



# Med-Connect

**Seamless connectivity. Assured continuity. Trusted reliability.**

## Application Documentation

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Version 1.6.0

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# Introduction

## EXECUTIVE OVERVIEW

MedConnect is built around a clear value proposition: Reliable analyzer-to-LIS connectivity for laboratories, healthcare solution providers, and implementation partners. It is a practical healthcare interoperability platform purpose-built for laboratory device integration. Since 2021, it has been deployed in 70+ laboratories, supporting 80+ medical devices through ASTM, HL7, and proprietary protocols. The platform is continuously maintained, backed by real deployment work and operational support, and suitable for partnership-oriented delivery models where reliability and technical depth matter.

## WHAT IS MEDCONNECT

MedConnect is middleware that connects medical laboratory analyzers to Laboratory Information Systems (LIS) and Hospital Information Systems (HIS). It acts as a bidirectional bridge between instruments and information systems, automating order retrieval from the LIS and result submission from the analyzer. The platform is designed to reduce integration effort, complexity, and cost by providing ready-made connectivity for a wide range of devices out of the box.

## WHY MEDCONNECT

Laboratory environments require reliable, unattended communication between diverse analyzers and central information systems. MedConnect addresses this with:

- **Reduced integration effort** — Pre-built device evaluators for 80+ analyzers reduce custom development effort per device
- **Protocol breadth** — ASTM E1394, HL7 v2.x, and proprietary device-specific protocols all handled within a single platform

- **Reduced operational risk** — Centralized monitoring, per-device logging, and structured error handling reduce troubleshooting time
- **Partnership-ready delivery** — Straightforward deployment model with installer-based setup, configurable LIS connections, and a licensing model suitable for partnership-oriented implementation
- **Continuously maintained** — Active development with regular releases addressing real-world edge cases and new device support
- **Technical depth** — Full protocol-level logging, LIS test tools, and device-level diagnostics support validation and compliance workflows

## CORE CAPABILITIES

- **Analyzer connectivity** — Bidirectional communication with 80+ medical analyzers via serial (RS232), TCP/IP, and file-based interfaces
- **Protocol support** — ASTM E1394 (40+ devices), HL7 v2.x (15+ devices), and proprietary protocols (15+ implementations) within a single platform
- **LIS/HIS integration** — API-based and database-driven workflows for order retrieval, result submission, and sample tracking with configurable connection profiles
- **Monitoring and diagnostics** — Real-time device monitoring, per-session logging, protocol-level transaction views, and structured error handling
- **Test mapping and configuration** — Database-driven test code mapping between analyzer profiles and LIS test definitions; no code changes required for new tests or LIS updates
- **Deployment and support readiness** — Windows-based installer, per-device LIS test environment switching, firewall diagnostics, and direct technical support with protocol-level logging for issue resolution

## WHO IS THIS FOR

- **Laboratory IT teams** responsible for connecting instruments to the LIS/HIS and maintaining daily operations
- **LIS/HIS vendors** seeking a proven device integration layer to reduce implementation timelines for new customer sites
- **Healthcare software providers** building laboratory or clinical data management solutions that require analyzer connectivity
- **Laboratory solution providers** delivering turnkey environments who need a reliable, configurable middleware component
- **Hospital IT departments** managing multi-analyzer environments that require centralized monitoring and control
- **Digital health platforms** integrating laboratory data flows into broader clinical or informatics ecosystems
- **Implementation and integration partners** deploying and supporting laboratory infrastructure across customer sites
- **Organizations handling analyzer and medical device connectivity** who need protocol-level control and structured data exchange

## KEY BUSINESS VALUE

Area	Impact
Integration speed	Pre-built evaluators for 80+ devices; helps shorten integration timelines for new sites
Protocol coverage	40+ ASTM, 15+ HL7, and 15+ proprietary implementations
Operational cost	Single platform replaces ad-hoc integrations; reduces vendor-specific middleware sprawl

Area	Impact
Deployment model	Windows-based installer, no server infrastructure required; runs on standard laboratory PCs
Support model	Direct technical support with protocol-level logging for fast issue resolution
Maintainability	Database-driven test mapping and device configuration; no code changes for new tests or LIS updates

## PROVEN IN THE FIELD

Since 2021, MedConnect has been deployed in 70+ laboratories spanning hematology, chemistry, immunoassay, coagulation, urinalysis, and electrolyte workflows. The platform handles real production workloads with continuous bidirectional communication, automated order processing, and structured result delivery. Each deployment is supported by direct operational engagement and protocol-level troubleshooting capability.

## HOW MEDCONNECT WORKS

The MedConnect workflow streamlines the entire testing process from sample placement to result delivery.

## SYSTEM REQUIREMENTS

### MINIMUM REQUIREMENTS

- **Operating System:** Windows 7 or later (Windows 10/11 recommended)
- **Processor:** Intel Core i3 or equivalent
- **Memory:** 4 GB RAM minimum, 8 GB recommended
- **Storage:** 500 MB free disk space (database grows with usage)



- **Network:** Ethernet adapter for TCP/IP devices and LIS communication
- **.NET Framework:** .NET 8 Runtime (included with installer)

## ADDITIONAL REQUIREMENTS

- **Serial Devices:** Available COM ports (USB-to-Serial adapters supported)
- **Network Devices:** Static IP addresses or DHCP reservations for devices
- **LIS Integration:** LIS API endpoints or SQL Server access credentials
- **Firewall:** Inbound rules for TCP port listening (default: port 5000)

## QUICK INSTALL & REMOVAL

### DOWNLOAD & INSTALL

- Download MedConnect-1.6.0.exe from your distribution source.
- Run the installer normally. If Windows asks for administrator approval, approve the prompt.
- Follow the wizard (default path C:\Program Files\ShamConsultancy\MedConnect); optional desktop/Start shortcuts.
- For upgrades, run the same installer and choose **Install/Reinstall** to replace the existing version while keeping data.

### UNINSTALL

- Windows Settings -> **Apps** -> **MedConnect** -> **Uninstall** (preferred), or rerun the installer and pick **Uninstall**.
- Ensure MedConnect is closed; the uninstaller removes files and registry entries. Manually delete the install folder only if leftovers remain.

## SUPPORTED DEVICES

MedConnect supports 80+ medical analyzers across multiple categories:

## DEVICE CATEGORIES

- **Hematology** - Blood cell counters (Sysmex, Mindray, Beckman, etc.)
- **Chemistry** - Clinical chemistry analyzers (Roche, Abbott, Siemens, etc.)
- **Immunoassay** - ELISA and immunochemistry (BioMérieux, DiaSorin, etc.)
- **Coagulation** - Hemostasis analyzers (Stago, Sysmex, etc.)
- **Urinalysis** - Urine chemistry and sediment analyzers
- **Electrolytes** - ISE and blood gas analyzers

## PROTOCOL SUPPORT

- **ASTM E1394** - 40+ devices
- **HL7 v2.x** - 15+ devices
- **Proprietary Protocols** - 15+ custom device-specific implementations

*See Appendix A for complete device list*

## WHAT'S NEW IN VERSION 1.6.0

### LICENSE VALIDATION

- **Continuous background validation** — License is verified at startup and re-validated periodically to ensure it remains valid.
- **Graceful operation stopping** — If a license problem is detected at runtime, all device connections stop immediately. No data is lost.
- **License problem persistence** — Problem state survives application restarts and is displayed on every launch until resolved.
- **Contact Support form** — Submit support requests directly from the app when a license issue blocks operation (problem type, optional email, optional message).

- **Analyzer Overflow handling** — When a license update reduces the analyzer limit, a dialog lets you choose which analyzers to deactivate (no automatic deletion).
- **Actionable notifications** — Distinct messages for disabled, expired, reassignment blocked (with escalating cooldown: 24h → 48h → 96h → 168h), invalid server ID, and invalid license key.

## LIS TEST ENVIRONMENT

- Per-device LIS test environment switching — route any device's LIS traffic to a separate test/staging LIS.
- Dual LIS connection settings with **Production** and **Test Environment** tabs.
- **Test LIS** checkbox in device configuration (disabled when test LIS is not configured).
- **TEST ENV** indicator in device monitor for test-environment devices (amber header).
- Notice banner on test definitions when the device's analyzer uses the test environment.

## FIREWALL DIAGNOSTICS

- New **firewall Diagnostics** tool (System Tools) for checking port rules, scanning ports, viewing active listeners, and one-click firewall fix.
- Firewall rules are now automatically synced when saving or deleting an analyzer configuration.

## ANALYZER CONFIGURATION

- Search and filter analyzers by Test List, Name, or Connection type.
- Device Type is now derived from the selected Test List (no manual selection needed).
- **Order file Name** field added for File Monitor devices.

## LOG VIEWER

- **Device Logs** tab renamed to **Transaction Logs** for clarity.
- **Raw Logs** tab renamed to **Protocol Logs** for clarity.
- LIS raw protocol capture is now always-on for all LIS HTTP traffic.

## LIS TEST TOOL

- **Device** and **Test List** filter selectors added to the Tests tab for accurate multi-device mapping results.

## PER-DEVICE VERBOSE LOGGING

- Replaced global verbose logging toggle with per-device control.
- Each device has its own verbose logging setting, with a live toggle in the device monitor panel.

## CONNECTION STABILITY

- fixed TCP server mode binding issue that caused repeated connect/disconnect cycles.
- Progressive TCP keep-alive backoff with auto-recovery for improved reliability.

## TEST MAPPING

- **TestForm** search strip added for filtering by Test List, LIS Test, Sample Type, and Host Code.
- Device dropdown removed (now derived from Test List selection).
- Column sorting enabled on test grids.

*See [MedConnect/changelog.md](#) for complete version history*

# Getting Started

## INSTALLATION

### INSTALLING MEDCONNECT

Download the MedConnect installer (Setup.exe)

Run the installer normally. If Windows asks for administrator approval, approve the prompt.

Follow the installation wizard:

- Accept the license agreement
- Choose installation directory (default: C:\Program Files\MedConnect)
- Click **Install**

Wait for installation to complete

Click **Finish** to launch MedConnect

*\*\*Note\*\*: Administrator rights are required only for initial installation. Normal operation does not require admin privileges.*

### FIRST LAUNCH

When you launch MedConnect for the first time:

The application creates the initial database automatically

Default user credentials:

- **Username:** user
- **Password:** 123456

You will see the login screen

***\*\*Security Tip\*\*:** Change the default password and create additional users with appropriate permissions after first login.*

## LOGIN & AUTHENTICATION

Launch MedConnect and enter your username and password. After first login, change the default password via **\*\*Users**

Security → Users**\*\***.

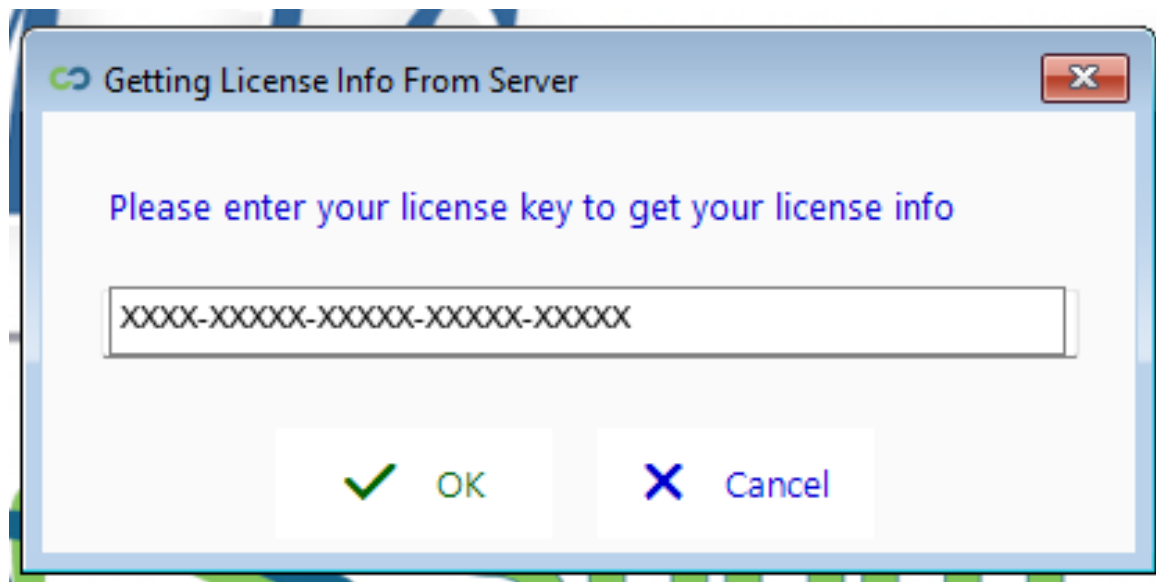


*Login form*

## LICENSE MANAGEMENT

### LICENSE ENTRY

On first launch or when the current license is no longer valid, MedConnect displays the License Update dialog.



*License Update Dialog*

Enter the 29-character license key provided by your service provider and click **OK**. MedConnect validates the key against the licensing server and activates the license if valid.

## CONTINUOUS BACKGROUND VALIDATION

MedConnect validates the license automatically:

- **Startup check:** License is verified every time the application launches
- **Periodic re-validation:** License is re-verified periodically in the background
- If validation passes, the application continues normally
- If validation detects a problem, the issue is persisted and displayed on every launch until resolved

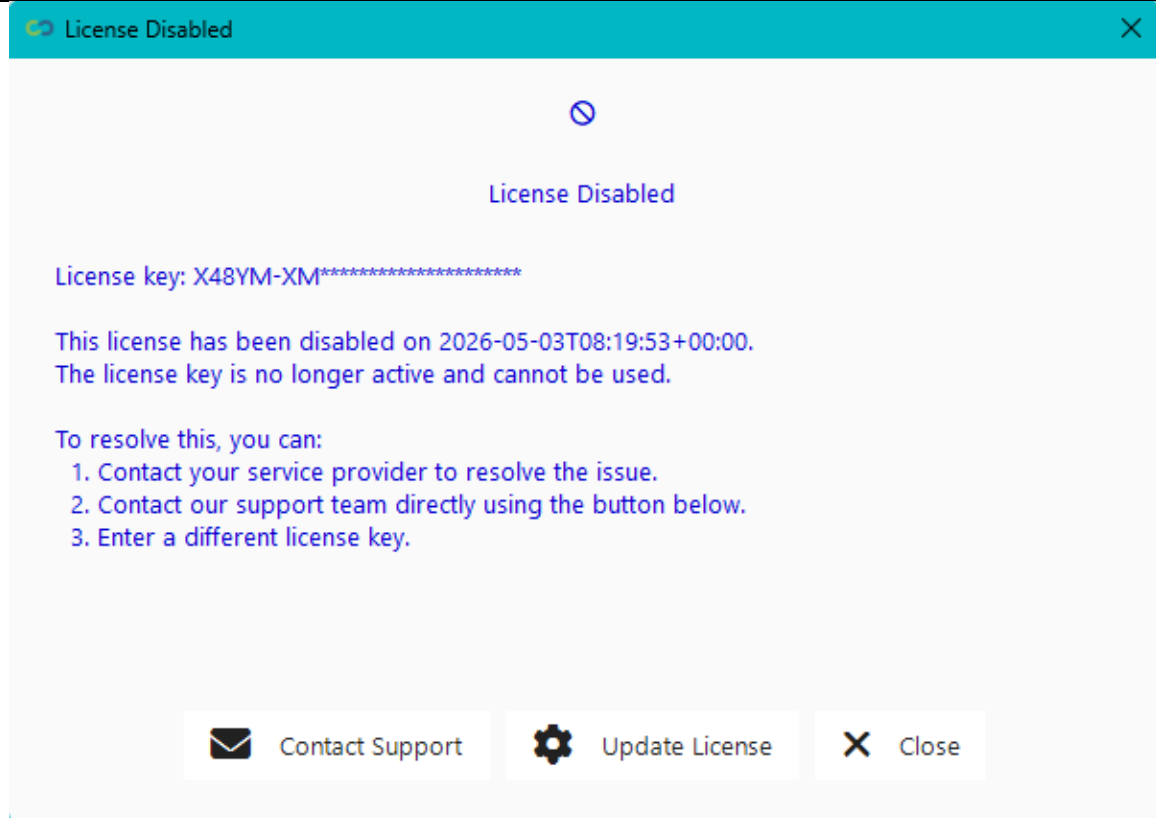
## LICENSE PROBLEM STATES

If MedConnect detects a license problem, you will see a notification telling you exactly what went wrong. Here is what

each problem means and what you can do to fix it:

Problem	What to Do
<b>**License Disabled**</b> or <b>**Expired**</b>	Click the <b>**Contact Support**</b> button in the error dialog to request a renewal,

Problem	What to Do
	or enter a new valid license key if you already have one.
<b>**Reassignment Blocked**</b>	You need to wait for the cooldown timer shown in the message to finish. If you cannot wait, use the <b>**Contact Support**</b> form to request an emergency release.
<b>**Invalid Server ID**</b>	Your license is tied to a different machine. Contact your service provider and ask them to release the license so you can activate it on this machine.
<b>**Invalid License Key**</b>	Double-check the 29-character key you entered for typos and try again. If the problem persists, contact your service provider for a corrected key.



*License Problem Notification*



If a license problem was detected in a previous session, MedConnect will show the problem message again on startup and

open the License Update dialog right away. You must resolve the issue before you can continue using the application.

## GRACEFUL OPERATION STOPPING

When a license problem is detected during runtime (via the background check):

All device connections are immediately disconnected

The main processing loop stops

Devices remain in the monitor list but show as **Disconnected**

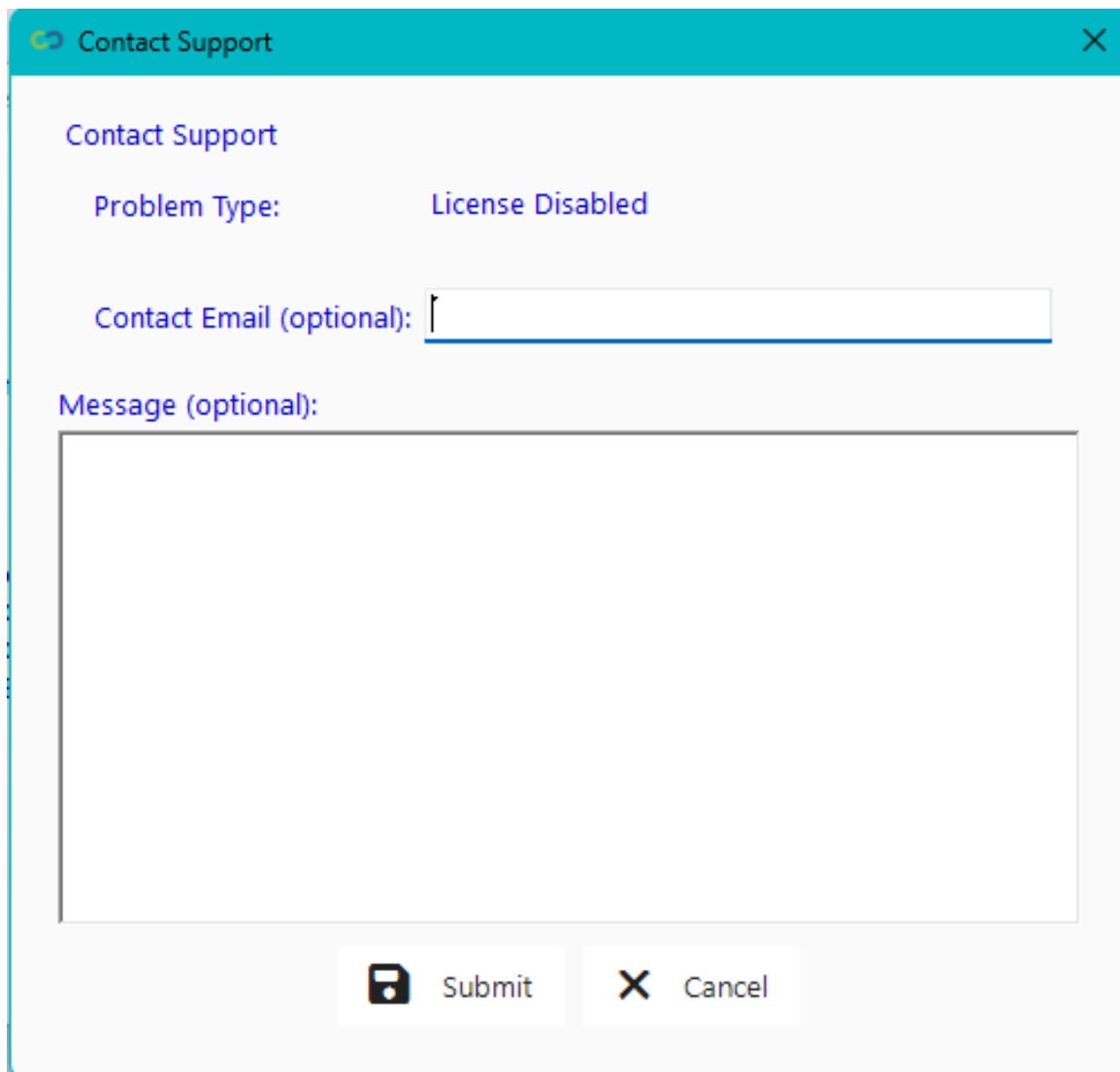
The license problem state is persisted for the next launch

Devices cannot reconnect until the license issue is resolved

No data is lost — the application simply stops processing until the license is restored.

## CONTACT SUPPORT

When a license error occurs (disabled, expired, or reassignment blocked), MedConnect offers to open the Contact Support dialog.

A screenshot of a 'Contact Support' dialog box. The dialog has a teal header bar with the title 'Contact Support' and a close button (X). Below the header, the text 'Contact Support' is repeated. The 'Problem Type' is set to 'License Disabled'. There is a text input field for 'Contact Email (optional)' and a larger text area for 'Message (optional)'. At the bottom, there are two buttons: 'Submit' with a floppy disk icon and 'Cancel' with an X icon.



Contact Support

Contact Support

Problem Type: License Disabled

Contact Email (optional):

Message (optional):

 Submit  Cancel

*Contact Support Dialog*

**Fields:**

- **Problem Type:** Automatically filled based on the detected issue (read-only)
- **Contact Email (optional):** Provide your email address for follow-up
- **Message (optional):** Describe your issue or provide additional context

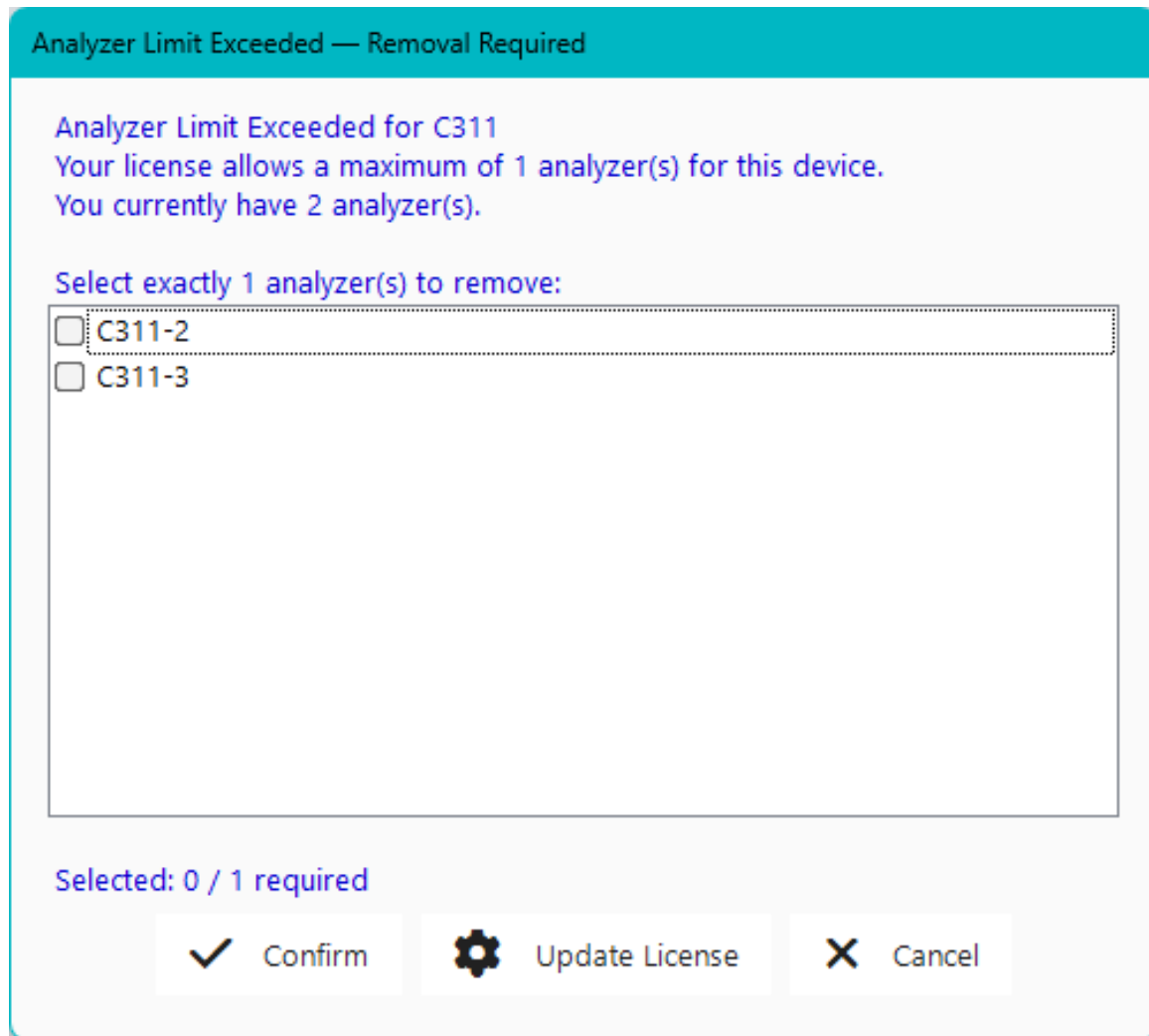
Click **Submit** to send the support request via a secure server relay endpoint. The request is rate-limited to prevent

abuse. A confirmation message appears when the request is sent successfully.

## ANALYZER OVERFLOW

When a license update reduces the allowed analyzer count for a device type below the number of currently active

analyzers, the **Analyzer Limit Exceeded** dialog appears.



Analyzer Limit Exceeded — Removal Required

Analyzer Limit Exceeded for C311  
Your license allows a maximum of 1 analyzer(s) for this device.  
You currently have 2 analyzer(s).

Select exactly 1 analyzer(s) to remove:

- ☐ C311-2
- ☐ C311-3

Selected: 0 / 1 required

✓ Confirm    ⚙ Update License    ✕ Cancel

*Analyzer Overflow Dialog*

### How to resolve:

The dialog lists all active analyzers for the affected device type, pre-checked

The count indicator shows **red** when the checked count exceeds the new limit

Uncheck analyzers you wish to deactivate to bring the count within the new limit

The count indicator turns **green** when the checked count is within the allowed limit

Click **Confirm** to apply the changes

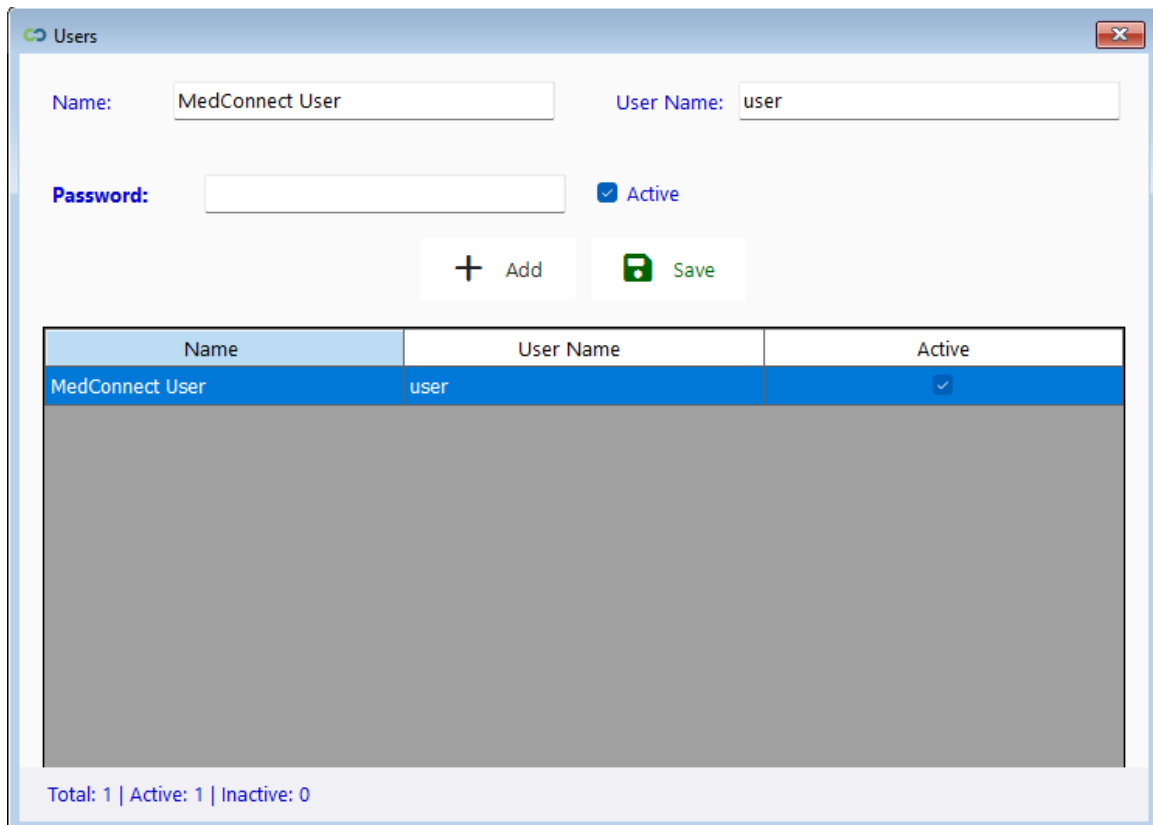
***\*\*Important\*\***: No analyzers are deleted. Unchecked analyzers are only **\*\*deactivated\*\*** and can be reactivated later if the license limit increases again.*

## USER MANAGEMENT

Access **Users Security** → **Users** to create and manage user accounts. Users can be assigned specific permissions to

control access to different features and settings. Permissions can be configured via **\*\*Users Security** → **User**

**Permissions\*\***.



The screenshot shows a window titled "Users" with a close button in the top right corner. The window contains a form for adding a new user and a table of existing users.

**Form Fields:**

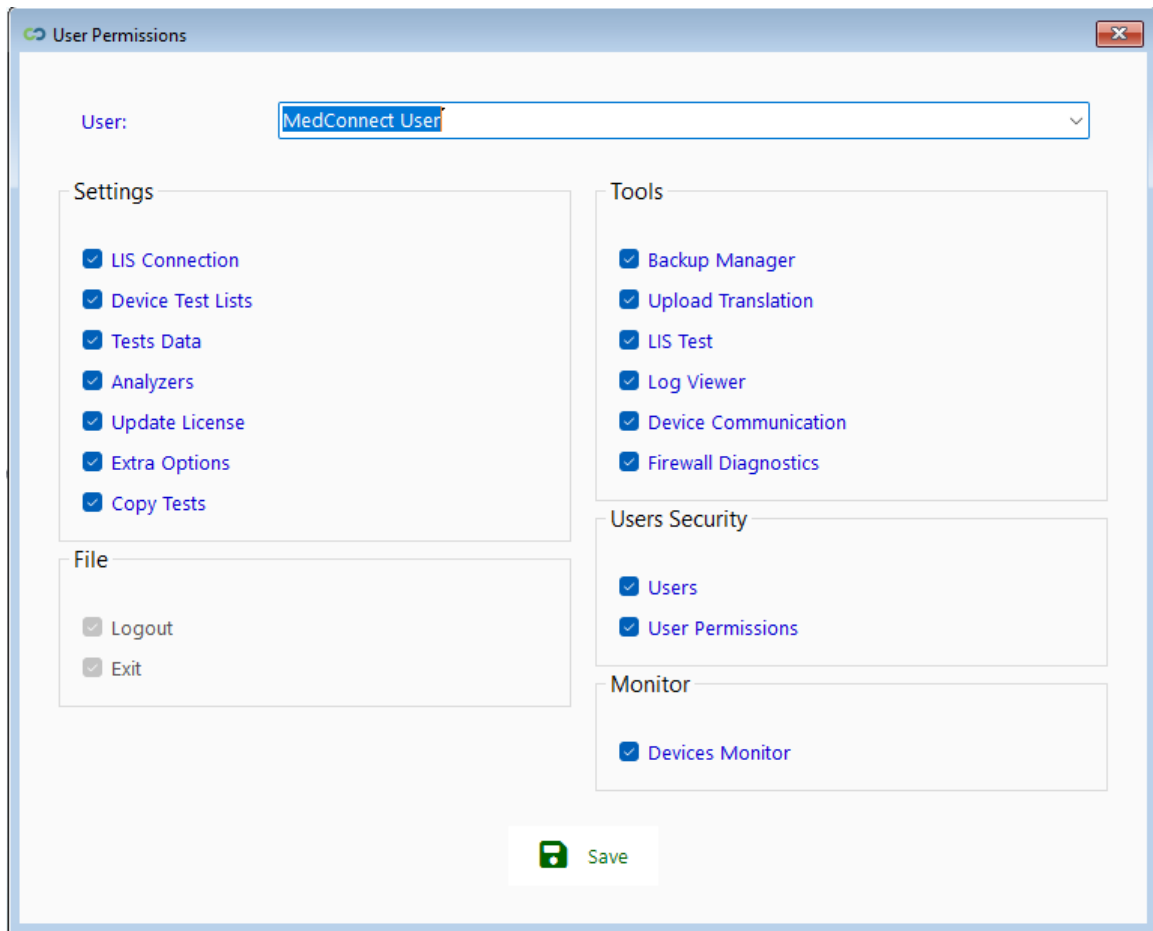
- Name:** MedConnect User
- User Name:** user
- Password:** (empty field)
- Active:** ☒

**Buttons:** + Add, Save

Name	User Name	Active
MedConnect User	user	<input checked="" type="checkbox"/>

**Total: 1 | Active: 1 | Inactive: 0**

*User Management*



*User Permissions*

## NEXT STEPS

Configure your LIS connection (**Settings** → **LIS Connection**), add devices (**Settings** → **Analyzers**), map tests

(**Settings** → **Tests Data**), and start monitoring (**Monitor** → **Devices Monitor**). For detailed information on each

feature, see the Core Features and System Tools sections.

# Core Features

## MAIN INTERFACE

The main window provides access to all features through organized menus: **File**, **Settings**, **Monitor**, **Users Security**

**Security**, **Tools**, and **Help**.



*Main form*

The menu bar organizes features by category: **Settings** for device and test configuration, **Monitor** for real-time

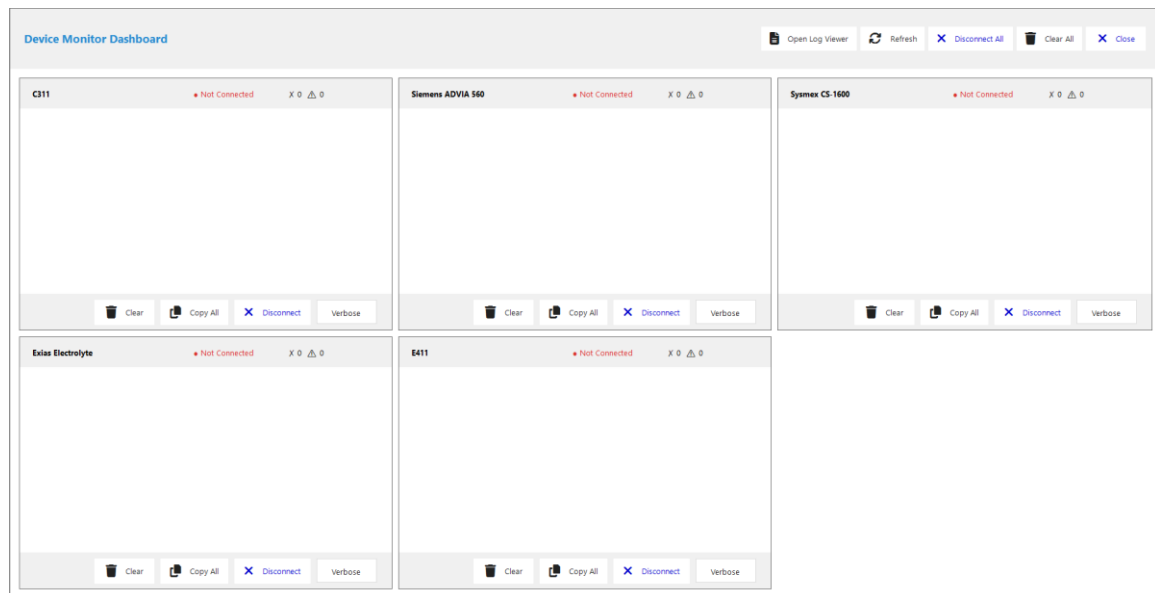
device tracking, **Users Security** for access control, and **Tools** for diagnostic and maintenance functions. The

status bar displays current user and connection status.

## DEVICE MONITORING

**Devices Monitor** (Monitor → Devices Monitor) provides real-time visibility into all connected analyzers, showing

their status, communication activity, and test processing workflow.



*Unified Monitor Dashboard*

**What you see:** Each device displays as a panel with Start/Stop buttons, status indicator

(Connected/Disconnected/Running), and a message feed showing recent activity. Devices configured for the test

environment show a **TEST ENV** indicator with an amber header. The unified view allows simultaneous monitoring of

multiple devices.

**How it works:** Click **Start** to activate a device connection. The monitor displays three types of messages:

- Order requests (device queries for sample information)
- Data processing (LIS communication, test mapping)
- Result transmission (sending results to LIS)

Messages appear in real-time as devices communicate. Right-click the message feed to clear old messages or export logs.

## DEVICE CONFIGURATION

**Analyzers** (Settings → Analyzers) is where you add and configure medical devices that MedConnect will connect to.

The screenshot shows the 'Analyzers' configuration window. The top section contains form fields for configuring a new analyzer: 'Test List' (C311), 'Connection' (TCP/IP), 'Port' (4001), 'TCP/IP Type' (Server), 'Device Name' (C311), 'Options' (Active checked, Verbose unchecked, Test LIS unchecked), and 'IP Address' (192.168.0.23). Below these fields are buttons for 'Clear', 'Save', 'Delete', and 'Options'. A table below lists configured analyzers:

Analyzer Name	Device Type	Connection Type	Test List Name	Port	Active	VerboseLogging	UseTestEnvironment
C311	C311	TCP/IP	C311	4001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Siemens ADVIA 5...	Siemens ADVIA 5...	TCP/IP	Siemens ADVIA 5...	6600	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sysmex CS-1600	Sysmex CS-1600	TCP/IP	Sysmex CS-1600	5001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exias Electrolyte	Exias Electrolyte	TCP/IP	Exias Electrolyte	5002	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E411	E411	TCP/IP	E411	4001	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Total: 5 | Active: 5 | Inactive: 0

*Analyzer Configuration*

### Key fields:

- **Analyzer Name:** Unique identifier for this device
- **Test List:** Select the device model — this automatically sets the Device Type and protocol
- **Connection Type:** Serial (COM port), TCP (network), or File Monitor
- **Connection Parameters:** Port number for TCP, COM port settings for serial
- **Order File Name:** (File Monitor devices) File name for order output
- **Test LIS:** Route this device's LIS traffic to the test/staging environment (requires test LIS configuration)

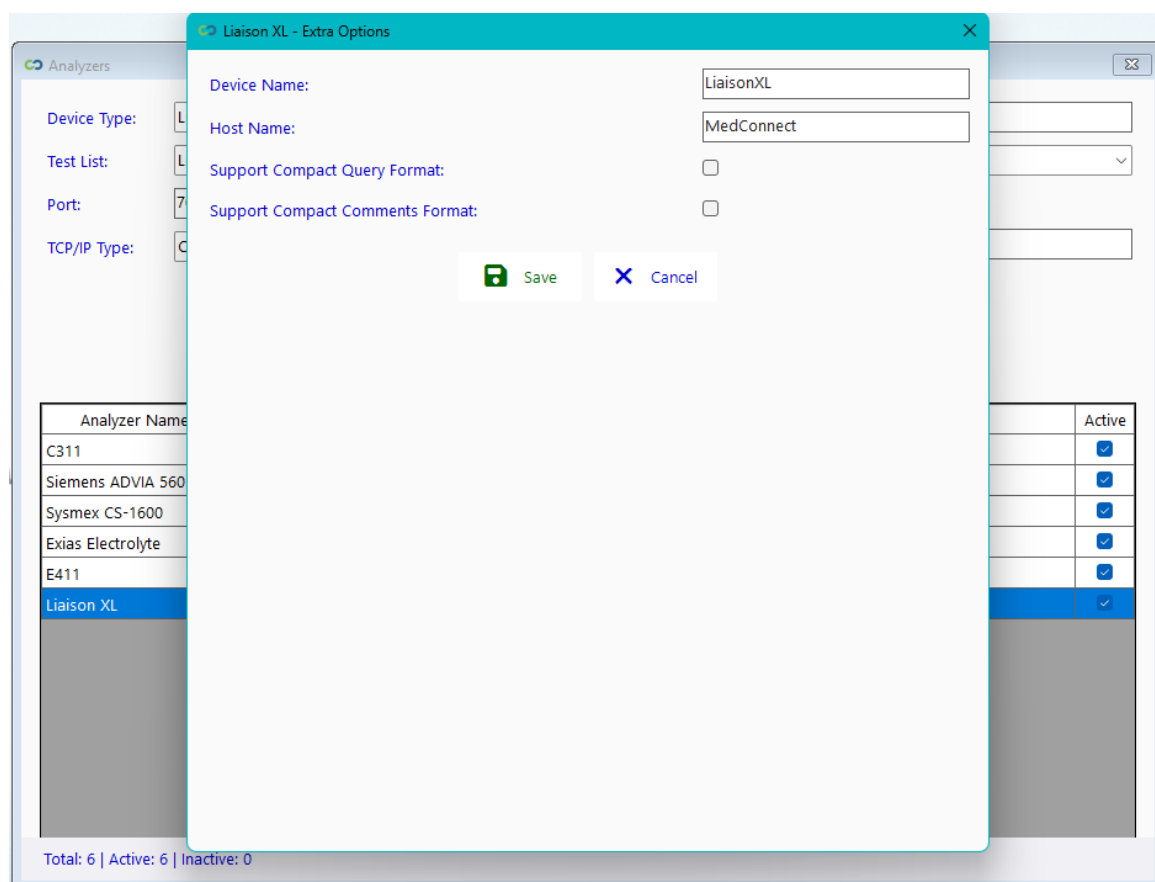


Use the search bar at the top to filter analyzers by **Test List**, **Name**, or **Connection type**. Column headers are clickable for sorting.

After selecting a Test List, configure connection details. For serial devices, set baud rate, parity, data bits, and stop bits to match the analyzer's communication settings. For TCP devices, enter the IP address and port number.

Some devices support **Extra Options** for device-specific settings (custom timeouts, protocol variations, special handling).

Firewall rules for TCP devices are managed automatically — rules are created or updated when you save an analyzer, and removed when you delete one. Use **Firewall Diagnostics** (System Tools) to troubleshoot if needed.



*Analyzer Extra Options*

**Note:** This is different from **Settings** → **Extra Options**, which controls system-level logging and archiving.

Click **Save** to store the configuration. The device will appear in the Devices Monitor and can be started to begin

communication.

## TEST MAPPING

**Tests Data** (Settings → Tests Data) maps device test codes to LIS test codes, ensuring results are sent to the

correct tests in your laboratory system.

LIS Test Code	Host Code	Host Name	Priority	Sample Type	Send To Device	Receive From Device	Round Up
1009	214	Vitamin D (25-hydroxycho...	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
513	135	17-Beta-Estradiol (E2) , Se...	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
243	106	Ferritin,Serum	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
238	104	Prostatic Specific Antigen,...	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
226	130	Follicular Stimulating Hor...	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
249	124	Thyroxine (FT4), Free, Ser...	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
29	122	Triiodothyronine (FT3), Fr...	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
514	127	Insulin Level Serum	Routine	Serum	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Total: 111 | Send To Device: 109 | Receive From Device: 111

### Test Configuration

**Purpose:** Medical devices use their own test codes (e.g., "GLU" for glucose), while your LIS may use different codes

(e.g., "GLUC" or "1001"). Test mapping creates the link between these systems.

**How to configure a test:**

Select a Test List (device) from the dropdown — the device is derived automatically

Use the search strip to filter by **LIS Test**, **Sample Type**, or **Host Code**

Click **Add Test**

Enter device test code and LIS test code

Configure test name, sample type, priority

Set rounding direction for numerical results using Smart Rounding

Set **Send** (send orders to device) and **Receive** (accept results from device) flags

When the device has an analyzer configured for the test environment, a notice banner appears at the top of the test

form to alert you that results will be routed to the test LIS.

**Smart Rounding** applies precision first, then uses a simple rule: With **Round Up**, digits 1–4 round down and 5–9

round up; with **Round Down**, digits 1–5 round down and 6–9 round up.

## PANEL TESTS AND SUBTESTS

Some tests are **panels** - groups of related tests that devices process together. For example, a Complete Blood Count

(CBC) includes WBC, RBC, HGB, HCT, PLT, and more.

Sub Tests

Sub Test

WBC

LIS Sub Test

Q

WBC

Name:

Precision:

2

☐ Round Up

Clear

Save

Delete

Sub Test Code	LIS Sub Test Code	Name	Precision	Round Up
WBC	WBC		2	<input checked="" type="checkbox"/>
RBC	RBC		2	<input type="checkbox"/>
HGB	HGB		2	<input type="checkbox"/>
HCT	HCT		2	<input type="checkbox"/>
MCV	MCV		2	<input type="checkbox"/>
MCH	MCH		2	<input type="checkbox"/>
MCHC	MCHC		2	<input type="checkbox"/>
PLT	PLT		0	<input type="checkbox"/>
RDW-SD	RDW-SD		2	<input type="checkbox"/>

Total: 23

Sub Tests

## Configuring panel subtests:

Create the parent test (e.g., "CBC")

Select the test and click **Sub Tests** tab

Add each component with its device code and LIS code

Set precision and rounding direction using Smart Rounding

**Smart Rounding** applies precision first, then uses a simple rule: With **Round Up**, digits 1–4 round down and 5–9

round up; with **Round Down**, digits 1–5 round down and 6–9 round up.

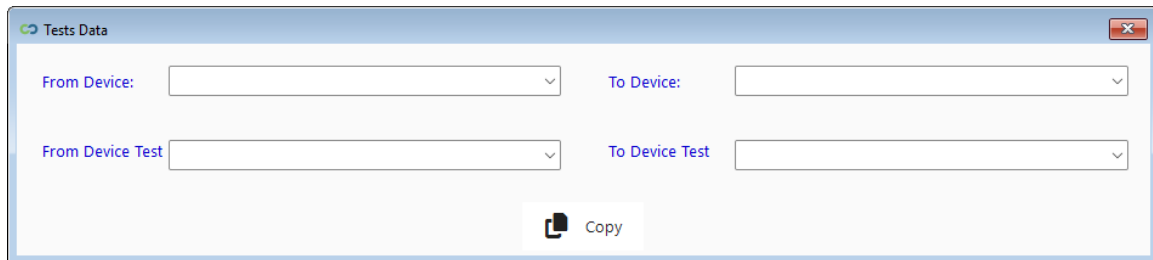
When a device sends CBC results, MedConnect automatically splits the panel into individual subtest results and maps each

to its LIS code before submission.

## TEST COPY TOOL

When adding multiple similar devices or tests with common properties, the **Test Copy** tool speeds up configuration by

copying existing test definitions and allowing you to modify only the differences.



*Test Copy*

**When to use:** You have two identical analyzers that use the same test codes, or you're adding tests with similar configurations (same sample type, priority, precision).

**How it works:**

Select source device and destination device

Choose which tests to copy

Tests are duplicated to the destination device

Edit individual tests if codes or settings differ

This eliminates repetitive data entry when setting up multiple devices or expanding test menus.

## LIS CONNECTION SETTINGS

**LIS Connection** (Settings → LIS Connection) configures how MedConnect communicates with your Laboratory Information

System to retrieve orders and submit results.

**LIS Connection**

Production Test Environment

Connection Type: HTTP

Lab Tests API: https://api.luzmilalab.com/api/tests

Transaction Info API: https://api.luzmilalab.com/api/order

Results API: https://api.luzmilalab.com/api/results/save

Order Completed: https://api.luzmilalab.com/api/order/processed

Bearer Token: 69081c8603e59c7363195444584eb44d31d21488c6731cb1057

Local API Port:

Local API Address:

Save Cancel

*LIS Connection*

#### Connection types:

- **HTTP/REST API:** Modern web-based integration using JSON
- **SQL Server Direct:** Direct database access for legacy systems

#### Environment tabs:

- **Production** — Primary LIS connection for live device traffic
- **Test Environment** — Separate LIS connection for staging/testing (used when a device has **Test LIS** enabled)

**Key settings** (per environment):

- **Base URL:** LIS API endpoint (e.g., <https://your-lis-server/api>)
- **Authentication:** API token or username/password
- **Endpoint paths:** URLs for GetOrder, ProcessOrder, SaveResults operations

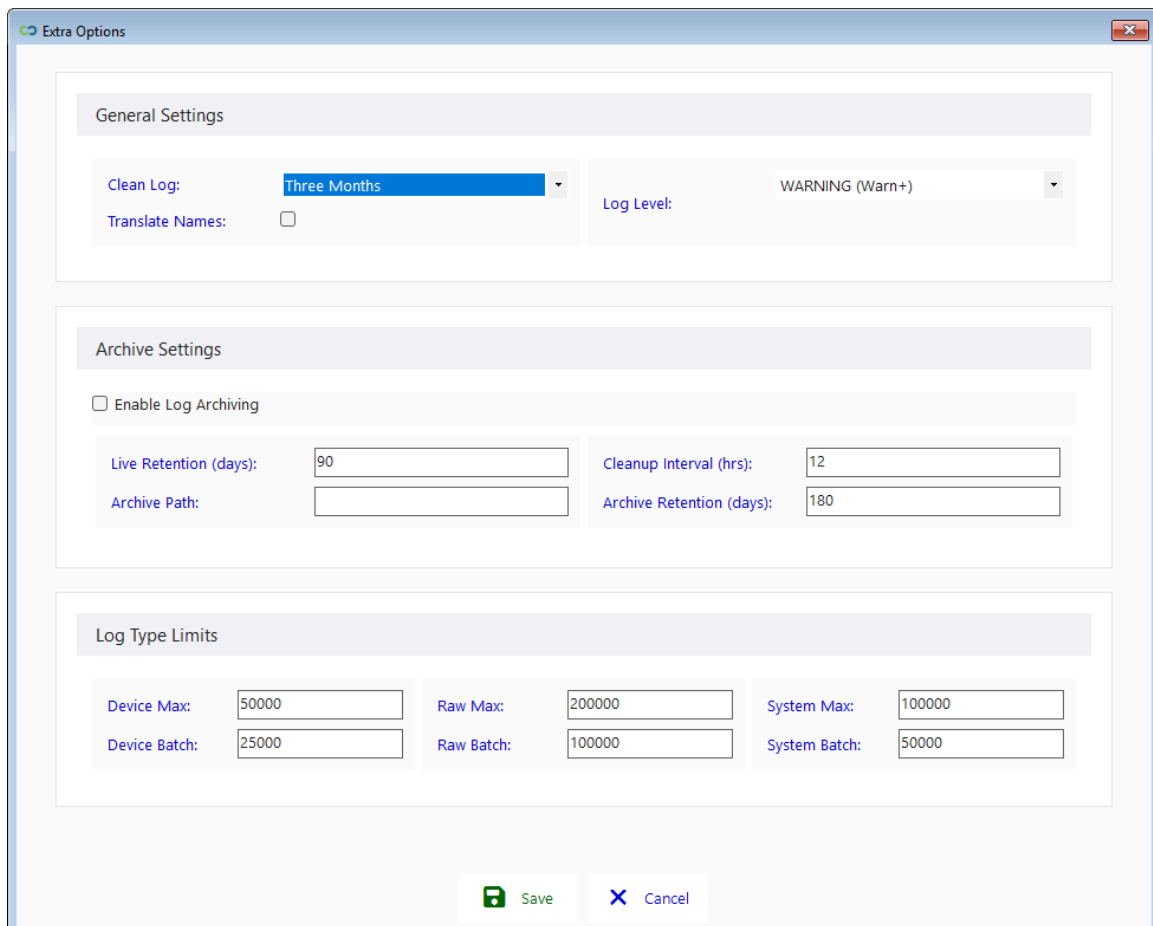
Click **Test Connection** to verify MedConnect can reach the LIS and authenticate successfully. The test shows response

times and any error messages.

## EXTRA OPTIONS

**Extra Options** (Settings → Extra Options) configures logging, archiving, and cleanup settings for the MedConnect

system.



The screenshot shows the 'Extra Options' configuration window. It is divided into three main sections: General Settings, Archive Settings, and Log Type Limits. At the bottom, there are 'Save' and 'Cancel' buttons.

General Settings	
Clean Log:	Three Months
Translate Names:	<input type="checkbox"/>
Log Level:	WARNING (Warn+)

Archive Settings	
<input type="checkbox"/> Enable Log Archiving	
Live Retention (days):	90
Cleanup Interval (hrs):	12
Archive Path:	
Archive Retention (days):	180

Log Type Limits					
Device Max:	50000	Raw Max:	200000	System Max:	100000
Device Batch:	25000	Raw Batch:	100000	System Batch:	50000

*Extra Options form*

## GENERAL SETTINGS (TWO-COLUMN LAYOUT)

- **Clean Log:** Automatically delete logs older than the selected period (None, Week, Month, Three Months, Six Months)
- **Log Level:** Minimum log level for system logs (DEBUG, INFO, WARNING, ERROR)
- **Translate Names:** Translate Arabic patient names to English before sending to LIS

## ARCHIVE SETTINGS (TWO-COLUMN LAYOUT)

- **Enable Log Archiving:** Archive old logs to compressed files instead of deleting
- **Live Retention (days):** Days to keep logs in main database (default: 90)
- **Cleanup Interval (hours):** Hours between automatic cleanup runs (default: 12)
- **Archive Path:** Custom path for archived log files (empty = default path)
- **Archive Retention (days):** Days to keep archived files before permanent deletion (default: 180)

## LOG TYPE LIMITS (THREE-COLUMN LAYOUT)

Each log type has **Max Records** and **Archive Batch** settings:

Log Type	Max Records	Archive Batch	Description
Device	50,000	25,000	Device communication logs
Raw	200,000	100,000	Raw message logs (ASTM, HL7 frames)
System	100,000	50,000	System event logs

**ToolTips:** Hover over any field for detailed descriptions and recommended values.



## SECURITY & USER MANAGEMENT

**Users** (Users Security → Users) creates and manages user accounts with add/edit/deactivate/password change

capabilities. **User Permissions** (Users Security → User Permissions) assigns granular access control for device

management, system tools, and security features.

**Access control:** Assign permissions for specific features (Analyzer configuration, Monitor access, Backup management,

etc.). Users only see menu items they have permission to access.

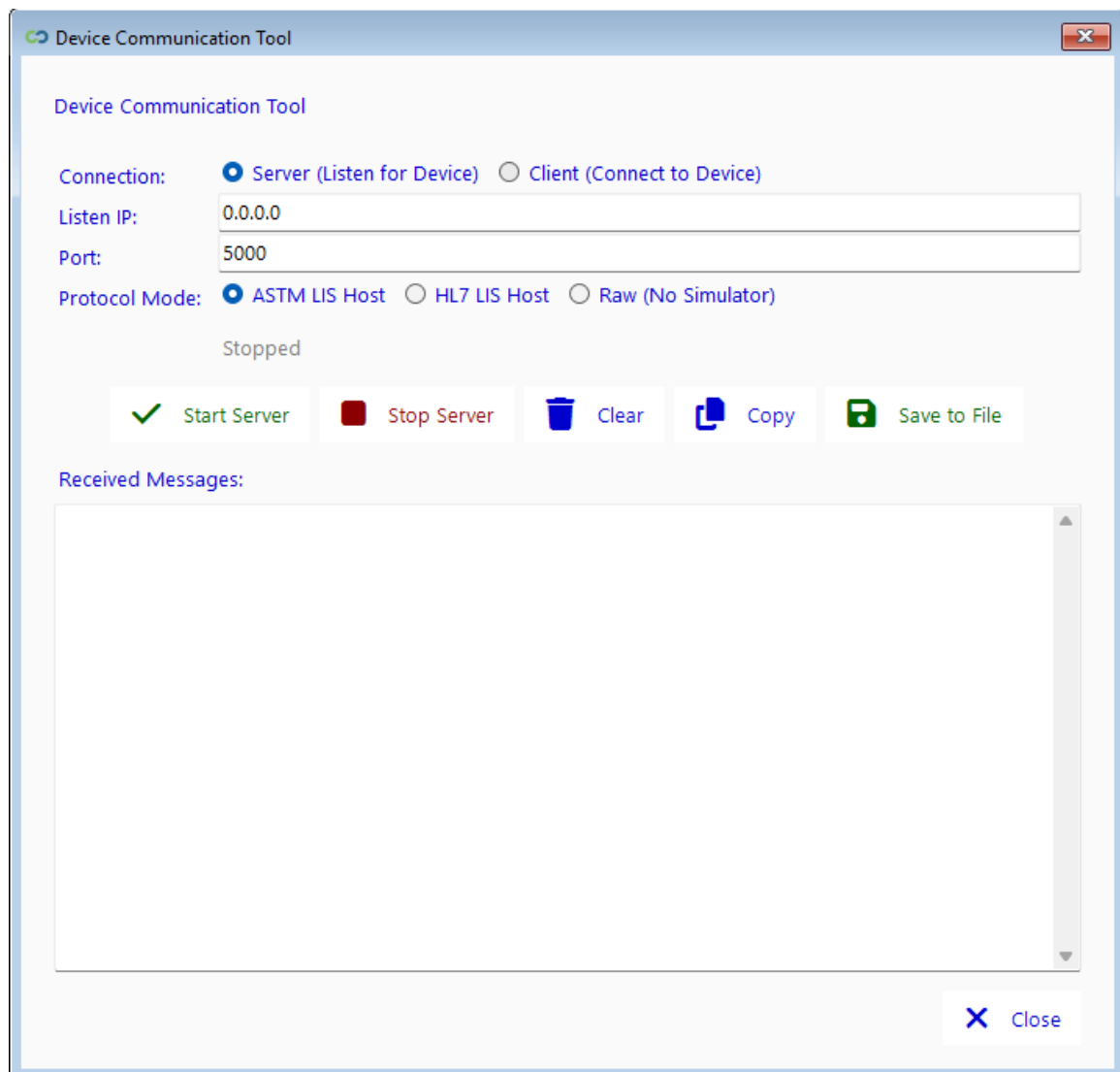
# System Tools

MedConnect provides diagnostic and testing tools for troubleshooting device communication, validating LIS integration, analyzing logs, and managing backups.

## DEVICE COMMUNICATION TOOL

**Device Communication** (Tools → Device Communication) acts as a bidirectional testing tool that simulates either the

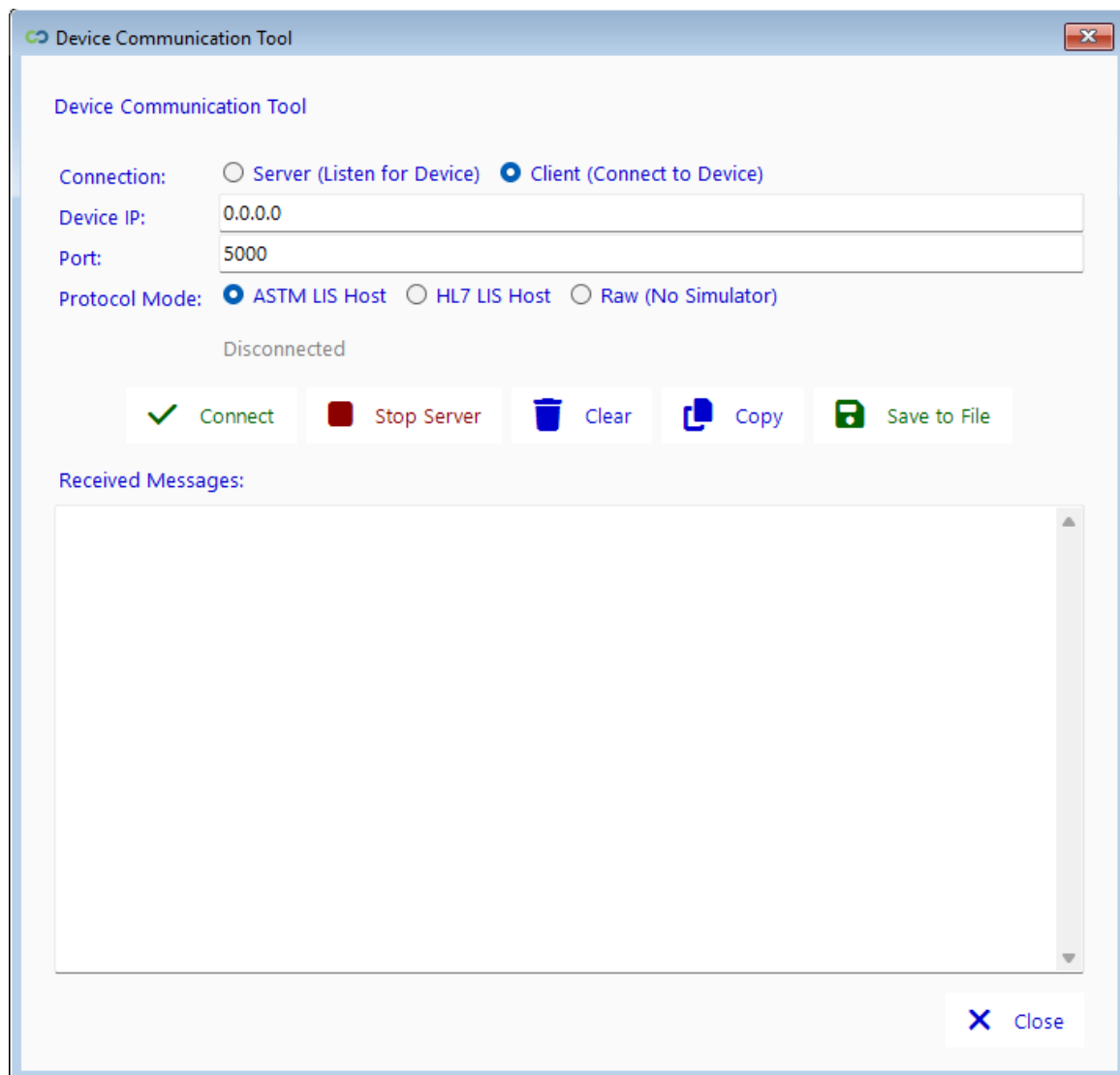
LIS host or a medical device, allowing you to test protocol communication without requiring actual hardware.



*Device Communication Server*

**Server Mode** (simulates LIS host):

- Listens on a TCP port for device connections
- Receives messages from devices
- Sends responses according to ASTM/HL7 protocols
- Useful for testing device configuration before connecting to real LIS



*Device Communication Client*

**Client Mode** (simulates device):

- Connects to a LIS or another MedConnect instance
- Sends test messages (queries, results)
- Receives responses
- Useful for testing LIS integration without requiring a physical device

**Protocol support:** Select ASTM, HL7, or Raw mode. The tool displays hex dumps and decoded messages in real-time,

helping diagnose communication issues.

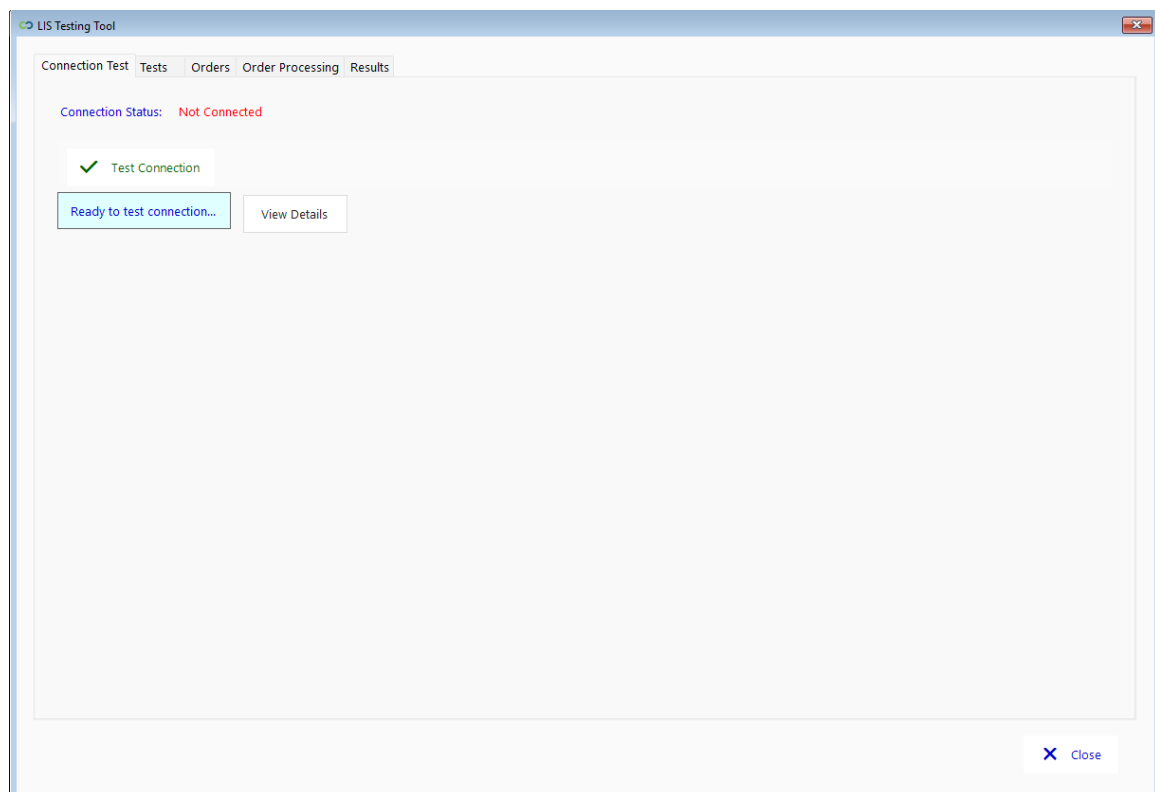
## LIS TEST TOOL

**LIS Test** (Tools → LIS Testing) provides comprehensive diagnostics for LIS integration, allowing you to test each LIS

operation independently before enabling live device communication.

The tool has five tabs covering the complete workflow:

### CONNECTION TEST



*LIS Test Connection*

Verifies basic connectivity to the LIS server. Click **Test Connection** to check:

- Network reachability
- Authentication (API token or credentials)
- SSL/TLS certificate validation
- Response time

Shows detailed error messages if connection fails.

## TESTS CATALOG

	LIS Test ID	Test Name	Code	Type	Mapping Status	Mapped To
▶	2	Glomerular Filtration Rate (GFR)	GFR		X Unmapped	No mapping
	3	Glucose - CSF	Glucose CS		✓ Mapped	717 (C311)
	4	HDL/LDL Ratio	HDL/LDL		X Unmapped	No mapping
	5	Urinary Protein/Creatinine Ratio	Protein/Cr		X Unmapped	No mapping
	7	Cholesterol - LDL	LDL		✓ Mapped	962 (C311)
	8	Creatinine (Serum)	Crea		✓ Mapped	690 (C311)
	9	Creatine Kinase (CPK)	CPK		✓ Mapped	550 (C311)
	10	Total Iron Binding Capacity (TIBC)	TIBC		✓ Mapped	966 (C311)
	11	Magnesium (Serum)	Mg		✓ Mapped	701 (C311)
	12	Magnesium - 24hr Urine	Mg 24hr		X Unmapped	No mapping
	13	Calcium, Ionized	Ionised Ca		✓ Mapped	Ca (Exias Electrolyte)

### *LIS Test Tests*

Retrieves the list of tests available in the LIS. This helps verify:

- LIS API is returning test data
- Test codes match your expectations
- Test names and types are correct

Use the **Device** and **Test List** filter selectors to scope results to a specific device's mapping. Use the search

function to find specific tests.

## ORDERS RETRIEVAL

Sample Number: 10154305120 ☒ All Tests [Get Order](#)

✓ Order retrieved successfully for '10154305120' (API: 714ms, Total: 1767ms) [View Details](#)

**VALIDATION STATUS:**  
 ✓ Input Valid  
 ✓ Request Sent  
 ✓ Response Valid

**Order Information**  
 Sample ID: 1015430  
 Date: 2026042003  
 Type: Serum  
 Priority: R

**Patient Information**  
 Patient ID: 101543  
 Patient: [Redacted]  
 Date of Birth: 19\*  
 Sex: M  
 Age: \*\* y

FIELD MAPPING INFO: 6 field(s) using default mapping (no LabDataStructure override)

Order Summary: API: 714ms | Total: 1767ms  
☐ Show only not mapped tests

Host Code	Device/Analyzer	Mapped Test Name	Status
▶ CBC With Dif	Siemens ADVIA 560	CBC With Dif	✓ Mapped
418	C311	Urea (Serum)	✓ Mapped
690	C311	Creatinine (Serum)	✓ Mapped
K	Exias Electrolyte	Potassium (Serum)	✓ Mapped
Na	Exias Electrolyte	Sodium (Serum)	✓ Mapped
Cl	Exias Electrolyte	Chloride (Serum)	✓ Mapped

[Close](#)

### LIS Test Orders

Tests order retrieval for a specific sample number. Enter a barcode/accession number and click **Get Order** to:

- Verify LIS has the order
- See patient information (PHI-safe display)
- View requested tests
- Check test mapping status (mapped/unmapped)

This is the most common diagnostic step when devices report "order not found."

## ORDER PROCESSING

The screenshot shows the 'LIS Testing Tool' window with the 'Order Processing' tab selected. The interface includes a tab bar at the top with 'Connection Test', 'Tests', 'Orders', 'Order Processing', and 'Results'. Below the tabs, there are two input fields: 'Sample Number:' and 'Tests (comma-separated):'. The 'Tests' field has a placeholder text: 'Enter test codes separated by commas (e.g. 12,15,23) or leave empty for all tests'. Below these fields, there is a green checkmark icon and the text 'Set Order Processed'. At the bottom left, there are two buttons: 'Ready to process order...' and 'View Details'. At the bottom right, there is a 'Close' button with a blue 'X' icon.

*LIS Test Order Processing*

Simulates the complete order workflow:

Retrieves order from LIS

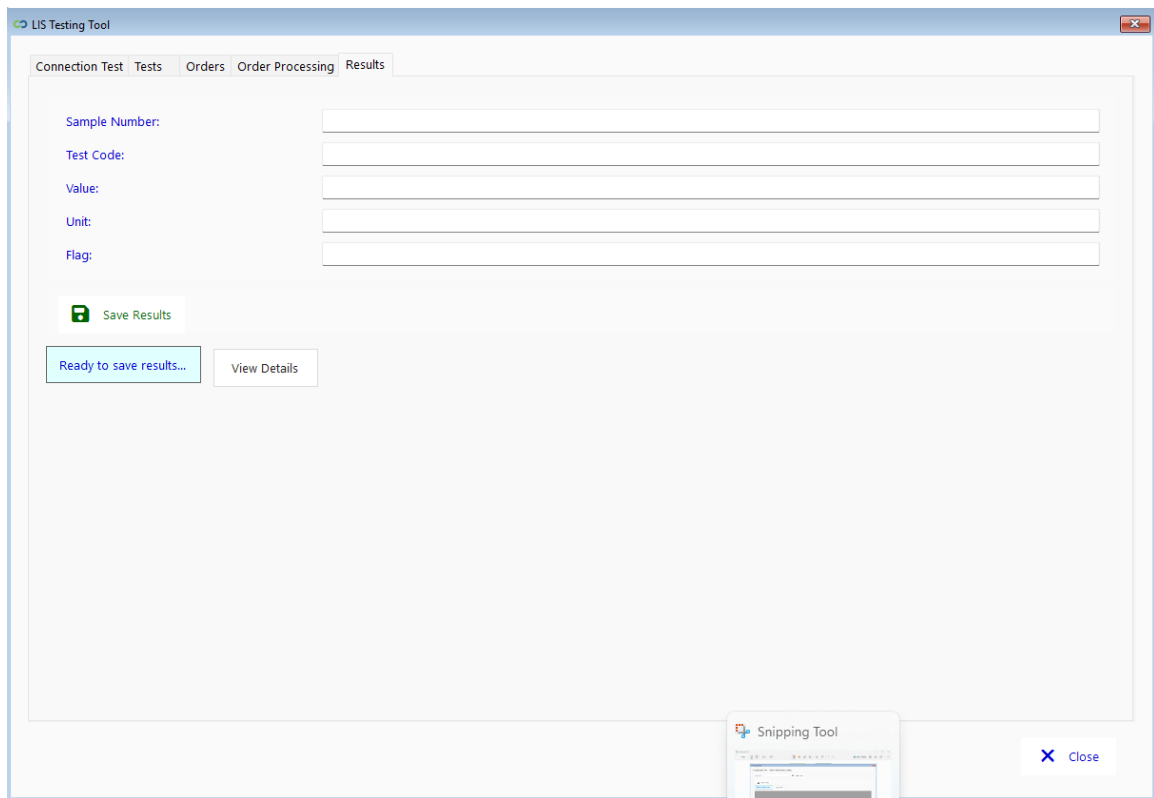
Processes test mapping

Shows what would be sent to the device

Helps diagnose issues where orders are retrieved but devices don't receive expected test parameters.



## RESULTS SUBMISSION



The screenshot shows the 'LIS Testing Tool' application window. The 'Results' tab is selected, displaying a form for submitting test results. The form includes five input fields: 'Sample Number:', 'Test Code:', 'Value:', 'Unit:', and 'Flag:'. Below these fields are three buttons: 'Save Results' (with a green save icon), 'Ready to save results...' (highlighted in light blue), and 'View Details'. A 'Snipping Tool' window is visible in the bottom right corner, and a 'Close' button is located at the bottom right of the main application window.

### *LIS Test Results*

Tests result submission to the LIS. Enter sample number, add test results manually, and click **Submit** to:

- Verify LIS accepts results
- Check field validation
- Test error handling
- View LIS response

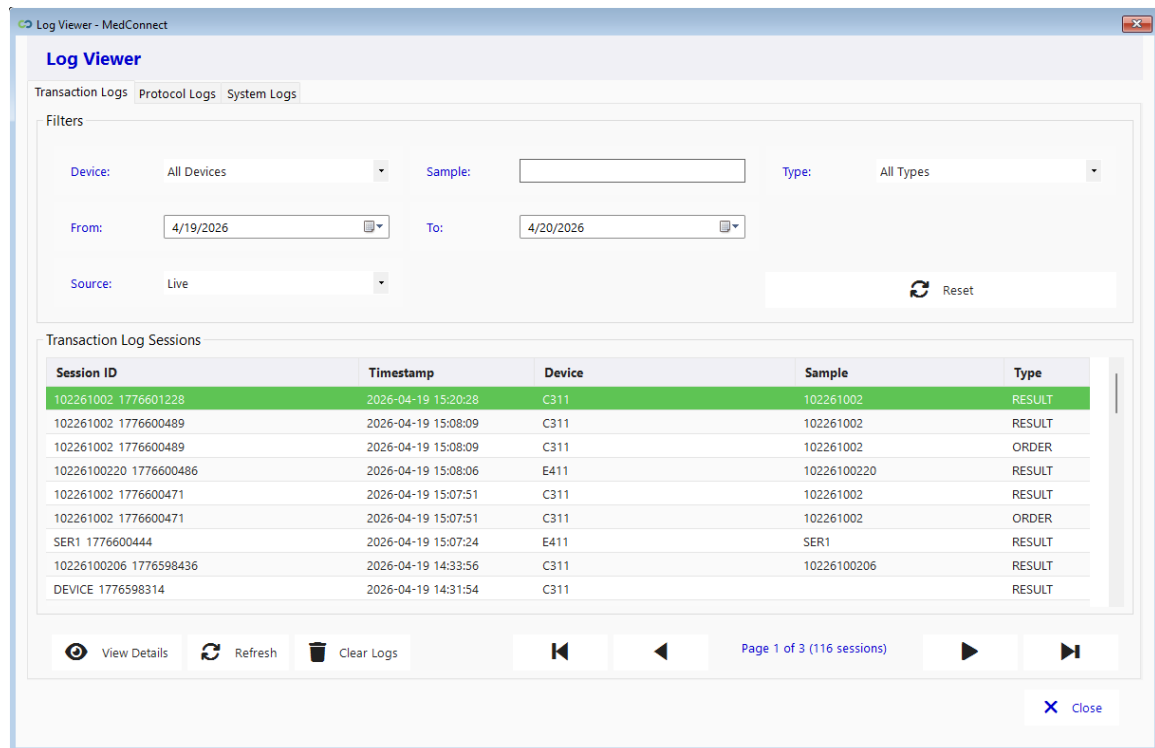
Click **View Details** on any operation to see the raw request and response JSON/XML, helping troubleshoot API issues.

## LOG VIEWER

**Log Viewer** (Tools → Log Viewer) displays three types of logs stored in the MedConnect database, providing complete

visibility into system operation. The interface uses a tab-based layout with dedicated controls for each log type, showing 100 messages per page with pagination controls.

## TRANSACTION LOGS



*Log Viewer Transaction Logs*

User-facing messages showing the workflow:

- Order requests ("Requesting order for sample ABC123")
- Test results ("GLU (Glucose): 95 mg/dL")
- LIS communication ("Saving results to LIS")
- Session completion markers

**Purpose:** Understand what happened during a sample processing session.

**filters** (3×3 grid layout):

- **Device:** Filter by specific analyzer
- **Session Type:** ORDER, QC, CALIBRATION, MAINTENANCE, GENERAL
- **Sample ID:** Search by sample/barcode number

- **From/To Date:** Default last 7 days
- **Search:** free text search in messages
- **Reset:** Clear all filters
- **Export:** Export current search results to TXT, CSV, or JSON files with comprehensive filtering applied

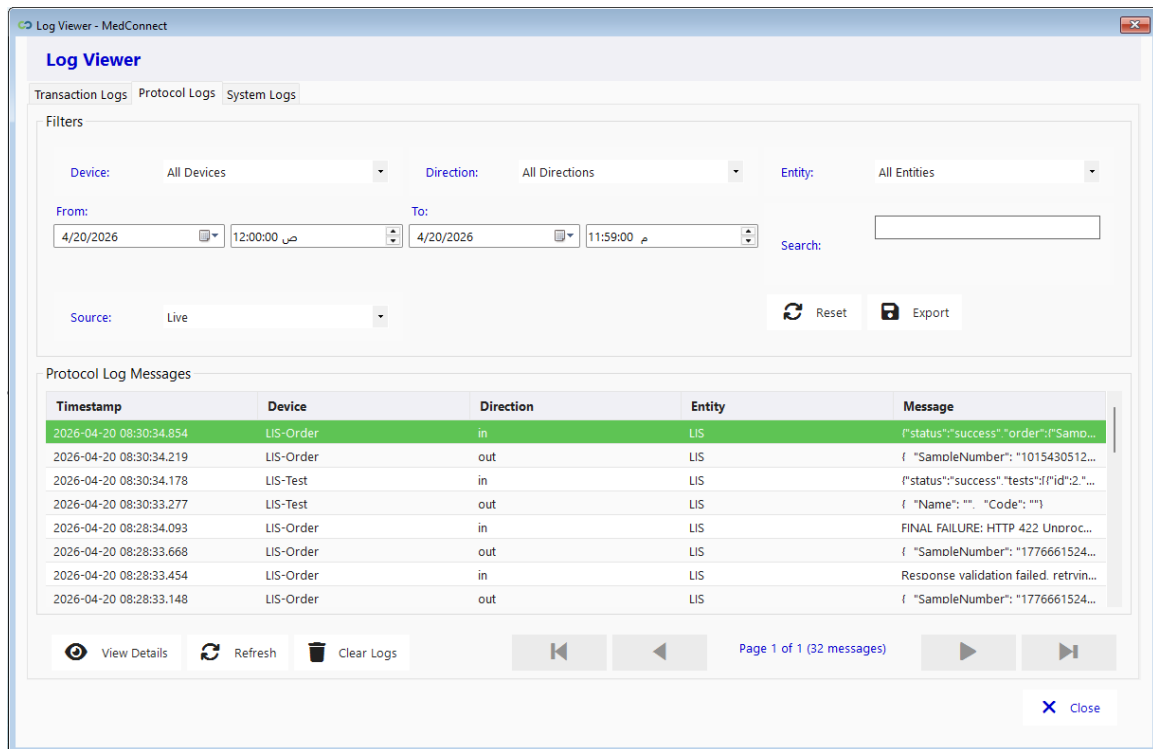
#### Export functionality:

- **Smart Export:** Exports all records matching current filter criteria (not just the visible page)
- **Multiple Formats:** Support for TXT, CSV, and JSON export formats
- **TXT:** Custom formatted layout with filter criteria header and timestamp-based message display
- **CSV:** Standard comma-separated format with proper field escaping
- **JSON:** Structured data format with complete protocol information
- **File Naming:** Automatic naming with timestamp (RawLogs\_YYYYMMDD\_HHmmss.ext)
- **Progress feedback:** Shows number of records exported and confirmation messages
- **Filter Preservation:** Exported files include applied filter criteria for reference

#### Detail View: Double-click any log entry to see:

- Complete message properties (Device, Sample ID, Direction, Participant, Session Type, Session ID, Timestamp)
- Full message content with formatting
- **Related Session Messages:** All messages from the same session with navigation
- **Copy buttons:** Copy current message or all session messages to clipboard

## PROTOCOL LOGS



*Log Viewer Protocol Logs*

Protocol-level communication traces showing exact data sent and received:

- Hexadecimal dumps of serial/TCP communication
- ASTM/HL7 frames with checksums
- Timing information

**Purpose:** Diagnose protocol issues, verify device is sending correct data, troubleshoot checksum errors.

**Filters** (3x3 grid layout):

- **Device:** filter by specific analyzer
- **Direction:** in (device → MedConnect), out (MedConnect → device)
- **Entity:** ASTM entity type (Header, Patient, Order, Result, etc.)
- **From/To Date:** Default last 7 days
- **Search:** free text search in protocol data
- **Reset:** Clear all filters

- **Export:** Export current search results to TXT, CSV, or JSON files with comprehensive filtering applied

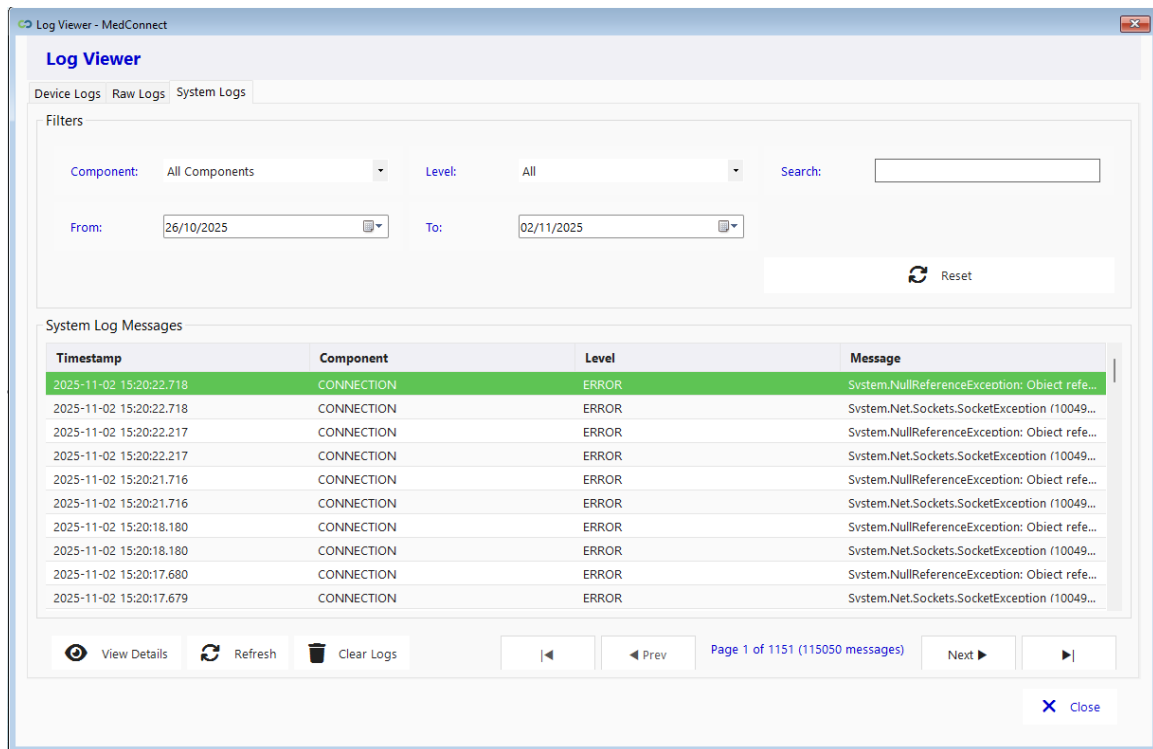
#### Export Functionality:

- **Smart Export:** Exports all records matching current filter criteria (not just the visible page)
- **Multiple Formats:** Support for TXT, CSV, and JSON export formats
- **TXT:** Custom formatted layout with filter criteria header and timestamp-based message display
- **CSV:** Standard comma-separated format with proper field escaping
- **JSON:** Structured data format with complete protocol information
- **File Naming:** Automatic naming with timestamp (RawLogs\_YYYYMMDD\_HHmmss.ext)
- **Progress feedback:** Shows number of records exported and confirmation messages
- **Filter Preservation:** Exported files include applied filter criteria for reference

#### Detail View: Double-click any log entry to see:

- Complete message properties (Device, Connection ID, Direction, Entity, Timestamp)
- Full raw protocol data with ASTM/HL7 formatting
- **Copy button:** Copy protocol message to clipboard

## SYSTEM LOGS



*Log Viewer System Logs*

Internal application events with color-coded severity levels:

- LIS API calls with request/response details
- Database operations
- Error exceptions with stack traces (ERROR: red text)
- Warnings and diagnostics (WARN: orange, INFO: blue, DEBUG: gray)
- Configuration changes

**Purpose:** Technical troubleshooting of MedConnect operation.

**Filters** (3×3 grid layout):

- **Component:** SYSTEM, EVALUATOR, LIS\_API, DATABASE, MIGRATION, SECURITY, etc.
- **Level:** ERROR, WARN, INFO, DEBUG
- **Search:** Free text search in log messages
- **From/To Date:** Default last 7 days
- **Reset:** Clear all filters

- **Export:** Export current search results to TXT, CSV, or JSON files with comprehensive filtering applied

#### Export Functionality:

- **Smart Export:** Exports all records matching current filter criteria (not just the visible page)
- **Multiple Formats:** Support for TXT, CSV, and JSON export formats
- **TXT:** Custom formatted layout with filter criteria header and timestamp-based message display
- **CSV:** Standard comma-separated format with proper field escaping
- **JSON:** Structured data format with complete protocol information
- **File Naming:** Automatic naming with timestamp (RawLogs\_YYYYMMDD\_HHmmss.ext)
- **Progress feedback:** Shows number of records exported and confirmation messages
- **Filter Preservation:** Exported files include applied filter criteria for reference

#### Detail View: Double-click any log entry to see:

- Complete log properties (Component, Session ID, Level, Timestamp)
- Full log content with exception stack traces if present
- **Related Session Logs:** All logs from the same session with navigation
- **Copy buttons:** Copy current log or all session logs to clipboard

#### Common Features:

- **Pagination:** Navigate through logs with first/Previous/Next/Last buttons (100 messages per page)
- **Color-coded levels:** Visual indicators for ERROR, WARN, INFO, DEBUG severity
- **Session correlation:** Related messages grouped by session ID with double-click navigation

- **Current message highlighting:** Selected message shown with yellow background and bold font in detail dialogs
- **Auto-apply filters:** Filters apply automatically when changed
- **Clear logs:** Admin function to delete old log entries (with confirmation)

## SYSTEM DIAGNOSTICS

**System Diagnostics** (Tools → System Diagnostics) provides a centralized view of network, firewall, and power settings relevant to MedConnect operation. It helps IT administrators quickly identify configuration issues that may prevent device communication.

The screenshot shows the 'System Diagnostics' window. At the top, it displays 'Change Mode: UAC prompt on changes' and 'Firewall Status: Enabled'. Below this, a 'System Diagnostics' section shows 'Domain Status: Not domain-joined', 'Active Profile: Private', and 'Firewall Profiles' for Domain, Private, and Public. A tooltip for 'GPO MedConnect Rule' explains the per-profile firewall state and merge policy. The 'MedConnect Firewall Rules' section contains a table with columns: Type, Name, Port, Status, Details, and an action button.

Type	Name	Port	Status	Details	
Application	MedConnect		OK	Application inbound rule. Profile...	Remove
Analyzer	C311-2	5002	OK	Inbound TCP port 5002. Profiles:...	Remove
Analyzer	C311-3	5003	OK	Inbound TCP port 5003. Profiles:...	Remove
Maintenance	Unused MedConnect ru...		OK	No unused MedConnect firewall...	Fix

Below the firewall rules is the 'Power Sleep Settings' section with a table:

Type	Setting	Status	Details	
Power	Sleep Timeout	AC: 0 min   DC: 0 ...	Sleep is currently disabled.	Enable

At the bottom, there is a search bar, 'Port & Listener Tool', and a 'Close' button.

*System Diagnostics*

The screen has four main sections:



## STATUS BAR

Shows the current admin mode (“Direct admin changes” or “UAC prompt on changes”) and whether Windows firewall is enabled. Click **Refresh** to reload all diagnostics data.

## NETWORK DIAGNOSTICS

Read-only information about the current network environment:

- **Domain Status** — Whether the machine is joined to an Active Directory domain
- **Active Profile** — Current Windows firewall profile (Domain, Private, or Public)
- **Firewall Profiles** — State, default inbound action, and merge policy for each profile
- **GPO MedConnect Rule** — Whether a Group Policy firewall rule for MedConnect already exists
- **Warnings** — Active configuration warnings (e.g., local rules ignored by GPO)

When the **Merge** policy shows “No” on a domain-joined machine, locally created firewall rules are ignored. The recommended solution is to deploy rules via **Group Policy (GPO)** instead.

## FIREWALL RULES

A grid showing all MedConnect firewall rules with their status and action buttons:

Action	When It Appears	What It Does
Remove	Rule exists and is OK	Removes the firewall rule
Add	Rule is missing	Creates the firewall rule
Recreate	Rule is duplicate or invalid	Replaces with a clean rule
Fix Profiles	Rule has incomplete profile coverage	Recreates with all profiles

Action	When It Appears	What It Does
fix	Unused rules detected	Removes rules for analyzers no longer configured

Actions require administrator privileges. If not running as admin, a UAC prompt appears and an elevated CMD window executes the command.

## POWER & SLEEP SETTINGS

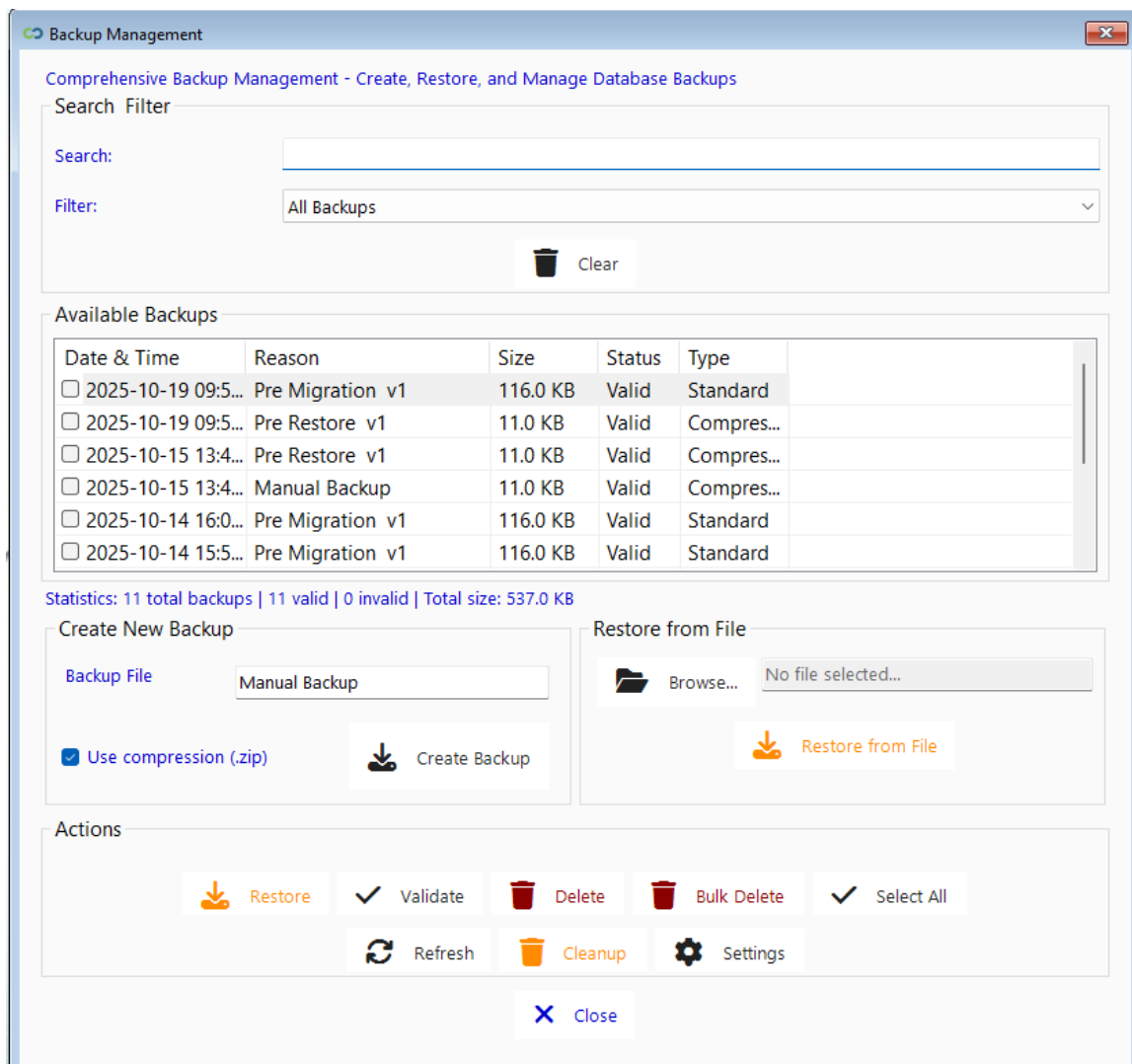
Controls Windows sleep/standby timeout that may interrupt long-running device connections:

- **Disable** — Sets AC and DC standby timeout to 0 (prevents sleep)
- **Enable** — Restores default timeouts (AC: 30 min, DC: 15 min)

Use this if device connections drop during idle periods. Requires administrator privileges.

## BACKUP MANAGEMENT

**Backup Manager** (Tools → Backup Manager) provides database backup and restore functionality with automated retention management.



*Backup Management*

### Key functions:

- **Create Backup:** Manual backup with optional compression
- **Validate:** Verify backup file integrity before restore
- **Restore:** Replace current database with backup
- **Bulk Operations:** Create/delete multiple backups
- **Auto-cleanup:** Automatically delete backups older than specified retention period

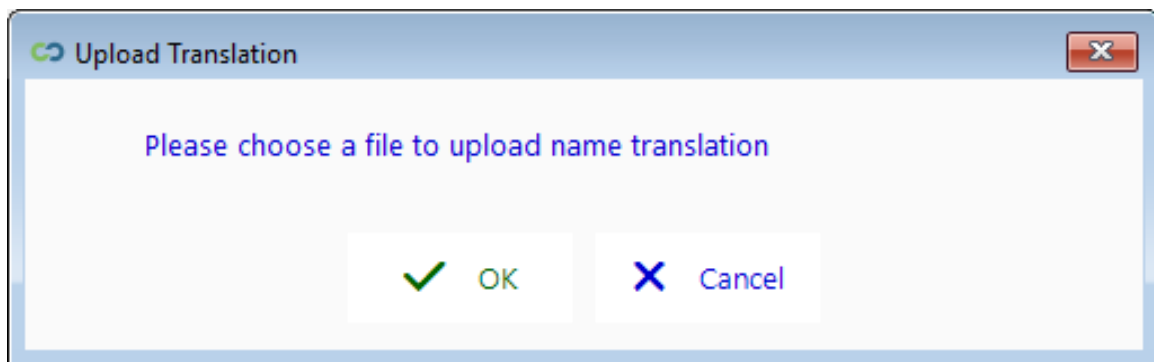
**Settings:** Configure backup location, compression (50-70% size reduction), and retention policies. Pre-migration

backups are created automatically when database schema updates occur.

**Best practice:** Create backups before major configuration changes or software updates. Validate backups periodically to ensure they can be restored.

## UPLOAD TRANSLATION TOOL

**Upload Translation** (Tools → Upload Name Translation) imports test name translations from JSON files for systems that need to display test names in multiple languages or with institution-specific naming conventions.



*Upload Translation*

### How it works:

Prepare JSON file with translations (English name → Local name mappings)

Click **Select file** and choose the JSON file

Click **Upload** to process

The tool uses batch processing to handle large volumes efficiently (30,000 records in approximately 1 minute). Progress is displayed during import.

**Use case:** Laboratories displaying test results in local language or using custom test naming schemes that differ from device defaults.

# Appendix

## APPENDIX A: SUPPORTED DEVICES

MedConnect supports 80+ medical analyzers in production. Highlights of tested devices (not an exhaustive list):

<!-- SUPPORTED\_DEVICES\_TABLE\_START -->

Manufacturer / Model	Protocol
Abbott Architect	ASTM
Abbott CELL-DYN Ruby	Proprietary
Abbott Emerald22	Proprietary
Abbott TouchPro	ASTM (LIS2-A)
Autobio AutoLumo A2000	HL7
Beckman Access2	ASTM
Beckman AU480 / AU680	ASTM
Beckman Coulter DxH 500	ASTM
Beckman Coulter UniCelDxH	ASTM
Bio-Rad D10	ASTM
Bio-Rad Variant	ASTM
BioMerieux VIDAS / VIDAS Mini	Proprietary
BioSystems BA-400	ASTM
Convergent X5	HL7
Cormay Accent 200	HL7
Diagon D-Cell60	Proprietary
DiaSorin Liaison / LiaisonXL	ASTM

Manufacturer / Model	Protocol
DIESSE CHORUS EVO	ASTM
Dirui FUS-3000Plus	ASTM
Dirui T240	ASTM
Ebra XL-200	Proprietary
Elektronika UriSed	Proprietary
Euroimmun	ASTM
Evidence MultiSTAT	ASTM
Exias Electrolyte	ASTM
Fuji NX500	Proprietary
GenoTEK Nano.5	HL7
Hipro A1	Proprietary
Horiba Micros ES60 / ESV60	ASTM
Human HumaStar	ASTM-like
IDS iSYS	ASTM
Integra	Proprietary
Keysmile SMART 500	HL7 (Custom)
Lifotronic GH-900Plus	Proprietary
Lifotronic H100	Proprietary
Maglumi 1000	ASTM
Medconn MQ-3000	Proprietary
Mindray BC-3107	HL7
Mindray BC-5000 / BC-5150	ASTM
Mindray BS-600M	ASTM / HL7
Mindray CL-2000i	ASTM

Manufacturer / Model	Protocol
Mindray XT-1800i / XT-2000i	ASTM
MISPA CXL PRO	ASTM
Nihonkohden MEK-6510 / MEK-7300K	ASTM
Nihonkohden MEK-9100	HL7
Norma Icon-5	HL7
OPTI CCA-TS2	ASTM
Orphee Mythic 18	Proprietary
Orphee Mythic 22	Proprietary
Orphee Mythic 70 04	ASTM
Randox Daytona	ASTM
Rayto Hematology	HL7
Rayto RAT	HL7
Roche C111	ASTM
Roche C311	ASTM
Roche Cobas 6000 / 311 / 411	ASTM
Roche Cobas Pure	HL7
Roche E411	ASTM
Roche Infinity	ASTM
Roche T411	Proprietary
Selectra TouchPro LIS2-A	ASTM
Siemens ADVIA 2120	Proprietary
Siemens ADVIA 360	HL7
Siemens ADVIA 560	HL7 / Proprietary
Siemens Atellica	ASTM

Manufacturer / Model	Protocol
Siemens Dimension	ASTM
Spinreact Spincell3	HL7
Stago STA Compact Max	ASTM
Swelab Alfa	HL7
Sysmex CS-1600	ASTM
Sysmex KX-21N	Proprietary
Sysmex XN-1000 / XN-350	ASTM
Sysmex XT-1800i / XT-2000i	ASTM
Thermo fisher	Proprietary
Tosoh AIA-900	ASTM
Tosoh HLC-72368	Proprietary
Urilyzer	ASTM
Urit 8030	HL7
URIT-5160	HL7
Yhlo iFlash	HL7
Zybio Z5 / Z5-1	HL7

<!-- SUPPORTED\_DEVICES\_TABLE\_END -->

*\*\*Note\*\*: Device support is continuously expanded. Contact support for devices not listed.*

## APPENDIX C: GLOSSARY

**ACK** - Acknowledgment character (0x06). Indicates successful receipt of data.

**ASTM** - American Society for Testing and Materials. Standards organization that publishes E1394.

**Analyzer** - Medical laboratory device that performs diagnostic tests.



**API** - Application Programming Interface. Set of protocols for software communication.

**Barcode** - Machine-readable code identifying a patient sample.

**Bidirectional** - Communication in both directions (device to LIS and LIS to device).

**COM Port** - Communication port for serial device connection (e.g., COM1, COM3).

**CSV** - Comma-Separated Values. Text file format for tabular data.

**Database** - SQLite database storing MedConnect configuration and logs.

**ENQ** - Enquiry character (0x05). Requests permission to transmit data.

**EOT** - End of Transmission character (0x04). Signals end of communication session.

**ETX** - End of Text character (0x03). Marks end of a frame.

**Evaluator** - MedConnect component that handles device-specific protocol logic.

**Frame** - Single unit of ASTM message (Header, Patient, Order, Result, etc.).

**HIS** - Hospital Information System. Enterprise system managing hospital operations.

**HL7** - Health Level 7. International healthcare messaging standard.

**HTTP** - Hypertext Transfer Protocol. Web-based communication protocol.

**LIS** - Laboratory Information System. Software managing laboratory operations and data.

**Middleware** - Software that connects two systems (MedConnect connects devices to LIS).

**NAK** - Negative Acknowledgment character (0x15). Indicates error or busy status.

**Panel** - Group of related tests (e.g., CBC includes WBC, RBC, HGB, etc.).

**Protocol** - Set of rules governing data communication (ASTM, HL7, etc.).

**REST API** - Representational State Transfer API. Modern web service architecture.

**RS-232** - Serial communication standard for device connectivity.

**Sample ID** - Unique identifier for a patient sample (barcode/accession number).

**Serial Port** - Physical port for RS-232 serial communication.

**SQL** - Structured Query Language. Database query language.

**SQLite** - Lightweight embedded database used by MedConnect.

**STX** - Start of Text character (0x02). Marks beginning of a frame.

**Subtest** - Component of a panel test (e.g., WBC is subtest of CBC).

**TCP/IP** - Transmission Control Protocol/Internet Protocol. Network communication standard.

**Test Code** - Unique identifier for a diagnostic test (e.g., "GLU" for Glucose).

**Test Mapping** - Configuration linking device test codes to LIS test codes.

## APPENDIX E: TECHNICAL SPECIFICATIONS

### SYSTEM ARCHITECTURE

#### Application Layer:

- .NET 8 Desktop Application
- Windows Forms UI
- C# 12

#### Data Layer:

- SQLite 3.x Database
- Dapper ORM
- Database Migrations

#### Communication Layer:

- Serial Port (System.IO.Ports)
- TCP/IP Sockets (System.Net.Sockets)
- File System Watcher (System.IO.FileSystemWatcher)
- HTTP Client (HttpClient)

#### Supported Protocols:

- ASTM E1394

- HL7 v2.x (various versions)
- Proprietary device protocols
- HTTP REST APIs

## DATABASE SCHEMA

### Core Tables:

- analyzers - Device configurations
- testdata - Test mappings and subtests
- users - User accounts
- permissions - User permissions
- settings - Application settings
- migrations - Database migration history

### Log Tables (Logs Database):

- device\_logs - User-facing device messages
- raw\_logs - Protocol-level communication traces
- system\_logs - Internal system events

## PERFORMANCE SPECIFICATIONS

**Concurrent Devices:** 20+ devices simultaneously

### Message Processing:

- ASTM: <100ms per message
- HL7: <50ms per message
- LIS API calls: Network latency + LIS response time

### Database Performance:

- Test mapping lookup: <1ms (cached)
- Log query: <500ms for 10,000 records

### Backup/Restore:

- 100 MB database: ~10-15 seconds
- Compression ratio: 50-70% size reduction

## End of User Guide

For additional support, contact:

- Email: <support@medconnect.com>
- Documentation: See Documentation/Features/ folder
- Technical Specs: See Resources/TechnicalSpecs/ folder