixed data format (register layout, address display base, word order and byte order). This area shares the same settings with the “Modbus RTU / RS-232 & RS-485” window.
“02 Modbus TCP (TMS as server / slave)”	Enabling Modbus TCP, IP address, port, Unit ID and connection limits.
“Firewall: Windows inbound rule TCP 1502”	The port number follows “TCP Port”. A reminder that Windows Firewall must allow the PLC to connect to this port. It is only a reminder; TMS does not check or create firewall rules (see “Windows Firewall” in this section).
× / “Cancel”	Closes the window without saving; unsaved changes are discarded. Pressing Esc or clicking outside the window does the same. Not available while saving.
“Save Settings”	Saves locally and, depending on the enable state, immediately starts, re-applies or stops the service. On success, the window shows “Communication settings saved locally”. Not available without edit permission or before the settings have finished loading.

Note If you press “Save Settings” while Modbus TCP is running, connected PLCs may be disconnected and must reconnect. Change the settings during a changeover or downtime.

13.2.2 Fields

Field	Description	Range and default
Configuration Name	Name of this Modbus configuration, used only for identification.	Required; the default is “Default communication settings”
Connection Method	Quick switch: selecting “Modbus TCP” enables TCP and disables RTU; selecting “Modbus RTU” does the opposite; selecting “Off” disables both. To use TCP and RTU at the same time, use the “Enable …” check box in each window instead.	“Off”, “Modbus TCP”, “Modbus RTU”; “Off” after a fresh installation
Register layout	Fixed to “Data Registers”: “Read-only: settings and replies (FC03)”, “Read-only: measurements and status (FC04)”, “Write: complete command (FC16)”.	Fixed; cannot be changed
Address Display Base	Listed addresses start at 30001/40001. The protocol address that the PLC actually sends is the listed address minus 30001 or 40001 (see Section 13.5).	Fixed “1-based (30001 / 40001)”
Word Order	32-bit and 64-bit values are sent high word first.	Fixed “Big-endian (high word first) ABCD”
Byte Order	Within each register, the high byte comes first.	Fixed “High byte first (H to L)”
Enable Modbus TCP server	When selected and saved, the service starts immediately, and from then on it starts automatically every time TMS opens.	Cleared by default
Bind IP Address	The network adapter on which TMS waits for connections. 0.0.0.0 means all network adapters of this computer; to accept connections only from the production network, enter the IP address of the production network adapter.	IPv4 address; default 0.0.0.0
TCP Port	The port the PLC connects to. Must not be the same as the port of another program or of Open Protocol.	1–65535; default 1502
Unit ID	The Unit ID in the PLC request must match this value. If it differs, TMS does not reply and the PLC waits until it times out.	0–255; default 1
Max Clients	Maximum number of PLCs/programs connected at the same time; new connections beyond this limit are closed.	1–32; default 4
Idle Disconnect (s)	If a connection sends no data for this period, TMS disconnects it. The PLC polling interval must be shorter than this.	1–3600 seconds; default 60

13.2.3 Enabling Modbus TCP and Connecting a PLC

Before you start, make sure that:

- The TMS computer and the PLC are on the same production network segment, or the network administrator has opened routing between them.
- You have the “Edit · Work Parameters, Pairing and Calibration” and “Edit · Communication and Layout” permissions.

Steps:

1. On the TMS computer, press the Windows key, type `cmd` to open “Command Prompt”, type `ipconfig` and press Enter. Note the “IPv4 Address” of the network adapter connected to the production network, for example `192.168.1.20`.
2. In TMS, open “Communication Settings” and click ⚙ on the right of the “Modbus TCP” row. The “Modbus TCP (TMS as server / slave)” window opens (see Figure 13-2).
3. In “Connection Method”, select “Modbus TCP”. “Enable Modbus TCP server” is selected automatically.
4. Check “Bind IP Address”, “TCP Port” and “Unit ID”. Unless you have special requirements, keep 0.0.0.0, 1502 and 1.
5. Click “Save Settings”. The window shows “Communication settings saved locally”, and the service starts immediately.
6. If Windows displays a firewall prompt, handle it as described in “Windows Firewall” in this section.
7. Click “Cancel” or × to close the window. The “Modbus TCP” row shows “Modbus TCP server: Running”, and “Communication health status” shows “No data”.
8. On the PLC, create a Modbus TCP master (client) connection: the IP address from step 1, port 1502, Unit ID 1, and function code 04 to read the data starting at 30001 (protocol address 0).
9. When the PLC starts reading, “Total” and “OK” start to increase, “Data Quality” changes to “Good”, and “Last Client” shows the IP address of the PLC.

> **Example** The IP address of the TMS computer is 192.168.1.20, and the IP address of the PLC is 192.168.1.50.
> TMS settings: Bind IP Address 0.0.0.0, TCP Port 1502, Unit ID 1, Max Clients 4, Idle Disconnect 60 seconds.
> PLC settings: remote IP 192.168.1.20, remote port 1502, Unit ID 1, reading 64 registers starting at protocol address 0 with FC04 every 200 ms.
> After the connection succeeds, “Last Client” in TMS shows “192.168.1.50:…” (the number after the colon is the port chosen automatically by the PLC), and “Total” increases by about 5 per second.

> **Tip** The PLC polling interval must be much shorter than “Idle Disconnect (s)”. If the PLC reads only when needed, the connection is closed after more than 60 seconds without traffic; make the PLC program reconnect automatically after a disconnection, or increase this setting.

13.2.4 Windows Firewall

TMS does not create Windows Firewall rules by itself. Whether the PLC can connect depends on whether Windows allows TMS to accept connections on this port (see also Section 2.6).

1. The first time Modbus TCP starts, Windows may display a firewall notification; the program name may appear as TMS RF, static-torque-tauri or ZIPPTORK TMS RF Portable.
2. Follow your company's IT rules; on a typical factory LAN, select “Private networks” and click “Allow access”. The exact wording may differ slightly depending on the Windows version.
3. If you clicked Cancel earlier, or if the company computer is managed centrally by IT and no prompt appears, the PLC connection times out. Ask IT to add an inbound rule for TMS that allows TCP 1502 (or the port you configured).

> **Tip** If you connect from another computer with the test tool in Example 1 and read 30001 = 21581, both the network and the firewall allow the connection. A successful test on the TMS computer itself (IP 127.0.0.1) does not mean that the firewall allows external connections.

13.2.5 Example 1: Checking the Connection with a PC Test Tool

Before connecting the PLC, use a Modbus test tool on a laptop (for example Modbus Poll or QModMaster) to read TMS and confirm that the IP address, port and Unit ID are correct. Menu names differ between tool versions; find the corresponding settings and enter the values in the table below.

Setting	Value	Description
Connection type	Modbus TCP/IP	Not RTU, and not RTU over TCP
IP address	192.168.1.20	IPv4 address of the TMS computer
Port	1502	“TCP Port” in TMS
Slave ID / Unit ID	1	“Unit ID” in TMS
Function code	04 Read Input Registers	Reads the 3xxxx measurement and status data
Start address	0	Listed address 30001 minus 30001
Quantity	6	Reads 30001–30006

Steps:

1. In the test tool, open the connection settings, select Modbus TCP/IP, and enter the IP address and port.
2. In the read settings, enter Slave ID 1, function code 04, start address 0 and quantity 6.
3. Click Connect. The tool starts reading periodically, and its table shows 6 values.

4. Compare them with the table below. If the first cell reads 21581, the connection, Unit ID and address are all correct.

Listed address	Expected value	Meaning
30001	21581 (hexadecimal 0x544D)	Protocol identifier; a fixed value showing that you are connected to TMS
30002	2	Protocol major version
30003	0	Protocol minor version
30004	63 (0x003F)	Protocol capability flags; supports batch selection, tool control, batch reset, applying work parameters, battery level and tool errors
30005	1000	Torque scale factor
30006	1000	Angle scale factor

The packets actually sent over the network for this read are shown below (hexadecimal; the first 7 bytes are the Modbus TCP header, and the transaction ID at the beginning is generated automatically by the tool):

```
Request : 00 03 00 00 00 06 01 04 00 00 00 06
Response: 00 03 00 00 00 0F 01 04 0C 54 4D 00 02 00 00 00 3F 03 E8 03 E8
```

> **Tip** Whether addresses start from 0 or from 1 is the most common configuration error. Listed address 30001 in TMS corresponds to protocol address 0. In most test tools, the address field starts from 0, so enter 0; if the tool has been switched to 1-based addressing (PLC address mode), enter 1. If the first cell reads 2 instead of 21581, the address is offset by one; reduce the start address by 1.
>
> **Tip** You can also check with function code 03, which reads holding registers: start address 0, quantity 1. You should read 2 (40001, command version).

13.2.6 Example 2: PLC Polling for Completed Results

The most common PLC use is to read TMS continuously and, when there is a new completed result, take the judgement and the final torque. A “new result” is detected with 30011–30012 “Completed result sequence”, which increases by 1 for each completed result.

Steps (PLC program logic):

1. Use FC04 to read 64 registers at once: start address 0, quantity 64 (30001–30064). Up to 125 registers can be read at once, so all 64 registers fit in one read.
2. Take 30007–30008 “TMS boot identifier”. If it differs from the value remembered last time (including on the first read), TMS has just started or restarted: remember the new boot identifier and the current completed result sequence, and do not process any result in this cycle.
3. Take 30011–30012 “Completed result sequence” and compare it with the value remembered last time. If it is the same, there is no new result; go back to step 1.
4. If the sequence differs and bit2 (completed result valid) of 30013 “Data validity flags” is 1: take the result fields from the same read (see the table below), then remember the new sequence.

5. Go back to step 1 at the required interval (for example, 200 ms).

Example TMS works in "Torque Wrench" mode with a target torque of 25.00 N·m and a tolerance of ±5%. The operator completes one tightening with a final torque of 25.12 N·m, judged OK. The completed result sequence the PLC remembered in the previous cycle is 127; part of what it reads in this cycle is shown in the table below.

Listed address	Raw value read	Conversion	Meaning
30011–30012	0, 128	0 × 65536 + 128 = 128	Completed result sequence changed from 127 to 128: there is a new result
30016	1	Code 1	Completed result mode: Torque Wrench
30018	1	Code 1	Completed result unit: N·m
30021	1	Code 1	QC result: pass (OK)
30022	0	All bits are 0	No low, high or other abnormality
30035–30036	0, 25120	(0 × 65536 + 25120) ÷ 1000 = 25.12	Final torque 25.12 N·m
30039–30040	0, 25000	25000 ÷ 1000 = 25.00	Target torque 25.00 N·m
30043–30044	0, 23750	23750 ÷ 1000 = 23.75	Torque lower limit 23.75 N·m (25 × 95%)
30045–30046	0, 26250	26250 ÷ 1000 = 26.25	Torque upper limit 26.25 N·m (25 × 105%)
30057–30060	0, 417, 56915, 56128	$417 \times 2^{32} + 56915 \times 2^{16} +$ 56128 = 1794731400000	Result time 2026-11-15 08:30:00 UTC (16:30:00 Taiwan time)

Conversion rules:

- 32-bit values: high word × 65536 + low word.
- 64-bit time: multiply the 4 registers in order by 2^{48}, 2^{32}, 2^{16} and 1, then add them up to get the number of milliseconds since 1970-01-01 00:00:00 UTC. Times are always UTC; add 8 hours for Taiwan time.
- Signed values (INT32): if the 32-bit result is greater than or equal to 2147483648, subtract 4294967296. Example: reading 65535, 64036 → 65535 × 65536 + 64036 = 4294965796 → minus 4294967296 = −1500 → ÷ 1000 = −1.5.
- Fields with a scale of 1000 (torque, angle, tolerance): divide the integer read by 1000.

Note Torque fields use the unit shown in 30018 "Completed result unit" (30017 for live torque), which is not necessarily N·m. Only 30029–30030 "Sensor capacity" is always in N·m. Make the PLC program read the unit code before converting.

Note The completed result sequence exists only in memory and restarts from 0 after TMS restarts. Always check the boot identifier in step 2; otherwise the PLC will mistake a restart for a new result.

13.2.7 Example 3: Sending a “Select batch” Command with FC16

The PLC can write commands with FC16 to ask TMS to switch batches, lock the tool, and so on. Commands are always written to the 20 registers 40002–40021. A normal FC16 response only means that TMS has “received” the command; to know whether it was executed successfully, read the reply in 40022–40025.

Warning FC16 commands directly change the operating state of TMS: they switch the active batch, apply new work parameters, lock the tool or clear the current batch progress, and the operator screen changes immediately. Get approval from the line supervisor first, and test during downtime or a changeover.

Example The PLC asks TMS to switch to batch 012 (Pset 12), using command sequence 101. Batch 012 has already been created with its steps in Chapter 9, and TMS has no work in progress.

Steps:

1. Use FC04 to read 30007–30008 “TMS boot identifier”: start address 6, quantity 2. In this example, it reads 23100, 37346 (hexadecimal 0x5A3C, 0x91E2).
2. Choose a command sequence: a number larger than that of the previous command, and not 0. This example uses 101.
3. Write with FC16: start address 1 (40002), quantity 20, with the content shown in the table below.
4. TMS returns a normal FC16 response, which means that the command has been accepted. If it returns an exception code, handle it according to the exception code table in Section 13.5.
5. Use FC03 to read 40022–40025: start address 21, quantity 4.
6. If 40022–40023 equal 0, 101 (the same as the sequence sent), 40024 “Reply status” = 2 and 40025 “Reply error” = 0, the batch has been switched successfully. 40024 = 1 means processing; wait 100–200 ms and read again. 40024 = 3 means failure; handle it according to the error code in 40025 (see Section 13.5).

FC16 write content:

Listed address	Value written	Description
40002	2	Command code: select batch (Pset)
40003	0	Command sequence, high word
40004	101	Command sequence, low word (sequence 101)
40005	23100	Boot identifier, high word (30007 from step 1)
40006	37346	Boot identifier, low word (30008 from step 1)
40007	12	Number of the batch to select: 012
40008–40020	0	Not used by command 2; fill all 13 registers with 0
40021	42330 (0xA55A)	Fixed command trigger value; if it is not this value, the whole command is rejected

Actual packets (hexadecimal):

```
FC16 request : 00 01 00 00 00 2F 01 10 00 01 00 14 28 00 02 00 00 00 65 5A 3C 91 E2 00 0C
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 A5 5A
FC16 response: 00 01 00 00 00 06 01 10 00 01 00 14
FC03 request : 00 02 00 00 00 06 01 03 00 15 00 04
FC03 response: 00 02 00 00 00 0B 01 03 08 00 00 00 65 00 02 00 00
```

In the FC03 response, `00 00 00 65` is reply sequence 101, `00 02` is reply status “Success”, and the final `00 00` is reply error “None”.

For other commands, change only the command code in 40002 and write 0 in 40007; everything else is written the same way:

Command code (40002)	Command	TMS action
3	Lock tool	Disconnects RF and locks the tool; 30014 bit5 “Tool locked” changes to 1
4	Unlock tool	Re-detects RF and unlocks the tool
5	Reset current batch	Clears the progress of the current batch

Note Commands 1, 2 and 5 fail while the operator is working, with 40025 reply error 1 “Busy”; send them after the work is finished. If you send a new command while the previous one is still being processed (40024 = 1), TMS returns exception code 06; wait until the reply status is no longer 1 before sending.

Tip Always increase the command sequence. If you resend the same sequence with exactly the same content, TMS accepts it but does not execute it again; the same sequence with different content, or a sequence older than the previous one, returns exception code 03.

Apply work parameters (command 1) is written in the same way as the example above, but more fields must be filled in. The following example switches TMS to “Torque Wrench” mode with a target torque of 25.00 N·m and a tolerance of ±5%, using command sequence 102. First use FC03 to read 40026–40027 “Reply settings revision” (start address 25, quantity 2); in this example it reads 0, 7.

Listed address	Value written	Description
40002	1	Command code: apply work parameters
40003–40004	0, 102	Command sequence 102
40005–40006	0, 7	Current settings revision (the value read from 40026–40027, not the boot identifier)
40007	0	Not used by command 1
40008	1	Work mode: Torque Wrench
40009	1	Torque unit: N·m
40010	0	Judgement condition: plus/minus tolerance range
40011–40012	0, 25000	Target torque 25.00 × 1000
40013–40014	0, 0	Target angle; must be 0 in Torque Wrench mode

Listed address	Value written	Description
40015–40016	0, 0	Start torque; must be 0 in Torque Wrench mode
40017–40018	0, 5000	Torque tolerance 5% × 1000
40019–40020	0, 0	Angle tolerance; may be non-zero only in Torque & Angle mode
40021	42330 (0xA55A)	Fixed command trigger value

Rules for command 1:

- Allowed work modes: 1 Torque Wrench, 2 Power Tool, 3 Torque & Angle, 4 Torque Inspection, 6 Tool Inspection. 5 Batch Jobs cannot be applied with command 1 (reply error 5 “Not supported”); use command 2 to select a batch instead.
- In Torque Wrench mode, the tolerance must be a whole number from 1% to 30% (write a multiple of 1000 between 1000 and 30000). In Tool Inspection mode, the tolerance must be greater than 0.
- In Torque Wrench, Power Tool and Tool Inspection modes, the target angle and the start torque must be 0.
- The target torque must be within the sensor capacity; otherwise reply error 3 “Invalid parameter” is returned.
- The work mode must already have been configured in TMS; otherwise reply error 4 “Not found” is returned.
- If the settings revision does not match the current one, reply error 2 “Revision out of date” is returned: read 40026–40027 again and resend the command with a new sequence. After success, 40026–40027 are updated to the new revision.

13.2.8 Example 4: Reading Results and Sending Commands with Python

The following two programs can run on any computer that can reach TMS, and are useful for MES or IT staff to verify integration logic. Python 3.9 or later is required. First run `pip install pymodbus` to install the package, then change `TMS_IP` at the top of the program to the IP address of the TMS computer.

Program 1: reads continuously and prints each new completed result (same logic as Example 2). Press Ctrl+C to exit.

```
# Poll TMS over Modbus TCP and print each new completed result.
# Requires Python 3.9+ and pymodbus (tested with 3.16): pip install pymodbus
import datetime
import time

from pymodbus.client import ModbusTcpClient

TMS_IP = "192.168.1.20"   # IPv4 address of the TMS computer
TMS_PORT = 1502           # "TCP Port"
UNIT_ID = 1               # "Unit ID"

MODES = {0: "-", 1: "Torque wrench", 2: "Power tool", 3: "Torque & angle",
         4: "Torque measurement", 5: "Batch", 6: "Capability"}
UNITS = {0: "-", 1: "N.m", 2: "kgf.cm", 3: "kgf.m", 4: "ozf.in", 5: "lbf.in", 6: "lbf.ft"}
```

```
QC = {0: "No result", 1: "OK", 2: "NOK", 3: "Rehit"}


def u32(regs, i):
    # High word first (ABCD)
    return (regs[i] << 16) | regs[i + 1]


def i32(regs, i):
    value = u32(regs, i)
    return value - 0x1_0000_0000 if value & 0x8000_0000 else value


def u64(regs, i):
    return (u32(regs, i) << 32) | u32(regs, i + 2)


def decode_result(r):
    # r[n] is register 30001 + n
    ts_ms = u64(r, 56)
    when = (datetime.datetime.fromtimestamp(ts_ms / 1000, datetime.timezone.utc)
            if ts_ms else None)
    return {
        "sequence": u32(r, 10),
        "mode": MODES.get(r[15], r[15]),
        "unit": UNITS.get(r[17], r[17]),
        "qc": QC.get(r[20], r[20]),
        "detail_flags": r[21],
        "final_torque": i32(r, 34) / 1000,
        "target_torque": i32(r, 38) / 1000,
        "lower": i32(r, 42) / 1000,
        "upper": i32(r, 44) / 1000,
        "time_utc": when,
    }


def main():
    client = ModbusTcpClient(TMS_IP, port=TMS_PORT, timeout=2)
    if not client.connect():
        raise SystemExit("Cannot connect: check IP, port and firewall")
    last_boot = None
    last_seq = None
    try:
        while True:
            rr = client.read_input_registers(0, count=64, device_id=UNIT_ID)
            if rr.isError():
                print("Read failed:", rr)
                time.sleep(1)
                continue
            r = rr.registers
            if r[0] != 0x544D:
                raise SystemExit("Register 30001 is not 0x544D: not a TMS device")
            boot = u32(r, 6)
            seq = u32(r, 10)
            if boot != last_boot:
                # First read or TMS restarted: remember the counters, report nothing
                last_boot, last_seq = boot, seq
            elif seq != last_seq and r[12] & 0x0004:
                last_seq = seq
                print(decode_result(r))
            time.sleep(0.2)
    finally:
        client.close()


if __name__ == "__main__":
    main()
```

After it starts, one line is printed each time the operator completes a result, for example:

```
{'sequence': 128, 'mode': 'Torque wrench', 'unit': 'N.m', 'qc': 'OK', 'detail_flags': 0,
'final_torque': 25.12, 'target_torque': 25.0, 'lower': 23.75, 'upper': 26.25, 'time_utc':
datetime.datetime(2026, 11, 15, 8, 30, tzinfo=datetime.timezone.utc)}
```

Program 2: sends command 2 to switch to batch 012 and waits for the result (same logic as Example 3).

```
# Send command 2 (select batch / Pset) to TMS over Modbus TCP and wait for the reply.
# Requires Python 3.9+ and pymodbus (tested with 3.16): pip install pymodbus
import time

from pymodbus.client import ModbusTcpClient

TMS_IP = "192.168.1.20"
TMS_PORT = 1502
UNIT_ID = 1

REPLY_ERRORS = {0: "None", 1: "Busy", 2: "Revision out of date", 3: "Invalid parameter",
                4: "Not found", 5: "Not supported", 6: "Database error",
                7: "Tool unavailable", 8: "Device communication error"}


def select_pset(client, sequence, pset_id):
    # 1. Read the BootId (30007-30008, offset 6)
    boot = client.read_input_registers(6, count=2, device_id=UNIT_ID)
    if boot.isError():
        return f"Cannot read BootId: {boot}"
    # 2. Build the 20-register command block 40002-40021
    values = [2, sequence >> 16, sequence & 0xFFFF,
              boot.registers[0], boot.registers[1], pset_id] + [0] * 13 + [0xA55A]
    wr = client.write_registers(1, values, device_id=UNIT_ID)
    if wr.isError():
        return f"Command rejected: {wr}"
    # 3. FC16 accepted only means "received"; poll 40022-40025 (offset 21) for the result
    for _ in range(50):
        rep = client.read_holding_registers(21, count=4, device_id=UNIT_ID)
        if not rep.isError():
            r = rep.registers
            if ((r[0] << 16) | r[1]) == sequence and r[2] in (2, 3):
                return "Success" if r[2] == 2 else f"Failed: {REPLY_ERRORS.get(r[3], r[3])}"
        time.sleep(0.1)
    return "No final reply within 5 seconds"


if __name__ == "__main__":
    client = ModbusTcpClient(TMS_IP, port=TMS_PORT, timeout=2)
    if not client.connect():
        raise SystemExit("Cannot connect: check IP, port and firewall")
    try:
        print(select_pset(client, sequence=101, pset_id=12))
    finally:
        client.close()
```

On success, it prints `Success`; if the batch does not exist, it prints `Failed: Not found`; if TMS rejects the command, it prints `Command rejected:` followed by the exception code details.

> **Tip** This example was tested with pymodbus 3.16. If an older pymodbus version reports an error about the `device_id` parameter, change `device_id=UNIT_ID` to `slave=UNIT_ID`, or upgrade pymodbus.

> **Warning** Program 2 really switches the TMS batch. Run it only in a test environment, or with the approval of the line supervisor.

13.2.9 Error Messages

Screen message	Cause and solution
“Unable to save communication settings.” followed by “請輸入通訊設定名稱。” (the second part is shown in Chinese even in English: enter a name for the communication settings)	“Configuration Name” is empty. Enter a name and save again.
“Unable to save communication settings.” followed by “TCP 綁定 IP 必須是有效的 IPv4 位址。” (the second part is shown in Chinese even in English: the TCP bind IP must be a valid IPv4 address)	“Bind IP Address” has an invalid format. Enter 0.0.0.0 or an IPv4 address such as 192.168.1.20.
“Unable to save communication settings.” followed by “TCP 連接埠必須介於 1 到 65535。” (the second part is shown in Chinese even in English: the TCP port must be between 1 and 65535)	“TCP Port” is out of range. Change it to 1–65535; keeping 1502 is recommended.
“Unable to save communication settings.” followed by “TCP Unit ID 必須介於 0 到 255。” (the second part is shown in Chinese even in English: the TCP Unit ID must be between 0 and 255)	“Unit ID” is out of range. Change it to 0–255.
“Unable to save communication settings.” followed by “TCP 最大連線數必須介於 1 到 32。” (the second part is shown in Chinese even in English: the TCP maximum number of connections must be between 1 and 32)	“Max Clients” is out of range. Change it to 1–32.
“Unable to save communication settings.” followed by “TCP 閒置中斷時間必須介於 1 到 3600 秒。” (the second part is shown in Chinese even in English: the TCP idle disconnect time must be between 1 and 3600 seconds)	“Idle Disconnect (s)” is out of range. Change it to 1–3600.
“Communication settings were saved, but the Modbus TCP server could not apply them: …”	The settings were saved, but the service cannot start with the new settings; common causes are a port already used by another program, or a bind IP that is not a network adapter of this computer. Use another port, or set the bind IP to 0.0.0.0, and save again.
“You do not have permission to perform this operation.”	The “Edit · Communication and Layout” permission is missing. Ask an administrator to adjust it (see Chapter 15).

Common results on the PLC or test tool side:

Symptom	Cause and solution
Connection refused	Modbus TCP is not running, or the port is wrong. Check that “Modbus TCP server: Running” is shown, and verify the port.
Connection timeout, or read timeout after connecting	Wrong IP address, the firewall does not allow the connection, or the Unit ID differs from “Unit ID” (TMS does not reply). Check the IP address, the firewall and the Unit ID in that order.
Disconnected after being connected for a while	No request was sent for longer than “Idle Disconnect (s)”, or the number of connections exceeded “Max Clients”. Shorten the polling interval, or increase the setting.
Exception code 01 (Illegal Function)	A function code not supported by TMS was used, for example FC06. Use only FC03/FC04 for reading and only FC16 for writing.
Exception code 02 (Illegal Data Address)	The address is out of range, or FC16 does not write 20 registers starting at protocol address 1. Check the addresses and the 0-based conversion in Section 13.5.
Exception code 03 (Illegal Data Value)	The read quantity is not 1–125, or the command content is invalid (for example, 40021 is not 0xA55A, the sequence is 0, or the boot identifier does not match). Check each item according to Section 13.5.
Exception code 06 (Server Device Busy)	The previous command is still being processed. Wait until 40024 is no longer 1 before sending.

13.3 Modbus RTU

Path: “Communication Settings” → ⚙ (Edit Modbus RTU) on the right of the “Modbus RTU” row.

Modbus RTU lets a PLC or HMI that has only a serial port read TMS data over an RS-485 (or RS-232) line. TMS is the slave and the PLC is the master; the addresses, data format and command writing are exactly the same as for Modbus TCP (see Examples 2 and 3 in Section 13.2, and Section 13.5). Permission requirements are the same as in Section 13.2.

13.3.1 Wiring and Identifying the COM Port

A typical computer has no RS-485 connector, so you need a USB-to-RS-485 adapter.

Wiring (2-wire RS-485):

Adapter terminal	Connect to PLC terminal	Description
A (sometimes marked D+ or 485+)	A (D+ / 485+)	Data line, positive
B (sometimes marked D− or 485−)	B (D− / 485−)	Data line, negative
GND (signal ground)	GND / SG	Recommended; reduces communication errors caused by interference

- Use twisted-pair cable, with A and B in the same twisted pair; for long distances or environments with strong interference, use shielded twisted-pair cable.
- When the bus is long or several devices are connected, add a 120 Ω termination resistor at each end of the line (many adapters and PLCs have a built-in switch for this). Short single-device connections usually do not need one.
- Manufacturers do not label A and B consistently. If you get no response at all after wiring, swap A and B and try again.
- For RS-232, connect TX to the RX of the other device and RX to its TX, and connect GND; the distance is usually no more than 15 m.

Identifying the COM port number of the adapter:

1. Plug the USB-to-RS-485 adapter into the TMS computer. Windows installs the driver automatically; if it does not, install it according to the adapter manufacturer's instructions.
2. Right-click “Start” and click “Device Manager”.
3. Expand “Ports (COM & LPT)” and find the adapter, for example “USB Serial Port (COM5)”. The COM5 in parentheses is the port to select in TMS. The actual name varies with the adapter and the Windows version.
4. If you are not sure which entry it is, unplug the adapter and see which entry disappears; plug it back in and see which entry appears.

Note The TMS computer may have several COM ports at the same time: the RF receiver, the indicator light (see Section 12.6) and the RS-485 adapter each use one. A COM port can be used by only one function at a time. On a computer upgraded from an earlier version, the indicator light port may still be COM3, the same as the Modbus RTU default; if both are set to the same port, one of them cannot be opened.

Tip If you plug the adapter into a different USB port, Windows may assign it a new COM number. Always plug it into the same USB port; if the number changes, go back to TMS and select the port again.

13.3.2 Screen Description

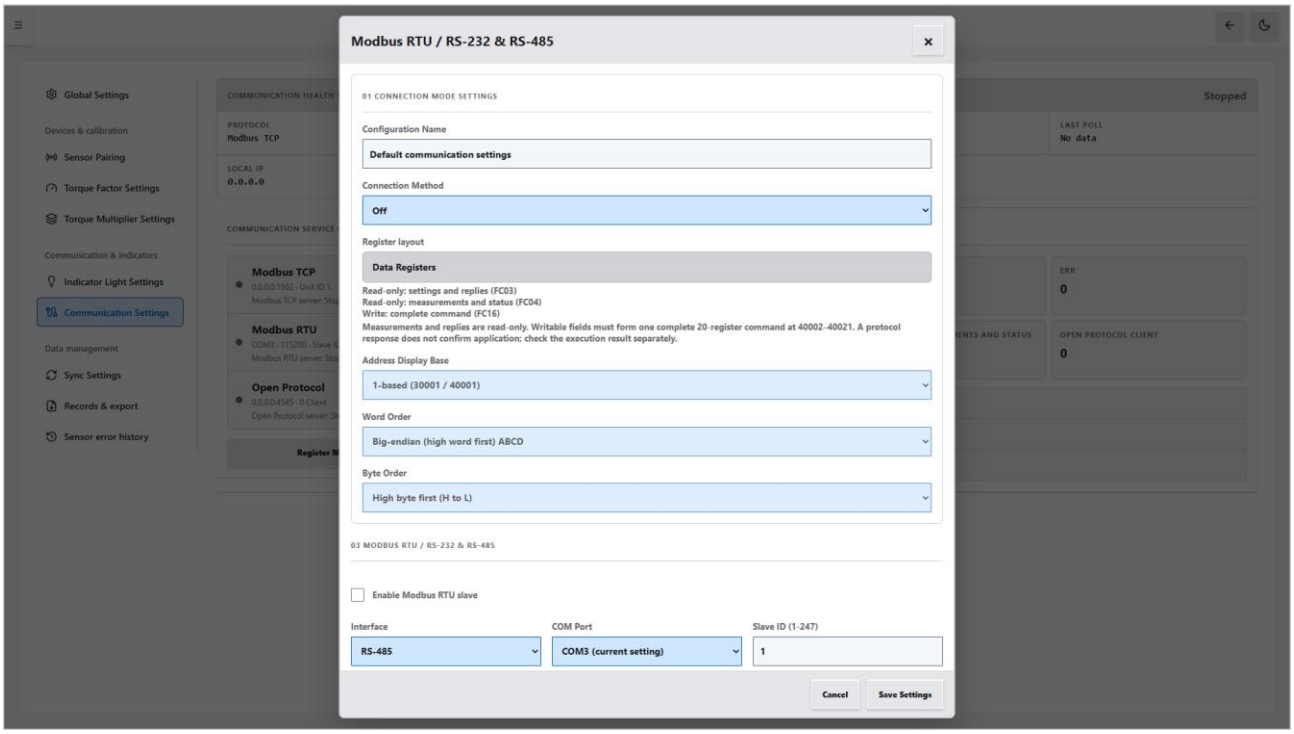

Figure 13-3 Modbus RTU settings window

Area / button	Description
“01 Connection Mode Settings”	Same as in the “Modbus TCP (TMS as server / slave)” window; the two windows share it (see Section 13.2).
“03 Modbus RTU / RS-232 & RS-485”	Enabling Modbus RTU, the COM port and the serial parameters.
“Refresh RTU ports”	Re-detects the COM ports of this computer and updates the “COM Port” list; below it, “N serial port(s) detected” or “No available serial ports detected” is shown. Does not save.
× / “Cancel”	Closes the window without saving.
“Save Settings”	Saves locally and, depending on the enable state, immediately starts, re-applies or stops Modbus RTU. On success, “Communication settings saved locally” is shown.

13.3.3 Fields

Field	Description	Range and default
Enable Modbus RTU slave	When selected and saved, TMS immediately opens the COM port and starts the service, and from then on it starts automatically every time TMS opens. Can be enabled together with Modbus TCP.	Cleared by default
Interface	Records whether this line is RS-485 or RS-232. The electrical interface is determined by the adapter; this option does not change the actual signal.	“RS-485”, “RS-232”; default RS-485

Field	Description	Range and default
COM Port	The COM port of the adapter (see “Wiring and Identifying the COM Port” in this section). A saved port that is currently not detected is shown as “COMx (current setting)”.	Detected COM ports; default COM3
Slave ID (1-247)	The slave ID that the PLC specifies when reading must match this value; if it differs, TMS does not reply. Each device on the same RS-485 line must have a different ID.	1–247; default 1
Baud Rate	Transmission speed; must match the PLC.	9600, 19200, 38400, 57600, 115200; default 115200
Data Bits	Must match the PLC.	7, 8; default 8
Parity	Must match the PLC.	“None”, “Even”, “Odd”; default “None”
Stop Bits	Must match the PLC.	1, 2; default 1

13.3.4 Enabling Modbus RTU

1. Wire the line as described in “Wiring and Identifying the COM Port” in this section, and find the COM port number in Device Manager, for example COM5.
2. In TMS, open “Communication Settings” and click ⚙ on the right of the “Modbus RTU” row. The “Modbus RTU / RS-232 & RS-485” window opens (see Figure 13-3).
3. Click “Refresh RTU ports”. “N serial port(s) detected” appears below it.
4. If you use RTU only, select “Modbus RTU” in “Connection Method”; to keep Modbus TCP as well, select “Enable Modbus RTU slave” instead.
5. In “COM Port”, select COM5.
6. Select “Slave ID (1-247)”, “Baud Rate”, “Data Bits”, “Parity” and “Stop Bits” according to the PLC settings.
7. Click “Save Settings”. The window shows “Communication settings saved locally”, and TMS opens COM5 immediately.
8. Close the window. The “Modbus RTU” row shows the current settings, such as “COM5 · 19200 · Slave ID 3”, and shows that the service is running.
9. On the PLC, configure a Modbus RTU master with the parameters in the table below and read 30001 (protocol address 0); you should read 21581.

Parameters to set on the PLC (master):

PLC setting	Must be set to	Corresponding TMS field
Communication mode	Modbus RTU master	—
Slave ID	Same as TMS	“Slave ID (1-247)”
Baud rate	Same as TMS	“Baud Rate”

PLC setting	Must be set to	Corresponding TMS field
Data bits / parity / stop bits	Same as TMS, for example 8 / Even / 1	"Data Bits", "Parity", "Stop Bits"
Read function codes	FC04 (measurements and status), FC03 (commands and replies)	—
Write function code	FC16 only, writing the 20 registers 40002–40021 at once	—
Response timeout	As recommended for the PLC, for example 500 ms or more	—

Example The PLC requires 19200 bps, 8 data bits, even parity and 1 stop bit, and the slave ID of TMS is 3.
TMS settings: COM Port COM5, Slave ID 3, Baud Rate 19200, Data Bits 8, Parity "Even", Stop Bits 1.
PLC settings: Modbus RTU master, 19200, 8, Even, 1; read FC04 from slave 3, start address 0, quantity 64.
Result: the first value the PLC reads is 21581; from then on, reading works the same way as in Modbus TCP Example 2.

Note Modbus RTU traffic is not counted in the "Live communication summary" or in the "Diagnostics & Test" window. While the RTU service is running, "Data Quality" always shows "Good", which does not mean that the PLC is actually reading. Check on the PLC or test tool that data is being read.

13.3.5 Example: Checking the RTU Connection with a PC Test Tool

Before connecting the PLC, you can use another laptop with a USB-to-RS-485 adapter and a Modbus test tool (for example Modbus Poll or QModMaster) in the role of the PLC. Connect the two adapters A to A, B to B and GND to GND.

Test tool setting	Value	Description
Connection type	Serial / RTU	Not ASCII
Serial port	COM port of the adapter on the laptop, for example COM7	Check it in Device Manager on the laptop
Baud rate / data bits / parity / stop bits	19200 / 8 / Even / 1	Same as TMS
Slave ID	3	Same as "Slave ID (1-247)" in TMS
Function code / start address / quantity	04 / 0 / 6	Reads 30001–30006

After connecting, you should read 21581, 2, 0, 63, 1000, 1000 (the same as Example 1 in Section 13.2). The RTU packets actually sent on the line are shown below (hexadecimal; the last 2 bytes are the CRC, calculated automatically by the tool):

```
Request : 03 04 00 00 00 06 71 EA
Response: 03 04 0C 54 4D 00 02 00 00 00 3F 03 E8 03 E8 C5 7F
```

The leading `03` is slave ID 3, `04` is the function code, and `54 4D` in the response is 21581.

13.3.6 Common Problems

Symptom	What to check
"Service Status" keeps showing "Waiting for COM5; retrying every 2 seconds"	The COM port is used by another program, or the adapter is not plugged in properly. Close the program that uses the port (for example, a test tool on the same computer), and make sure the indicator light does not use the same COM port; if the adapter was unplugged, plug it back into the same USB port. When the COM port becomes available, TMS opens it automatically within 2 seconds; you do not need to press any button. To stop waiting, press "Stop".
The PLC gets no response at all (timeout)	Slave ID mismatch; a mismatch in baud rate, data bits, parity or stop bits; A and B swapped; wrong COM port selected (the RF receiver or the indicator light). Check each item, then try swapping A and B.
Occasional wrong data or CRC errors	Parity or stop bits mismatch; long line without termination resistors; GND not connected; cable that is not twisted pair, or cable routed near motors or inverters.
Works intermittently	Two masters on the same line transmitting at the same time, or another device using the same slave ID. Each RS-485 line can have only one master, and slave IDs must not be duplicated.
Stops working after the adapter is unplugged and plugged back in	The COM number has changed. Check the new number in Device Manager, select it again in TMS and save.
The PLC receives an exception code	Same as Modbus TCP; see the error messages in Section 13.2 and the exception code table in Section 13.5.

> **Tip** When parity is set to "None", some PLCs require 2 stop bits. TMS supports both; just make the settings match the PLC.

13.3.7 Error Messages

Screen message	Cause and solution
"Unable to save communication settings." followed by "請選擇 RTU 連接埠。" (the second part is shown in Chinese even in English: select an RTU port)	"COM Port" is empty. Click "Refresh RTU ports" and select a COM port.
"Unable to save communication settings." followed by "RTU Slave ID 必須介於 1 到 247。" (the second part is shown in Chinese even in English: the RTU Slave ID must be between 1 and 247)	"Slave ID (1-247)" is out of range. Change it to 1–247.

Screen message	Cause and solution
“Unable to save communication settings.” followed by “RTU 波特率必須為 9600、19200、38400、57600 或 115200。” (the second part is shown in Chinese even in English: the RTU baud rate must be 9600, 19200, 38400, 57600 or 115200)	The baud rate is not in the list. Select it again from the drop-down list.
“Unable to save communication settings.” followed by one of “RTU 資料位元必須為 7 或 8。” / “RTU 同位檢查必須為 None、Even 或 Odd。” / “RTU 停止位元必須為 1 或 2。” / “RTU 介面必須為 Rs232 或 Rs485。” (the second part is shown in Chinese even in English: the RTU data bits must be 7 or 8 / the RTU parity must be None, Even or Odd / the RTU stop bits must be 1 or 2 / the RTU interface must be Rs232 or Rs485)	The serial parameters are invalid. Select them again from the drop-down lists and save.
“Unable to load the RTU serial-port list.”	COM port detection failed. Make sure the adapter is plugged in and its driver is installed, then click “Refresh RTU ports”.
“Communication settings were saved, but the Modbus RTU server could not apply them: …”	The settings were saved, but the service cannot start with the new parameters. Check the serial parameters and save again.
“Unable to start the Modbus RTU server.” followed by “Unable to start the ${protocol} server.” (the second part is shown exactly like this, including “${protocol}”)	The parameters were invalid when you pressed “Start”. Check each of the items above.
“Unable to start the Modbus RTU server.” followed by “Modbus RTU 服務已在執行。” (the second part is shown in Chinese even in English: the Modbus RTU service is already running)	The service is already running. To restart it, press “Stop” and then “Start”.

13.4 Open Protocol

Path: “Communication Settings” → ⚙ (Edit Open Protocol) on the right of the “Open Protocol” row.

Open Protocol is an Ethernet communication format commonly used by tightening equipment. Here TMS acts as a “tightening controller”: the MES or tightening management system (the client) connects to TMS to subscribe to tightening results, select batches, and lock or enable the tool. Permission requirements are the same as in Section 13.2.

Before you start, note the following:

- TMS sends tightening results only in “Batch Jobs” mode, and only when a batch (Pset) has been selected. Results from other work modes are not sent over Open Protocol; if you need them, use Modbus (Section 13.2) or the read API (see Chapter 14) instead.

- Torque in results is always expressed in N·m, multiplied by 100 (for example, 25.12 N·m is sent as 002512), regardless of the display unit on the TMS screen. Angles are whole degrees.
- Times are always UTC, in the format `YYYY-MM-DD:HH:MM:SS`; add 8 hours for Taiwan time.
- A “batch” corresponds to an Open Protocol Pset, numbered 001–999 (see Chapter 9). Only batches that are fully configured and have at least 1 torque step (with a count greater than 0) appear in the Pset list.

13.4.1 Screen Description

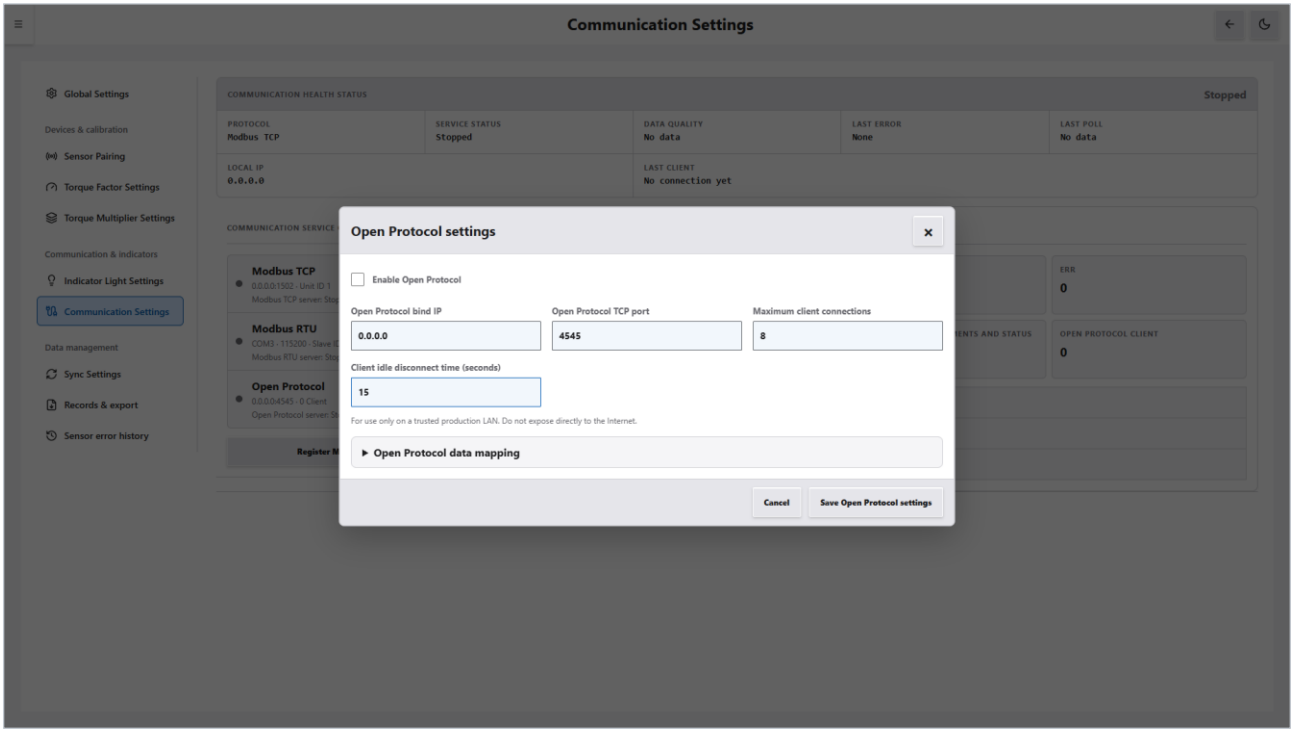

Figure 13-4 Open Protocol settings window

Area / button	Description
Enable and connection fields	“Enable Open Protocol”, IP address, port and connection limits (see the field table below).
“For use only on a trusted production LAN. Do not expose directly to the Internet.”	Security reminder. Open Protocol has no encryption and no account authentication.
“Open Protocol data mapping”	Click the title to expand the list of messages supported by TMS: “Direction”, “MID”, “Revision”, “Function”, “Mapped data or action” and “Response or acknowledgement MID”. The content is the same as the MID tables in this section.
× / “Cancel”	Closes the window without saving.
“Save Open Protocol settings”	Saves locally and, depending on the enable state, immediately starts, re-applies or stops the service. On success, “Open Protocol settings saved locally” is shown. Not available without edit permission or before the settings have finished loading.

13.4.2 Fields

Field	Description	Range and default
Enable Open Protocol	When selected and saved, the service starts immediately, and from then on it starts automatically every time TMS opens.	Cleared by default
Open Protocol bind IP	The network adapter on which TMS waits for connections; 0.0.0.0 means all network adapters.	IPv4 address; default 0.0.0.0
Open Protocol TCP port	The port the client connects to. Must not be the same as Modbus TCP or another program; conflicts are not checked when you save, and the service cannot start if there is a conflict.	1–65535; default 4545
Maximum client connections	Maximum number of clients connected at the same time; new connections beyond this limit are rejected.	1–32; default 8
Client idle disconnect time (seconds)	If a client sends no message for this period, TMS disconnects it. The client should send MID 9999 (keep alive) periodically.	5–3600 seconds; default 15

13.4.3 Enabling Open Protocol

1. Find the IP address of the TMS computer (in the same way as step 1 of the procedure in Section 13.2), for example 192.168.1.20.
2. In “Communication Settings”, click ⚙ on the right of the “Open Protocol” row. The “Open Protocol settings” window opens (see Figure 13-4).
3. Select “Enable Open Protocol”.
4. Check “Open Protocol TCP port”. Unless you have special requirements, keep 4545.
5. Click “Save Open Protocol settings”. The window shows “Open Protocol settings saved locally”, and the service starts immediately.
6. If Windows displays a firewall prompt, handle it as described in “Windows Firewall” in Section 13.2, with port 4545 instead.
7. Close the window. The “Open Protocol” row shows “0.0.0.0:4545 · 0 Client” and that the service is running.
8. In the MES or tightening management system, set up the controller connection: IP 192.168.1.20, port 4545, and a keep-alive interval of 10 seconds.
9. After the client connects, the client count in the “Open Protocol” row and “Open Protocol Client” in the “Live communication summary” change to 1.
10. In TMS, enter “Batch Jobs”, select a batch and complete one tightening. The client should receive the MID 0061 tightening result.

> **Tip** The keep-alive interval of the client must be shorter than “Client idle disconnect time (seconds)”. With the default of 15 seconds, sending MID 9999 every 10 seconds is recommended.

13.4.4 Message Format

Each message is ASCII text: the first 20 characters are the header, followed by the data, and the message must always end with 1 NUL character (0x00).

Character position	Length	Content	Example
1–4	4	Message length: number of characters in the header plus data, excluding the trailing NUL	0020
5–8	4	MID (message ID)	0001
9–11	3	Revision; blank or 000 is treated as 001	001
12	1	No Ack Flag; blank, 0 or 1	Blank
13–20	8	Station ID, Spindle ID, Sequence number, Message parts, Message part number; not used by TMS, filled with spaces	8 spaces
21 onward	Depends on the MID	Data	—
Last	1	NUL (0x00), required in every message	—

- A single message sent by the client can be up to 4096 characters long.
- In messages sent by TMS, header characters 12–20 are always 9 spaces.
- The first message after connecting must be MID 0001. If the client first sends another MID supported by TMS, TMS closes the connection immediately.

13.4.5 Supported MIDs

Client → TMS (sent by the client, answered by TMS):

MID	Revision	Purpose	TMS reply
0001	001	Communication start; must be sent first after connecting	0002 communication start acknowledge (controller name “TMS RF”)
0003	001	Communication stop	TMS closes the connection
9999	001	Keep alive	Returns 9999 unchanged
0010	001	Request the batch (Pset) list	0011 list: 3-digit count, followed by each 3-digit batch number
0014	001	Subscribe to “batch selected” notifications	0005; then 0015 whenever the batch changes (if a batch is already active when subscribing, 0015 is sent once immediately)
0016	001	Acknowledge 0015	—
0017	001	Unsubscribe from “batch selected”	0005
0018	001	Select a batch; the data is a 3-digit batch number 001–999	0005 or 0004

MID	Revision	Purpose	TMS reply
0020	001	Reset batch progress; the data is a 3-digit batch number, which must be the currently active batch	0005 or 0004
0040	001	Request tool data	0041 revision 006 (sensor serial number, model, capacity); 0004 with error 27 if there is no active sensor
0042	001	Disable tool: disconnect RF and lock	0005
0043	001	Enable tool: re-detect RF and unlock	0005
0060	002	Subscribe to tightening results; only revision 002 is accepted	0005; then 0061 for each result
0062	002	Acknowledge 0061	—
0063	002	Unsubscribe from tightening results	0005
0070	001 or 002	Subscribe to alarms	0005, and 0076 alarm status immediately
0072	001 or 002	Acknowledge 0071	—
0073	001 or 002	Unsubscribe from alarms	0005
0075	001 or 002	Acknowledge 0074	—
0077	001 or 002	Acknowledge 0076	—

TMS → Client (sent by TMS on its own initiative):

MID	Revision	Purpose	Client must reply
0002	001	Communication start acknowledge	—
0004	001	Command error: the data is the 4-digit failed MID + 2-digit error code	—
0005	001	Command accepted: the data is the 4-digit accepted MID	—
0015	001	Batch selected: 3-digit batch number + selection time	0016
0061	002	Tightening result (fields described in “Example: Complete Communication Sequence” in this section)	0062
0071	Same as the subscription	Alarm raised: alarm code, controller ready, tool ready, time	0072
0074	Same as the subscription	Alarm cleared: alarm code	0075
0076	Same as the subscription	Alarm status: whether there is an alarm, alarm code, controller ready, tool ready, time	0077

Alarm codes: 9001 = receiver not connected; 9002 = no new sensor data; other values are error flag values reported by the tool; 0 = no alarm. While TMS is waiting for the client's acknowledgement, it does not send new alarm messages.

> **Note** After sending MID 0061, TMS waits for the client to reply with 0062. If nothing is received within 1 second, TMS resends the message, up to 3 times; if there is still no reply, it closes the connection. If a new result is produced before the previous one has been acknowledged, TMS also closes the connection. Reply with 0062 immediately after receiving 0061. If you send 0062 when there is no message to acknowledge, TMS replies with 0004 error 01.

13.4.6 Example: Complete Communication Sequence

> **Example** The MES (client) connects to TMS at 192.168.1.20:4545, subscribes to tightening results, and selects batch 012; the operator completes the 3rd part of the batch, and finally the MES ends communication.

The messages actually sent and received are shown below. Every line ends with 1 invisible NUL (0x00); header characters 12–20 and the end of some fields are spaces.

```
1  Client → TMS : 00200001001
2  TMS → Client : 00570002001         010000020003TMS RF
3  Client → TMS : 00200060002
4  TMS → Client : 00240005001         0060
5  Client → TMS : 00230018001         012
6  TMS → Client : 00240005001         0018
7  Client → TMS : 00209999001
8  TMS → Client : 00209999001
9  TMS → Client : 03850061002         010000020003TMS RF                    04
0500000601207010800000090005100003111123131140150160170180190200000000000210023752200262523002500240025122500000260000027000002800000290000030000003100000320003300034000350000003600000037000000380000003900000040000000410000000128420000043000004420101603      452026-11-15:08:30:00462026-11-14:23:40:00
10 Client → TMS : 00200062002
11 Client → TMS : 00200060001
12 TMS → Client : 00260004001         006097
13 Client → TMS : 00200003001
```

Line	MID	Description
1–2	0001 → 0002	Communication start. 0002 data: `01` Cell ID 0000; `02` Channel ID 00; `03` controller name “TMS RF” (padded with spaces to 25 characters). Length 0057 = 20 + 37.
3–4	0060 → 0005	Subscription to tightening results with revision 002; TMS replies 0005 to accept it (data 0060).
5–6	0018 → 0005	Selection of batch 012. If the batch does not exist, TMS replies 0004 with error code 02 instead.
7–8	9999 → 9999	Keep alive, once every 10 seconds.
9	0061	The operator completes a tightening and TMS sends the result, 385 characters in total. See the table below for the fields.
10	0062	The client acknowledges it within 1 second.
11–12	0060 → 0004	Error example: subscribing with revision 001; TMS replies 0004 with data `0060` + `97` (unsupported revision).
13	0003	End of communication; TMS closes the connection.

The MID 0061 data consists of 46 fields, each a “2-digit field number + fixed-length content”. Meaning of each field in this example:

Field	Content in this example	Description
01 / 02	0000 / 00	Cell ID / Channel ID, always 0
03	TMS RF (padded with spaces to 25 characters)	Controller name
04 / 05	25 spaces / 0000	VIN / Job ID, not used
06	012	Batch (Pset) number
07 / 08	01 / 00000	Tightening strategy 01 (torque control) / strategy options
09	0005	Batch size: 5 parts
10	0003	Batch counter: 3rd part
11	1	Tightening status: 1 = OK; 0 = NOK (including rehits)
12	3	Batch status: 0 = this part NOK; 1 = batch completed; 2 = batch size is 0; 3 = in progress
13	1	Torque status: 0 = low; 1 = OK; 2 = high
14	0	Angle status: 0 = low or no angle judgement; 1 = OK; 2 = high
15–19	0	Other monitoring statuses, not used
20	0000000000	Error flags (decimal sum, see the table below); 0 means no error
21	002375	Torque lower limit 23.75 N·m (2375 ÷ 100)
22	002625	Torque upper limit 26.25 N·m
23	002500	Target torque 25.00 N·m
24	002512	Final torque 25.12 N·m
25–28	00000	Angle lower limit, angle upper limit, target angle, final angle (whole degrees); no angle in this example
29–40	0	Not used
41	0000000128	Tightening ID: TMS record number 128, which can be matched with the Records page (see Section 11.8)
42 / 43	00000 / 00000	Not used
44	20101603 (padded with spaces to 14 characters)	Sensor serial number
45	2026-11-15:08:30:00	Result time (UTC); 16:30:00 Taiwan time
46	2026-11-14:23:40:00	Time of the last change to the batch settings (UTC)

Values of the field 20 error flags (added together when several occur at the same time):

Value	Meaning
2	Angle low
4	Torque high
8	Angle high
16384	Torque low
131072	Rehit
262144	Invalid data
8388608	Sensor fault

Example Field 20 = 0000016384, field 11 = 0 and field 13 = 0 mean that this part had low torque and was judged NOK.

13.4.7 MID 0004 Error Codes

Error code	Meaning	Common causes and solutions
01	Invalid data	Wrong data format; subscribing to something already subscribed, or unsubscribing from something not subscribed; or sending an acknowledgement when there is no message to acknowledge (for example, sending 0062 one extra time). Check the format and the send/receive order.
02	Batch does not exist	The batch number specified in 0018 is not in the list; the batch specified in 0020 is not the currently active batch, or there is no active batch. Send 0010 first to get the list.
03	Batch cannot be selected	The batch settings are incomplete, or the batch has no torque step. Complete the batch settings in TMS (see Chapter 9).
16	Busy	Selecting or resetting a batch was requested while the operator was working, or 0001 was sent again during a connection. Send the request again after the work is finished.
27	Tool unavailable	No sensor is available, for example when 0040 requests tool data and there is no active sensor. Select a sensor in TMS first (see Section 12.3).
79	Command failed	TMS failed to read or write local data. Try again later; if it keeps happening, reopen TMS.
97	Unsupported revision	For example, sending 0060 with revision 001. Send the MID with the revision given in the “Supported MIDs” table in this section.
99	Unsupported MID	TMS does not support this MID. Use only the MIDs listed in the “Supported MIDs” table in this section.

13.4.8 Example: Receiving Tightening Results with Python

The following program uses only the Python standard library and can be used to verify the send/receive logic on the MES side: it connects, subscribes to results, sends keep-alive every 10 seconds, replies 0062 immediately after receiving 0061, and prints the parsed result. Python 3.9 or later is required; change `TMS_IP` to the IP address of the TMS computer, and press Ctrl+C to exit.

```
# Receive tightening results from TMS over Open Protocol (MID 0060 / 0061 / 0062).
# Requires Python 3.9+; uses only the standard library.
import socket
import time

TMS_IP = "192.168.1.20"     # IPv4 address of the TMS computer
TMS_PORT = 4545             # "Open Protocol TCP port"
KEEP_ALIVE_SECONDS = 10     # must be shorter than "Client idle disconnect time (seconds)"

# MID 0061 revision 2: data width of fields 01-46 (each field = 2-digit number + data)
FIELD_WIDTHS = [4, 2, 25, 25, 4, 3, 2, 5, 4, 4, 1, 1, 1, 1, 1, 1, 1, 1, 10,
                6, 6, 6, 6, 5, 5, 5, 5, 5, 5, 5, 3, 3, 3, 6, 6, 6, 6, 6, 6,
                10, 5, 5, 14, 19, 19]


def frame(mid, revision=1, payload=""):
    # 20-character header + payload + NUL terminator
    text = f"{20 + len(payload):04d}{mid:04d}{revision:03d}" + " " * 9 + payload
    return text.encode("ascii") + b"\x00"


def parse_0061(msg):
    fields, pos = {}, 20
    for number, width in enumerate(FIELD_WIDTHS, start=1):
        if msg[pos:pos + 2] != f"{number:02d}":
            raise ValueError(f"Unexpected data at position {pos}")
        fields[number] = msg[pos + 2:pos + 2 + width]
        pos += 2 + width
    return {
        "pset": int(fields[6]),
        "batch": f"{int(fields[10])}/{int(fields[9])}",
        "ok": fields[11] == "1",
        "torque_nm": int(fields[24]) / 100,
        "min_nm": int(fields[21]) / 100,
        "max_nm": int(fields[22]) / 100,
        "tightening_id": int(fields[41]),
        "serial": fields[44].strip(),
        "time_utc": fields[45],
    }


class Connection:
    def __init__(self, host, port):
        self.sock = socket.create_connection((host, port), timeout=5)
        self.buffer = b""

    def send(self, data):
        self.sock.sendall(data)

    def receive(self):
        # Every message ends with NUL (0x00)
        while b"\x00" not in self.buffer:
            chunk = self.sock.recv(4096)
            if not chunk:
                raise ConnectionError("TMS closed the connection")
            self.buffer += chunk
        raw, self.buffer = self.buffer.split(b"\x00", 1)
        return raw.decode("ascii")


def main():
    conn = Connection(TMS_IP, TMS_PORT)
```

```
    try:
        conn.send(frame(1))                    # MID 0001 communication start
        print("<-", conn.receive())            # expect MID 0002
        conn.send(frame(60, revision=2))       # MID 0060 subscribe to results, revision 2
        print("<-", conn.receive())            # expect MID 0005 (accepted 0060)
        conn.sock.settimeout(1)
        last_sent = time.monotonic()
        while True:
            if time.monotonic() - last_sent >= KEEP_ALIVE_SECONDS:
                conn.send(frame(9999))         # keep alive
                last_sent = time.monotonic()
            try:
                msg = conn.receive()
            except socket.timeout:
                continue
            mid = msg[4:8]
            if mid == "0061":
                print(parse_0061(msg))
                conn.send(frame(62, revision=2))  # acknowledge within 1 second
                last_sent = time.monotonic()
            elif mid == "0004":
                print("Error: MID", msg[20:24], "code", msg[24:26])
    except KeyboardInterrupt:
        conn.send(frame(3))                    # MID 0003 communication stop
    finally:
        conn.sock.close()


if __name__ == "__main__":
    main()
```

After it starts, it first prints 0002 and 0005; then it prints one line each time the operator completes a part in Batch Jobs, for example:

```
{'pset': 12, 'batch': '3/5', 'ok': True, 'torque_nm': 25.12, 'min_nm': 23.75, 'max_nm': 26.25,
'tightening_id': 128, 'serial': '20101603', 'time_utc': '2026-11-15:08:30:00'}
```

13.4.9 Error Messages

Screen message	Cause and solution
“Unable to save Open Protocol settings.” followed by “Open Protocol 綁定 IP 必須是有效的 IPv4 位址。” (the second part is shown in Chinese even in English: the Open Protocol bind IP must be a valid IPv4 address)	“Open Protocol bind IP” has an invalid format. Enter 0.0.0.0 or a local IPv4 address.
“Unable to save Open Protocol settings.” followed by “Open Protocol 連接埠必須介於 1 到 65535。” (the second part is shown in Chinese even in English: the Open Protocol port must be between 1 and 65535)	“Open Protocol TCP port” is out of range. Change it to 1–65535; keeping 4545 is recommended.
“Unable to save Open Protocol settings.” followed by “Open Protocol 最大連線數必須介於 1 到 32。” (the second part is shown in Chinese even in English: the Open Protocol maximum number of connections must be between 1 and 32)	“Maximum client connections” is out of range. Change it to 1–32.
“Unable to save Open Protocol settings.” followed by “Open Protocol 閒置中斷時間必須介於 5 到 3600 秒。” (the second part is shown in Chinese even in English: the Open Protocol idle disconnect time must be between 5 and 3600 seconds)	“Client idle disconnect time (seconds)” is out of range. Change it to 5–3600.

Screen message	Cause and solution
“Open Protocol settings were saved, but the server could not apply them: …”	The settings were saved, but the service cannot start; the text after the colon is the system reason, in English. The most common cause is a port that is the same as that of Modbus TCP or another program. Use another port and save again.
“Unable to load Open Protocol settings.”	Reading the settings failed. Close the window and open it again; if it still fails, log in again.
“Unable to start the Open Protocol server.” followed by “Unable to complete the operation.” (cause: the System Settings service is temporarily unavailable)	The service cannot start when you press “Start”, for example because the port is in use. Check the port and try again.
“You do not have permission to perform this operation.”	The “Edit · Communication and Layout” permission is missing. Ask an administrator to adjust it (see Chapter 15).

Common situations on the client side:

Symptom	Cause and solution
Disconnected immediately after connecting	The first message was not 0001, or the number of connections has reached “Maximum client connections”. Send 0001 first; close clients that are not in use.
Disconnected after about 15 seconds	No keep-alive was sent. Send 9999 every 10 seconds, or increase “Client idle disconnect time (seconds)”.
Disconnected a few seconds after receiving a result	0062 was not sent within 1 second. Reply with 0062 immediately after receiving 0061.
Subscription succeeded, but 0061 never arrives	TMS is not in “Batch Jobs” mode, or no batch is selected; other work modes do not send results.
TMS does not respond, or closes the connection after receiving a message	The message lacks the trailing NUL (0x00), or the length field does not match the actual number of characters: TMS keeps waiting for the rest of the data, or closes the connection after detecting a format error. Check the message against “Message Format” in this section.

13.5 Modbus Register Map

Path: “Communication Settings” → “Register Map”.

The “Modbus Register Map” lists all the Modbus addresses provided by TMS and can be exported to CSV or Excel for PLC programmers. Modbus TCP and Modbus RTU use the same register map. Requires the “View · System Settings” permission.

13.5.1 Screen Description

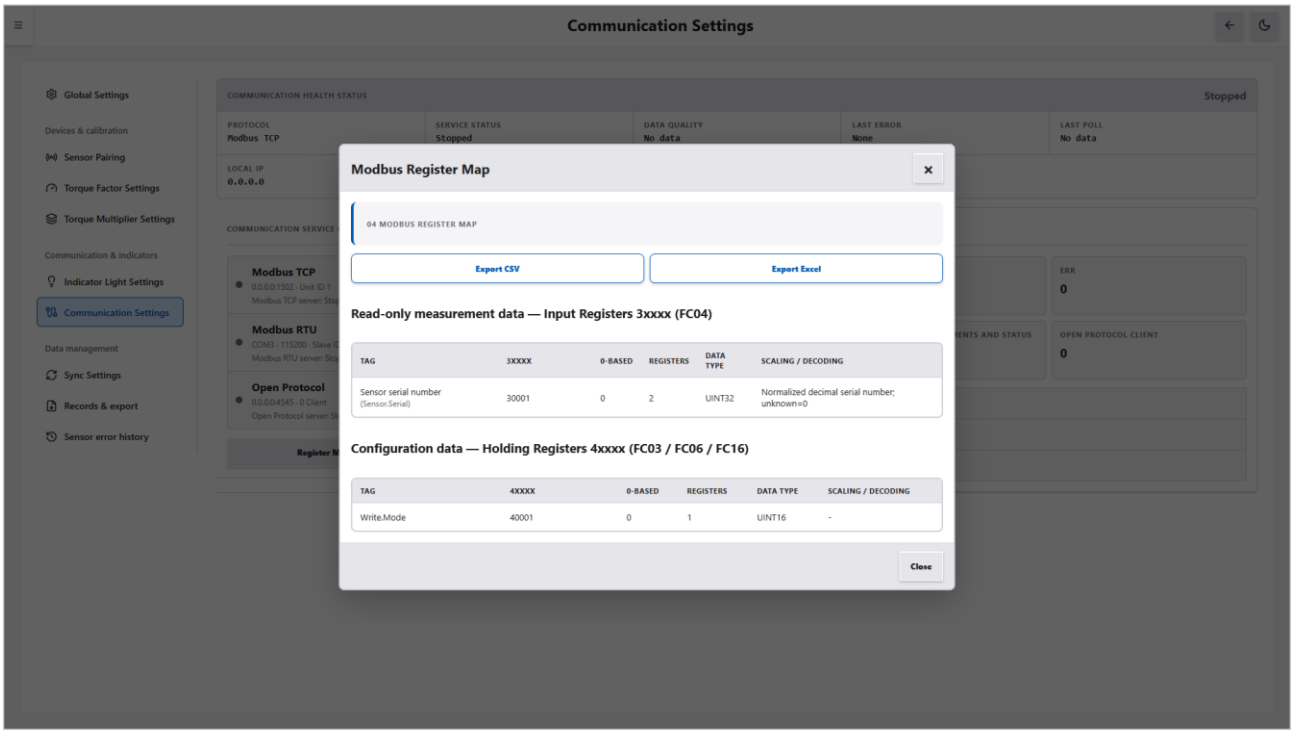

Figure 13-5 Modbus register map (simplified view)

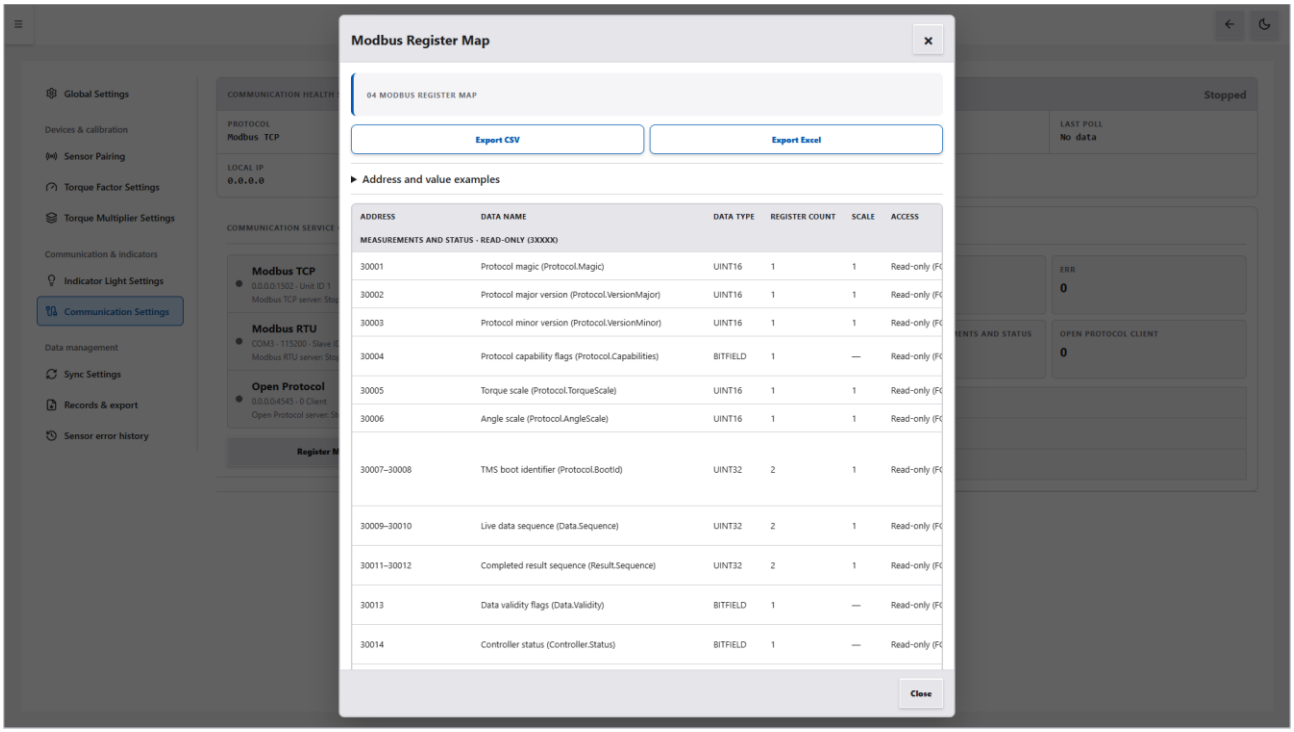

Figure 13-6 Modbus register map (full register map)

Area / button	Description
“04 Modbus Register Map”	Window title area.
“Export CSV”	Exports `modbus-register-map.csv` (UTF-8; opens directly in Excel with all characters displayed correctly). Does not switch screens.

Area / button	Description
"Export Excel"	Exports `modbus-register-map.xlsx`, with the worksheet name "Modbus Register Map". Does not switch screens.
"Address and value examples"	Uses "Current torque", "Live Angle" and "Command target torque" as examples, and lists "Listed address", "Protocol start address (zero-based)", "Raw register values (high word first)" and "Value conversion". Labeled "Illustrative values, not live device data."
Register table	The columns are "Address", "Data name", "Data Type", "Register Count", "Scale", "Access" and "Scaling / Decoding", divided into two groups: "Measurements and status · Read-only (3xxxx)" and "Commands and replies (4xxxx; access varies by row)" (see Figure 13-6).
"Platform differences and limitations"	Below the register table; describes the differences from the TMS Android version. If you use only this Windows version, you can skip it.
"Close" / ×	Closes the window.

When the window opens, if the full register map has not been loaded yet, two simplified tables are shown first, "Read-only measurement data — Input Registers 3xxxx (FC04)" and "Configuration data — Holding Registers 4xxxx (FC03 / FC06 / FC16)", with only a few rows (see Figure 13-5). In that case, close the window and open it again; if the simplified tables are still shown, leave the "Communication Settings" page and enter it again.

> **Note** FC06 in the title of the simplified table does not apply. TMS does not accept FC06; writes always use the complete 20-register FC16 command (see Example 3 in Section 13.2). Export only after the full register map is shown; otherwise the exported file contains only the simplified content.

13.5.2 General Read/Write Rules

Item	Rule
Address base	Listed addresses start from 1 (30001, 40001). Protocol address sent by the PLC = listed address minus 30001 (3xxxx) or minus 40001 (4xxxx). Example: 30011 → 10; 40022 → 21.
Reading measurements and status	FC04; 30001–30064 (protocol addresses 0–63); 1–125 registers per request.
Reading commands and replies	FC03; 40001–40027 (protocol addresses 0–26); 1–125 registers per request.
Writing	Only FC16 is accepted; it must start at 40002 (protocol address 1) and write all 20 registers at once (40002–40021), and 40021 must be 42330 (0xA55A).
32/64-bit values	High word first (ABCD); within each register, high byte first.
Scale 1000	Reading: integer read ÷ 1000 = actual value. Writing: actual value × 1000, rounded to an integer, then written.
Signed INT32	If the 32-bit result is greater than or equal to 2147483648, subtract 4294967296 to get the negative value.

Item	Rule
Torque unit	Torque values use the unit shown in 30017 (live) or 30018 (result); only 30029–30030 are always in N·m.
No data	"No data" is not the same as the value 0. First check the corresponding bit of 30013 "Data validity flags", or the special values (for example 65535, 4294967295).
Unit ID / slave ID	If the Unit ID (TCP) or slave ID (RTU) in the request differs from the setting, TMS does not reply.

13.5.3 Measurements and Status (3xxxx, Read-Only, FC04)

The number in parentheses in the address column is the protocol address (zero-based).

Address	Name	Type / scale	Description
30001 (0)	Protocol identifier `Protocol.Magic`	UINT16	Always 21581 (0x544D); used to confirm that you are connected to TMS
30002 (1)	Protocol major version `Protocol.VersionMajor`	UINT16	Always 2
30003 (2)	Protocol minor version `Protocol.VersionMinor`	UINT16	Always 0
30004 (3)	Protocol capability flags `Protocol.Capabilities`	Bits	bit0 batch selection; bit1 tool control; bit2 batch reset; bit3 apply work parameters; bit4 battery level; bit5 tool error. Always 63 (0x003F): all six are supported
30005 (4)	Torque scale factor `Protocol.TorqueScale`	UINT16	Always 1000
30006 (5)	Angle scale factor `Protocol.AngleScale`	UINT16	Always 1000
30007–30008 (6)	TMS boot identifier `Protocol.BootId`	UINT32	An ID generated each time TMS starts; commands 2–5 must write it to 40005–40006
30009–30010 (8)	Live data sequence `Data.Sequence`	UINT32	Increases by 1 each time the live state changes
30011–30012 (10)	Completed result sequence `Result.Sequence`	UINT32	Increases by 1 for each completed result (all work modes); does not increase on repeated reads; restarts from 0 after TMS restarts
30013 (12)	Data validity flags `Data.Validity`	Bits	See "Bit Definitions" in this section
30014 (13)	Controller status `Controller.Status`	Bits	See "Bit Definitions" in this section
30015 (14)	Live work mode `Mode.Live`	UINT16	See "Code Tables" in this section

Address	Name	Type / scale	Description
30016 (15)	Completed result mode `Mode.Result`	UINT16	Work mode of this completed result; same codes as 30015
30017 (16)	Live torque unit `Unit.Live`	UINT16	0 not set; 1–6, see “Code Tables” in this section
30018 (17)	Completed result unit `Unit.Result`	UINT16	Torque unit of this completed result; same codes as 30017
30019 (18)	Active batch `Batch.PsetId`	UINT16	Current batch (Pset) number; 0 means not set
30020 (19)	Active step `Batch.ActiveStep`	UINT16	Current batch step, starting from 1; 0 means not set
30021 (20)	QC result `Result.QC`	UINT16	0 no result yet; 1 pass (OK); 2 fail (NOK); 3 rehit (Rehit)
30022 (21)	Result detail flags `Result.DetailFlags`	Bits	See “Bit Definitions” in this section
30023 (22)	Tool error flags `Tool.ErrorFlags`	Bits	Raw error bits reported by the tool; several bits may be 1 at the same time; all 0 means no tool error
30024 (23)	Sensor battery level `Sensor.BatteryPercent`	UINT16	0–100 (%); 65535 (0xFFFF) means not yet available
30025 (24)	Sensor model code `Sensor.ModelCode`	UINT16	Model code reported by the sensor; 0 means unknown
30026 (25)	Sensor state `Sensor.State`	Bits	bit0 selected; bit1 paired; bit2 data fresh
30027–30028 (26)	Sensor serial number `Sensor.Serial`	UINT32	Decimal serial number; 0 means unknown
30029–30030 (28)	Sensor capacity `Sensor.CapacityNm`	INT32 ÷1000	Always in N·m; for example, 10000 means 10 N·m
30031–30032 (30)	Live torque `Torque.Live`	INT32 ÷1000	Unit according to 30017
30033–30034 (32)	Live angle `Angle.Live`	INT32 ÷1000	Degrees; for example, 90500 means 90.5°
30035–30036 (34)	Final torque `Torque.Final`	INT32 ÷1000	Unit according to 30018; held until the next result is completed
30037–30038 (36)	Final angle `Angle.Final`	INT32 ÷1000	Degrees; held until the next result is completed
30039–30040 (38)	Target torque `Torque.Target`	INT32 ÷1000	Unit according to 30018
30041–30042 (40)	Target angle `Angle.Target`	INT32 ÷1000	Degrees
30043–30044 (42)	Torque lower limit `Torque.Lower`	INT32 ÷1000	Lower OK limit; unit according to 30018

Address	Name	Type / scale	Description
30045–30046 (44)	Torque upper limit `Torque.Upper`	INT32 ÷1000	Upper OK limit; unit according to 30018
30047–30048 (46)	Angle lower limit `Angle.Lower`	INT32 ÷1000	Degrees
30049–30050 (48)	Angle upper limit `Angle.Upper`	INT32 ÷1000	Degrees
30051–30052 (50)	Batch OK count `Batch.CompletedOk`	UINT32	Counts OK only; NOK and rehits are not counted
30053–30054 (52)	Batch target count `Batch.Size`	UINT32	Number of parts planned for this batch
30055–30056 (54)	Pulse count `Pulse.Count`	UINT32	0 means no data
30057–30060 (56)	Result time `Result.TimestampMs`	UINT64	Milliseconds since 1970-01-01 00:00:00 UTC; 0 means not provided
30061–30062 (60)	Sensor data age `Sensor.AgeMs`	UINT32	Milliseconds; data older than 3000 is treated as invalid; 4294967295 means no data yet
30063–30064 (62)	Result age `Result.AgeMs`	UINT32	Milliseconds; 4294967295 means no data yet

13.5.4 Commands and Replies (4xxxx)

Address	Name	Type / scale	Description
40001 (0)	Command version `Command.Version`	UINT16	Read-only (FC03); always 2
40002 (1)	Command code `Command.Code`	UINT16	1 apply work parameters; 2 select batch; 3 lock tool; 4 unlock tool; 5 reset current batch
40003–40004 (2)	Command sequence `Command.Sequence`	UINT32	Must not be 0; each new command must be larger than the previous one
40005–40006 (4)	Settings revision / boot identifier `Command.RevisionOrBootId`	UINT32	Command 1: the settings revision from 40026–40027; commands 2–5: the boot identifier from 30007–30008
40007 (6)	Command batch number `Command.PsetId`	UINT16	Used by command 2, 1–999; 0 for other commands
40008 (7)	Command work mode `Command.Mode`	UINT16	Used by command 1; same codes as 30015; 1, 2, 3, 4 and 6 are allowed
40009 (8)	Command torque unit `Command.Unit`	UINT16	Used by command 1; 1–6, same codes as 30017

Address	Name	Type / scale	Description
40010 (9)	Command judgement condition `Command.Condition`	UINT16	Used by command 1: 0 plus/minus tolerance range; 1 target as the lower limit, target plus tolerance as the upper limit
40011–40012 (10)	Command target torque `Command.TargetTorque`	INT32 ×1000	Unit according to 40009; for example, write 25000 for 25.00
40013–40014 (12)	Command target angle `Command.TargetAngle`	INT32 ×1000	Degrees; for example, write 90500 for 90.5
40015–40016 (14)	Command start torque `Command.StartTorque`	INT32 ×1000	Unit according to 40009
40017–40018 (16)	Command torque tolerance `Command.Tolerance`	INT32 ×1000	%; for example, write 5000 for 5%
40019–40020 (18)	Command angle tolerance `Command.AngleTolerance`	INT32 ×1000	Degrees; for example, write 1500 for 1.5
40021 (20)	Command trigger `Command.Apply`	UINT16	Must be 42330 (0xA55A) for the command to be accepted
40022–40023 (21)	Reply sequence `Reply.Sequence`	UINT32	Read-only; the corresponding command sequence
40024 (23)	Reply status `Reply.Status`	UINT16	Read-only; 0 no reply yet; 1 processing; 2 success; 3 failure
40025 (24)	Reply error `Reply.Error`	UINT16	Read-only; see “Code Tables” in this section
40026–40027 (25)	Reply settings revision `Reply.Revision`	UINT32	Read-only; the current settings revision, updated after command 1 succeeds

13.5.5 Bit Definitions

A bit value of 1 means that the state is true. bit0 is the least significant bit (value 1); bit7 has the value 128.

Bit	30013 Data validity flags	30014 Controller status	30022 Result detail flags
bit0	Live torque valid	Ready	Torque low
bit1	Live angle valid	Cycle active	Torque high
bit2	Completed result valid	Cycle complete	Angle low
bit3	Work session active	Receiver connected	Angle high
bit4	Sensor data fresh	Sensor data fresh	Rehit
bit5	Encoding error	Tool locked	Sensor fault

Bit	30013 Data validity flags	30014 Controller status	30022 Result detail flags
bit6	Final angle valid	Low battery (10% or less)	Invalid data
bit7	Battery level valid	Tool fault	—

Example 30014 reads 25 (binary 0001 1001) = bit0 + bit3 + bit4: ready, receiver connected, sensor data fresh. A reading of 57 (0011 1001) means that bit5 “Tool locked” is also set.

13.5.6 Code Tables

Code	Work mode (30015, 30016, 40008)	Torque unit (30017, 30018, 40009)	QC result (30021)
0	Not set	Not set	No result yet
1	Torque Wrench	N·m	Pass (OK)
2	Power Tool	kgf·cm	Fail (NOK)
3	Torque & Angle	kgf·m	Rehit
4	Torque Inspection	ozf·in	—
5	Batch Jobs	lbf·in	—
6	Tool Inspection	lbf·ft	—

Code	Reply error (40025)	Common causes and solutions
0	None	Success.
1	Busy	The operator is working. Send commands 1, 2 and 5 after the work is finished.
2	Revision out of date	The settings revision in command 1 does not match the current one. Read 40026–40027 again and resend the command with a new sequence.
3	Invalid parameter	A value is outside the allowed range, for example the target torque exceeds the sensor capacity, the Torque Wrench tolerance is not a whole number from 1% to 30%, or the batch settings are incomplete.
4	Not found	The batch number does not exist, or the work mode has not been configured in TMS.
5	Not supported	For example, using command 1 to apply Batch Jobs mode.
6	Database error	TMS failed to read or write local data. Try again later; if it keeps happening, reopen TMS.
7	Tool unavailable	No sensor or tool is available. Make sure that a sensor is selected and connected (see Section 12.3).
8	Device communication error	Communication between TMS and the RF receiver or the tool failed. Check the receiver connection and try again.

13.5.7 Modbus Exception Codes

When TMS rejects a request, it returns a Modbus exception code (with the highest bit of the function code set to 1; for example, FC16 returns 0x90).

Exception code	Name	When TMS returns it
01	Illegal Function	A function code other than FC03, FC04 and FC16 is used, for example FC06.
02	Illegal Data Address	The read range is outside 30001–30064 or 40001–40027; FC16 does not start at 40002, or the quantity is not 20.
03	Illegal Data Value	The read quantity is not 1–125; 40021 in FC16 is not 0xA55A; the sequence is 0; the command code is not 1–5; the boot identifier in commands 2–5 does not match; the same sequence is sent with different content; the sequence is older than the previous one; the work mode, unit or judgement condition code is invalid; the batch number in command 2 is not within 1–999.
06	Server Device Busy	The previous command is still being processed (40024 = 1).

13.5.8 Error Messages

Screen message	Cause and solution
“Unable to load the Modbus register map.”	Reading the register map failed. Close the window and open it again; if it still fails, log in again. In the meantime, you can refer to the register tables in this section.
“The register map has not been loaded”	Shown in the simplified tables; the register map has not been loaded yet. Close the window and open it again; export only after the full register map is shown.

13.6 Modbus Diagnostics and Test

Path: “Communication Settings” → “Diagnostics & Test”.

The “Diagnostics & Test” window shows the number of requests and errors received over Modbus TCP, and the content of the latest request and response, to help you find out why a PLC cannot read data. This window only displays data; it does not send any command or change the state of TMS. Requires the “View · System Settings” permission.

13.6.1 Screen Description

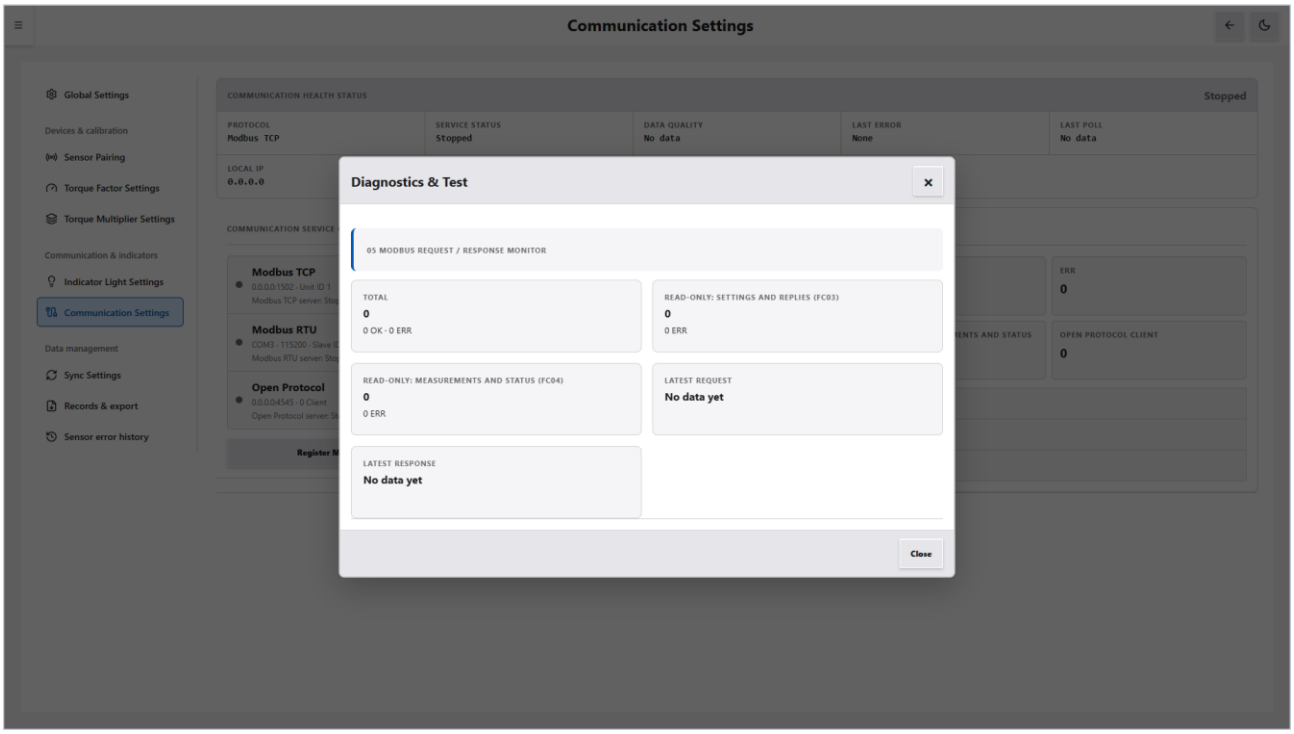

Figure 13-7 Modbus diagnostics and test

Area / button	Description
“05 Modbus Request / Response Monitor”	Block title. The content refreshes automatically every second.
“Total”	Total number of requests processed over Modbus TCP (including FC03, FC04, FC16 and unsupported function codes); below it, “N OK · N ERR”.
“Read-only: settings and replies (FC03)”	Number of FC03 requests reading 4xxxx; below it, the number of those requests that failed.
“Read-only: measurements and status (FC04)”	Number of FC04 requests reading 3xxxx; below it, the number of those requests that failed.
“Latest Request”	Content of the latest request, shown in a technical English format; for example, `ReadInputRegisters(0, 6)` means FC04 reading 6 registers from protocol address 0 (30001). Shows “No data yet” when there is no data.
“Latest Response”	Content of the latest response: the values read on success, or the exception name on failure, for example `IllegalDataAddress`. Shows “No data yet” when there is no data.
“Close” / ×	Closes the window. Pressing Esc or clicking outside the window does the same.

- The counters restart from 0 each time the Modbus TCP service starts.
- Only Modbus TCP is counted. Modbus RTU and Open Protocol traffic does not appear here.
- FC16 write commands are counted in “Total” and OK/ERR, but have no separate counter. An FC16 counted as OK only means that the command has been received; whether it was executed successfully is shown in 40024 “Reply status”.

- TMS does not reply to requests with a mismatched Unit ID and does not count them in “Total”, but “Latest Request” and “Latest Response” show content such as `IgnoredUnitId(expected=1, actual=2)` (expected is the Unit ID set in TMS; actual is the Unit ID sent by the PLC).

13.6.2 Finding Connection Problems with the Diagnostics Window

1. In “Communication Settings”, check that the “Modbus TCP” row shows that the service is running; if it is not running, press “Start” first.
2. Click “Diagnostics & Test” to open the “Diagnostics & Test” window (see Figure 13-7).
3. Ask the PLC to start reading, and watch for 5–10 seconds.
4. “Total” and “OK” keep increasing and “ERR” does not change: TMS is working normally. If the PLC still shows a problem, check the address conversion and data interpretation on the PLC (see Section 13.5).
5. “ERR” increases: look at the exception name in “Latest Response”, and correct the PLC program according to the table below.
6. None of the counters change: look at “Latest Response”. If it shows `IgnoredUnitId`, correct the Unit ID; if it still shows “No data yet”, the requests are not reaching TMS; check the IP address, port and firewall (see Section 13.2).
7. When you have finished checking, click “Close”.

> **Example** The PLC keeps timing out, “Total” in the diagnostics window stays at 0, and “Latest Response” shows `IgnoredUnitId(expected=1, actual=2)`. This means that the PLC sends Unit ID 2 while TMS is set to 1. After you change the Unit ID of the PLC to 1, “Total” and “OK” start to increase.

“Latest Response” shows	Cause and solution
`IgnoredUnitId(expected=…, actual=…)`	The Unit ID of the PLC differs from “Unit ID” in TMS. Make both the same.
`IllegalFunction`	FC06 or another unsupported function code was used. Use FC03/FC04 for reading and FC16 for writing.
`IllegalDataAddress`	The address or quantity is out of range, or FC16 does not write 20 registers starting at 40002. Pay attention to the 0-based conversion (see Section 13.5).
`IllegalDataValue`	The read quantity is not 1–125, or the content of the FC16 command is invalid. Check each item against the exception code table in Section 13.5.
`ServerDeviceBusy`	The previous command is still being processed. Wait until 40024 “Reply status” is no longer 1 before sending.

13.6.3 Communication Troubleshooting

Symptom	What to check
The PLC cannot connect to Modbus TCP (connection refused)	Whether the "Modbus TCP" row shows that the service is running; whether the port set on the PLC equals "TCP Port"; whether "Bind IP Address" is 0.0.0.0 or the IP address of this computer.
The PLC connection times out	Whether the IP address of the TMS computer is correct (`ipconfig`); whether both devices are on the same network segment; whether Windows Firewall allows the port (see Section 13.2); whether the Unit ID of the PLC matches TMS (the diagnostics window shows `IgnoredUnitId`).
All values read are shifted by one	The setting for whether addresses start from 0 or from 1 is wrong. 30001 must read 21581 (see Example 1 in Section 13.2).
Torque values are 1000 times too large, or the unit is wrong	Fields with a scale of 1000 must be divided by 1000; torque units must be interpreted according to 30017/30018; 32-bit values must be read high word first.
New results are never detected	Whether new results are detected with 30011–30012 "Completed result sequence"; whether 30013 bit2 "Completed result valid" is 1; whether TMS actually completed a result (see the records in Chapter 11).
After TMS is reopened, the PLC wrongly detects a new result	Whether the PLC also checks 30007–30008 "TMS boot identifier" (see Example 2 in Section 13.2).
The FC16 command succeeds, but TMS does nothing	Whether 40024 "Reply status" and 40025 "Reply error" were read; if 40024 = 3, handle the error code in 40025 (see Section 13.5).
No response over Modbus RTU	Whether the COM port, slave ID, baud rate, data bits, parity and stop bits match the PLC; whether A and B are swapped (see Section 13.3).
Modbus RTU keeps showing "Waiting for COMx; retrying every 2 seconds"	Whether the COM port is used by the indicator light or another program; whether the adapter is plugged in properly (see Section 13.3).
No tightening results are received over Open Protocol	Whether 0060 is sent with revision 002; whether TMS is in "Batch Jobs" mode with a batch selected (see Section 13.4).
The Open Protocol connection drops periodically	Whether 9999 is sent every 10 seconds; whether 0062 is sent within 1 second after receiving 0061 (see Section 13.4).
Only one of Modbus TCP and Open Protocol can start	Whether both use the same port. The defaults 1502 and 4545 do not conflict.
A service does not run automatically after TMS is reopened	Whether the "Enable …" check box in the settings window has been selected and saved. Pressing "Start" alone is not kept for the next time TMS opens (see Section 13.1).

> **Tip** When you report a communication problem, note down each field of "Communication health status", the "Latest Request" and "Latest Response" of the diagnostics window, and the PLC settings and error screen, and attach them to the problem report form (Appendix B).

Chapter 14 Sync and Read API

This chapter describes the two functions of the “Sync settings” page. Their data flows in opposite directions:

- **Read-only API** (read API): external systems (MES, SCADA, dashboard programs) actively read the torque and judgement results of the current sensor from TMS over HTTP.
- **Database sync**: TMS pushes completed measurement records through an HTTPS gateway to a MySQL or MS SQL database.

> **Warning** The read-only API uses unencrypted HTTP and requires no username or password; any device that can reach that IP address and port can read the data. Use it only on a trusted production network. If other computers do not need to read the data, keep the binding at `127.0.0.1` (only programs on this computer can read it).

14.1 Sync Settings Overview

Path: Navigation menu → “System Settings” → “Data management” on the left → “Sync Settings”.

The “Sync settings” page uses two tabs to manage how TMS provides data to other systems: “Read-only API” shows the status of the read service, the connection parameters, the API endpoints and the response fields; “Database sync” sets the HTTPS gateway to which records are pushed and shows the sync results. Opening this page requires the “View · System Settings” permission; changing any setting requires the “Edit · Server and Sync Settings” permission (by default, only template A has it). Without this permission, you can open the page to view it, but the input boxes and the save and sync buttons cannot be used.

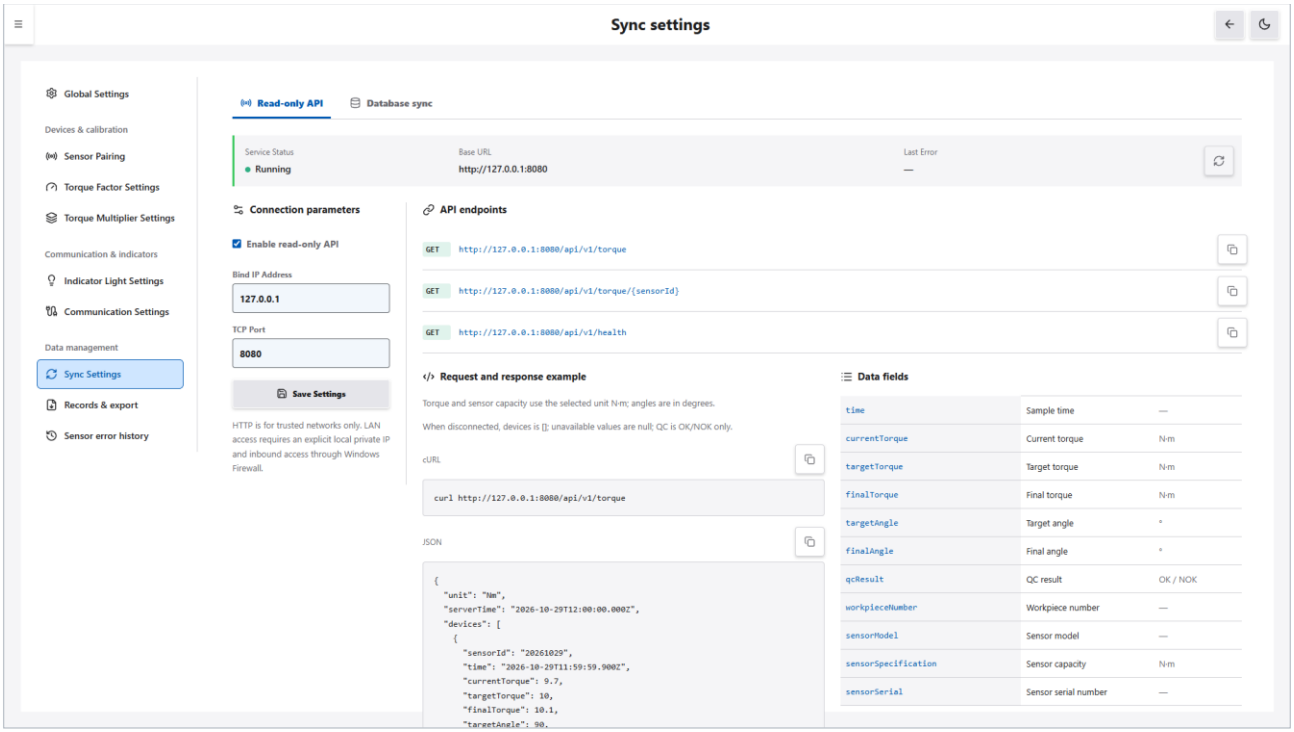

Figure 14-1 Sync settings screen (Read-only API tab)

Screen description

Area / button	Description
Page header	Title “Sync settings” in the center; “←” (back) and “Toggle light / dark mode” on the right
Left menu	List of the System Settings subpages; “Sync Settings” is in the “Data management” group
Tab bar	“Read-only API” and “Database sync”. Click a tab with the mouse, or switch tabs with the Left/Right arrow keys, Home and End while the tab bar has focus. The “Read-only API” tab is shown when you enter this page
Read-only API tab	Service status, connection parameters, API endpoints, request and response example, data fields (see Section 14.3)
Database sync tab	Sync target, HTTPS API, sync status (see Section 14.2)
“API display unit is not synchronized.”	Appears at the top of each screen only when this fails, with a refresh icon next to it (see the error messages below)

Buttons

Button	Description
Read-only API	Switches to the Read-only API tab; the service status is not reloaded, and unsaved input on both tabs is kept
Database sync	Switches to the Database sync tab; the sync target is loaded only the first time the tab is opened after you enter this page; unsaved input on both tabs is kept
← (back)	Leaves this page and returns to the previous page; unsaved input is lost
Refresh (next to "API display unit is not synchronized.")	Applies the current torque display unit to the read-only API again

Steps

1. Click "System Settings" in the navigation menu, then click "Sync Settings" in the "Data management" group on the left. The screen title is "Sync settings", and the "Read-only API" tab is shown.
2. Check "Service Status" in the status bar to see whether the read-only API is running (for the settings, see Section 14.3).
3. Click the "Database sync" tab to view the sync target and "Sync status" (for the settings, see Section 14.2).
4. When you are done, click "←" in the page header to leave.

Error messages

Screen message	Cause and solution
"API display unit is not synchronized."	TMS could not apply the current torque display unit to the read-only API (for example, because the login session is no longer valid). Click the refresh icon next to the message to retry; if it still fails, log in again, or click "Save Settings" again on the "Read-only API" tab. Until the problem is resolved, external systems may still receive the previous unit; always rely on the `unit` field in the response

14.2 Sync Target: Database and Gateway

Path: Navigation menu → "System Settings" → "Data management" → "Sync Settings" → "Database sync" tab.

"Database sync" pushes TMS measurement records to an **HTTPS API gateway**, which then writes them to a MySQL or MS SQL database. TMS does not connect to the database directly, and you do not enter a database host, account or password on the screen; "MySQL" and "MS SQL" only select which set of sync target settings you configure. Requires the "Edit · Server and Sync Settings" permission (by default, only template A has it). When an account without this permission opens this tab, the screen shows

“Unable to load sync target.” and none of the inputs and buttons can be used; this is a permission restriction, not a fault.

The synced content includes new Torque Wrench, Power Tool, Torque & Angle, Torque Inspection, Batch Jobs, batch category and Tool Inspection records, as well as record deletions.

Prerequisites:

- The HTTPS gateway is a service outside TMS; your company's IT or MES department must build it and provide the gateway URL and access token.
- The URL must start with `https://`. This computer must be able to reach the gateway (IT checks the network, DNS, firewall and certificate); TMS has no option to skip certificate checks.
- We recommend finishing any work in progress before you configure or sync.

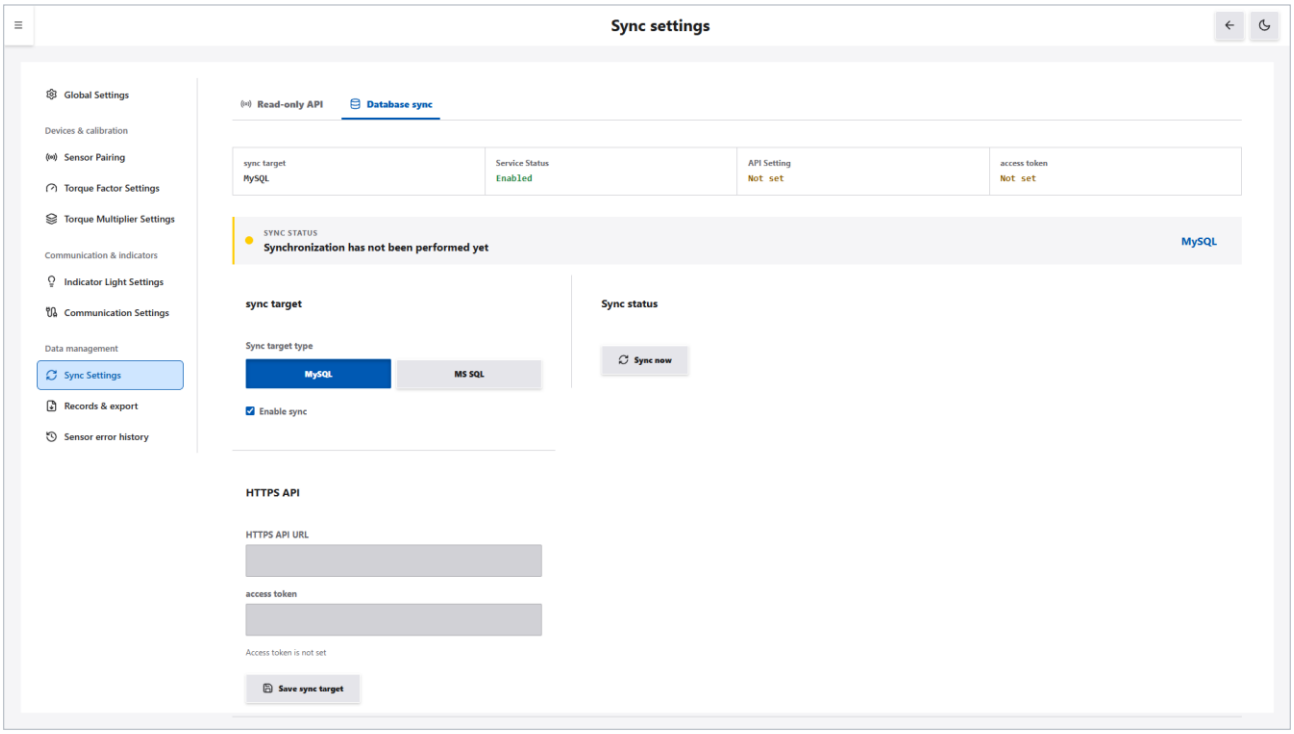

Figure 14-2 Sync settings screen (Database sync tab)

Screen description

Area / button	Description
Sync settings summary	Four fields at the top: “sync target”, “Service Status”, “API Setting” and “access token”. “Service Status” and “API Setting” reflect the current input on the screen and change even before you save; “access token” shows whether a token has been saved
Sync status bar	Shows the result of the most recent “Sync now”, or “Synchronization has not been performed yet”; the large text on the right is the current sync target. Color bar on the left: green means enabled, with a URL and a saved token; yellow means the settings are incomplete or not enabled; red means there is an error or the settings must be changed to HTTPS API
sync target	“Sync target type” (“MySQL”, “MS SQL”; a blue background means selected) and the “Enable sync” check box. Each type keeps its own set of settings
HTTPS API	“HTTPS API URL” and “access token” input boxes; below them, “Access token is set” or “Access token is not set”; when a token has been saved, “Clear stored tokens” is also shown; at the bottom, “Save sync target”
Sync status (right side)	Messages such as loading, not yet saved and the number of records that need attention, plus “Sync now”

Fields

Field	Description	Range and default
Sync target type	Selects whether to view and edit the MySQL or the MS SQL sync settings	MySQL, MS SQL; MySQL is shown when the tab opens
Enable sync	Whether this sync target is enabled	Selected by default if the target has never been saved; when selected, a token must already exist before you can save
HTTPS API URL	Full URL at which the gateway receives data	Required; must start with `https://`; must not contain a username/password, query parameters (`?`) or a fragment (`#`)
access token	Access token with which the gateway verifies the identity of TMS	Required when sync is enabled; must not have leading or trailing spaces; a saved token is not displayed again, and leaving the field empty keeps the saved token
Clear stored tokens	Deletes the saved token when you save	Appears only when a token has been saved; when selected, “access token” is cleared and cannot be edited; cannot be saved while “Enable sync” is also selected

The URL and token are encrypted and stored in the local database; the encryption key is stored in Credential Manager for the current Windows user.

Buttons

Button	Description
MySQL / MS SQL	Switches the sync target to edit and loads its settings. If there are unsaved changes, TMS first asks “Switching the sync target discards your unsaved changes here. Switch anyway?”; clicking “Cancel” does not switch
Save sync target	Checks and saves the URL, token and enable state; a beep sounds on success. Not available while saving, syncing or rescheduling is in progress
Sync now	Sends the data waiting to be synced for this target to the gateway in batches (up to 100 records per batch, waiting up to 15 seconds for the reply to each batch); while it runs, the button shows “Syncing...”. Not available when there are unsaved changes, or when the settings must be changed to HTTPS API
Reschedule	Shown only when “N records need attention” appears; returns those records to the waiting-to-sync state so that the next “Sync now” resends them (see Section 14.4)

> **Note** When you select “Enable sync” and save, TMS queues **all historical records** that have not yet been sent to this target. The next “Sync now” may send a large amount of data at once and take longer. If the historical data has already been imported on the gateway side by other means, first check with the gateway administrator that it will not be written twice.

Steps

1. Log in with an account that has the “Edit · Server and Sync Settings” permission, go to “Sync settings” and click the “Database sync” tab. The screen first shows “Loading sync target, please wait.”, and then the MySQL settings once loading is complete.
2. In “Sync target type”, select the database type that matches the gateway (“MySQL” or “MS SQL”).
3. In “HTTPS API URL”, enter the full URL provided for the gateway. “API Setting” in the summary changes to “Already set”, and “The sync settings have not been saved yet. Please save the sync target first.” appears on the right.
4. In “access token”, enter the token provided for the gateway. If a token has already been saved and you only need to change the URL, you can leave this field empty.
5. Make sure that “Enable sync” is selected, and click “Save sync target”. On success, a beep sounds, “access token” in the summary changes to “Already set”, “Access token is set” appears below the field, the “The sync settings have not been saved yet. ...” message disappears, and the sync status bar turns green.
6. Click “Sync now”. While it runs, the status bar shows “Synchronization is in progress, please wait.”; when it finishes, it shows “Pushed X records, Y failed”.
7. If “N records need attention” appears, handle it as described in Section 14.4.
8. Ask the gateway or database administrator to confirm that the data has been written.

Example The gateway information provided by the IT department is as follows (format example only; use the values your company actually provides):
Database type MS SQL; gateway URL `https://mes-gateway.example.com/tms/sync`; the access token is provided separately by the gateway administrator.
1. Click the “Database sync” tab, then click “MS SQL” in “Sync target type”.
2. In “HTTPS API URL”, enter `https://mes-gateway.example.com/tms/sync`.
3. Paste the token provided by the administrator into “access token”, make sure that “Enable sync” is selected, and click “Save sync target”.
4. Click “Sync now”. The status bar shows “Pushed 125 records, 0 failed”, which means that all 125 records were accepted by the gateway.
The following URLs are rejected: `http://mes-gateway.example.com/tms/sync` (not https), `https://mes-gateway.example.com/tms/sync?site=1` (contains query parameters), `https://user:pass@mes-gateway.example.com/tms/sync` (contains a username and password).

Note TMS does not sync automatically or on a schedule. Records are sent only when a user with the permission clicks “Sync now”; schedule regular manual syncs according to the needs of your site.

Tip If you do not have a token yet and only want to save the URL first, clear “Enable sync” and then save.

Note If an old-format direct database connection is saved on this computer, or the saved URL does not meet the current rules, the “Sync status” area shows the red text “The old database connection setting needs to be changed to HTTPS API.”, the URL field is empty, and “Sync now” cannot be used. Enter the `https://` URL of the gateway and the access token again, and click “Save sync target”; you can then sync.

Error messages

Screen message	Cause and solution
"Unable to load sync target."	The account does not have the "Edit · Server and Sync Settings" permission, the login has expired, or this computer cannot read the saved encrypted settings (for example, because the database was moved to another computer or another Windows account). For permission problems, use an account with the permission; for a moved database, see Section 14.4
"Unable to save sync target."	Common causes: "Enable sync" is selected but there is no token; the URL is not `https://`, has an invalid format, or contains a username/password, `?` or `#`; the token has leading or trailing spaces or contains invalid characters; insufficient permissions or an expired login. Check each item and save again
"Unable to perform synchronization."	The sync command failed. Log in again and retry; if the status bar shows an original error message, see Section 14.4
"Unable to load sync status." / "Unable to update sync status."	Reading the sync statistics failed; data already sent is not affected. Leave the "Sync settings" page and enter it again; if it still fails, log in again
"Unable to reschedule sync data."	Rescheduling failed; the status of the data is unchanged. Check the permissions and the login status, then try again

14.3 Read API (Read-only API)

Path: Navigation menu → "System Settings" → "Data management" → "Sync Settings" → "Read-only API" tab (this tab is shown when you enter the page). See Figure 14-1 for the screen.

The read-only API is an HTTP read service built into TMS. External systems such as MES, SCADA and dashboard programs use `GET` requests to read the live torque, target values, most recent completed result and QC judgement of the **currently connected sensor**. It can only read; it cannot write to or control TMS, and it does not provide queries of historical records (for historical records, use export or database sync; see Chapter 11 and Section 14.2).

Viewing the status, API endpoints and examples requires the "View · System Settings" permission; enabling or disabling the service or changing the connection parameters requires the "Edit · Server and Sync Settings" permission (by default, only template A has it). Without this permission, you can view the settings but cannot save them. External systems need no account or token to call the API itself.

14.3.1 Screen Description

Area / button	Description
Status bar	"Service Status" ("Running" or "Stopped"), "Base URL" (the root URL that external systems must use) and "Last Error", with a refresh button on the right. The status is read only once when you enter the "Sync settings" page; after that, click the refresh button
Connection parameters	"Enable read-only API", "Bind IP Address", "TCP Port" and "Save Settings"

Area / button	Description
Local IPv4 addresses	Appears below “Save Settings” when data is available; lists the IPv4 addresses of this computer that can currently be used for binding, with the network adapter names
Reminder text	“HTTP is for trusted networks only. LAN access requires an explicit local private IP and inbound access through Windows Firewall.”
API endpoints	Three `GET` URLs, each with its own copy button. When the service is not running, only the paths are shown and the copy buttons cannot be used
Request and response example	Unit note, data note, cURL command and JSON example, each with a copy button. The values in the JSON example are fixed; only the torque is converted to the selected unit
Data fields	Names, descriptions and units of the main response fields; for the full field descriptions, see “Response Format and Field Descriptions” in Section 14.3

Fields

Field	Description	Range and default
Enable read-only API	Whether the read service runs in the background	Enabled after a fresh installation, so the service starts automatically when TMS starts; clearing the check box and saving stops the service
Bind IP Address	The IP address of this computer on which the service accepts connections; you can select a local IPv4 address from the drop-down suggestions	Default `127.0.0.1` (only programs on this computer can read); only `127.x.x.x` or private IPv4 addresses (`10.x.x.x`, `172.16.x.x`–`172.31.x.x`, `192.168.x.x`) are accepted; `0.0.0.0`, public IP addresses, computer names and IPv6 are not accepted
TCP Port	The TCP port used by the service	Default `8080`; an integer from 1 to 65535; must not be the same as a port used by another program on this computer (including Modbus TCP and Open Protocol)

Buttons

Button	Description
Refresh (right side of the status bar)	Reloads the service status and the network adapter list; if there are no unsaved changes, the input boxes are updated to the current settings
Save Settings	Checks and saves “Enable read-only API”, “Bind IP Address” and “TCP Port”, and applies them immediately: when enabled, the service restarts at the new address; when cleared, the service stops. On success, “API settings saved.” is shown
Copy (next to each API endpoint)	Copies the full URL to the clipboard and shows “Copied”; not available when the service is not running
Copy (next to cURL)	Copies the `curl` read command; not available when the service is not running
Copy (next to JSON)	Copies the JSON example shown on the screen (a fixed example, not live data)

> **Warning** After you change the bind IP address or port, or disable the service, external systems that are reading are disconnected immediately or can no longer read data. Notify the departments that use this API first.

14.3.2 Enabling and Disabling

Enabling (read access for programs on this computer only)

1. Go to “Sync settings” and check the status bar on the “Read-only API” tab. After a fresh installation with unchanged settings, “Service Status” is “Running” and the Base URL is `http://127.0.0.1:8080`.
2. If it shows “Stopped”, select “Enable read-only API”, make sure that “Bind IP Address” is `127.0.0.1` and “TCP Port” is `8080`, and click “Save Settings”.
3. The screen shows “API settings saved.”, “Service Status” changes to “Running”, and “API endpoints” shows the full URLs.
4. Click the copy button next to `/api/v1/health`, paste the URL into the address bar of a browser on this computer and open it; you should see `{"apiVersion":1,"status":"ok"}`.

Disabling

1. Clear “Enable read-only API”.
2. Click “Save Settings”. “Service Status” changes to “Stopped”, the Base URL shows “—”, and external systems can no longer read data.

> **Tip** The settings are saved; after TMS restarts, the service starts or does not start according to the last saved settings.
>
> **Tip** Do not use port 80. When browsers and most programs connect to port 80, the host address does not include the port number, and TMS replies with 403.

14.3.3 Endpoints and Read Examples

The Base URL has the format `http://<bind-IP>:<port>`. Available endpoints:

Method and path	Purpose	Successful response
`GET /api/v1/health`	Checks whether the service is online	HTTP 200, content `{"apiVersion":1,"status":"ok"}`
`GET /api/v1/torque`	Reads the data of the currently connected sensor	HTTP 200, content includes `unit`, `serverTime`, `devices`
`GET /api/v1/torque/{sensorId}`	Reads only the data of the specified sensor ID; replace `{sensorId}` with the sensor serial number (decimal)	HTTP 200; 404 if that sensor is not currently connected

Reading with a browser

In the address bar of a browser on the TMS computer, enter the following URL and press Enter; the JSON is displayed directly:

```
http://127.0.0.1:8080/api/v1/torque
```

Reading with PowerShell

Check that the service is online:

```
Invoke-RestMethod -Uri http://127.0.0.1:8080/api/v1/health
```

Expected output:

```
apiVersion status
---------- ------
         1 ok
```

Read the torque data and extract the unit, final torque and QC judgement:

```
$r = Invoke-RestMethod -Uri http://127.0.0.1:8080/api/v1/torque
$r.unit
$r.devices[0].finalTorque
$r.devices[0].qcResult
```

To see the full JSON, use the following instead:

```
Invoke-RestMethod -Uri http://127.0.0.1:8080/api/v1/torque | ConvertTo-Json -Depth 5
```

Read once per second and show the most recent result (press Ctrl+C to exit):

```
while ($true) {
    $r = Invoke-RestMethod -Uri http://127.0.0.1:8080/api/v1/torque
    $d = $r.devices | Select-Object -First 1
    if ($d) { "{0}  {1} {2}  QC={3}  fresh={4}" -f $d.resultTime, $d.finalTorque, $r.unit,
$d.qcResult, $d.fresh }
    Start-Sleep -Seconds 1
}
```

Reading with cURL

In Windows PowerShell, `curl` is an alias for another command, so type `curl.exe`:

```
curl.exe http://127.0.0.1:8080/api/v1/torque
```

> **Example** Reading from another computer. The Ethernet address of the TMS computer is `192.168.1.20`, the bind IP is set to `192.168.1.20` and the port to `8080`, and the firewall allows inbound connections (see “Allowing Other Computers to Read” in this section). On the MES computer, run:
> `Invoke-RestMethod -Uri http://192.168.1.20:8080/api/v1/torque`
> You must use exactly the same address as the bind IP; using the computer name returns 403.

14.3.4 Response Format and Field Descriptions

TMS provides data for only one “currently connected” sensor at a time, so `devices` contains at most one entry; when no sensor is connected, it is an empty array `[]`. The following is an example response while work is in progress and the previous tightening has already been judged (torque unit N·m, sensor TTES 100 N·m):

```
{
  "unit": "Nm",
  "serverTime": "2026-11-16T02:15:30.125Z",
```

```
  "devices": [
    {
      "sensorId": "16909060",
      "time": "2026-11-16T02:15:30.040Z",
      "currentTorque": 12.35,
      "targetTorque": 50,
      "finalTorque": 50.4,
      "targetAngle": null,
      "finalAngle": null,
      "qcResult": "OK",
      "workpieceNumber": "WP-0001",
      "sensorModel": "TTES",
      "sensorSpecification": 100,
      "sensorSerial": "16909060",
      "resultTime": "2026-11-16T02:15:21.512Z",
      "fresh": true,
      "seq": 1287
    }
  ]
}
```


The actual response contains no line breaks or indentation, and the field order may differ. Read the fields by name; do not rely on their order.

Field	Description	Unit	When there is no value
`unit`	Unit used by the torque fields in this response; follows the torque display unit selected in “Global Settings”. Possible values: `Nm`, `Kgf-cm`, `Kgf-m`, `Ozf-in`, `Lbf-in`, `Lbf-ft`	—	Always present
`serverTime`	Time at which TMS responded	UTC, ISO 8601, to the millisecond	Always present
`devices`	Array of sensor data	—	`[]` when no sensor is connected
`sensorId`	Sensor ID, same as `sensorSerial`	—	Always present
`time`	Time of the most recent live reading	UTC, ISO 8601	`null` before work starts or before a reading has been received
`currentTorque`	Live torque	`unit`	`null` before work starts, after work stops, or when no new reading has arrived for more than 2 seconds
`targetTorque`	Target torque; when work starts, the target of that work; after a measurement is completed, the target of that result	`unit`	`null`
`finalTorque`	Final torque of the most recent completed result	`unit`	`null` before a measurement is completed, or after new work starts
`targetAngle`	Target angle	Degrees	`null` when the work has no angle target

Field	Description	Unit	When there is no value
`finalAngle`	Final angle of the most recent completed result	Degrees	`null` when the result contains no angle
`qcResult`	QC judgement of the most recent completed result: `"OK"` or `"NOK"` once judged (a rehit also returns `"NOK"`)	—	`null` when not judged, or after new work starts
`workpieceNumber`	Part number of the most recent completed result; always `AUTO-BATCH` for Batch Jobs results	—	Empty string or `null` when no part number was entered
`sensorModel`	Sensor model	—	Always present
`sensorSpecification`	Sensor capacity (measuring range)	`unit`	Always present
`sensorSerial`	Sensor serial number (decimal)	—	Always present
`resultTime`	Measurement time of the most recent completed result	UTC, ISO 8601	`null` before a measurement is completed, or after new work starts
`fresh`	Whether `currentTorque` is a valid live value	—	`false` when it is not a live value
`seq`	Change sequence; increases by 1 when a live reading is received, when work starts or stops, and when a result is completed	—	Starts from 0 when a new sensor connects

- The torque fields (`currentTorque`, `targetTorque`, `finalTorque`, `sensorSpecification`) are converted from N·m to the unit shown in `unit` **without rounding**, so they may have more decimal places than the screen. Angles are always in degrees and are not converted with the torque unit.
- `qcResult` is only ever `"OK"`, `"NOK"` or `null`. Other status texts that may appear on the Records page or in other communication methods do not apply to this API.
- In all work modes (including Batch Jobs and Tool Inspection), `finalTorque`, `qcResult` and `resultTime` are updated when a result is completed; these values are kept until the next work starts, and are then cleared.
- Polling programs should use `fresh` to decide whether `currentTorque` is valid, and `seq` or `resultTime` to detect new data.

> **Example** The unit follows the display unit. After you change the torque unit in “Global Settings” to lbf·ft, the response for the same data becomes:
> `"unit": "Lbf-ft"`, `"targetTorque": 36.87810746386328`, `"finalTorque": 37.17313232357419`, `"sensorSpecification": 73.75621492772656`.
> Calculation: 50 ÷ 1.3558179483314 = 36.878…; 50.4 ÷ 1.3558179483314 = 37.173…. External systems must always read `unit` to determine the unit and must not assume N·m.

14.3.5 Allowing Other Computers to Read

1. In “Bind IP Address”, enter the private IPv4 address of this computer on the production network, or select it from the drop-down suggestions (you can refer to the “Local IPv4 addresses” list).
2. Make sure that “TCP Port” is not used by another program or by Modbus TCP or Open Protocol in TMS, and click “Save Settings”.
3. “Service Status” is “Running”, and the Base URL changes to the new address, for example `http://192.168.1.20:8080`.
4. Ask IT staff to add an inbound rule for this TCP port in Windows Firewall on the TMS computer, according to company policy. TMS does not add firewall rules automatically.
5. On the external computer, read `/api/v1/health` using the IP address in the Base URL, and confirm that the reply is `{"apiVersion":1,"status":"ok"}`.

> **Example** IT staff open PowerShell as an administrator and allow only the MES host (`192.168.1.50`) to connect to port 8080:
> `New-NetFirewallRule -DisplayName "TMS RF Read API" -Direction Inbound -Protocol TCP -LocalPort 8080 -RemoteAddress 192.168.1.50 -Action Allow -Profile Domain,Private`

14.3.6 Call Rules and HTTP Status Codes

- Only `GET` is accepted. The URL must not contain a query string (`?…`), and the request must not contain a body.
- The host address of the request must be exactly the same as in the Base URL. When the service is bound to `127.0.0.1`, you can use `127.0.0.1` or `localhost`; when it is bound to a LAN IP address, you can use only that IP address.
- Requests with an `Origin` header (for example, from JavaScript in a web page) always receive 403. Call the API from a server-side program, a gateway or an MES service; opening the URL directly in the browser address bar is not affected.
- The connection is closed after each response; up to 16 connections are processed at the same time, and a connection that does not complete within 2 seconds is closed.
- Responses are always `application/json; charset=utf-8` and are not cached.

HTTP status	Response content	Cause	Solution
200	Normal data	The request is correct	—
400	`{"error":"unexpected_request_data"}`	The URL contains a query string, or the request contains a body	Send only a `GET` with a plain path

HTTP status	Response content	Cause	Solution
403	`{"error":"origin_not_allowed"}`	The host address does not match the bind address, or the request has an `Origin` header	Use the IP address in the Base URL; call the API from a program that is not a web page
404	`{"error":"not_found"}`	Wrong path	Use the three paths shown in “API endpoints”
404	`{"error":"sensor_not_connected"}`	The specified sensor is not currently connected	Check the sensor serial number and the connection status
405	`{"error":"read_only","allowed":"GET"}`	A method other than `GET` was used	Use `GET`
503	`{"error":"snapshot_unavailable"}` or `{"error":"unit_unavailable"}`	The data temporarily cannot be read, or the unit setting is invalid	Retry later; if it keeps happening, click “Save Settings” again

14.3.7 Error Messages

Screen message	Cause and solution
“Could not load API status.”	The login has expired, the permissions are insufficient, or the service is temporarily not responding. Click the refresh button; if it still fails, log in again
“Could not save API settings.”	The port is not an integer from 1 to 65535, the bind IP is empty or is not a `127.x.x.x`/private IPv4 address, the “Edit · Server and Sync Settings” permission is missing, or the login has expired. Correct the problem and click “Save Settings” again
“Last Error” shows “Read API listener failed: …”	The settings were saved, but the service cannot start at that address. Common causes are a port already used by another program, or a bind IP that does not belong to any network adapter of this computer. Use another port, or select an IP address from the “Local IPv4 addresses” list, and save again
“Last Error” shows “Read API worker has stopped”	The service ended unexpectedly. Click “Save Settings” to apply the settings again; if it still fails, restart TMS
“Last Error” shows “Invalid Read API settings: …” or “Read API settings could not be read: …”	The settings could not be read at startup, and the service did not start. Enter the settings again and click “Save Settings”
“Could not copy to the clipboard.”	The Windows clipboard is temporarily unavailable. Click again, or select and copy the text manually

Screen message	Cause and solution
“Could not read network interfaces.”	The list of network adapters of this computer cannot be read; saved settings are not affected. You can enter the IP address manually
External computers cannot connect, but `127.0.0.1` works on this computer	Make sure that the bind IP is a LAN IP address rather than `127.0.0.1`, that the firewall allows the port, and that the external program uses the IP address in the Base URL

14.4 Sync Status and Failure Handling

This section describes what happens to each record waiting to be sent after you click “Sync now” on the “Database sync” tab, and how to handle failures. See Figure 14-2 for the screen.

14.4.1 Status of Records Waiting to Be Sent

For each sync target, TMS keeps a local list of entries waiting to be sent. Each time a record is added or deleted, an entry is added to this list. The screen does not list the entries one by one; it only shows “Pushed X records, Y failed” and “N records need attention”.

Status	Meaning	Next step
Waiting to sync	Not sent yet, or failed last time but can be retried automatically	Sent at the next “Sync now”; if the gateway asks for a delay, it is sent again only after the specified number of seconds
Sending	Sent in the current sync and waiting for the gateway reply	Changes to another status when the reply arrives; if TMS is closed while sending, a “Sync now” after 120 seconds resends it
Synced	Accepted by the gateway	Not sent again
Needs attention	Explicitly rejected by the gateway, and not retried automatically	Counted in “N records need attention”; resolve the cause first, then click “Reschedule”

> **Note** Data for the same record is sent in order. While an earlier entry for a record has not been synced (including entries that need attention), later data for the same record (for example, a later deletion) keeps waiting. Handle entries that need attention as soon as possible.

14.4.2 Failure Types and Handling

After “Sync now” finishes, the status bar shows “Pushed X records, Y failed”; if there is an error, one of the following messages is appended.

Status bar message	Cause	Solution
“HTTPS API 連線失敗。” (shown in Chinese even in English: HTTPS API connection failed)	The gateway cannot be reached (network down, DNS, firewall, untrusted certificate), or it did not respond within 15 seconds	Retried automatically. Check the network and the URL, ask IT to check the certificate, then click “Sync now” again
“HTTPS API 暫時無法使用。” (shown in Chinese even in English: HTTPS API is temporarily unavailable)	The gateway is temporarily busy or under maintenance	Retried automatically. Wait a while, then click “Sync now” again
“HTTPS API 回應格式無效。” (shown in Chinese even in English: HTTPS API response format is invalid)	The gateway reply is not in the agreed format	Retried automatically. Ask the gateway administrator to check version compatibility
“HTTPS API 回應版本或請求 ID 不一致。” (shown in Chinese even in English: HTTPS API response version or request ID does not match)	The gateway reply does not correspond to the data sent	Same as above
“HTTPS API 回應缺少或多出事件結果。” (shown in Chinese even in English: HTTPS API response has missing or extra event results)	The number of entries in the gateway reply does not match the number of entries sent	Same as above
“HTTPS API 回應包含未知或重複的事件結果。” (shown in Chinese even in English: HTTPS API response contains unknown or duplicate event results)	The gateway reply contains unidentified data	Same as above
“HTTPS API 存取權杖驗證失敗。” (shown in Chinese even in English: HTTPS API access token verification failed)	The token is wrong or has expired	The whole batch is set to needs attention. Get a new token from the gateway administrator, enter it and click “Save sync target”, then click “Reschedule” and “Sync now”
“HTTPS API 未授權此同步目標。” (shown in Chinese even in English: HTTPS API has not authorized this sync target)	The gateway does not allow this target to write	The whole batch is set to needs attention. After the gateway administrator grants authorization, click “Reschedule”
“HTTPS API 拒絕批次資料。” (shown in Chinese even in English: HTTPS API rejected the batch data)	The gateway judged that the data content is not acceptable	The whole batch is set to needs attention. Ask the gateway administrator to check the reason for the rejection; after it has been fixed, click “Reschedule”

Status bar message	Cause	Solution
“HTTPS API 回應未預期狀態。” (shown in Chinese even in English: HTTPS API returned an unexpected status)	The gateway returned another error	Same as above
“HTTPS API 拒絕此事件。” (shown in Chinese even in English: HTTPS API rejected this event) or a custom gateway message	The gateway rejected some entries individually	According to the gateway's indication, retryable entries are retried automatically and the rest are set to needs attention. Follow the gateway message
“本機同步內容無法解析：…” (shown in Chinese even in English: the local sync content cannot be parsed)	This entry stored on this computer is corrupted	Affects only that entry, which is set to needs attention. Note the time and the number of entries, and contact the system administrator; rescheduling cannot fix it
“MySQL connection is not configured in this build” (or MS SQL)	This target has not been saved, or it has been saved but “Enable sync” is not selected; the status bar shows “Pushed 0 records, 1 failed”, but no data has been processed	Save and enable the sync target as described in Section 14.2
“同步設定需要改為 HTTPS API。” (shown in Chinese even in English: the sync settings need to be changed to HTTPS API)	An enabled target still has old-format connection settings	Enter the URL and token again and save, as described in Section 14.2

14.4.3 Handling “N records need attention”

1. Look at the message from the last “Sync now” in the status bar, and determine the cause using the failure type table above.
2. Ask the gateway or database administrator to resolve the cause, for example by updating the token, authorizing the target or correcting the data table. If the token needs to be updated, enter the new value in “access token” and click “Save sync target”.
3. Click “Reschedule” next to “N records need attention”. The screen shows “Rescheduling…”, and when it finishes, “N items have been rescheduled”.
4. Click “Sync now”, and check that the status bar shows “Pushed X records, 0 failed” and that “N records need attention” has disappeared.

> **Note** “N records need attention” is the total for both the MySQL and the MS SQL targets, but “Reschedule” only processes the target currently selected on the screen. If entries remain after rescheduling, switch to the other target and click it again.

Example The gateway has changed its token:
1. After you click “Sync now”, the status bar shows “Pushed 0 records, 40 failed” followed by “HTTPS API 存取權杖驗證失敗。” (shown in Chinese even in English: HTTPS API access token verification failed); “40 records need attention” appears on the right.
2. Get a new token from the gateway administrator, paste it into “access token” and click “Save sync target”; “Access token is set” appears below the field.
3. Click “Reschedule”; “40 items have been rescheduled” is shown.
4. Click “Sync now”; the status bar shows “Pushed 40 records, 0 failed”, and “40 records need attention” disappears.

14.4.4 Backup, Migration and Tokens

- The sync URL and token are encrypted and stored in the local database, and the decryption key is stored in Credential Manager for the current Windows user. Backups of the database file do not include this key (for backup methods, see Chapter 17).
- After the database is restored to another computer or another Windows account, opening “Database sync” shows “Unable to load sync target.”. Before migrating, note down the gateway URL and confirm with the gateway administrator that you can obtain the token again; if you still cannot save after entering them again, contact the supplier.
- When a new sync target is enabled, TMS queues all the historical records that have not yet been sent to that target (see Section 14.2). The gateway can eliminate duplicates using the request ID of each batch and the event ID of each entry.

14.4.5 Gateway Interface Summary (for IT Reference)

The following is provided as a reference for the IT staff who build the gateway.

- TMS sends a `POST` to the “HTTPS API URL”, with the headers `Authorization: Bearer {access token}` and `Idempotency-Key: {request ID}`.
- The request body is JSON: `api_version` (always 1), `request_id`, `destination` (`mysql` or `mssql`), and `events` (1–100 entries, each containing `event_id`, `aggregate_type` and `payload`).
- The gateway must reply with HTTP 200 and JSON: `api_version`, the same `request_id`, and `results` (exactly one entry for each `event_id`, containing `status` = `accepted` or `rejected`, `remote_id`, `error_code`, `message` and `retryable`).
- Possible values of `aggregate_type`: `static_torque_record`, `dynamic_torque_record`, `torque_angle_record`, `torque_test_record`, `batch_operation_record`, `batch_category`, `daily_inspection_detail`, `daily_inspection_result`, `tool_inspection_detail`, `tool_inspection_result`.
- When the gateway replies with HTTP 401, 403, 400 or 422, the batch is set to needs attention; when it replies with 408, 429, 500, 502, 503 or 504, TMS retries automatically and delays according to the `Retry-After` header.

- Each request waits up to 15 seconds. Only `https://` URLs are accepted.

Chapter 15 Users and Permissions

This chapter describes the accounts and function permissions of TMS RF, and how to add, edit, adjust permissions for, reset passwords of and delete accounts in “User Management”. It is intended for the system administrator who assigns accounts.

> **Tip** On a new installation, the only account is the default administrator account `admin` (see Section 2.8). The program does not force you to change the initial password, and there is no place where users can change their own password; reset it as described in Section 15.6 immediately after the first login.

15.1 Permission Model

15.1.1 Roles and Individual Adjustments

Every account has a “Role”. A role is a predefined set of function permissions (a template) that determines whether each of the 14 function permissions is “Allow” or “Deny” by default. TMS RF has three roles, referred to in this manual as A, B and C:

Role (as shown on screen)	Short name	Suitable for	What it can do by default
Admin	A	System administrators	All functions, including managing accounts, sync and read API settings.
Supervisor	B	Shop-floor supervisors, QC staff, process engineers	Work, saving work parameters, pairing and calibration, communication settings, deleting records, viewing the account list; cannot manage accounts or change sync settings.
User	C	Shop-floor operators	Running work, querying and exporting records, running the capability index test; cannot save any settings.

In addition to the role, an administrator can set a single permission of a single account to a value that differs from the role default; this manual calls this an “individual adjustment”. An individual adjustment applies only to that account and does not affect other accounts with the same role.

When the system decides whether an account can use a function, it checks in the following order:

1. The account has an individual adjustment for this item: the individual adjustment applies (Allow or Deny).
2. There is no individual adjustment: the role default applies.

Each item on the screen has only two buttons, “Deny” and “Allow”. When the value you select is the same as the role default, the item returns to “following the role default”; only when it differs from the

default does it become an individual adjustment. The screen does not mark which items are individual adjustments; to check, compare with the default table in Section 15.1.2.

> **Example** QC inspector `qc_lin` has the "Supervisor" role, and the administrator changes "Edit · File Management" to "Deny".
> Result: "Edit · File Management" is denied by the individual adjustment, and the other 13 items follow the Supervisor defaults. `qc_lin` can query and export records but cannot delete records.
> If the role of `qc_lin` is later changed to "Admin", the individual adjustment is cleared and all 14 items follow the Admin defaults (all allowed).

15.1.2 The 14 Function Permissions and Role Defaults

The following table lists the items in the order in which they appear in the "Function Permissions" area of the "User Management" screen (left to right, top to bottom). The "Roles allowed by default" column lists the roles for which the default is "Allow"; roles not listed are "Deny" by default.

Function permission	What it allows	Roles allowed by default
Run · Work	Enter the work screen of a mode that has been set up; start and stop work in each work mode, receive real-time torque, complete batch steps; light the indicator light automatically according to the judgement during work.	A, B, C
View · Work Settings	Open the settings of each work mode, batch recipes and capability index test settings; the "Settings" button is shown in the header of the work screen.	A, B, C
View · System Settings	"System Settings" in the navigation menu can be clicked; view system data such as communication, serial port and sensor status.	A, B, C
View · Work Records	Open the records page and query records.	A, B, C
Export · Work Records (CSV / Excel)	Export CSV or Excel on the records page; also requires "View · Work Records".	A, B, C
View · User List	"User Management" appears in the navigation menu; view the account list and roles.	A, B
Edit · User Management	Add accounts, edit, change roles, adjust permissions, reset passwords, delete accounts.	A
Edit · File Management	Delete records.	A, B
Edit · Communication and Layout	Save communication settings; start or stop the Modbus TCP, Modbus RTU and Open Protocol services; send indicator light commands manually in "Indicator Light Settings"; light the indicator light when a sensor error occurs.	A, B
Edit · Server and Sync Settings	Save sync targets, sync now, retry data waiting to be synced, save read API settings (see Chapter 14).	A

Function permission	What it allows	Roles allowed by default
Edit · Work Parameters, Pairing and Calibration	Save the settings of each work mode and batch recipes; pair sensors; save torque factor, torque multiplier and indicator light settings; edit the communication settings screen.	A, B
Run · Tool Inspection	Enter the work screen of the capability index test (“Run · Work” is also required) and confirm the capture of measured values (see Chapter 10).	A, B, C
Edit · Tool Inspection	Save capability index test settings.	A, B
Clear All · Tool Inspection	Use “Clear All” on the capability index test work screen.	A, B

Note For some functions, the button can still be clicked without the permission, and “You do not have permission to perform this operation.” appears only after you click it, for example “Run · Work”, “View · Work Settings”, “Edit · File Management”, “Edit · Communication and Layout”, “Run · Tool Inspection” and “Edit · Tool Inspection”. After adjusting permissions, try the function once with that account.

Tip To let someone change “Communication Settings”, allow both “Edit · Work Parameters, Pairing and Calibration” and “Edit · Communication and Layout”: the former makes the screen editable, and the latter allows the settings to be saved.

Tip “Run · Work” and “View · Work Settings” are independent of each other. An account with only “Run · Work” allowed can enter the work screen of a mode that has been set up, but the header has no “Settings” button; if the mode has not been set up yet, the screen shows the “Failed to load … settings.” message of that mode (for example “Failed to load torque wrench settings.”) without a “Reload settings” button, and someone who can open the settings must complete them first. An account with only “View · Work Settings” allowed can only open the settings screen and does not enter the work screen. If both are denied, the work modes in the navigation menu cannot be clicked.

Tip Lighting the indicator light automatically according to the judgement during work requires only “Run · Work”; all three roles light it by default, and “Edit · Communication and Layout” is not needed (see Section 12.6).

15.1.3 When Changes Take Effect

1. **Changing the role clears individual adjustments.** Whether you change the role directly in the list or change “Role” in the edit form and save, all individual adjustments of that account are cleared and all 14 items return to the defaults of the new role.
2. **Changing only the username or password does not affect individual adjustments.**
3. **“Reset to Role Defaults” only changes what is on the screen.** After you click it, the 14 items immediately show the role defaults, but nothing has been saved yet; the change takes effect only when you click “Save Settings”. If you leave without saving, the permissions do not change.

4. **Saving a role or permissions, or deleting an account, immediately invalidates the screens where that account is logged in.** Work and real-time data in progress for that account also stop, and the account must log in again (a deleted account can no longer log in). When the change is to your own account, the program logs out immediately and the login screen shows “Permissions updated. Please sign in again.”.
5. **Resetting only the password does not log out.** Screens where that account is logged in can still be used until it logs out or the 8-hour login expires (see Section 3.5).

> **Warning** Changing permissions or deleting an account immediately stops the work that account has in progress. Ask the person to finish work first (stop the work and confirm that records have been created) before adjusting the account; it is best to do this at a shift change or line stop.

15.1.4 Protection of the Last Administrator

An “effective administrator” is an account that allows both “View · User List” and “Edit · User Management”. This is not limited to the “Admin” role: a “Supervisor” account that allows both items through individual adjustments also counts as an effective administrator.

The system always keeps at least one effective administrator. If an account is the only effective administrator, the system does not allow you to:

1. Change its role to a role that loses these two permissions.
2. Change either of these two permissions to “Deny”.
3. Delete it.

When you try, the screen shows “必須至少保留一位管理員，請先建立其他管理員帳號。” (shown in Chinese even in English: at least one administrator must be kept. Create another administrator account first) and the account remains unchanged. Make another account an effective administrator first, then handle the original account.

15.1.5 Accounts After Upgrading from an Earlier Version

After an upgrade from an earlier version, the roles of existing accounts do not change and they have no individual adjustments, so their permissions are exactly the role defaults and no extra permissions are added automatically. When someone needs permissions other than the defaults, set them for each person after the upgrade as described in Section 15.4.

15.2 User List

Path: navigation menu → “User Management” at the bottom of the menu (above “Log Out”).

Here you view all accounts and roles on this computer, and from the list you can add accounts, open an account for editing, change roles directly, reset passwords or delete accounts. Opening this screen requires the “View · User List” permission; without it, “User Management” does not appear in the navigation menu. Adding, editing, changing roles, resetting passwords and deleting require the “Edit ·

User Management" permission; with only the view permission (for example, the "Supervisor" default), the list is read-only and there is no "+ Add User", no action buttons and no form on the right.

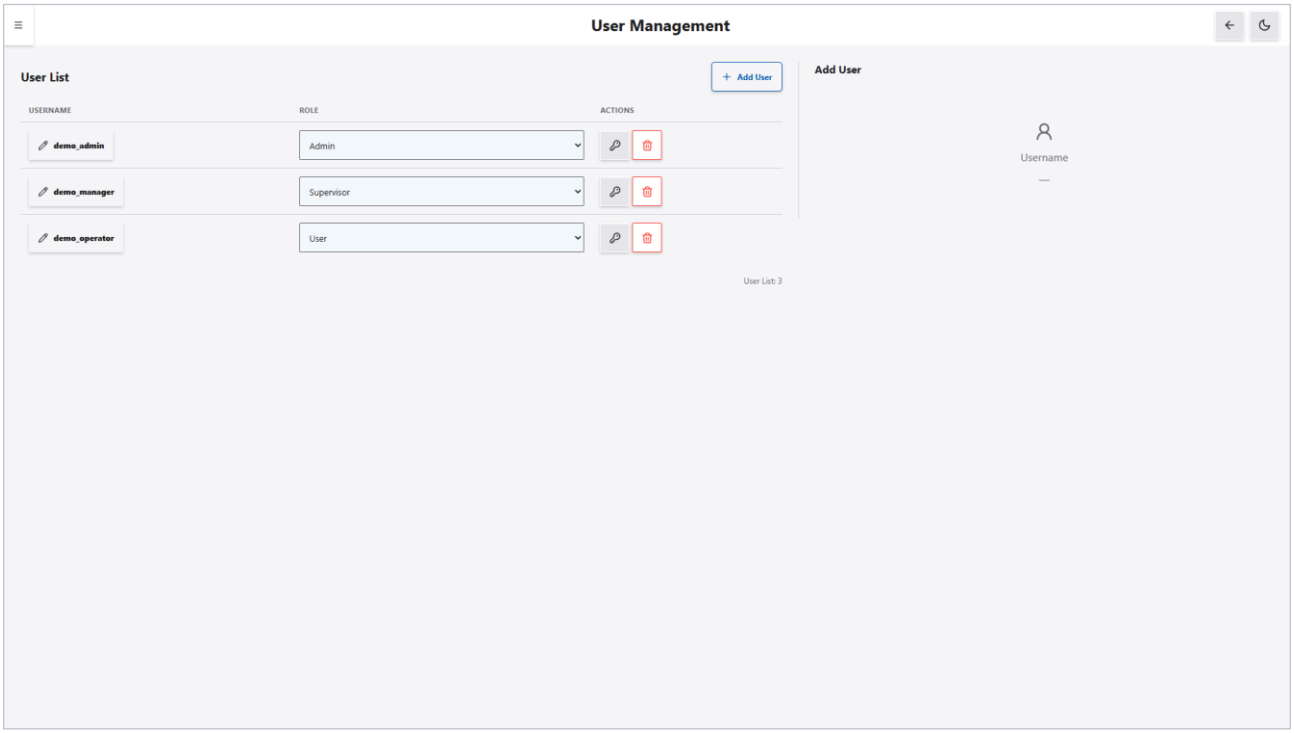

Figure 15-1 User Management screen

15.2.1 Screen Description

Area / button	Description
Top bar	Title "User Management"; at the top right, "Back" and "Toggle light / dark mode"; at the top left, "Toggle navigation menu".
"User List"	Title of the account list. On the right is "+ Add User", shown only with the "Edit · User Management" permission.
User table	Three columns, "Username", "Role" and "Actions", one account per row, sorted by username.
"User List: N"	Below the table on the right; N is the current number of accounts.
Form area on the right	Title "Add User". Before an account is selected, it shows only a person icon, "Username" and "—". After you click a username or "+ Add User", you edit here (see Sections 15.3 and 15.5).

15.2.2 Fields

Field	Description	Range and default
Username	The login name of the account. With the edit permission, it is shown as a button with a pencil icon; click it to open the account for editing.	Always has a value.
Role	The current role of the account. With the edit permission, it is a drop-down list and the change takes effect as soon as you select a value (see Section 15.2.4); when read-only, it is text.	“Admin”, “Supervisor”, “User”.
Actions	Key icon “Reset Password” and red trash can icon “Delete”.	Shown only with the “Edit · User Management” permission.

15.2.3 Buttons

Button	Description
Back (arrow at the top right)	Returns to the screen you were on before entering “User Management”. Does not save; unsaved content in the form on the right is lost.
+ Add User	Opens the add form on the right (see Section 15.5); once it is open, the button changes to “Cancel”.
Username (pencil icon)	Loads the account into the form on the right for editing (see Section 15.3); the row is marked with a blue vertical bar on the left.
Role drop-down list	After you select a new role, a confirmation window appears; after you confirm, the change is saved immediately. This clears the individual adjustments of the account and invalidates the screens where that account is logged in.
Key icon (Reset Password)	Opens the “Reset Password” window (see Section 15.6).
Red trash can icon (Delete)	A confirmation window appears; after you confirm, the account is deleted immediately (see Section 15.2.5).

15.2.4 Operating Steps: Changing the Role Directly in the List

1. Navigation menu → “User Management” at the bottom. The table first shows “Loading users...”, then lists all accounts.
2. In the row of the account to change, click the “Role” drop-down list and select the new role. The confirmation window “Change this user's permission role?” appears.
3. Click “Save Settings” to confirm; click “Cancel” to restore the original role without making any change.
4. After you confirm, “Role updated” appears at the top of the screen and the list shows the new role.

The confirmation window is a Windows system dialog titled “TMS RF”; its text and buttons come from TMS RF, and its appearance may differ slightly depending on the Windows version.

> **Example** Operator `op_lee` is promoted to team leader and needs to adjust work parameters.
> In the `op_lee` row, change "Role" from "User" to "Supervisor", click "Save Settings" in the confirmation window, and the screen shows "Role updated".
> The screens where `op_lee` is logged in are invalidated immediately. After `op_lee` logs in again, they can save work mode settings, and "User Management" (view only) also appears at the bottom of the navigation menu.

15.2.5 Operating Steps: Deleting an Account

After deletion, the account disappears from the list and can no longer log in; the username also cannot be used again to create a new account. Past work records are not deleted.

1. Ask the person to finish work and log out first.
2. "User Management" → click the red trash can icon in the row of the account. The confirmation window "Delete this user?" appears.
3. Click "Delete" to confirm; click "Cancel" to keep the account.
4. The screen shows "User deleted", the row disappears from the list, and N in "User List: N" decreases by 1.

You can also click "Delete" in the edit form, with the same effect (see Section 15.3).

> **Warning** Deleting an account cannot be undone, and the same username cannot be used again later. If the person is only temporarily not using the account, use the method in Section 15.2.6 instead.

> **Example** Operator `op_chen` leaves the company. The administrator clicks the trash can icon in the `op_chen` row, then clicks "Delete", and the screen shows "User deleted".
> Half a year later, a new employee is also named Chen. Creating `op_chen` again shows "使用者名稱已存在。" (shown in Chinese even in English: username already exists); use another name such as `op_chen2`.

15.2.6 Temporarily Disabling an Account

TMS RF has no "Disable" button. When a person temporarily does not use the account (for example, during long leave or a transfer) but the account must be kept, proceed as follows:

1. As described in Section 15.6, reset the password of the account to a new password known only to the administrator. The person can then no longer log in.
2. As described in Section 15.4, change "Run · Work" of the account to "Deny" and click "Save Settings". The screens where the account is currently logged in are invalidated immediately, and the account can no longer run work.
3. When the account is to be used again, change "Run · Work" back to "Allow" and save, then reset a new password and give it to the person.

> **Example** Operator op_wang takes two weeks of leave. The administrator resets the password to a new value, then changes “Run · Work” to “Deny” and saves. Two weeks later, the administrator changes “Run · Work” back to “Allow”, saves, resets a new password and gives it to op_wang, who can then log in and work as usual.

15.2.7 Error Messages

Message on screen	Cause and solution
“Loading users...”	The list is being read; this is not an error. Wait a moment; if it stays for a long time, click “Back” and enter again.
“The current user does not have permission to view user management.”	The current account does not have “View · User List”. Log in with an account that has the permission, or ask the administrator to grant it.
“必須至少保留一位管理員，請先建立其他管理員帳號。” (shown in Chinese even in English: at least one administrator must be kept. Create another administrator account first)	You tried to downgrade or delete the only effective administrator (see Section 15.1.4). Make another account an effective administrator first, then handle the original account.
“You do not have permission to perform this operation.”	Your account no longer has “Edit · User Management” (for example, it has just been changed by another administrator). Log in again to check the permissions.
“Your session has expired. Please sign in again.”	You logged in more than 8 hours ago, or your role has been changed. Log in again, then retry.
“User management operation failed.” (cause: the user management service is temporarily unavailable)	Account data temporarily cannot be read or saved. Try again later; if it keeps happening, see Chapter 16.
“User management operation failed.”	The operation failed for another reason, for example the confirmation window could not be opened. Try again; if it keeps happening, see Chapter 16.

15.3 Editing a User

Path: navigation menu → “User Management” → click the username with the pencil icon.

Change the username, password and role of an existing account, and adjust individual permissions in the same form (for the permission area, see Section 15.4). Requires the “Edit · User Management” permission; without it, the usernames in the list cannot be clicked and there is no form on the right.

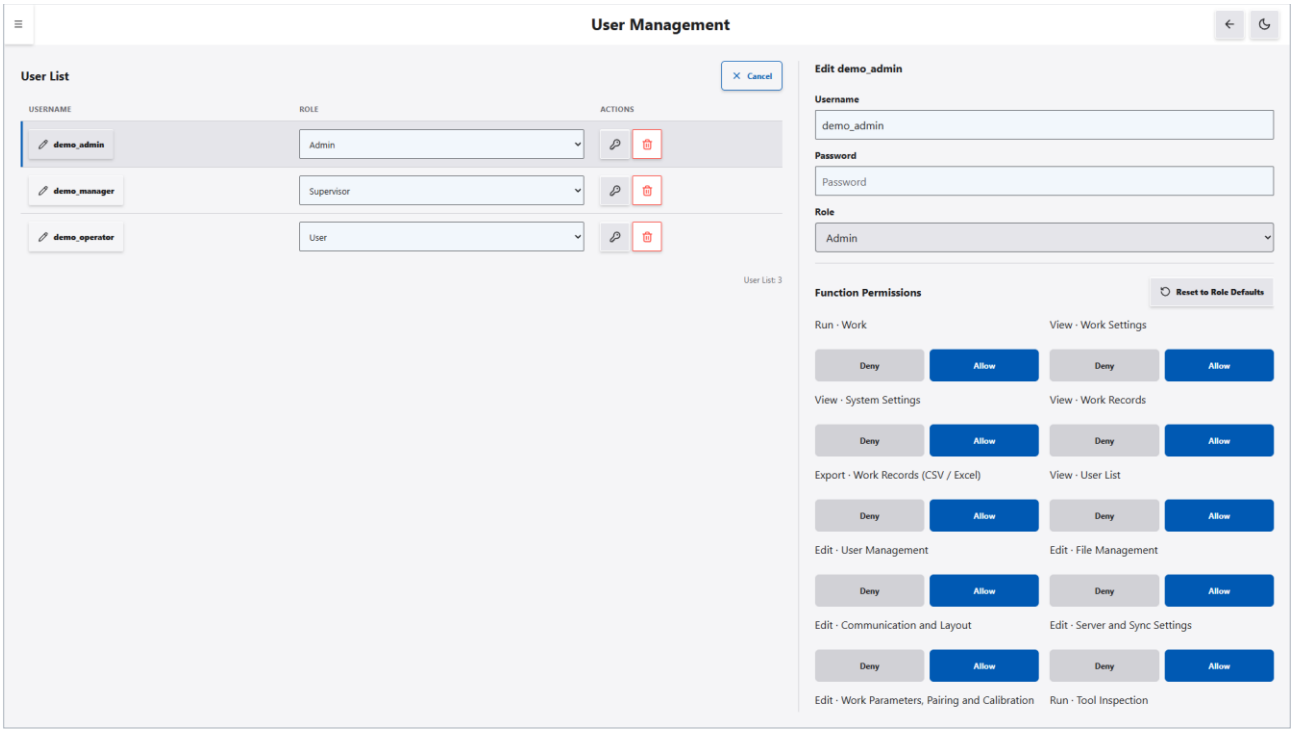

Figure 15-2 User Management: editing a user

15.3.1 Screen Description

Area / button	Description
Selection mark in the list	The row of the account being edited has a darker background and a blue vertical bar on the left.
Form title	“Edit {username}”, for example “Edit demo_admin”.
“Username”	The login name; can be changed.
“Password”	Empty by default (gray hint text “Password”). Empty means the password is not changed.
“Role”	Drop-down list with the options “User”, “Supervisor” and “Admin”.
“Function Permissions”	The 14 permissions and “Reset to Role Defaults”; see Section 15.4.
Bottom of the form	“Save Settings” and “Delete” (see Figure 15-4).
“Cancel” at the top right of the list	While you are editing, the button above the list shows “Cancel”; clicking it closes the form on the right without saving.

15.3.2 Fields

Field	Description	Range and default
Username	The name entered at login. Filled with the current name when the form opens.	Required; leading and trailing spaces are removed automatically; must not be the same as any other account (including deleted accounts).
Password	Sets a new password. The old password is not shown.	Optional; empty keeps the original password; leading and trailing spaces are removed automatically.
Role	The role of the account.	Filled with the current role; when it changes, the 14 items below immediately change to the defaults of the new role, and individual adjustments are cleared after saving.
Function Permissions (14 items)	Individual adjustments; see Section 15.4.	Each item “Deny” or “Allow”.

> **Note** The screen has no “Display name” field. A new account uses its username as the operator name in records; if you change the username later, the operator name in records keeps the original name. If you need a different name, it is best to add a new account and then delete the old one (a deleted name cannot be used again).

15.3.3 Buttons

Button	Description
Save Settings	Checks and saves the name, password, role and permissions. On success, “User saved.” appears at the top of the screen, the password field is cleared and the list is updated. If the role or permissions have changed, the screens where that account is logged in are invalidated immediately; if the change is to your own account, the program logs out.
Delete	The confirmation window “Delete this user?” appears; the account is deleted only when you click “Delete”. On success, “User deleted” is shown and the right side returns to an empty form (see Section 15.2.5).
Cancel	Closes the form on the right without saving and without asking.
Another username	Switches to editing another account; unsaved changes are discarded without asking.

15.3.4 Operating Steps

1. “User Management” → click the username to change. The title on the right changes to the account name, the fields are filled with the current data, and the password field is empty.
2. To rename the account, change “Username”.
3. To change the password, enter the new password in “Password”; to keep it, leave the field empty. It is better to use the “Reset Password” window (see Section 15.6), which requires you to enter the password twice and is less prone to typing errors.

4. To change the role, select the new role in “Role”. The 14 permissions below immediately change to the defaults of the new role.
5. For individual adjustments, set them as described in Section 15.4.
6. Scroll to the bottom of the form and click “Save Settings”. “User saved.” appears at the top of the screen, and the role in the list is updated accordingly.
7. If you changed your own role or permissions, the program logs out immediately and shows “Permissions updated. Please sign in again.”; log in again.

> **Example** Supervisor sv_huang becomes a system administrator.
> Click sv_huang, select “Admin” in “Role”, and all 14 permissions below show “Allow”.
> Click “Save Settings”, and the screen shows “User saved.”. After sv_huang logs in again, they can add and edit accounts in “User Management”.

15.3.5 Error Messages

Message on screen	Cause and solution
“Username is required”	The username is empty; the message appears below the field. Enter a name, then save.
“使用者名稱已存在。” (shown in Chinese even in English: username already exists)	The name is the same as another account, including deleted accounts. Use another name.
“必須至少保留一位管理員，請先建立其他管理員帳號。” (shown in Chinese even in English: at least one administrator must be kept. Create another administrator account first)	This is the only effective administrator, and the new role or permissions would make it lose “View · User List” or “Edit · User Management”. Make another account an effective administrator first, then adjust this account.
“You do not have permission to perform this operation.”	Your account no longer has “Edit · User Management”. Log in again to check the permissions.
“Your session has expired. Please sign in again.”	You logged in more than 8 hours ago, or your role has been changed. Log in again, then retry.
“User management operation failed.” (cause: the user management service is temporarily unavailable)	The data temporarily cannot be saved. Try again later; if it keeps happening, see Chapter 16.

15.4 Per-User Permission Settings

Path: navigation menu → “User Management” → click a username (see Section 15.3) or “+ Add User” (see Section 15.5) → scroll down to “Function Permissions”.

In addition to the role defaults, allow or deny functions item by item for a single account. For example, let an operator only run work without opening the work settings, or prevent a supervisor from deleting records. Requires the “Edit · User Management” permission.

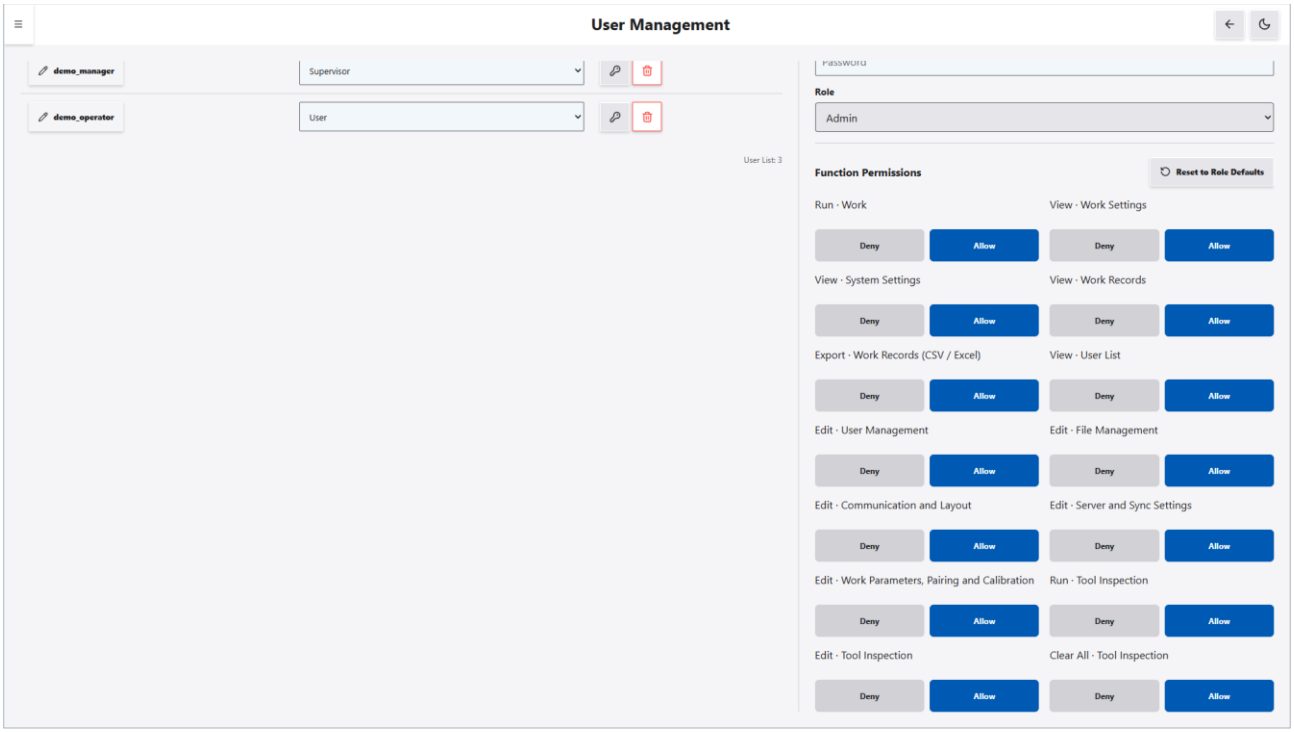

Figure 15-3 User Management: function permission area

15.4.1 Screen Description

Area / button	Description
“Function Permissions”	Area title.
“Reset to Role Defaults”	At the top right of the area, with a counterclockwise arrow icon.
Permission grid	The 14 items in two columns and 7 rows, in the same order as the table in Section 15.1.2. Each item has the permission name above (for example “Run · Work”) and two buttons, “Deny” and “Allow”, below; the current selection is shown in white text on a blue background.
Bottom of the form	“Save Settings” and “Delete”; when adding an account, “Add” and no “Delete”.

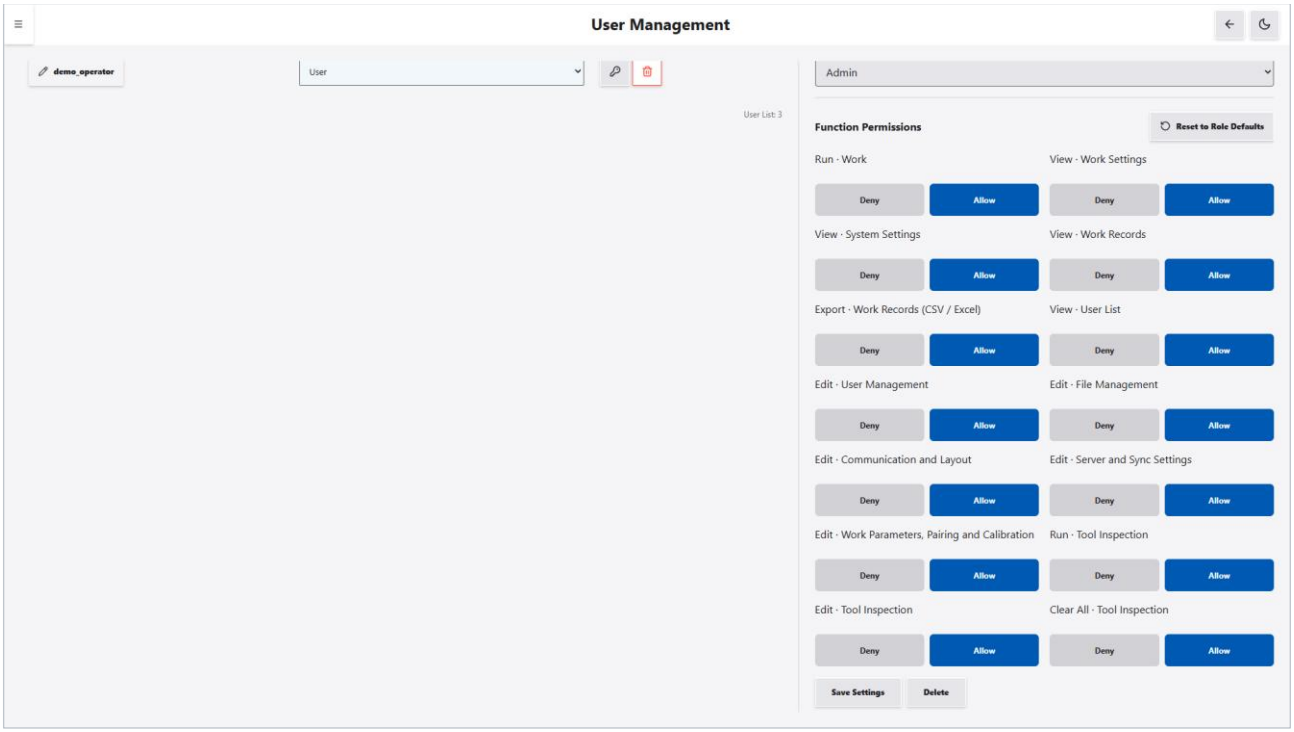

Figure 15-4 User Management: bottom of the function permission area

Figure 15-4 shows the screen scrolled to the bottom of the form, with the last few permissions and “Save Settings” and “Delete”. To keep permission changes, click “Save Settings” at the bottom of the form; leaving with “Back” at the top right does not save.

15.4.2 Fields

Field	Description	Range and default
Function Permissions (14 items)	Determine whether this account can use each function; for a description of each item, see Section 15.1.2.	Each item “Deny” or “Allow”. When opened, shows the result of “the role defaults plus the individual adjustments of this account”; when adding an account, all items follow the defaults of the selected role.

15.4.3 Buttons

Button	Description
Deny / Allow (each item)	Switches the setting of the item. When it differs from the role default, it becomes an individual adjustment; when it is the same, the item returns to following the role default. Not saved after clicking; cannot be clicked while saving or deleting is in progress.
Reset to Role Defaults	Clears all individual adjustments in the form, and the 14 items immediately show the defaults of the currently selected role. Not saved yet; takes effect only when you click “Save Settings”; if you leave without saving, the permissions do not change.
Save Settings	Writes the role and permissions. If the permissions have changed, the screens where that account is logged in are invalidated immediately.

15.4.4 Operating Steps

1. “User Management” → click the username to adjust. The form on the right is filled with the account data.
2. Check that “Role” is correct. To change the role, change it first, then go to the next step; changing the role returns this area to the defaults of the new role.
3. Scroll down to “Function Permissions”. You see the 14 permissions and the current selections (blue).
4. Click “Deny” or “Allow” for each item. The selected side turns blue.
5. To discard all individual adjustments and return to the role defaults, click “Reset to Role Defaults”. The 14 items immediately return to the defaults (not saved yet).
6. Scroll to the bottom of the form and click “Save Settings”. “User saved.” appears at the top of the screen. If the permissions have changed, the screens where that account is logged in are invalidated immediately and the account must log in again; if the change is to your own account, the program logs out immediately and shows “Permissions updated. Please sign in again.”.
7. Ask the person to log in again and check that the navigation menu and available functions are as expected. Some permissions show “You do not have permission to perform this operation.” only when the operation is actually performed (see Section 15.1.2); try a denied operation once.

> **Example** Operator `op_wu` has the “User” role, and the shop floor requires this operator to only run work, without opening the work settings.
> Click `op_wu`, scroll to “Function Permissions”, click “Deny” for “View · Work Settings”, then click “Save Settings”, and the screen shows “User saved.”.
> The other 13 items still follow the “User” defaults. After `op_wu` logs in again, the account can still enter the work screen of a mode that has been set up and work there, but the header no longer shows the “Settings” button.
> To cancel this later, click “Reset to Role Defaults” and then “Save Settings”; “View · Work Settings” returns to “Allow”.

15.4.5 Error Messages

Message on screen	Cause and solution
“必須至少保留一位管理員，請先建立其他管理員帳號。” (shown in Chinese even in English: at least one administrator must be kept. Create another administrator account first)	You denied “View · User List” or “Edit · User Management” for the only effective administrator. First give another account both items, then adjust this account.
“Permissions updated. Please sign in again.”	Not an error: you changed your own role or permissions, and the program has logged out. Simply log in again.
“You do not have permission to perform this operation.”	When it appears on another screen, the corresponding function has been denied for that account. Check whether this is the intended setting; if needed, the administrator changes it to “Allow”.

15.5 Adding a User

Path: navigation menu → “User Management” → “+ Add User” at the top right of the list.

Create a personal account for a new operator, QC inspector, supervisor or administrator. Only when each person uses their own account can the operator in records be matched to the person who actually performed the work. Requires the “Edit · User Management” permission; without it, “+ Add User” is not shown.

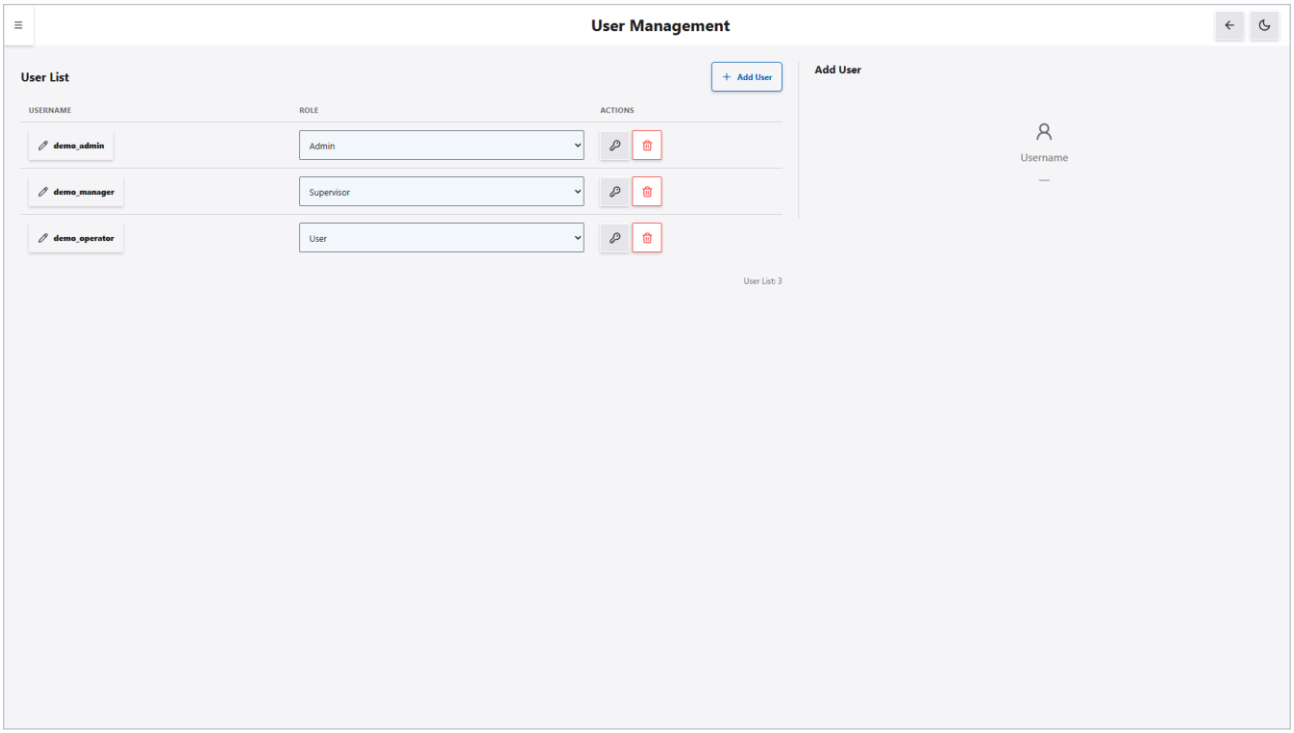

Figure 15-5 User Management: Add User button

After you click "+ Add User" at the top right of the list, the add form opens on the right (Figure 15-6). The layout of the form is the same as when editing (see Figure 15-2); the differences are that the fields are empty and the button at the bottom is "Add".

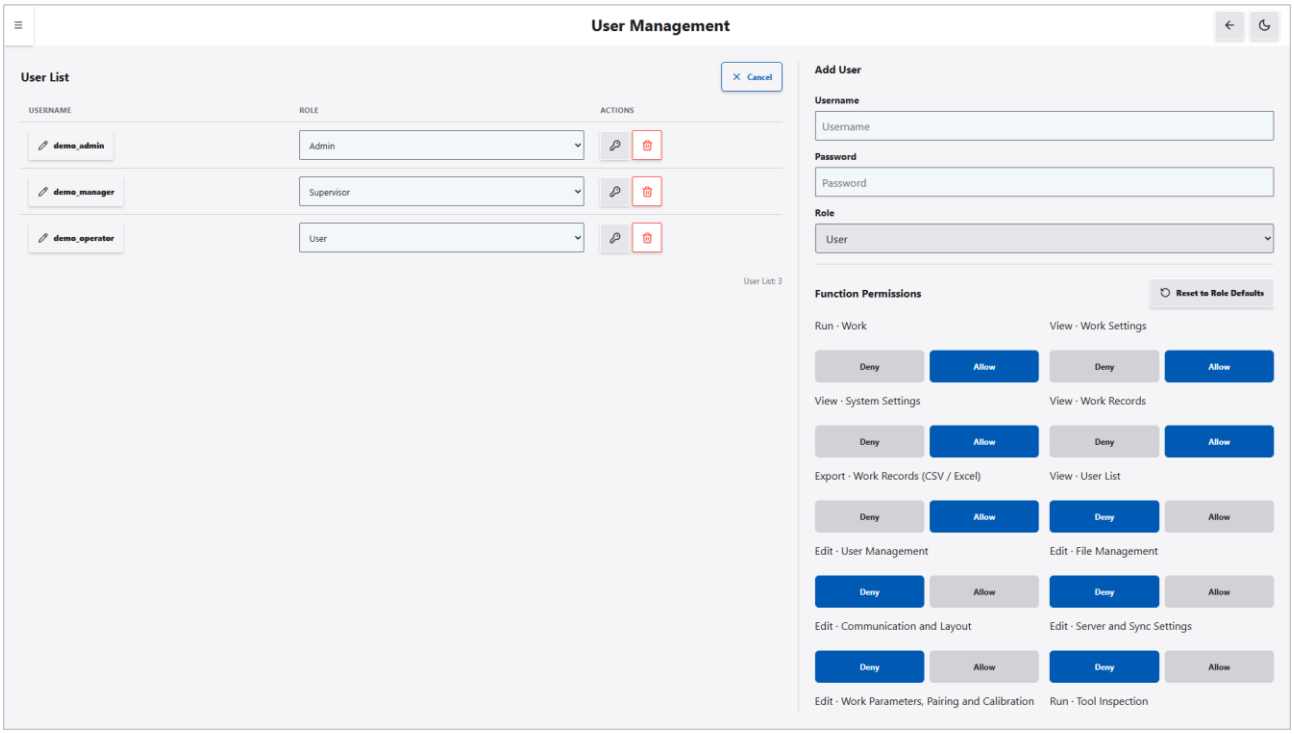

Figure 15-6 User Management: add user form

15.5.1 Screen Description

Area / button	Description
"+ Add User"	At the top right of the list. After you click it, the add form opens on the right and the button changes to "Cancel".
Form title	"Add User".
"Username", "Password"	Empty, with the gray hint text "Username" and "Password".
"Role"	"User" by default.
"Function Permissions"	Shown according to the defaults of the selected role (see Section 15.4).
"Add" at the bottom of the form	You must scroll down to see it; there is no "Delete" when adding.

15.5.2 Fields

Field	Description	Range and default
Username	The login name of the new account, which is also the operator name in records.	Required; leading and trailing spaces are removed automatically; must not be the same as any account (including deleted accounts).
Password	The initial password of the new account.	Required; must not consist only of spaces; leading and trailing spaces are removed automatically; the program does not check length or complexity; the form has no “Confirm password” field.
Role	The role of the new account.	“User” by default; when it changes, the permission grid returns to the defaults of the new role.
Function Permissions (14 items)	Individual adjustments of the new account.	By default all follow the role (see Section 15.4).

15.5.3 Buttons

Button	Description
Add	Checks the input and creates the account. On success, “User created” appears at the top of the screen and the form automatically switches to editing the new account: the title changes to the new account name, the button changes to “Save Settings”, and “Delete” appears.
Cancel	Closes the form and discards the entered content without asking.
Reset to Role Defaults	See Section 15.4.

15.5.4 Operating Steps

1. “User Management” → “+ Add User”. An empty form appears on the right with the role “User”, and the button at the top right of the list changes to “Cancel”.
2. Enter the “Username”.
3. Enter the “Password”. The form has no confirmation field, so check the password again after entering it.
4. Select the “Role”: select “User” for operators, “Supervisor” for shop-floor supervisors or QC staff, and “Admin” for system administrators. The permission grid is updated according to the role defaults.
5. If needed, adjust permissions item by item as described in Section 15.4.
6. Scroll to the bottom of the form and click “Add”. “User created” appears at the top of the screen, the new account appears in the list, and the form on the right switches to editing this account.
7. Ask the person to log in with the new account and check that the available functions are as expected.

Example Add QC inspector `qc_lin` with the "Supervisor" role, then turn off the permission to delete records.
Click "+ Add User", enter `qc_lin` in "Username", enter the initial password in "Password", and select "Supervisor" in "Role".
The permission grid shows the Supervisor defaults: "Edit · User Management" and "Edit · Server and Sync Settings" are "Deny", and the other 12 items are "Allow".
The QC inspector does not need to delete records, so click "Deny" for "Edit · File Management".
Scroll to the bottom and click "Add"; the screen shows "User created", and `qc_lin` appears in the list with the role "Supervisor".
After logging in, `qc_lin` can query and export records, view the user list and save work parameters, but cannot delete records.

Tip If you mistyped the initial password, simply set it again with "Reset Password" (see Section 15.6).

15.5.5 Error Messages

Message on screen	Cause and solution
"Username is required"	The username is empty; the message appears below the field. Enter a name.
"Password is required"	The password is empty or consists only of spaces; the message appears below the field. Enter a password.
"使用者名稱已存在。" (shown in Chinese even in English: username already exists)	The name is the same as an existing account or a deleted account. Deleted accounts do not appear in the list, but their names are still taken. Use another name, for example by adding a number.
"You do not have permission to perform this operation."	Your account no longer has "Edit · User Management". Log in again to check the permissions.
"User management operation failed." (cause: the user management service is temporarily unavailable)	The data temporarily cannot be saved. Try again later; if it keeps happening, see Chapter 16.

15.6 Resetting a Password

Path: navigation menu → "User Management" → key icon in the "Actions" column of the target account row ("Reset Password" appears when the pointer rests on it).

The administrator sets a new password for any account (including their own), to replace the initial password, when someone forgets their password, or for periodic changes. TMS RF has no place where users can change their own password; all password changes are made by the administrator here or in the "Password" field described in Section 15.3. Requires the "Edit · User Management" permission; accounts without it (including the "Supervisor" and "User" defaults) cannot change any password, including their own.

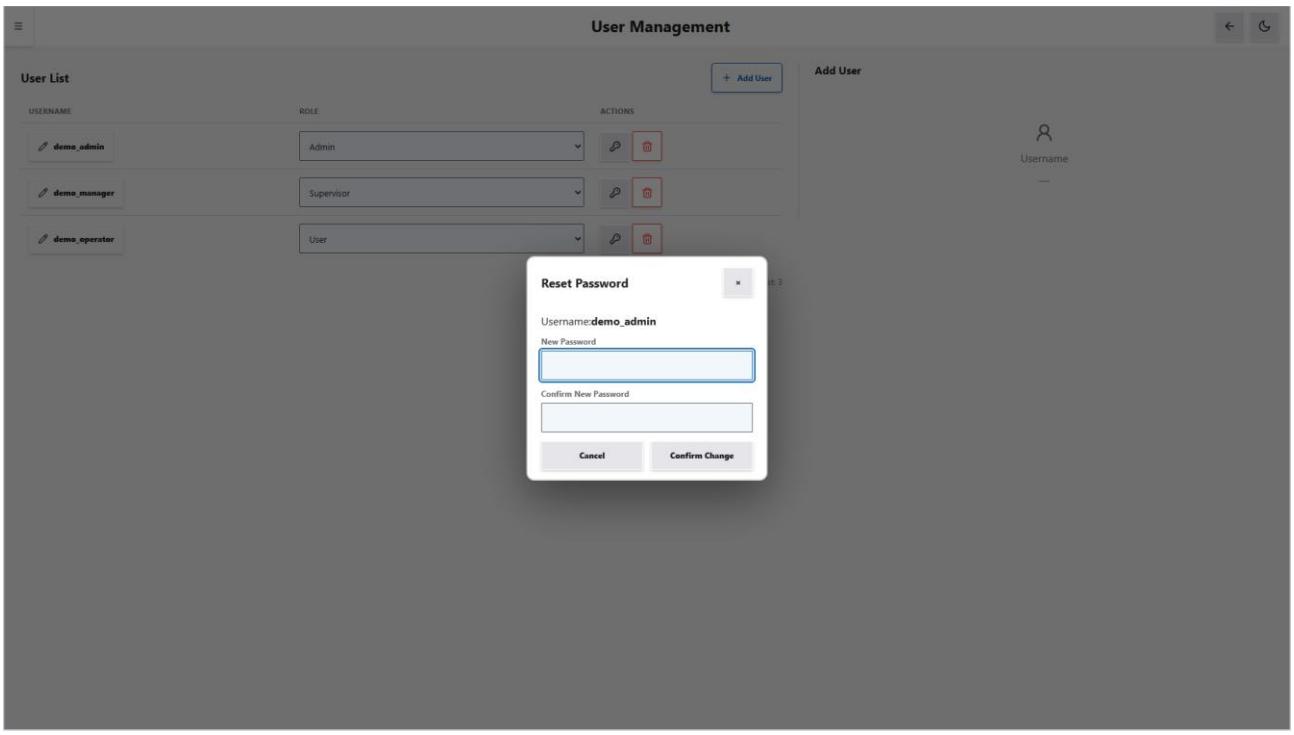

Figure 15-7 User Management: Reset Password window

15.6.1 Screen Description

Area / button	Description
“Reset Password” and “×”	The window title and the close button at the top right.
“Username:”	Followed by the account to reset, in bold. Check first that you have not selected the wrong account.
“New Password”, “Confirm New Password”	Two password fields, shown with masked characters. When the window opens, the cursor is in “New Password”.
Error message area	When checking or saving fails, the message appears below the two fields.
“Cancel”, “Confirm Change”	Buttons at the bottom of the window.

While the window is open, the screen behind it cannot be used. Pressing Esc, clicking the dark area outside the window, clicking “×” or clicking “Cancel” closes the window and clears the input. After you click “Confirm Change” and until processing is complete, none of these can close the window, and the fields and buttons are temporarily unavailable.

15.6.2 Fields

Field	Description	Range and default
New Password	The new password to set. Empty each time the window opens.	Required; must not consist only of spaces; leading and trailing spaces are removed automatically; the program does not check length or complexity.
Confirm New Password	Enter the password again to avoid typing errors.	Required; must be exactly the same as “New Password”.

15.6.3 Buttons

Button	Description
Confirm Change	Checks both fields and saves the new password. On success, the window closes and “Password reset” appears at the top of the screen. Changes only the password, not the role or permissions, and does not invalidate the current logins of that account.
Cancel / ×	Closes the window without saving. Cannot be clicked while processing is in progress.

> **Tip** After clicking “Confirm Change”, wait for the window to close automatically. If the reset fails, the window does not close, the error message appears below the fields and your input is kept; after correcting it, you can click “Confirm Change” again.

15.6.4 Operating Steps

1. “User Management” → click the key icon in the target account row. The “Reset Password” window appears, showing “Username:” and the account name.
2. Check that the account name is correct.
3. Enter the new password in “New Password”.
4. Enter it again in “Confirm New Password”.
5. Click “Confirm Change”. The window closes and “Password reset” appears at the top of the screen.
6. Give the new password to the person in a secure way. If you reset your own password, the current screen is not logged out; use the new password the next time you log in.

> **Example** Operator `op_wang` has forgotten the password.
> Administrator `adm_chen` clicks the key icon in the `op_wang` row, and the window shows “Username:op_wang”.
> Enter the same new password in both fields and click “Confirm Change”; the screen shows “Password reset”.
> `op_wang` logs in successfully with the new password; when logging in with the old password, the screen shows “Incorrect username or password”.
> If the second entry is mistyped, the window shows “New passwords do not match”; simply enter both fields again.

> **Note** Resetting a password does not invalidate the screens where that account is logged in. If the account may have been used by someone else, follow point 7 of Section 15.7.

15.6.5 Error Messages

Message on screen	Cause and solution
"Please fill in all fields"	"New Password" or "Confirm New Password" is empty or consists only of spaces. Fill in both fields, then click "Confirm Change".
"New passwords do not match"	The two fields differ (including differences in leading or trailing spaces). Enter both fields again.
"You do not have permission to perform this operation."	Your account no longer has "Edit · User Management". Log in again to check the permissions.
"Your session has expired. Please sign in again."	You logged in more than 8 hours ago, or your role has been changed. Log in again, then retry.
"User management operation failed." (cause: the user management service is temporarily unavailable)	The data temporarily cannot be saved. Try again later; if it keeps happening, see Chapter 16.

15.7 Security Recommendations

1. **Change the initial password immediately.** After a new installation, first log in as `admin` (for the initial password, see Section 2.8), then reset the password as described in Section 15.6. The program does not force a change and does not check password length or complexity; set the password according to your company's password rules.
2. **Keep at least two administrators.** The system only guarantees at least one effective administrator, and there is no password recovery function; if the only administrator forgets the password, no other account can reset it. Create another "Admin" account, kept by a different person.
3. **One account per person, never shared.** The operator name in records comes from the logged-in account; shared accounts make it impossible to match records to individuals.
4. **Grant only the permissions that are needed.** Operators use "User", and extra permissions are allowed item by item only when really needed. Give "Edit · User Management" and "Edit · Server and Sync Settings" only to system administrators.
5. **Finish work first, then manage accounts.** Changing the role or individual permissions of an account, or deleting it, immediately invalidates its logins and stops its work in progress. Do this at a shift change or line stop.
6. **Test after setting.** Some permissions are checked only after a button is clicked (see Section 15.1.2). After adjusting permissions, log in with that account and try a denied operation once to confirm that "You do not have permission to perform this operation." appears.
7. **If an account may have been compromised.** Resetting the password only invalidates the old password; it does not end screens that are already logged in (a login is valid for up to 8 hours). To end them immediately, first reset the password, then temporarily change any one permission of the

account to “Deny” and save (this invalidates all logins of the account), and after confirming, change it back and save; or delete the account.

8. **Think carefully before deleting.** A deleted account disappears from the list, but its username is still taken and cannot be used to recreate the account later. If the person is only temporarily not using the account, follow Section 15.2.6.
9. **Log out when you leave the workstation.** Click “Log Out” at the bottom of the navigation menu to prevent others from working with your permissions.
10. **Check accounts after an upgrade.** After an upgrade from an earlier version, the permissions of existing accounts equal their role defaults (see Section 15.1.5). Check one by one whether each role still fits the current situation, and adjust individual accounts if needed. For backup before an upgrade, see Chapter 17.

> **Warning** If all administrators have forgotten their passwords, do not delete the TMS RF data files to “reset” the accounts; this also clears all sensors, settings and records and cannot be undone. Contact the supplier for help.

Chapter 16 Error Handling and Troubleshooting

This chapter lists the causes of and solutions to common problems, organized by “what you see”. When a message appears on the screen, you can look up the message text directly in Section 16.9.

16.1 General Principles

1. **First note down the exact message and the time it occurred.** Copy the message on the screen word for word or take a screenshot, then look up the solution in Section 16.9.
2. **First finish the current work.** Finish work before changing settings, pairing sensors or managing accounts. When you leave a work screen, work stops automatically (see Section 5.2). Adjust accounts and permissions when nobody is working (see Chapter 15).
3. **If you cannot save, check permissions first.** Many save failures are caused by insufficient account permissions. Some permissions are checked only when you click save, and the button is not disabled in advance. When saving fails on the batch settings screen, it always shows only “Unable to connect to the local service. Open the desktop application to continue.” (see Section 9.3).
4. **Do not delete, move or modify database files yourself.** When data needs to be handled, first close the program and make a cold backup as described in Section 17.2.
5. **Do not disable security protection.** Do not disable SmartScreen or antivirus software or bypass company policies to solve a problem; ask IT to handle it according to company policy (see Section 2.5).
6. **Do not run communication tests on equipment in production.** Run communication tests only in a non-production environment and with authorization (see Chapter 13).
7. **Do not run the installed version and the portable version at the same time.** Both use the same data (see Section 2.7).

16.2 Installation and Startup

Symptom	Possible cause and solution
An unknown publisher or SmartScreen warning appears when you run the installer or the main program	The installation file has no digital signature. Ask IT to approve it according to company policy before running it; do not disable SmartScreen. See Section 2.5.
The program is blocked by company policy and cannot run	The company's application control policy does not allow this program. Ask IT to handle it according to policy. See Section 2.5.
The standard installer fails on a computer without a network connection, or shows “Error: Downloading WebView2 Failed - ...”	The computer does not have the WebView2 Runtime, and the standard installer must download it from the network. Use the offline installer instead, or ask IT to install the WebView2 Runtime first. See Section 2.2.

Symptom	Possible cause and solution
The portable program does not open	The computer does not have the WebView2 Runtime, and the portable program does not install it automatically. Ask IT to install the WebView2 Runtime, or use an installer instead. See Section 2.4.
“TMS RF data migration was stopped.” appears when the new version starts, and the program closes	The data of a version earlier than 1.4.1 could not be copied safely. Nothing has been overwritten. Act as described in Section 17.4.5.
“TMS RF is running! Click OK to kill it” appears during installation or uninstallation	TMS RF is still open. Click “Cancel”, close TMS RF completely as described in Section 16.2.1, then run the installer again. Clicking “OK” to force it to close is not recommended, because data from work in progress may not be saved in time.
“A newer version of TMS RF is already installed! It is not recommended that you install an older version. …” appears during installation	This installer is older than the version on the computer. Click “Cancel” and do not downgrade. See Section 17.4.
After startup, the window fills the whole screen	The program maximizes automatically at startup; this is not full screen. Click the “Restore Down” button in the title bar to make the window smaller. See Section 2.6.
Settings or records of the installed version and the portable version affect each other	Both use the same data. Use only one of them, and do not run them at the same time. See Section 2.7.
After logging in with another Windows account, TMS RF cannot be found or the original data is not visible	The installation and the data belong to each individual Windows account. Log in with the original Windows account; another account must install the program separately to use it. See Sections 2.3 and 2.7.

16.2.1 Closing TMS RF Completely

Before installation, upgrade, uninstallation and backup, always close TMS RF completely first.

1. Finish work on every screen where work is in progress.
2. Click “Log Out” at the bottom of the navigation menu. The screen returns to the login screen.
3. Close the TMS RF window. Close both the installed version and the portable version; if several TMS RF windows are open, close them all.
4. Press Ctrl+Shift+Esc to open the Windows “Task Manager”, and check that TMS RF is no longer in the list.

16.3 Login, Permissions and Sessions

Symptom	Possible cause and solution
After a new installation, you do not know which account to log in with	A new database automatically creates one administrator account. Log in as described in Section 2.8, and change the password immediately after logging in.
"Incorrect username or password" appears at login	The username or password was entered incorrectly, or the account has been deleted. Check upper/lower case and the input method; if you forgot the password, ask the administrator to reset it (see Section 15.6).
Some items are missing from the navigation menu, or some buttons cannot be clicked	The permissions of the account do not allow this function. Ask the administrator to adjust the permissions in "User Management" (see Section 15.4).
"You do not have permission to perform this operation." appears after you click save	Some permissions are checked only when you click save. Ask the administrator to adjust the permissions, then try again (see Section 15.1).
"Your session has expired. Please sign in again." or "Please sign in." appears	You logged in more than 8 hours ago, or the administrator changed the permissions of this account or deleted it. When the login expires, work in progress stops. Log in again; if you cannot log in, contact the administrator (see Section 3.5).
The login screen shows "Permissions updated. Please sign in again."	The role or permissions of your own account were changed and saved, and the system logged you out automatically. Log in again to apply the new permissions.
You cannot lower the permissions of an administrator or delete the account, and "必須至少保留一位管理員，請先建立其他管理員帳號。" (shown in Chinese even in English: at least one administrator must be kept. Create another administrator account first) appears	The last effective administrator cannot be deleted or downgraded. First give another account both the "View · User List" and "Edit · User Management" permissions (see Section 15.1).
After a password reset, screens the person already has open can still be used	A password reset only invalidates the old password; it does not log out screens that are already logged in. To end them immediately, change the permissions of the account and save (see Section 15.7).
After an upgrade, some accounts still cannot use a function	An upgrade does not add permissions to any account automatically. The administrator allows this function for the account in "User Management" (see Section 15.4).

Symptom	Possible cause and solution
The interface language is not the one you want	At first startup, the language is selected automatically from the Windows display language; unsupported languages show English. Switch the language as described in Section 3.4; your selection is kept afterwards.
The date and time format does not match the interface language	The date and time format follows the Windows regional settings, not the interface language. To change the format, adjust the Windows regional settings (see Section 3.4).

16.4 Sensors and RF Receiver

Symptom	Possible cause and solution
The sensor list is empty	On a new installation, the sensor list is empty; this is normal. Pair sensors as described in Section 12.3.
“Sensor Pairing” shows “No RF receiver detected yet”	The RF receiver is not plugged in properly, the driver is not installed, or the USB connection is unstable. Reconnect it following the steps in “Reconnecting the RF Receiver” below in this section.
“Please connect to the RF receiver first.” appears when you click “Pair”	The RF receiver is not connected yet. Reconnect it following the steps in “Reconnecting the RF Receiver” below in this section, then pair.
“Failed to write to the RF receiver. Make sure the COM port is not in use, then run detection again.” appears	Another program is using the COM port of the RF receiver. Close that program, then click “Rescan”.
During pairing, “The RF receiver timed out. Make sure the torque sensor is powered on and in pairing mode.” or “Channels do not match. Make sure the tool is in pairing mode, then start pairing again.” appears	The sensor is not switched on or not in pairing mode. Put the sensor into pairing mode, then send the pairing again (see Section 12.3).
When work starts, “Failed to start work.” appears because the RF receiver is not connected (the Power Tool screen shows “找不到 RF 接收器，請確認已連接並保持通電。” instead, in Chinese even in English)	The RF receiver is not connected. Reconnect it following the steps in “Reconnecting the RF Receiver” below in this section, then return to the work screen.

Symptom	Possible cause and solution
The reading on the work screen does not change while you apply torque	The sensor is not switched on, the battery is low, the sensor is out of communication range, or the sensor selected on the settings screen is not this sensor. Check the sensor power and battery, and check the sensor selected on the settings screen (see Section 5.2).
The work screen shows “Sensor error, work stopped”	The sensor reported an error that stops work. Click “Go to sensor pairing” to check the sensor, and look up the error code and time in “Sensor error history” (see Section 12.7). If the account does not have the “View · System Settings” permission, the screen shows a “Log Out” button instead; log out and notify the administrator.

16.4.1 Reconnecting the RF Receiver

1. Check that the RF receiver is plugged into a USB port of the computer.
2. Close other programs that may be using the COM port.
3. Click “System Settings” in the navigation menu, then click “Sensor Pairing”.
4. Click “Rescan”. When detection succeeds, the connection status of the RF receiver shows that it is connected.
5. If it still cannot be detected, unplug the receiver, plug it in again, and click “Rescan” once more.
6. Check that the sensor is switched on and has enough battery, then return to the work screen.

16.5 Work Settings and Judgement

Symptom	Possible cause and solution
“Target torque must be between 10% and 100% of the selected sensor capacity (…).” appears when saving settings	The target torque is outside the capacity range of the selected sensor. Correct the value, or select a sensor with a more suitable capacity. The system does not adjust the value into the range automatically (see Sections 5.4 and 7.3).
“Select a torque sensor.” or “Select a torque sensor with a valid capacity.” appears	No sensor has been selected yet, or the sensor has no capacity data. First pair and set up the sensor as described in Section 12.3, then return to the settings screen and select it.
“Failed to start work.” appears when you enter the work screen	The command to start work was not sent successfully. Check that the RF receiver is connected and the sensor is switched on, then switch to another mode and back.
The station or part number in records is empty	These two fields were not filled in on the settings screen. If you need traceability, fill them in on the settings screen before starting work (see Section 5.5). For Power Tool, “Station” is required; the settings cannot be saved when it is empty.
The target torque shows fewer decimal places than you entered	The target torque shows at most two decimal places; the saved value is not truncated.

Symptom	Possible cause and solution
After you click save in the batch settings, only “Unable to connect to the local service. Open the desktop application to continue.” appears	Every save failure on this screen shows the same sentence; common causes are insufficient permissions or incomplete step data. Check the account permissions and check that every step is completely set (see Section 9.3).
The torque factor cannot be saved	“Displayed Torque” has no valid reading, or the displayed torque is 0. Select an active sensor and apply torque, get a reading, then save (see Section 12.4).
The indicator light does not light automatically when a work result is produced	No COM port has been selected and saved in “Indicator Light Settings” yet (“Not selected yet” after a fresh installation), or the saved port is not the port of the controller; in these cases the screen gives no indication. Select the COM port as described in Section 12.6, test the lights, then click “Save Settings”. Automatic lighting requires only the “Run · Work” permission.
When you enter a work mode, a “Failed to load … settings.” message (for Batch Jobs, “Failed to load batch work data.”) appears without a “Reload settings” button	The account does not have the “View · Work Settings” permission and this work mode has not been set up yet; the capability index test also requires the “Run · Tool Inspection” permission. Ask someone who can open the settings to complete them first, or ask the administrator to adjust the permissions (see Section 15.1).
The Batch Jobs work screen shows “This batch recipe is no longer available. Select an available recipe before starting work.”	The batch recipe to be loaded has been deleted or is no longer completely set up. Select an available recipe in the “Batch Name” menu, then click “Start work”; the program does not switch to another recipe automatically (see Chapter 9).

16.6 Records and Export

Symptom	Possible cause and solution
The record list shows “No records found”	There are no records for this mode on this computer yet. First complete a measurement on the work screen (see Section 11.3).
The record list shows “No records match these filters.”	There are records, but none of them match the current filter conditions. Click “Clear filters”, or relax the conditions yourself.
The records page shows “The end date is before the start date. Change either date.”, and the statistics bar and the list disappear	“End Date” is earlier than “Start Date”. After you correct either date, the screen is restored automatically (see Section 11.2).
The export buttons on the records page are gray and cannot be clicked	No “Export · Work Records (CSV / Excel)” permission, a query is running, a query has failed, or the dates are reversed. Wait for the query to finish; if the query failed, click “Reload”; if the dates are reversed, correct them; if the permission is missing, ask the administrator to adjust it.
The record list shows “Failed to load records. Displayed data has not been updated.”	Reading the records failed; common causes are a missing “View · Work Records” permission or an expired login. Click “Reload”; if it still fails, check the permissions or log in again.

Symptom	Possible cause and solution
Only the newest 2000 records are shown, and older records cannot be found	One query shows and exports at most 2000 records. Narrow the date range, and query and export in parts (see Section 11.2).
The file exported from the list has no raw samples	List exports do not include raw samples. Export from the detail page of a single record (see Section 11.4).
You need separate statistics for each work mode	An “All work modes” export puts all modes in the same sheet. Select each mode in turn in “Work mode filter” and export them separately (see Section 11.2).
“Export failed” appears when exporting	No “Export · Work Records (CSV / Excel)” permission, the save folder cannot be written to, or the file is too large. Check the permission and the save location, narrow the range and try again.
“Failed to delete record” appears when deleting a record	No “Edit · File Management” permission, the login has expired, or the record has already been deleted. Check the permission, then click “Query” to refresh.
The detail page shows “No data points”	No chart samples were stored for this record. The other fields of the record are still valid.
Capability index records have no raw samples	This is normal. Capability index records have only a list and details, with no raw samples (see Section 11.9).

16.7 Communication Settings and Sync

Symptom	Possible cause and solution
“Unable to start the Modbus TCP server.” followed by “Unable to start the ${protocol} server.” (the second part is shown exactly like this, including “${protocol}”) appears	The port is used by another program, or the bind IP is not an address of this computer. Use a port that is not in use, set the bind IP to 0.0.0.0 or the actual IP address of this computer, save, then click “Start” (see Section 13.2).
The Modbus RTU status shows “Waiting for COMx; retrying every 2 seconds”	The COM port does not exist or is used by another program. Connect the adapter, or close the program that is using the port; if you do not need it for now, click “Stop” (see Section 13.3).
“Communication settings were saved, but the Modbus TCP server could not apply them: …” appears	The settings have been saved, but the service did not start. Correct the cause given in the second part of the message, then click “Start” (see Section 13.2).
The PLC cannot read data, and “Latest Response” shows “IgnoredUnitId”	The Unit ID sent by the PLC differs from the TMS setting. Make the Unit ID the same on both sides (see Section 13.6).
The “Database sync” tab shows “Unable to load sync target.” and cannot be used	The account does not have the “Edit · Server and Sync Settings” permission, or the login has expired. Use an account with the permission, or ask the administrator to adjust it (see Section 14.1).

Symptom	Possible cause and solution
The sync target shows “N records need attention”	These records were rejected by the gateway and are not resent automatically. Resolve the cause as described in Section 14.4, click “Reschedule”, then click “Sync now”.
Data is not synced to the database automatically	Sync can only be run manually; there is no scheduled sync. Click “Sync now” when needed (see Section 14.1).
After changing computers or restoring a backup, the sync target settings cannot be used	The encryption key of the sync settings is not copied with the folder. Enter the sync target settings again and save (see Sections 14.2 and 17.3).
Other computers cannot connect to the read API	By default, the read API only allows local connections (127.0.0.1). If other computers really need to read it, change the bind address after IT has evaluated it (see Section 14.3).
The torque unit returned by the read API differs from what you expected	The torque of the read API follows the display unit you selected. Check the current torque display unit (see Section 14.3).
“API display unit is not synchronized.” appears at the top of the page	The display unit was not applied to the read API successfully. Click the refresh icon next to the message to try again.

16.8 Information to Provide When Reporting a Problem

If the problem still exists after you have tried to solve it yourself, fill in the “Problem Report Form” in Appendix B and give it to the system administrator or technical support. When reporting, provide:

- The software version (“Version” at the bottom of the login screen) and the installation method used (offline installer, standard installer or portable program).
- The Windows version.
- The date and time of occurrence, the screen name and the operating steps.
- The exact text or a screenshot of the message on the screen.
- The account and role used. **Do not provide passwords.**
- For sensor-related problems: the sensor model, serial number, and the content of “Sensor error history” (see Section 12.7).
- For communication-related problems: the communication method used (Modbus TCP, Modbus RTU, Open Protocol) and the service status text on the screen.

> **Note** Database files and sync settings contain production data and confidential information. Handle them according to company policy, and do not send or upload them without authorization.

16.9 Error Message Reference

This section lists, by function, the messages that TMS RF may show. “…” in a message stands for content that varies with the actual situation, such as a value, a unit, a COM port name or an error cause. If you

cannot find the same message, first handle the problem according to the symptoms in Sections 16.2 to 16.7.

16.9.1 Installation, Upgrade and Uninstallation

The following messages are shown by the installer, and their language depends on the Windows display language.

Message on screen	When it appears	Solution
"TMS RF is running! Click OK to kill it"	TMS RF is still running when you run the installer or uninstall	Click "Cancel", close TMS RF as described in Section 16.2.1, then run it again; clicking "OK" to force it to close is not recommended
"TMS RF is running! Please close it first then try again."	After you click "Cancel" in the previous message	Close TMS RF as described in Section 16.2.1, then run it again
"Failed to kill TMS RF. Please close it first then try again"	You clicked "OK" to close TMS RF, but it did not succeed	Close it manually as described in Section 16.2.1; if it still cannot be closed, ask IT for help
"A newer version of TMS RF is already installed! It is not recommended that you install an older version. ..."	You used an installer older than the version on the computer	Click "Cancel" and do not downgrade (see Section 17.4)
"Unable to uninstall!"	During an upgrade, you selected "Uninstall before installing", but the old version was not removed successfully	Check that TMS RF is closed as described in Section 16.2.1, then run it again; if it still fails, first uninstall the old version as described in Section 17.5
"Error: Downloading WebView2 Failed - ..."	While the standard installer downloads WebView2	Use the offline installer instead, or ask IT to install the WebView2 Runtime first (see Section 2.2)
"Error: Installing WebView2 failed with exit code ..."	While WebView2 is being installed	Run the installer again; if it still fails, ask IT to check permissions or company policy
"Failed to install WebView2! The app can't run without it. Try restarting the installer."	WebView2 was not installed completely	Run the installer again; if it still fails, ask IT for help

16.9.2 Login and Messages Common to All Screens

Message on screen	When it appears	Solution
"Incorrect username or password"	At login; the account does not exist, has been deleted, or the password is wrong	Check upper/lower case and the input method; if you forgot the password, ask the administrator to reset it (see Section 15.6)
"The sign-in service is temporarily unavailable."	At login	Wait a moment and try again; if it still appears, restart TMS RF

Message on screen	When it appears	Solution
“Unable to connect to the local service. Open the desktop application to continue.”	Login screen; loading, saving or switching batches in the batch settings	Start TMS RF from the Start menu or the main program; when it appears in the batch settings, check the permissions and step settings (see Section 9.3)
“Permissions updated. Please sign in again.”	After your own role or permissions were changed	Log in again
“Your session has expired. Please sign in again.”	You logged in more than 8 hours ago, or the account permissions were changed	Log in again
“Please sign in.”	The login has been revoked, for example because the account was deleted or its permissions were changed	Log in again; if you cannot log in, contact the administrator
“You do not have permission to perform this operation.”	Any operation that requires a permission	Ask the administrator to adjust the permissions (see Chapter 15)
“Failed to load records. Displayed data has not been updated.”	In the “Version date” position on the login screen	The date cannot be shown according to the Windows regional settings; login is not affected. If it still appears after a restart, check the Windows regional settings
“Time: Failed to load records. Displayed data has not been updated.”	Message line on the records page, the sensor error history or the indicator light operation log; on the Tool Inspection work screen, in the “Time” cell of the latest record	The time cannot be shown according to the Windows regional settings; enter the page again, or check the Windows regional settings
“PC alarm sound could not play. Check the speaker/audio device and rely on the on-screen indicator instead.”	Any page	Check the speaker and audio device; during work, watch the on-screen lights and the records instead
“API display unit is not synchronized.”	Top of the page	Click the refresh icon next to the message; if it still fails, log in again, or save the settings again on the read API tab (see Section 14.3)
“Unable to load sync status.”	After login; “Database sync” tab	Leave the “Sync settings” page and enter it again, or log in again (see Section 14.4)

16.9.3 Work Screens

Applies to the work screens of Torque Wrench, Torque & Angle, Torque Inspection, Power Tool, Batch Jobs and Tool Inspection (capability index).

Message on screen	When it appears	Solution
“Failed to load torque wrench settings.”, “Failed to load torque and angle settings.”, “Failed to load torque measurement settings.”, “Failed to load power tool settings.”, “Failed to load batch work data.”	When entering the work or settings screen of the mode	If a “Reload settings” button appears next to the message, click it first; if a “Work” button appears on the screen after the settings are loaded, work starts only after you click it. If it still fails, log in again, then click the navigation item again; when this message appears on a settings screen, the fields are empty, so do not save directly
One of the messages above, or “Failed to load capability test settings.”, without a “Reload settings” button	When entering a work mode; the account does not have the “View · Work Settings” permission and this mode has not been set up yet, or the capability index test lacks the “Run · Tool Inspection” permission	Ask someone who can open the settings to complete them first, or ask the administrator to adjust the permissions (see Section 15.1)
“Failed to load the paired torque sensor list.”	Work or settings screen	Leave the screen and enter it again; check the sensor settings (see Section 12.3)
“Failed to start work.”	When entering the work screen	Check that the RF receiver is connected, the sensor is switched on and the account has the “Run · Work” permission, then switch to another mode and back
“Failed to start work.” (cause: the RF receiver is not open, and automatic detection also failed; the Power Tool screen shows “找不到 RF 接收器，請確認已連接並保持通電。” instead, in Chinese even in English)	When work starts	Reconnect the RF receiver as described in Section 16.4

Message on screen	When it appears	Solution
“The RF receiver cannot be found, please make sure the receiver is plugged in and not being used by other programs.”	When “Sensor Pairing” detects the receiver (when work starts, “Failed to start work.” appears instead; the Power Tool screen shows “找不到 RF 接收器，請確認已連接並保持通電。”, in Chinese even in English)	Check that the receiver is plugged in, close the program that is using the COM port, then click “Rescan”
“Failed to start work.” (cause: the RF receiver did not respond in time; the Power Tool screen shows “裝置回應逾時，請確認接收器連線是否穩定。” instead, in Chinese even in English)	When work starts	Check that the sensor is switched on, then click “Rescan”
“Failed to start work.” (cause: the RF receiver is not connected or has been disconnected, and automatic detection failed; the Power Tool screen shows “找不到 RF 接收器，請確認已連接並保持通電。” instead, in Chinese even in English)	When work starts	Reconnect the RF receiver as described in Section 16.4
“Failed to start work.” (cause: the sensor selected in the work settings is no longer in the sensor list; the Power Tool screen shows “找不到目前工作設定使用的感測器。” instead, in Chinese even in English)	When work starts	The sensor selected in the settings is no longer in the list; go back to the settings screen, select it again and save
“Failed to start work.” (cause: the serial number or channel of the current sensor is invalid; the Power Tool screen shows “目前感測器序號無效，請重新配對後再開始工作。” or “目前感測器頻道無效。” instead, in Chinese even in English)	When work starts	Pair the sensor again (see Section 12.3)
“Failed to start work.” (cause: the device did not respond in time; the Power Tool screen shows “裝置回應逾時，請確認接收器連線是否穩定。” instead, in Chinese even in English)	When work starts	Check that the USB connection of the receiver is stable, then try again

Message on screen	When it appears	Solution
“Failed to start work.” (cause: the device service is temporarily unavailable; the Power Tool screen shows “Unable to complete the operation.” instead)	When work starts	Enter the screen again; if it still appears, restart TMS RF
“Realtime torque monitoring is unavailable.”	Work screen	Enter the screen again; if it still fails, restart TMS RF
“Invalid binary realtime data format.”	During work	Real-time data that cannot be interpreted was received; check that the sensor and receiver work normally, then enter the screen again; if it keeps appearing, report it as described in Appendix B
“Work stop could not be confirmed. Check the RF receiver connection and work session status before PLC writes or restart testing.”	After leaving the work screen	The command to stop work was not confirmed; check the status of the RF receiver and sensor, and confirm that work has stopped before doing any PLC-related work
“Sensor error, work stopped”	Work screen	Click “Go to sensor pairing” to check the sensor, and look in “Sensor error history” (see Section 12.7); without the “View · System Settings” permission, click “Log Out” and notify the administrator
“Failed to save the measurement result.”	When the wrench is released or tightening ends and the result is saved	This result was not saved as a record; apply torque again; if it keeps happening, enter the work screen again
“Failed to save the measurement result.” (cause: the measurement service is temporarily unavailable)	When the result is saved	Apply torque again; in Torque Inspection mode, a common cause is that the torque at the target angle does not exceed 50% of the lower judgement limit; check the target torque, tolerance and target angle
“峰值扭矩必須大於 0。”, “初始扭矩必須大於 0。” (shown in Chinese even in English: peak / initial torque must be greater than 0), “動力工具擷取需要大於 0 的峰值扭矩。” (shown in Chinese even in English: power tool capture requires a peak torque greater than 0)	When the result is saved	Apply torque again; check that the sensor has a reading and that the tool type setting is correct
“The record was saved, but the records could not be refreshed.”	After the result is saved	The record has been saved; enter the work screen again, or check on the records page

Message on screen	When it appears	Solution
“Failed to save the measurement result.” (Torque & Angle or Torque Inspection screen)	When the result is saved	Check on the records page whether this result has been saved; if not, measure again
“不支援的扭矩單位。” (shown in Chinese even in English: unsupported torque unit), “Unsupported torque unit: …”	When opening a settings or work screen, or when saving	Select the torque unit again on the settings screen and save
“Failed to save the measurement result.” (cause: the result belongs to a batch step that is no longer the current step)	When a result is saved on the Batch Jobs work screen	Go back to the settings screen, then enter the work screen again
“This batch recipe is no longer available. Select an available recipe before starting work.”	Batch Jobs work screen; the batch recipe to be loaded has been deleted or is no longer completely set up	Select an available recipe in the “Batch Name” menu, then click “Start work”

16.9.4 Saving Work Settings

Applies to the settings screens of Torque Wrench, Torque & Angle, Torque Inspection and Power Tool, and to the step settings of Batch Jobs. Batch Jobs messages are prefixed with “Step N:”, indicating which step has the problem.

Message on screen	When it appears	Solution
“Select a torque sensor.”	No sensor was selected when saving the settings	Select a paired sensor
“Select a torque sensor with a valid capacity.”	The sensor is not in the list or has no capacity	Select the sensor again, or complete the capacity in System Settings (see Section 12.3)
“Target torque must be between 10% and 100% of the selected sensor capacity (minimum to maximum unit).”	The target torque is empty or out of range	Enter a value within the range in the message; the system does not adjust it automatically
“Failed to save … settings.” when saving, “Failed to start work.” when work starts (cause: the target torque is outside 10% to 100% of the sensor capacity; at work start the Power Tool screen shows “目標扭矩必須在傳感器 型號 (序號) 規格的 10% 到 100% 範圍內（下限 到 上限 Nm）。” instead, in Chinese even in English)	When saving the settings or starting work; the sensor capacity was changed after the screen was opened	Enter the screen again and enter a value according to the new capacity

Message on screen	When it appears	Solution
“Failed to save … settings.” (cause: the selected sensor has been deleted)	When saving the settings; the sensor has been deleted	Enter the screen again and select another sensor
“Failed to save … settings.” (cause: the capacity of the selected sensor is invalid)	When saving the settings	Correct the sensor capacity (see Section 12.3), or select another sensor
“Failed to save … settings.” (cause: the target torque is 0 or less)	When saving the settings	Enter a target torque greater than 0
“Target angle must be between 1 and 360 degrees.”	When saving the settings or starting work	Enter 1 to 360
“Tolerance range must be an integer from 1 to 30.”	When saving Torque Wrench or Torque Inspection settings	Enter an integer from 1 to 30
“Tolerance range must be 0 or greater.”, “Failed to save … settings.” (cause: the torque tolerance range is negative)	When saving Torque & Angle, Power Tool or batch steps	Enter a value of 0 or more
“Initial torque must be 0 or greater.”	“Seating Torque” or “Target Torque (Angle Start)” is empty or negative	Enter a value of 0 or more
“Angle range must be 0 or greater.”, “Failed to save torque and angle settings.” (cause: the angle range is negative)	When the control mode is “Torque”	Enter a value of 0 or more
“Failed to save torque and angle settings.” (cause: the angle condition or control mode is invalid, or they do not match)	When saving Torque & Angle settings	Select the control mode and the angle tolerance standard again
“Work time must be 0 or greater.”	When saving Power Tool (Pulse, Impact) or batch steps	Enter a number of seconds of 0 or more
“Batch quantity must be an integer greater than 0.”, “Failed to save … settings.” (cause: the batch quantity is 0 or negative)	When saving the settings	Enter an integer of 1 or more; if you do not use batch work, turn the function off
“Failed to save … settings.” (cause: the work settings service is temporarily unavailable)	When saving settings	Try again later; if it still appears, restart TMS RF
“Failed to save torque wrench settings.”, “Failed to save torque and angle settings.”, “Failed to save torque measurement settings.”, “Failed to save power tool settings.”	When saving the settings	Try again later; if it still fails, restart TMS RF

16.9.5 Batch Jobs Settings

Message on screen	When it appears	Solution
“Please fill in all fields”	When saving a batch; the group name, batch number or batch name is empty, or a value has an invalid format	Fill in the missing fields
“Unable to connect to the local service. Open the desktop application to continue.”	Loading, saving or switching batches; every failure on this screen shows this sentence, including insufficient permissions, no steps, and batch IDs used up	Check the permissions and the settings of each step, then try again
“Torque Ratio > 0”	When saving a batch; the torque ratio of the torque multiplier is invalid	Check the torque multiplier parameters in System Settings (see Section 12.5)
“Stage: 1-3”	When the torque multiplier is turned on and the parameter set is not 1 to 3	Select the parameter set again
“Switching or creating a batch discards your unsaved changes. Continue?”	Switching or adding a batch while there are unsaved changes	Click “Discard Changes” to continue switching; click “Cancel” to keep the changes
“Enter a batch group name.”, “Enter a batch group code.”	A field is empty when saving a group	Enter the name or code
“Unable to save the batch group.”	When saving a group	Check the permissions, then try again
“Enter a batch category name.”	The name is empty when saving a category	Enter a name
“Unable to save the batch category.”	When saving a category; insufficient permissions or a duplicate name	Check the permissions, or use another name
“Unable to load batch groups.”, “Unable to load batch categories.”	When entering advanced group management	Go back and enter again

16.9.6 Capability Index

Message on screen	When it appears	Solution
“No positive sensor torque has been received. Capability capture cannot be confirmed.”	There is no real-time torque greater than 0 when you click “Confirm capability capture”	Check that the sensor is connected and under load, then click it
“Failed to confirm capability capture.”	Saving failed during automatic or manual capture for an unidentified reason; when the cause is known, a message about it appears instead	Check the permissions and settings, then try again

Message on screen	When it appears	Solution
"能力檢測擷取需要大於 0 的扭矩。" (shown in Chinese even in English: capability capture requires a torque greater than 0)	The torque is 0 at capture	Check that the sensor is under load, then capture
"Failed to reset capability data collection."	When you click "Start collecting data"	Check that the account has the "Clear All · Tool Inspection" permission, then try again
"Failed to load capability test settings."	When entering the work or settings screen	If a "Reload settings" button appears next to the message, click it first; if it still fails, log in again, then enter again
"Enter the tool number."	When saving the settings	Fill in "Tool Number"; "Work Station" can be left blank
"The lower limit must be a valid number.", "The upper limit must be a valid number.", "The target value must be a valid number.", "The specification center must be a valid number."	A field is empty when saving the settings	Enter a value
"Sample count must be 30, 50, or 100."	When saving the settings	Click 30, 50 or 100
"Failed to save capability test settings."	When saving the settings; the lower limit is greater than or equal to the upper limit	Correct the limits
"Failed to save capability test settings."	When saving the settings fails, for example because of insufficient permissions; the message does not include the cause	Check the permissions and the entered values, then save again

16.9.7 Records and Export

Message on screen	When it appears	Solution
"Failed to load records. Displayed data has not been updated."	Record list	Click "Reload"; if it still fails, check the "View · Work Records" permission or log in again
"More than 2000 records match this filter. Only the newest 2000 are shown and exported -- narrow the date range to see the rest."	The query result has more than 2000 records	Narrow the date range, and query and export in parts
"No records found"	There are no records for this mode on this computer	First complete a measurement on the work screen (see Section 11.3)

Message on screen	When it appears	Solution
“No records match these filters.”	After filter conditions are set	Click “Clear filters”, or relax the conditions yourself
“The end date is before the start date. Change either date.”	“End Date” is earlier than “Start Date” on the records page	Correct either date; until then, you cannot query or export
“Export failed”	After you click export	No export permission, the save folder cannot be written to, or the file exceeds 64 MiB; check the permission and the save location, narrow the range and try again
“Delete this record? This marks it deleted and queues it for sync.”	When you click the trash can icon	Click “Delete” to proceed, or “Cancel” to abandon
“Record marked deleted, pending sync.”	Deletion succeeded	No action needed
“Failed to delete record”	When deleting a record	Check that the account has the “Edit · File Management” permission, then click “Query” to refresh
“Failed to load chart samples”	Chart area of the detail page	Click “Reload”; if it still fails, go back to the list and open the record again, or log in again
“No data points”	Chart area of the detail page	No action needed; the other fields of the record are still valid

16.9.8 System Settings

Message on screen	When it appears	Solution
“RF receiver detection failed.”	“Sensor Pairing” detects the receiver	Unplug and plug in the receiver again, close the program that is using the COM port, then click “Rescan”
“Failed to write to the RF receiver. Make sure the COM port is not in use, then run detection again.”	When a command is sent to the receiver	Close the program that is using the COM port, then click “Rescan”
“The RF receiver timed out. Make sure the torque sensor is powered on and in pairing mode.”	After pairing is sent	Switch on the sensor and put it into pairing mode, then send again
“Please connect to the RF receiver first.”	When you click “Start pairing”, “Pair” or “Select”	Click “Rescan” until the receiver is connected
“The selected channel must be between 03 and 62.”	When pairing is sent	Select a channel from 03 to 62 again
“Failed to send the pairing command.”	When pairing is sent	Check that the receiver is connected, then try again

Message on screen	When it appears	Solution
“Channels do not match. Make sure the tool is in pairing mode, then start pairing again.”	Pairing result	Put the sensor into pairing mode, then send again
“Unable to switch to the selected RF receiver COM port.”	When you select another COM port	The screen returns to the original COM port; check which port the receiver is on, then try again
“Unable to disconnect the RF receiver.”	When you click “Disconnect”	Wait a moment and click again; if it still fails, restart TMS RF
“Unable to read torque sensor information.”	When reading the list or selecting a saved sensor	Finish work, check that the receiver is connected, then try again
“Failed to delete the saved sensor.”	When clearing a saved sensor	Try again; if it still fails, restart TMS RF
“Torque detection delay must be between 0.5 and 5.0 seconds.”	When saving the torque factor	Enter 0.5 to 5.0
“Measured torque must be zero or greater.”	When saving the torque factor	Enter the torque measured with the external reference instrument
“Realtime torque monitoring is unavailable.”	When saving the torque factor; no sensor is selected, or there has been no reading for more than 3 seconds	Select an active sensor, keep applying torque, then try again
“Torque factor must be zero or greater.”	When saving the torque factor; no valid factor can be calculated	Check “Measured Torque” and “Displayed Torque”, then try again
“Failed to save torque factor settings.” (cause: a required field, such as the configuration name, is empty)	When saving the torque factor	Fill in fields such as the configuration name
“Failed to save torque factor settings.” (cause: the configuration being overwritten no longer exists)	When overwriting a saved torque factor	The original configuration no longer exists; click “Add Configuration” to create it again
“Failed to save torque factor settings.”, “Failed to load torque factor settings.”	Torque factor page	Switch to another subpage, come back and try again
“Torque multiplier ratios must be finite values greater than zero.”, “Gear ratios must be finite values greater than zero.”	When saving the torque multiplier parameters, or when saving Torque Wrench, Torque & Angle or Torque Inspection settings with the torque multiplier turned on	Change the value to a number greater than 0; on the torque multiplier parameters page, enter 1 for unused stages; if the work settings do not use the torque multiplier, set the switch to “Off”

Message on screen	When it appears	Solution
“Failed to load torque multiplier settings.”, “Failed to save torque multiplier settings.”	Torque multiplier page	Click “↻” to refresh, then try again
“The saved indicator light port COMx is not connected yet”, “Indicator port not found: COMx”, “找不到指示燈通訊埠 COMx，請確認裝置已連接。” (shown in Chinese even in English: indicator light port COMx not found; make sure the device is connected)	Indicator light log	Connect the indicator light controller, refresh the ports, select the correct port and save
“No available port COM detected”	Indicator light log; when refreshing the ports	Check the USB connection and the driver
“Not connected yet, no indicator light command sent: …”	When you click a test button while not connected	Click “Connect” first
“Failed to send indicator light command: …”	When an indicator light command is sent	Close the program that is using the COM port, check the wiring, then try again; if the message contains “You do not have permission to perform this operation.”, ask the administrator to allow the “Edit · Communication and Layout” permission
“Indicator COM Scan failed: …”, “Indicator connection check failed: …”	Indicator light log	Refresh the ports later
“Failed to load indicator light settings: …”, “Failed to save indicator light settings: …”	Indicator light page	Click “↻” to refresh; if saving fails, check the permissions, then try again
“Unable to read tool error history: You do not have permission to view sensor error history.”	When opening “Sensor error history”	Ask the administrator to allow the “View · System Settings” permission
“Unable to read tool error history: Your session has expired. Please sign in again.”, “Unable to read tool error history: Please sign in.”	When opening “Sensor error history”	Log in again
“Unable to read tool error history: Sensor error history is temporarily unavailable. Please try again.”	When opening “Sensor error history”	Refresh later

16.9.9 Communication Settings

Message on screen	When it appears	Solution
“Unable to load communication settings.”, “Unable to load Open Protocol settings.”	When entering the communication settings page	Enter this page again; if it still fails, log in again
“Unable to load Modbus TCP server status.”	The communication settings page updates the status every second; RTU and Open Protocol have messages in the same format	The screen retries automatically; if the message persists, log in again or restart TMS RF
“Unable to load the Modbus register map.”, “The register map has not been loaded”	When entering the communication settings page or opening the register map	Enter the communication settings page again
“Unable to start the Modbus TCP server.” followed by “Unable to start the ${protocol} server.” (the second part is shown exactly like this, including “${protocol}”)	When you click “Start” for Modbus TCP	The port is in use or the bind IP is not an address of this computer; correct it, then start again (see Section 13.2)
“Unable to start the Modbus RTU server.” followed by “Unable to start the ${protocol} server.” (the second part is shown exactly like this, including “${protocol}”)	When you click “Start” for Modbus RTU	Check the RTU settings, then start again (see Section 13.3)
“Unable to start the Modbus TCP server.” followed by “Modbus TCP 服務已在執行。” (the second part is shown in Chinese even in English: the Modbus TCP service is already running), “Unable to start the Modbus RTU server.” followed by “Modbus RTU 服務已在執行。” (the second part is shown in Chinese even in English: the Modbus RTU service is already running)	When you click “Start” repeatedly	To restart the service, click “Stop” first, then “Start”
“Unable to start the Modbus TCP server.” or “Unable to stop the Modbus TCP server.” followed by “Unable to load ${protocol} server status.” (same format for Modbus RTU; the second part is shown exactly like this, including “${protocol}”; cause: the Modbus service is temporarily unavailable)	When starting or stopping Modbus	Wait a moment and try again; if it still fails, restart TMS RF
“Stopping the Modbus TCP server immediately disconnects all connected PLC/MES clients. Continue?”	When you click “Stop” for Modbus; RTU has a confirmation in the same format	Click “Stop” only if you really want to disconnect; otherwise click “Cancel”

Message on screen	When it appears	Solution
“Stopping the Open Protocol server immediately disconnects all connected clients. Continue?”	When you click “Stop” for Open Protocol	Click “Stop” only if you really want to disconnect; otherwise click “Cancel”
“Unable to save communication settings.” followed by “請輸入通訊設定名稱。” (the second part is shown in Chinese even in English: enter a name for the communication settings)	When saving the Modbus settings	Enter a name
“Unable to save communication settings.” followed by “TCP 綁定 IP 必須是有效的 IPv4 位址。” (the second part is shown in Chinese even in English: the TCP bind IP must be a valid IPv4 address), “Unable to save Open Protocol settings.” followed by “Open Protocol 綁定 IP 必須是有效的 IPv4 位址。” (the second part is shown in Chinese even in English: the Open Protocol bind IP must be a valid IPv4 address)	When saving the settings	Change it to 0.0.0.0 or an IPv4 address of this computer
“Unable to save communication settings.” followed by “TCP 連接埠必須介於 1 到 65535。” (the second part is shown in Chinese even in English: the TCP port must be between 1 and 65535), “Unable to save Open Protocol settings.” followed by “Open Protocol 連接埠必須介於 1 到 65535。” (the second part is shown in Chinese even in English: the Open Protocol port must be between 1 and 65535)	When saving the settings	Enter 1 to 65535
“Unable to save communication settings.” followed by “TCP Unit ID 必須介於 0 到 255。” (the second part is shown in Chinese even in English: the TCP Unit ID must be between 0 and 255)	When saving the Modbus TCP settings	Enter 0 to 255
“Unable to save communication settings.” followed by “TCP 最大連線數必須介於 1 到 32。” (the second part is shown in Chinese even in English: the TCP maximum number of connections must be between 1 and 32), “Unable to save Open Protocol settings.” followed by “Open Protocol 最大連線數必須介於 1 到 32。” (the second part is shown in Chinese even in English: the Open Protocol maximum number of connections must be between 1 and 32)	When saving the settings	Enter 1 to 32
“Unable to save communication settings.” followed by “TCP 閒置中斷時間必須介於 1 到 3600 秒。” (the second part is shown in Chinese even in English: the TCP idle disconnect time must be between 1 and 3600 seconds)	When saving the Modbus TCP settings	Enter 1 to 3600

Message on screen	When it appears	Solution
“Unable to save Open Protocol settings.” followed by “Open Protocol 閒置中斷時間必須介於 5 到 3600 秒。” (the second part is shown in Chinese even in English: the Open Protocol idle disconnect time must be between 5 and 3600 seconds)	When saving the Open Protocol settings	Enter 5 to 3600
“Unable to save communication settings.” followed by one of “RTU 介面必須為 Rs232 或 Rs485。”, “RTU 資料位元必須為 7 或 8。”, “RTU 同位檢查必須為 None、Even 或 Odd。”, “RTU 停止位元必須為 1 或 2。”, “RTU 波特率必須為 9600、19200、38400、57600 或 115200。” (the second part is shown in Chinese even in English: the RTU interface must be Rs232 or Rs485 / the RTU data bits must be 7 or 8 / the RTU parity must be None, Even or Odd / the RTU stop bits must be 1 or 2 / the RTU baud rate must be 9600, 19200, 38400, 57600 or 115200)	When saving the Modbus RTU settings	Select the values again from the drop-down lists
“Unable to save communication settings.” followed by “請選擇 RTU 連接埠。” (the second part is shown in Chinese even in English: select an RTU port)	When saving the Modbus RTU settings	Refresh the ports, then select a COM port
“Unable to save communication settings.” followed by “RTU Slave ID 必須介於 1 到 247。” (the second part is shown in Chinese even in English: the RTU Slave ID must be between 1 and 247)	When saving the Modbus RTU settings	Enter 1 to 247
“Unable to load the RTU serial-port list.”, “No available serial ports detected”	When opening the page or clicking “Refresh RTU ports”	Click it once more; check the adapter and the driver
“Waiting for COMx; retrying every 2 seconds”	Modbus RTU status	The COM port does not exist or is in use; connect the adapter or close the program that is using it; if it is not needed, click “Stop”
“Communication settings were saved, but the Modbus TCP server could not apply them: …”	After saving the Modbus settings; RTU has a message in the same format	The settings have been saved; correct the cause, then save again or click “Start”
“Open Protocol settings were saved, but the server could not apply them: …”	After saving the Open Protocol settings	Correct the port or close the program that is using the port, then save again

Message on screen	When it appears	Solution
“Unable to save communication settings.” or “Unable to start the Open Protocol server.”, followed by “Unable to complete the operation.” (cause: the System Settings service is temporarily unavailable)	When saving communication settings; Open Protocol failed to start	Check that the port is not in use, then try again; if it still fails, restart TMS RF
English error message shown in the Open Protocol status	While Open Protocol is running	Accepting a connection failed or a client message had an invalid format; ask the client vendor to check according to the message; it is cleared when the server is restarted
“IgnoredUnitId”	“Latest Response” in Modbus diagnostics	The Unit ID of the PLC differs from the setting; make both the same
“IllegalFunction”, “IllegalDataAddress”, “IllegalDataValue”, “ServerDeviceBusy”	Modbus diagnostics; the PLC receives exception code 01, 02, 03 or 06	The function code is not supported, the address or quantity is out of range, the command content is invalid, or the previous command is still being processed; correct it according to the read and write rules in Section 13.5

16.9.10 Sync and Read API

Message on screen	When it appears	Solution
“Could not load API status.”	Read API tab	Click “Refresh”; if it still fails, log in again
“Could not save API settings.”	When you click “Save Settings” for the read API	The port must be an integer from 1 to 65535, and the bind IP must be a loopback or private IPv4 address of this computer; correct it and try again; if permissions are insufficient, ask the administrator to adjust them
“Could not copy to the clipboard.”	When you click a copy button	Try again, or select and copy the text manually
“Could not read network interfaces.”	Read API tab	Enter the IP address manually
“Read API listener failed: …”	“Last Error” of the read API	The port is in use or the bind IP is not an address of this computer; use another port or an IP address from the list, then save

Message on screen	When it appears	Solution
“Read API worker has stopped”	“Last Error” of the read API	Click “Save Settings” to apply the settings again; if it still appears, restart TMS RF
“Invalid Read API settings: …”, “Read API settings could not be read: …”	“Last Error” of the read API	Enter the settings again and save
`{"error":"origin_not_allowed"}` (HTTP 403)	An external program calls the read API	Use the address in the Base URL, and call it from a program that is not a browser
`{"error":"unexpected_request_data"}` (HTTP 400)	An external program calls the read API	Do not include a query string or request body; send only `GET`
`{"error":"sensor_not_connected"}` (HTTP 404)	Reading a specified sensor	Check the sensor ID and connection status
`{"error":"read_only","allowed":"GET"}` (HTTP 405)	An external program calls the read API	Use `GET` instead
`{"error":"snapshot_unavailable"}` (HTTP 503)	An external program calls the read API	Try again later
“Unable to load sync target.”	“Database sync” tab	Use an account with the “Edit · Server and Sync Settings” permission, or log in again; if it appears after changing computers, see Section 14.4
“Unable to save sync target.”	When you click “Save sync target”	The URL must be HTTPS and must not contain a username/password, query string or fragment, and a valid access token must be entered when sync is enabled; correct each item, or clear “Enable sync” first and then save
“Unable to perform synchronization.”	When you click “Sync now”	Log in again, then try again
“Unable to update sync status.”	After syncing now or rescheduling	Leave the “Sync settings” page and enter it again, or log in again
“Unable to reschedule sync data.”	When you click “Reschedule”	Check the permissions and the login status, then try again
“The old database connection setting needs to be changed to HTTPS API.”, “同步設定需要改為 HTTPS API。” (shown in Chinese even in English: the sync settings need to be changed to HTTPS API)	“Database sync” tab; when syncing now	Enter the HTTPS URL and access token again and save (see Section 14.2)

Message on screen	When it appears	Solution
“HTTPS API 連線失敗。” (shown in Chinese even in English: HTTPS API connection failed)	When syncing now	The gateway cannot be reached, did not respond within 15 seconds, or the certificate is not trusted; check the network, URL and certificate, then sync again
“HTTPS API 暫時無法使用。” (shown in Chinese even in English: HTTPS API is temporarily unavailable)	When syncing now	Sync again later
“HTTPS API 存取權杖驗證失敗。” (shown in Chinese even in English: HTTPS API access token verification failed)	When syncing now	Update the access token and save, click “Reschedule”, then sync again
“HTTPS API 未授權此同步目標。” (shown in Chinese even in English: HTTPS API has not authorized this sync target)	When syncing now	After the gateway administrator grants authorization, click “Reschedule”
“HTTPS API 拒絕批次資料。”, “HTTPS API 回應未預期狀態。”, “HTTPS API 拒絕此事件。” (shown in Chinese even in English: HTTPS API rejected the batch data / HTTPS API returned an unexpected status / HTTPS API rejected this event)	When syncing now	Ask the gateway administrator to find the cause; after it has been resolved, click “Reschedule”
“HTTPS API 回應格式無效。” (shown in Chinese even in English: HTTPS API response format is invalid)	When syncing now	Ask the gateway administrator to check the gateway version
“本機同步內容無法解析：…” (shown in Chinese even in English: the local sync content cannot be parsed)	When syncing now	Contact the system administrator, and report it as described in Appendix B
“MySQL connection is not configured in this build”	When syncing now	The sync target has not been saved or is not enabled; save and enable the sync target

16.9.11 Users and Permissions

Message on screen	When it appears	Solution
“The current user does not have permission to view user management.”	When entering “User Management”	Use an account with the “View · User List” permission
“Username is required”	The name is empty when adding or saving an account	Enter a username
“Password is required”	The password is empty when adding an account	Enter a password

Message on screen	When it appears	Solution
“Please fill in all fields”	A password field is empty when you click “Confirm Change” while resetting a password	Fill in both password fields
“New passwords do not match”	When you click “Confirm Change” while resetting a password	Enter the same password again
“使用者名稱已存在。” (shown in Chinese even in English: username already exists)	When saving after adding or renaming	The name is the same as an existing or deleted account; use another name
“必須至少保留一位管理員，請先建立其他管理員帳號。” (shown in Chinese even in English: at least one administrator must be kept. Create another administrator account first)	When downgrading, adjusting permissions or deleting an account	The target is the last effective administrator; first make another account an effective administrator
“User management operation failed.” (cause: the user management service is temporarily unavailable)	When loading the list or saving	Try again later
“User management operation failed.”	Any operation in user management	Try again; if it keeps happening, report it as described in Appendix B

Chapter 17 Backup, Upgrade and Removal

This chapter describes which data to back up, how to make a cold backup and restore it, how to upgrade to a new version, how to remove TMS RF, and the limitations to keep in mind during use.

> **Warning** Before upgrading, restoring or uninstalling, always complete the cold backup described in Section 17.2 first. Database updates and data deletion cannot be undone within the program; a cold backup is the only way to recover.

17.1 Data to Protect

TMS RF data is not stored in the installation folder, but in the application data folder of the current Windows account (see Section 2.7). The installed version and the portable version use the same data.

Data	Location	Covered by cold backup	Description
Main database: accounts, sensors, settings of each mode, measurement records, communication and sync settings, data waiting to be synced	`%APPDATA%\com.tms.zipptork\static-torque.sqlite3`	Yes	Copy the whole folder, including the other files in it
Read API settings	`%APPDATA%\com.tms.zipptork\read-api.json`	Yes	If the read API settings have never been changed, this file may not exist
Interface language, theme, last used RF receiver COM port	`%LOCALAPPDATA%\com.tms.zipptork`	Optional	Display preferences only; without a backup, you can simply select them again
Encryption key of the sync settings	Windows Credential Manager, the entry named `static-torque`	No	Copying the folder does not take this key with it; after changing computers, enter the sync settings again (see Section 17.3)
Exported CSV / Excel files	The location you chose when exporting	No	Keep them separately according to your company's document management rules (see Chapter 11)
Remote sync database	Remote server	No	Backed up by the administrator of the remote system (see Chapter 14)

Data	Location	Covered by cold backup	Description
The program itself	Installation folder, `%LOCALAPPDATA%\TMS RF` by default	Not needed	Simply install it again
Data of a version earlier than 1.4.1	`%APPDATA%\com.tms.static-torque` and `%LOCALAPPDATA%\com.tms.static-torque`	No	After the automatic copy to the new folders, the program no longer uses these folders; they are kept unchanged (see Section 17.4.5)
Automatic backup made during that copy	`%LOCALAPPDATA%\TMS-RF-data-backups\com.tms.zipptork-…`	No	Created when the new version copies the data of a version earlier than 1.4.1 (see Section 17.4.5)

> **Note** The folder contains the password data of all accounts and all measurement records. Store backups in a location that only authorized personnel can access, and do not send them by e-mail or through shared folders. The same applies to the folders of a version earlier than 1.4.1 and to the automatic backup in `TMS-RF-data-backups`.

17.2 Cold Backup

A cold backup means that you first **close TMS RF completely** and then copy the folder. While the program is running, it uses the database continuously, and copying it at that time may produce incomplete files, so always close it first. TMS RF has no built-in backup button.

This operation is performed in Windows File Explorer and does not require any TMS RF permission. The data belongs to the Windows account that runs TMS RF; log in to Windows with that account to perform it.

17.2.1 When to Back Up

1. Before upgrading to a new version (required).
2. Before uninstalling or replacing the computer (required).
3. Regularly according to company rules, for example every week or after each production lot is closed (recommended).

17.2.2 Operating Steps

1. Close TMS RF completely as described in Section 16.2.1.
2. Open File Explorer, enter `%APPDATA%\com.tms.zipptork` in the address bar and press Enter. The folder contains `static-torque.sqlite3`, and possibly other files such as `read-api.json`.

3. Go up one level and copy the whole `com.tms.zipptork` folder to the backup location, for example another disk, a USB flash drive or a location specified by IT.
4. Rename the copy to a name that includes the date and version.
5. (Optional) Copy `%LOCALAPPDATA%\com.tms.zipptork` in the same way to keep the language and theme preferences.
6. Check that `static-torque.sqlite3` in the copy has the same size as the original file.
7. Start TMS RF again to continue working, or proceed with the upgrade or removal.

> **Example** On December 1, 2026, v1.7.10 is to be upgraded to a new version.
> After closing TMS RF, copy the `com.tms.zipptork` folder to `D:\TMS-Backup\`.
> Rename the copy to "TMS-RF-Backup-20261201-v1.7.10".
> Check that `D:\TMS-Backup\TMS-RF-Backup-20261201-v1.7.10\static-torque.sqlite3` has the same size as the original file; the backup is complete.

17.2.3 Errors and Recovery

Message on screen	Cause and solution
When copying, Windows shows that a file is in use and cannot be copied	TMS RF is still running, possibly in another window or as the portable version. Close all TMS RF instances as described in Section 16.2.1, then copy again. The actual text may differ slightly depending on the Windows version.
`%APPDATA%\com.tms.zipptork` cannot be found	The Windows account currently logged in is not the account that runs TMS RF, or TMS RF has never been run on this computer. Log in with the Windows account that actually runs TMS RF, then look again.
The file size of the copy differs from the original file	Copying did not finish or was interrupted. Delete this copy and copy again.

> **Note** Do not open or modify `static-torque.sqlite3` with tools other than TMS RF. Modifying the database directly may corrupt the data.

17.3 Restoring from a Cold Backup

Restoring **replaces** all current data with the data at the time of the backup. Records, accounts and settings added after the backup are lost. Before restoring, make sure it is really necessary, and first make a cold backup of the current data as well.

17.3.1 Operating Steps

1. Close TMS RF completely as described in Section 16.2.1.
2. Open `%APPDATA%` and rename the current `com.tms.zipptork` folder to keep it, for example by adding "-before-restore" to the end of the name. Do not delete it directly.
3. Copy the backup folder back to `%APPDATA%` and rename it to `com.tms.zipptork`.

4. Start TMS RF. The login screen appears. If the backup comes from an older version, the program updates the database automatically at startup (see Section 17.4).
5. Log in with **an account and password that existed at the time of the backup**, and check that the sensors, settings and records are what you want.

17.3.2 Restoring to Another Computer or Another Windows Account

1. Accounts, sensors, settings and records are all in the folder and are restored with it.
2. The encryption key of the sync settings is not copied with the folder. On the new computer or the new Windows account, the original sync target settings cannot be used, and the “Database sync” tab may show “Unable to load sync target.”. Enter the sync target settings again and save (see Section 14.2).
3. The COM port numbers (RF receiver, indicator light controller, Modbus RTU adapter) and the IP addresses (Modbus TCP and Open Protocol bind IP, and the address of this computer set in the PLC) may differ from the original computer; check them again as described in Chapters 12 and 13.

17.3.3 Errors and Recovery

Message on screen	Cause and solution
After restoring, login shows “Incorrect username or password”	This account does not exist in the backup, or the password was different at that time. Log in with an account and password from the time of the backup.
After restoring, the “Database sync” tab shows “Unable to load sync target.”	The data was restored to another computer or another Windows account. Enter the sync target settings again and save (see Section 14.2).
After restoring, TMS RF does not start	Rename the folder you have just restored, then rename the “-before-restore” folder back to `com.tms.zipptork` to return to the state before the restore, and report it as described in Appendix B.

17.4 Upgrading to a New Version

An upgrade keeps the existing accounts, sensors, settings and records. When the new version starts for the first time, the program updates the database automatically, and this cannot be undone within the program afterwards, so always make a cold backup before upgrading.

17.4.1 Preparing for the Upgrade

1. Obtain the installation file of the new version, and ask IT to approve running it according to company policy (the installation file has no digital signature; see Section 2.5).
2. Notify all users to finish work and log out.
3. Close all TMS RF instances on this computer as described in Section 16.2.1, including the installed version and the portable version.

4. Complete a cold backup as described in Section 17.2, and note **the version before the upgrade** in the backup name. If the upgrade fails or you need to return to the old version, this backup is the only way to recover.

> **Note** If you are upgrading from a version earlier than 1.4.1, its data is in `%APPDATA%\com.tms.static-torque`. For the cold backup, copy this folder instead of `com.tms.zipptork`.

17.4.2 Upgrading the Installed Version

If an old version of TMS RF is already installed on the computer, running the installer of the new version shows the “Already Installed” page after the welcome page.

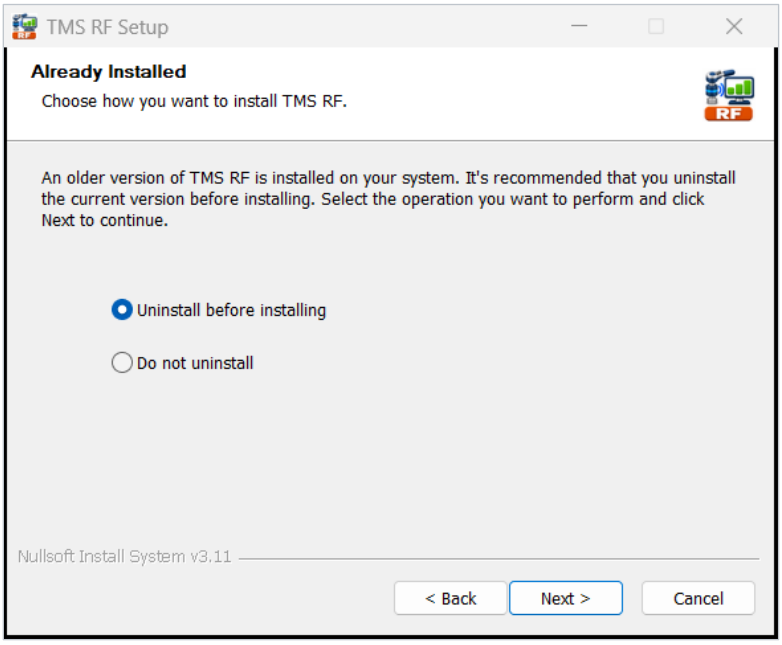

Figure 17-1 The installer detects an installed older version

Screen description:

Area / button	Description
“Already Installed”	Page title, indicating that the installer has detected TMS RF on the computer.
Description text	“An older version of TMS RF is installed on your system. It's recommended that you uninstall the current version before installing.”
“Uninstall before installing”	Default option. After you click “Next >”, the old program is removed first, then the new version is installed. The database is stored in %APPDATA% and is not deleted by this.
“Do not uninstall”	Installs the new version directly without removing the old program first. Use the default option in normal cases.
“< Back”	Returns to the previous page.
“Next >”	Continues the installation according to the selected option.
“Cancel”	Exits the installer without making any changes.

Operating steps:

1. Double-click the installer of the new version. The setup wizard appears (see Section 2.3).
2. Click “Next >” as prompted; the “Already Installed” page appears (Figure 17-1).
3. Keep the default “Uninstall before installing” and click “Next >”. The installer removes the old program first.
4. When the “Choose Install Location” page appears, complete the installation as described in Section 2.3.
5. Check the data following the steps in “First Startup After the Upgrade” below.

> **Note** If an uninstall window appears while the old version is being removed, do **not** select “Delete the application data”. Selecting it deletes the database and settings.

17.4.3 Upgrading the Portable Version

1. Close the old version of TMS RF as described in Section 16.2.1.
2. Delete the old main program (for example `static-torque-tauri.exe`), or move it to an archive location that only administrators can access.
3. Put the new `ZIPPTORK TMS RF Portable.exe` in the original folder.
4. Double-click the new main program, and check the data following the steps in “First Startup After the Upgrade” below.

> **Note** After the upgrade, do not run the old main program again. The old and new versions use the same data, and the old program does not support the per-user permissions of the new version (see “Do Not Downgrade” in this section).

17.4.4 First Startup After the Upgrade

1. Start the new version of TMS RF. If you are upgrading from a version earlier than 1.4.1, the program first copies the data to the new folders (see Section 17.4.5). It then updates the database automatically without asking. When it finishes, the login screen appears.
2. Log in with an existing account, and check that the sensors, the settings of each mode, the records and the communication settings are all there.
3. The administrator checks the permissions of each account in “User Management”. An upgrade does not add permissions to any account automatically; if needed, allow or deny functions for individual accounts (see Section 15.4).
4. If the default administrator account `admin` cannot log in with the old default password, log in with the initial password described in Section 2.8 and change the password immediately.

> **Warning** If the program does not start after the upgrade, do not keep retrying, and do not delete the folder. Close the program, restore the cold backup made before the upgrade as described in Section 17.3, go back to the version used before the upgrade, and report it as described in Appendix B.

17.4.5 Automatic Data Copy from Versions Earlier than 1.4.1

Since version 1.4.1, data is stored in folders named `com.tms.zipptork` (see Section 2.7). Versions earlier than 1.4.1 used folders named `com.tms.static-torque`. The first time the new version starts, it moves the data over as follows:

1. The copy runs only if `%APPDATA%\com.tms.zipptork` does not contain a database yet. If it already contains one, the program uses it as it is and does not copy, overwrite or merge the old data.
2. The program first makes a complete backup of the old folders in `%LOCALAPPDATA%\TMS-RF-data-backups\com.tms.zipptork-…` (subfolders `roaming` and `local`), then copies the data to `%APPDATA%\com.tms.zipptork` and `%LOCALAPPDATA%\com.tms.zipptork`.
3. The old folders are not changed or deleted, but the program no longer uses them. Changes made after the upgrade are saved only in the new folders. After you have checked the data in the new version, you may delete the old folders and the automatic backup according to your company's rules (see Section 17.5.3).
4. Communication settings that were enabled in the old version remain enabled. Before you start the new version, make sure that the connected equipment and the work area are in a safe state.
5. Only the data of an earlier TMS RF version on this computer is copied. Data of TMS RF editions of other brands on the same computer is not copied; if you need it, restore a cold backup of that data as described in Section 17.3.

If the copy cannot be completed safely, the program does not start and shows a message titled “TMS RF - Data migration” whose first line is “TMS RF data migration was stopped.”. This message is always in English. Nothing has been overwritten or merged, and the old data and any backup already made are kept. Click “OK”, then act according to the last line of the message:

Last line of the message	Cause and solution
Starts with `Cannot cold-copy`	A file of the old data is in use, usually because an old TMS RF (for example the old portable program) is still running. Close all TMS RF windows as described in Section 16.2.1, then start the new version again.
Starts with `SQLite sidecar present`	The old program was not closed normally (for example because of a power failure), so the old database was not closed completely. Report it as described in Appendix B.
Any other text	The new folder already contains part of the data, a previous copy was interrupted, or a folder cannot be used safely. Report the full text of the message as described in Appendix B.

> **Warning** Do not delete, rename or overwrite folders or files to get around this message; doing so can cause data loss. Keep the old folders and the automatic backup until the problem has been solved.

17.4.6 Data Changes After the Upgrade

1. The station `local-workstation` and the part number `AUTO-STATIC`, which the old version used to represent values that were not filled in, are permanently changed to empty after the upgrade. Other custom values are not affected, and the number of records does not change. Values already synced to the remote database are not modified.
2. For records saved afterwards, if the station happens to be `local-workstation` or the part number happens to be `AUTO-STATIC`, it is also saved as empty. Do not use these two strings as actual numbers.
3. The permissions of each account are the same as before the upgrade; no permissions are added automatically.
4. Changing the permissions of an account or deleting an account invalidates the screens where that account is logged in. Make these adjustments when nobody is working (see Chapter 15).
5. After an upgrade from version 1.7.3 or earlier, the batch job records saved before the upgrade have no batch number, and none is added after the upgrade: the “Batch Number” column of the export file contains “--”, and these records do not appear when you filter by “Batch Number”. Only batch job records saved after the upgrade keep the batch number (see Section 11.8).

These changes cannot be undone within the program; they can only be reverted by restoring the cold backup made before the upgrade.

17.4.7 Do Not Downgrade

1. When the installer detects that the version on the computer is newer than the installer, it shows “A newer version of TMS RF is already installed! It is not recommended that you install an older version. …”. Click “Cancel” and do not install a downgrade.
2. Older programs do not support per-user permissions. When an older program opens the upgraded data, per-user “Deny” settings do not take effect. **Do not use an older program to bypass permissions.**
3. If you really need to return to the old version, restore the cold backup made before the upgrade as described in Section 17.3, then use the old version. Data added after the upgrade is lost.

17.5 Removal

17.5.1 Uninstalling (Installed Version)

Uninstalling removes the TMS RF program. Whether the data is deleted as well is determined by “Delete the application data” in the uninstall window.

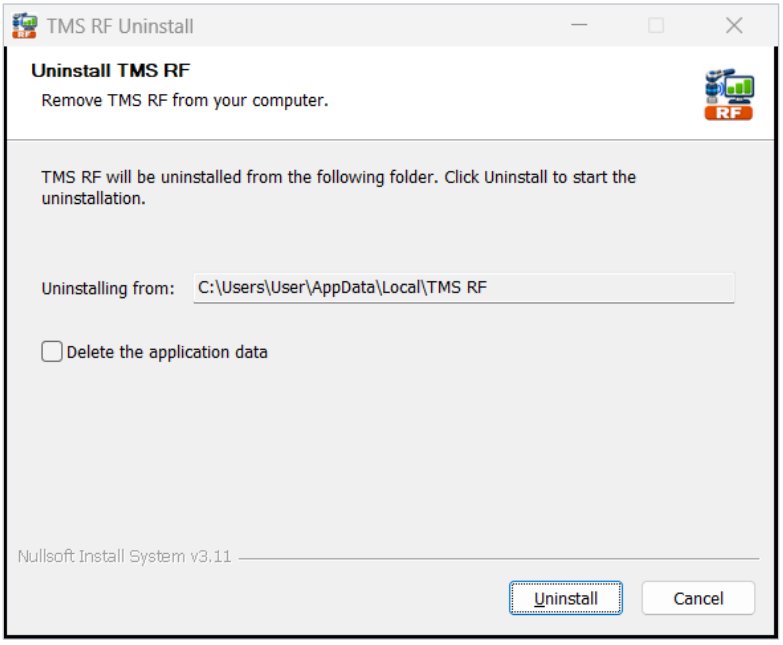

Figure 17-2 Uninstall TMS RF

Screen description:

Area / button	Description
“Uninstall TMS RF”	Page title; the description below it is “Remove TMS RF from your computer.”
“Uninstalling from:”	Shows the installation folder of TMS RF, `%LOCALAPPDATA%\TMS RF\` by default.
“Delete the application data”	Not selected by default. When not selected, only the program is removed and the database and settings remain on the computer; when selected, the database and settings are deleted as well. The folders of a version earlier than 1.4.1 and the automatic backup in `TMS-RF-data-backups` are not deleted (see Section 17.5.3).
“Uninstall”	Starts the uninstallation.
“Cancel”	Exits the uninstaller without making any changes.

Operating steps:

1. Complete a cold backup as described in Section 17.2.
2. Close TMS RF completely as described in Section 16.2.1. If TMS RF is still running, the uninstaller shows “TMS RF is running! Click OK to kill it”; click “Cancel”, close TMS RF yourself, then start again.
3. With the same Windows account that installed TMS RF, open Windows “Settings” → “Apps” → “Installed apps”, find “TMS RF” and select “Uninstall”. You can also run `uninstall.exe` in the installation folder directly. The actual text may differ slightly depending on the Windows version.

4. The “Uninstall TMS RF” window appears (Figure 17-2). To keep the data, do not select “Delete the application data”.
5. Click “Uninstall” and complete the uninstallation as prompted.

> **Warning** Selecting “Delete the application data” deletes all accounts, sensors, settings and measurement records as well, and this **cannot be undone**. Always complete the cold backup in Section 17.2 before selecting it.

17.5.2 Removing the Portable Version

After closing TMS RF as described in Section 16.2.1, simply delete `ZIPPTORK TMS RF Portable.exe`. The data remains in `%APPDATA%\com.tms.zipptork`; deleting the main program does not delete the data.

17.5.3 Clearing All Data

Perform these steps only when you are sure that no TMS RF data on this computer is needed any more, a cold backup has been completed, and the required records have been exported or synced.

1. Check that the installed version has been uninstalled, the portable program has been deleted, and no TMS RF is running.
2. Delete the `%APPDATA%\com.tms.zipptork` folder. If “Delete the application data” was selected during uninstallation, this folder has already been deleted.
3. Delete the `%LOCALAPPDATA%\com.tms.zipptork` folder.
4. If they exist, delete the folders of a version earlier than 1.4.1, `%APPDATA%\com.tms.static-torque` and `%LOCALAPPDATA%\com.tms.static-torque`, and the folders in `%LOCALAPPDATA%\TMS-RF-data-backups` whose names start with `com.tms.zipptork-`.
5. If Windows “Credential Manager” contains an entry named `static-torque` and no other TMS RF edition on this computer uses database sync, ask IT to delete it.

> **Warning** Deleting the folders permanently deletes all accounts, sensors, settings and measurement records, and this cannot be undone. When TMS RF is started afterwards, it is treated as a new installation and the default administrator account is created again (see Section 2.8).

17.6 Usage Notes

Item	Description
Installation files have no digital signature	The offline installer, the standard installer and the portable program have no digital signature. When they are run, an unknown publisher or SmartScreen warning may appear, or they may be blocked by company policy. Ask IT to approve them according to policy, and do not disable protection (see Section 2.5).
WebView2 Runtime	The offline installer contains the WebView2 installer; the standard installer needs a network connection to download WebView2 when the computer does not have it; the portable program requires WebView2 to be already installed on the computer (see Section 2.2).
The portable version and the installed version must not run at the same time	Both use the same data (%APPDATA%). Do not run them at the same time, and do not open two TMS RF windows at the same time (see Section 2.7).
Not a portable-data version	If you run the portable program from a USB flash drive, the data is still written to %APPDATA% of the current Windows account on this computer. Running it on another computer means a separate set of data.
Data belongs to individual Windows accounts	The installation and data of each Windows account are independent. Other Windows accounts must install the program separately to use it.
No built-in backup function	Data can be protected only with the cold backup in Section 17.2.
The database is updated automatically during an upgrade	When the new version starts for the first time, it updates the database automatically without asking, and this cannot be undone within the program. Always make a cold backup before upgrading.
New data folders from version 1.4.1	Since version 1.4.1, data is stored in folders named `com.tms.zipptork`. The first time the new version starts, it copies the data of a version earlier than 1.4.1 automatically and keeps the old folders (see Section 17.4.5).
The sync key does not move with the backup	After restoring data on another computer or another Windows account, enter the sync target settings again (see Section 17.3).
Default administrator account	A new database automatically creates the default administrator account. Change the password immediately after the first login (see Section 2.8).
Login validity	A login expires 8 hours after logging in and is not extended by activity. When it expires, work in progress stops and you must log in again (see Section 3.5).
Leaving the work screen stops work	If you switch to another page during work, work stops automatically without asking first (see Section 3.2).
Do not open new-version data with an older program	Older programs do not support per-user permissions, and per-user “Deny” settings do not take effect (see Section 17.4).
Capability index records	Capability index records have only a list and details, with no raw samples (see Section 11.9).

Appendix A Glossary

This table is ordered by usage: installation and data, login and permissions, measurement and judgement, torque multiplier and calibration, batch work, capability index, records, sensors and peripherals, communication and sync. Text shown on the screen is enclosed in quotation marks (“ ”).

Term	Description
Offline installer	The installer that includes the WebView2 installer. If the computer lacks WebView2, installation can be completed without an internet connection (see Chapter 2).
Standard installer	The installer that does not include the WebView2 installer. If the computer lacks WebView2, an internet connection is needed during installation to download it.
Portable program	`ZIPPTORK TMS RF Portable.exe`, which runs directly without installation. The computer must already have WebView2, and it shares the same data with the installed version.
WebView2 Runtime	A Windows component provided by Microsoft that TMS RF uses to display its screens. Without WebView2, the program cannot open.
Digital signature	An electronic signature that proves where a program comes from. The TMS RF installation files have no digital signature, so Windows may show a security warning.
SmartScreen	The Windows mechanism that warns about and blocks unknown or unsigned programs. Do not turn it off just to run TMS RF.
Automatic maximize	When TMS RF starts, the window is maximized but keeps its title bar and can be restored; it is not full screen.
Application data folder	`%APPDATA%\com.tms.zipptork`, which stores the main database and the read API settings. Shared by the installed version and the portable version.
Automatic data copy	Since version 1.4.1, the first time the new version starts, the program backs up the data of a version earlier than 1.4.1 to `%LOCALAPPDATA%\TMS-RF-data-backups` and copies it to the new `com.tms.zipptork` folders; the old folders are kept (see Section 17.4.5).
Cold backup	A backup method in which you first close TMS RF completely and then copy the application data folder (see Section 17.2).
Database update	The database is updated automatically the first time a new version starts. Once complete, it cannot be undone within the program, so make a cold backup before upgrading (see Section 17.4).
Downgrade	Replacing a newer version with an older one. Downgrading is not recommended; if you need to return to an older version, restore a cold backup (see Section 17.4).
Uninstall	Removing the installed program. If “Delete the application data” is checked, the database and settings are deleted as well (see Section 17.5).
Windows Credential Manager	Where Windows stores passwords and keys. TMS RF stores the encryption key for the sync settings here; this key is not copied by a cold backup.
Default administrator account	The `admin` account created automatically in a new database. Change its password immediately after the first login (see Section 2.8).

Term	Description
Role	The permission template of an account: A (Admin), B (Supervisor) or C (User) (see Chapter 15).
Function permission	A function that can be allowed or denied item by item, for example “Run · Work”, “View · Work Records” and “Edit · Work Parameters, Pairing and Calibration”.
Individual adjustment	Allowing or denying a function individually for a single account; it takes precedence over the role template (see Section 15.4).
Reset to Role Defaults	Clears all individual adjustments of the account in the form and returns to the role template; takes effect only after you save.
Effective administrator	An account that is not deleted and is allowed both “View · User List” and “Edit · User Management”. The system always keeps at least one.
Login session	The validity period of one login, up to 8 hours; it is not extended by activity. It ends immediately when the account permissions are changed or the account is deleted.
Navigation menu	The list of pages on the left side of the main screen; it can be collapsed.
Work mode	A way of working in TMS RF: Torque Wrench, Torque & Angle, Torque Inspection, Power Tool, Batch Jobs and Tool Inspection.
Settings screen / work screen	Each work mode has two screens: you enter the target and judgement conditions on the settings screen and measure on the work screen. Work stops automatically when you leave the work screen.
Regional format	The Windows setting for date and time formats. TMS RF displays dates and times according to this setting, not according to the interface language.
Live torque	The torque at each sample point of the curve, with the torque multiplier and torque factor applied.
Result panel	The shared layout in the center of the work screen of each work mode: the verdict banner, the final torque reading and range bar, and the statistics panel and chart button on the right (see Section 5.2.5).
Range bar	The horizontal bar below the reading that marks the positions of the lower limit, the target, the upper limit and the current reading (see Section 5.2.5).
Chart dialog	The dialog that opens when you click the chart button at the bottom of the statistics panel; it shows the curve of the current torque application (see Section 5.2.6).
Target torque	The judgement reference saved on the settings screen; it must be between 10% and 100% of the selected sensor spec; the settings screen indicates this range with the “Allowed range” hint below the field. The screen displays up to two decimal places; the saved value is not truncated.
Final torque	The large reading on the Torque Wrench, Torque & Angle and Power Tool work screens: the peak of the current torque application or tightening so far. It is saved in the record when the application ends. What OK or NOK is judged on depends on the mode; for example, Torque Inspection judges on the angle torque (see Chapters 5 to 8).
Peak torque	The highest torque during a torque application or tightening.

Term	Description
Sensor spec	The rated capacity of the sensor, expressed in N·m. It determines the range in which the target torque can be set.
Tolerance	The deviation allowed in judgement, determined by “Tolerance Type” and “Tolerance Range” together.
Tolerance type	The direction of the deviation. “±” means both above and below the target are allowed; “+” means only above the target is allowed.
Tolerance range	The allowed deviation as a percentage. For Torque Wrench and Torque Inspection, an integer from 1 to 30.
OK / NOK	Judgement results. OK means the result is within tolerance (pass); NOK means it is outside tolerance (fail).
Rehit (repeated tightening)	One of the judgement results, meaning the same joint was tightened again. The statistics row on the records page counts Rehit records separately.
QC status	The judgement result of the current torque application on the work screen: “Pending”, “OK” or “NOK”. “Pending” means not yet judged.
Batch work	A counting function in the settings of a single work mode; whether a batch is complete is determined by the number of OKs.
Station / part number	Identifying text for the work location and the workpiece, written to the record for traceability.
Seating torque (angle start)	In Torque & Angle mode, the angle starts counting from 0 when the torque reaches this value.
Target torque (angle start)	The only torque start value in Torque Inspection mode; it is both the angle starting point and the center value for judgement.
Target angle	The reference for angle judgement, from 1 to 360 degrees.
Final angle	The largest angle in the current torque application, counted from the angle starting point.
Control mode	In Torque & Angle mode, whether “Angle” or “Torque” is the basis for judging OK/NOK.
Tool type	The type of power tool: pulse, impact or clutch. It determines how the end of a tightening is detected.
Cycle	One tightening of a power tool, from when the reading rises above 0 until it returns to 0.
Torque multiplier	A mechanism that amplifies the output torque of a wrench. When “Enable torque multiplier” is turned on, the torque is multiplied by the torque ratio and the angle is divided by the gear ratio. Torque Wrench, Torque & Angle and Torque Inspection can enter their own ratios on the settings screen; otherwise the ratios of the system-wide torque multiplier settings are used (see Section 12.5).
Torque ratio	The torque amplification factor of the torque multiplier.
Gear ratio	The angle reduction factor of the torque multiplier.

Term	Description
Torque multiplier parameter set	Torque multiplier parameter sets 1 to 3 in System Settings. Each step of a batch job can select which set to use.
Torque factor	Torque calibration factor, calculated as measured torque ÷ displayed torque (see Section 12.4).
Displayed torque	The torque reported in real time by the selected sensor before correction by the factor and the torque multiplier, in N·m; read automatically by the system.
Measured torque	The actual torque measured by an external reference instrument, entered manually, in N·m.
Batch Jobs	A work mode that chains several tightening steps into one recipe and executes them in sequence (see Chapter 9).
Batch ID	The batch number assigned automatically by the system, 001 to 999. The Pset ID in Open Protocol and Modbus corresponds to this number.
Batch group	The group a batch must belong to, with a group number, group code and group name.
Batch category	An optional classification label for batches; names must be unique.
Work step	A tightening task executed in sequence within a batch; each step has its own work mode and target.
Batch quantity	The number of OKs required to complete one batch: the “Batch Quantity” setting of a single work mode with batch work enabled, or the “Batch Count” of a step in Batch Jobs.
Tool Inspection (capability index test)	A function that evaluates the repeatability of a tightening tool from consecutive samples (see Chapter 10).
LSL / USL	Lower specification limit / upper specification limit; also the OK/NOK judgement limits (inclusive).
Cp	Potential process capability index: (USL − LSL) ÷ (6 × standard deviation), calculated from the latest 20 samples.
Cpk	Process capability index, which takes into account how far the mean deviates from the center: the smaller of (USL − mean) ÷ (3 × standard deviation) and (mean − LSL) ÷ (3 × standard deviation), calculated from the latest 20 samples.
Cm / Cmk	Machine capability indices; the formulas are the same as those of Cp / Cpk respectively, calculated from the latest N samples (N is the target sample count).
Target sample count	The number of samples used to calculate Cm/Cmk, and the sampling target: 30, 50 or 100.
Acceptance threshold	When CPK or CMK reaches this value, “Pass” is shown.
Residual torque	Torque measured with another instrument after tightening is complete.
Record details	The single-record page that opens when you click a record, containing the summary, curve, judgement, work parameters and sensor information.
Curve samples / data points	Measurement samples saved in a record. For records with angle they are called curve samples; for torque-only records they are called data points.

Term	Description
Sensor information	The sensor model, serial number, spec and channel at the time of work, saved in the record; it does not change with later settings.
Soft delete	When a record is deleted, it is only marked as deleted and added to the sync queue; the data is not actually removed from the local computer.
RF receiver	The wireless receiver plugged into a USB port of the computer; it appears as a COM port and communicates with the sensors.
COM port	A Windows serial communication port. The RF receiver, the indicator light controller and the Modbus RTU adapter all connect through COM ports.
Pairing channel	The channel used for RF communication, from 03 to 62.
Active sensor	The sensor currently connected through the RF receiver and providing real-time readings.
Saved sensor	A sensor saved to the database after successful pairing; it can be selected directly afterwards.
Sensor error history	Records of errors reported by sensors. When an error disappears, the time it was cleared is recorded automatically (see Section 12.7).
Indicator light	An external red, yellow and green three-color light with a buzzer that lights automatically according to the judgement result (see Section 12.6).
PLC	Programmable logic controller, a control device on the production line that can read TMS RF data through Modbus (see Chapter 13).
Modbus TCP	Modbus communication over Ethernet; default port 1502 (see Section 13.2).
Modbus RTU	Modbus communication over an RS-485 or RS-232 serial line (see Section 13.3).
Open Protocol	A TCP communication protocol widely used in the tightening industry; messages are identified by MID; default port 4545 (see Section 13.4).
Unit ID (slave ID)	The device number in a Modbus request. Requests that do not match the TMS RF setting are not answered.
Function code	The type of Modbus request, for example FC03 read holding registers, FC04 read input registers, FC16 write multiple registers.
Register	A location where Modbus stores data. Input registers (3xxxx) are read-only; holding registers (4xxxx) include the writable command area.
Exception code	A Modbus error reply: 01 unsupported function, 02 address error, 03 value error, 06 device busy.
MID	Open Protocol message number, for example 0001 communication start, 0061 tightening result.
Baud rate	Serial transmission speed, in bps.
Parity	Error checking method for serial transmission: none, even parity or odd parity.
Read API	The read-only HTTP service built into TMS RF that lets other programs read the current sensor data. Torque follows the selected display unit (see Section 14.3).

Term	Description
Bind IP address	The local address on which the service accepts connections. `127.0.0.1` means that only programs on this computer can connect.
Database sync	The function that sends records through an HTTPS gateway to a remote database; it can only be run manually (see Chapter 14).
HTTPS gateway	An independent service that receives the data sent by TMS RF and writes it to the database.
Access token	The secret key the gateway uses to verify the identity of TMS RF; it is stored encrypted and is never shown on the screen again.
Needs attention	Sync data rejected by the gateway that is not resent automatically. After removing the cause, use “Reschedule” to return it to waiting for sync.

Appendix B Problem Report Form

If a problem persists after you have followed Chapter 16, print this form, fill it in and give it, together with screenshots, to your system administrator or technical support. The more complete the information, the faster the cause can be found.

Instructions for filling in the form:

- Copy screen messages exactly as shown, or attach screenshots.
- For fields with options, check the matching □.
- **Do not write down any passwords.**
- The database file and the sync settings contain production data and confidential information. Do not attach them to this form; if they are needed, provide them separately according to your company policy.

Item	Details (fill in)
Report date	
Reporter and contact information	
Software version (“Version” at the bottom of the login screen)	
Installation method	□ Offline installer □ Standard installer □ Portable program
Windows version (Windows “Settings” → “System” → “About”)	
Computer name or location of use	
Date and time of occurrence	
Username used to log in (do not write the password)	
User role	□ A (Admin) □ B (Supervisor) □ C (User)
Work mode	□ Torque Wrench □ Torque & Angle □ Torque Inspection □ Power Tool □ Batch Jobs □ Tool Inspection □ Other: _____
Screen where the problem occurred	
Sensor model	
Sensor serial number	
COM port of the RF receiver	
Communication or sync	□ Not related □ Modbus TCP □ Modbus RTU □ Open Protocol □ Read API □ Database sync
Service status text (if communication or sync is involved)	

Item	Details (fill in)
Operating steps (write down what you did, in order)	1. 2. 3. 4.
Screen message (exact text)	
Expected result	
Actual result	
Reproducible?	□ Happens every time □ Happens occasionally □ Happened only once
Impact on work	□ Cannot work □ Some functions cannot be used □ Does not affect work
Actions already tried (for example, which section of Chapter 16)	
Attachments	□ Screenshots □ Exported record file □ Sensor error history □ Other: _____
Resolution (filled in by technical support)	
Handled by and completion date (filled in by technical support)	