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1 Introduction

Welcome to METTLER TOLEDO LabX

LabX is a high quality software designed and built by METTLER TOLEDO assuring the highest integration, compatibility and reliability.

Congratulations on your choice of LabX as a system to be closely evaluated and welcome to our fast growing community of LabX users. LabX is a single software for multiple instruments bringing instrument control and data control to your Lab.

LabX is by design a client server application so that users can work entirely from either the touchscreen of the instrument or from any of the connected PCs. Starting with connecting one instrument on a local system to up to 30 instruments per server, your LabX system can grow with your needs even into a multiple server and distributed system.

LabX as part of METTLER TOLEDO product portfolio benefits from a world wide service of competence provided locally by your METTLER TOLEDO partner of trust. That assures the excellent services you as a METTLER TOLEDO customer are used to.

LabX is delivered on a write protected USB flash drive which ensures that no data can be written or deleted on the drive. This write protected mode allows the same security level as a DVD.

METTLER TOLEDO LabX is either a registered trademark or a trademark of Mettler-Toledo GmbH in Switzerland and/or other countries.

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All other trademarks are the property of their respective owners.

2 Purpose of the software

LabX is a single laboratory software for multiple instruments that brings instrument control and data control to the following benchtop instruments:

- Excellence balances XP / XS / XPE / XSE
- Excellence balances XPR / XSR
- Quantos, automatic dosing systems
- Titration Excellence T50 / T70 / T90
- Titration Excellence T5 / T7 / T9
- Compact Titration G20 / G20 S not in combination with the option **Regulation**.
- Compact Titration V20 / V30 / C20 / C30
- Compact Titration V20 S / V30 S / C20 S / C30 S
- SevenExcellence™ multi parameter instruments
- UV/VIS Excellence spectrophotometers
- Thermal Value Excellence, melting point systems MP70 / MP80 / MP90
- Density meters and refractometers DM40 / DM45 / DM50 / RM40 / RM50 / DX40 / DX45 / DX50 / X40 / RX50
- Density meters and refractometers D4 / D5 / D6 / R4 / R5 / RX4 / RX5

Regulations like 21 CFR part 11, EU Annex 11, and the aspects of GMP are fully supported and validation services qualify the system at point of installation.

The unique design of LabX allows users to work from the computer or the instrument, or from both. The instrument becomes like any other client within the network, connected to the same server database.

The LabX system is at the instrument level controlling the instruments and securing the data. This complete solution can in turn be connected to other Lab systems like ELN, LIMS, ERP, SAP or other data management systems. The loop of data security, traceability and paperless Lab is made possible because the instruments that start the process of data acquisition like a Balance or a Titrator are then connected in true bi-directional data flow all the way through to the final data repository.

Methods are brought directly onto the instrument. The complete step-by-step user guidance ensures that the users follow the SOP of the lab. The user works entirely on the touchscreen of the instrument or from the computer and the data is automatically transferred to the database, to reports, and on to other systems without the need of manual transcription.

LabX powers the bench in that it handles multiple instruments with one common user interface and database and removes the need for manual transcription of data.

3 Purpose of this document

This document is intended to provide a structured overview of METTLER TOLEDO LabX software. It serves as a walkthrough guide to plan an upcoming installation as well as to identify and provide the optimal network infrastructure to run LabX smoothly.

IT technicians, managers as well as key users and employees involved in the project will find information about:

- preparation and planning of the installation
- the general layout of the software
- the implemented components
- dimensioning and scalability of the system
- typical and recommended installation

Installation team and skills

For installation and maintenance an experienced computer user is required. If LabX is operated in the distributed installation mode, an IT specialist for installation and maintenance who has knowledge of Microsoft networks configuration and Microsoft SQL Server is required.

Operators at instruments do not need additional knowledge of LabX. An operator who is trained in operating a stand-alone instrument is able to operate the same instrument that is connected to LabX.

Operators designing methods and reports need the following skills: Good knowledge of company internal processes and standard operating procedures as well as good general computer knowledge. Training by METTLER TOLEDO is highly recommended.

4 How to use the document

This document focuses on common criteria and questions when preparing an installation of LabX. However, it is essential that the intended installation has been chosen in advance. Within the following three overall sections you will be guided through:

Sections 1 to 7 provide information about the software in general. The required components as well as the built-in frameworks are mentioned here. Influences on the design and layout of your installation are addressed in section 7.

Section 8 The most common installation types are listed within this section. Information about hardware with good performance, communication blueprint, ports and firewall settings, as well as infrastructure information can be found in this section. Please choose your installation type and go directly to the appropriate paragraph:

- [Single PC ▶ Page 14]
- [Distributed System ▶ Page 18]
- [Virtualized environment ▶ Page 26]

Sections 9 to 10 General information and follow ups are provided in this section. Access to METTLER TOLEDO Services and Support and the appendix with a collection of additional information can be found here.

All devices supported by LabX and the software versions are mentioned in the table [Compatibility matrix ▶ Page 28].

General instructions

The current document will be updated regularly. It can be found for download on the METTLER TOLEDO extranet in the corresponding product community. Please contact your METTLER TOLEDO representative for an updated version.

Where to find further information:

- The **Installation Instructions** manual enclosed enables you to quickly become familiar with the easy installation on a single computer or the more complex procedure on a distributed system. You will find an overview of the main working principles and the basic steps for setting up a system. In detailed topics you will learn how to use the software efficiently.
- The context-sensitive **On-line Help** integrated in the software provides a complete description of all components and modules and a detailed description of all parameters.

It can be accessed via the question mark in the upper right-hand corner of the appropriate title bar, or by using the F1 key from within LabX on the computer keyboard. A help button is also provided sometimes in dialog boxes.

See also

- 📄 Compatibility matrix ▶ Page 28

5 System specifications

5.1 Available systems

LabX is a client/server system. Every attached computer and instrument is treated as a client to the server. The system can be distributed over multiple servers (both virtual and physical) or strictly on one local computer. For the local system (Express edition) up to 3 instruments can be connected to one local computer. For the larger systems (Server edition), that can be either distributed or localized, up to 30 instruments can be connected to each server.

5.2 Licensing structure

LabX™ software comes conveniently on a USB flash drive, with all configurations and options handled via license keys. Choose your system based on a Starter Pack. In addition, LabX is licensed per connected instrument, therefore you only need a license per instrument and not for every computer. Further Option Licenses are added based on your needs.

Step 1

Select a Starter Pack according to your first instrument and the number of instruments you want to connect.

Starter Pack LabX Express

Connect up to three instruments

LabX Express

Instrument License *

Starter Pack LabX Server

Connect up to 30 instruments

LabX Server

Instrument License *

User Management

Auto Import / Export

Step 2

Extend your systems with optional packages according to your needs.

Option Licenses

User Management

Auto Import / Export

Regulation

Product Database

Statistical Evaluation

Report Designer

System Integration

STAReX Integration

Step 3

Add additional instrument licenses for all of your instruments.

Instrument Licenses

Balance

Titration

UV/VIS

SevenExcellence

Density Refractometry

Thermal Values

Quantos

Step 4

Complete your system by choosing your software services.

Software Services

Software Care Standard

Always get the latest software release and remote support.

Software Care Comprehensive

Always get the latest software release and profit from remote support and on-site support.

On-Demand Services

Choose additional services you need to complete your system.

* Starter Pack Titration includes both, one instrument license for a titrator and one for a balance.

5.2.1 LabX™ Starter Packs

Express Edition

Full version of LabX for installation on a single computer. Up to 3 instruments can be connected to this edition.

Name	Description	Order no.
Balance	1 Balance instrument license.	11153120
Density Refractometry	1 Density Refractometry instrument license.	11153130
Thermal Value	1 Thermal Value instrument license.	30005779
Quantos	1 Quantos instrument license.	30062403
Titration	1 Titration instrument license. 1 Balance instrument license.	30097754
UV/VIS	1 UV/VIS instrument license.	30247984
SevenExcellence	1 SevenExcellence instrument license.	30247987

Server Edition

Full version of LabX for installation on multiple computers and available in distributed network. Up to 30 instruments can be connected to this edition.

Name	Description	Order no.
Balance	1 Balance instrument license. User Management Option. Auto Import/Export Option.	11153121
Density Refractometry	1 Density Refractometry instrument license. User Management Option. Auto Import/Export Option.	11153131
Thermal Value	1 Thermal Value instrument license. User Management Option. Auto Import/Export Option.	30005810
Quantos	1 Quantos instrument license. User Management Option. Auto Import/Export Option.	30062404
Titration	1 Titration instrument license. 1 Balance instrument license. User Management Option. Auto Import/Export Option.	30097755
UV/VIS	1 UV/VIS instrument license. User Management Option. Auto Import/Export Option.	30247985
SevenExcellence	1 SevenExcellence instrument license. User Management Option. Auto Import/Export Option.	30247988

5.2.2 Instrument licenses

For each additional instrument to be connected to the LabX system, an "Instrument License" is needed.

Name	Description	Order no.
Excellence Balance	License for 1 Excellence balance	11153220
Density Refractometry	License for 1 Density Refractometry instrument	11153250
Thermal Value	License for 1 Thermal Value instrument	30005811
Quantos	License for 1 Quantos instrument	30062405
Titration	License for 1 Titration instrument	30097756
UV/VIS	License for 1 UV/VIS instrument	30247986
SevenExcellence	License for 1 SevenExcellence instrument	30247989

5.2.3 Option licenses

The LabX installation is fully extendable. See the options & functionalities below that can be added to the installation.

Name	Description	Order no.
User Management	Centrally maintain and control users and roles within LabX.	11153102
Product Database ¹⁾	Manage product data within LabX centrally – run methods based on product data.	11153103
Auto Import / Export	Import and export data into and from CSV and XML formats.	11153105
Statistical Evaluation	Analyze measurements and monitor trends and process changes, taking into account applicable regulations.	30262374
Regulation	Full support of regulatory requirements, including 21 CFR Part 11.	11153104
Report Designer	Freely customize your reports with all details and possibilities including charts, graphics, and tables.	11153106
System Integration	Integrate LabX installation with other software packages including LIMS and ERPs using API webservice.	11153107
STAReX Integration	Use LabX and any connected balance to automatically transfer the weight into STARe software for thermal analysis.	30486416

1) Option not available for titration applications

5.2.4 LabX Express to Server Sidegrade

LabX Express systems can be expanded to LabX Server.

Name	Description	Order no.
LabX Express - Server	Sidegrade a LabX Express edition installation into a LabX Server edition.	11153117

5.3 Languages

The following languages are available for LabX on the computer and the instrument.

Excellence instruments supported

Language	LabX	Balance	Quantos	Titration	Density Refractometry	Thermal Values	Seven-Excellence	UV/VIS
English	•	•	•	•	•	•	•	•
German	•	•	•	•	•	•	•	•
French	•	•	•	•	•	•	•	•
Italian	•	•	•	•	•	•	•	•
Spanish	•	•	•	•	•	•	•	•
Portuguese	•	• ¹⁾	• ¹⁾	•	•	•	•	•
Russian ²⁾	•	•	•	•	•	•	•	•
Chinese	•	•	•	•	•	•	•	•
Japanese	•	•	•	•	-	•	•	•

- 1) If the language of the LabX installation is not available on the instrument, individual texts are displayed on the instrument in English.
- 2) With a Russian installation of LabX, Russian keyboards are displayed on the balances for text input. Since not all characters can be entered via these keyboards, this must be taken into account when entering user names and passwords on the PC.

6 Software specifications

- LabX is a client server system.
- Clients are implemented as Windows executables. They are **not** web-based and **do not** require a web browser.
- Server components are hosted in Windows services and are controlled by the Windows Service Controller.

General specifications

After installation, LabX does not require write access to the installation directory. Write access is required for the LabX service user to the following folders:

Location		Permission	Applies to server
LabX\	Dir	Read / Execute / Write	Business server/Instrument server
- Log\	Dir	+ Write	Business server/Instrument server
- Licensing\	Dir	+ Write	Business server
- Ltfm.dat	File	+ Write	Business server
Export Directories	Dir	+ Write	Business server
Import Directories	Dir	+ Write	Business server

Machine key store permissions

Location	Permission	Applies to server
Keystore "SequoiaPasswordContainer" (2d38db507644999e24add5e4b60f96c1 _xxxxxxxx-xxxx-xxxx-xxxxxxxxxxxx)	Read	Business server

http namespace permissions

The "LabXServiceAccount" does also require permission on the following http namespaces to create the needed services. Default ports 51112 and 51155 on the LabX system can be changed during installation.

Location	Permission	Applies to server
http://servername:51153/LabX/BusinessService/meta	Generic All	Business server
http://servername:51112/LabX/DoorBellService	Generic All	Business server
http://servername:51156/LabX/SystemIntegrationService	Generic All	Business server
http://servername:51156/LabX/BasicSystemIntegrationService	Generic All	Business server

Database permissions

- Access to the DBMS that runs the LabX database.
- Insert, update, delete permissions on all tables (and views) of the LabX database ('data reader' and 'data writer' roles).

6.1 Client components

PC Client

The client contains a graphical user interface to operate the system from a PC.

DBMaintenance (Utility)

LabXDBMaintenance is required to manage (backup/restore/initialize/archiving) the LabX database.

InstallationChecker (Utility)

The InstallationChecker Application allows doublechecking the system where LabX is installed on, its configuration and installed components.

6.2 Server components

Business Server (part of Host Service)

A Business Server is the entry point for clients and is therefore the point of authentication to any client that wants to interact with the LabX system. The business server is the only component that accesses the database. The business service provides the core functionality of the system.

Instrument Server (part of Host Service)

An Instrument Service is responsible to connect instruments to the LabX system.

6.3 Third party components

Database

The database stores all data of the LabX system in a reliable way and provides fast access to it. The SQL Server Express Edition can be installed by the LabX installer. The option to access any SQL Server database that is installed and maintained by the customer is also provided.

The database collation for LabX has to be Latin1_General_CI_AS. The isolation level "snapshot" has to be enabled.

6.4 Other 3rd-Party Components

The following third party software is required by LabX Version 11 to run. The LabX installation will install the necessary components.

Software

Name	Version	Installed by LabX
PDF Reader ¹⁾	6.0	required but not installed
.Net Framework ²⁾	4.7.2	•

1) ► <http://www.adobe.com/de/products/reader.html>

2) ► <https://www.microsoft.com/net/download> > .NET Framework 4.7.2

E-Learning tutorial

To view the LabX training videos you require one of the following internet browsers.

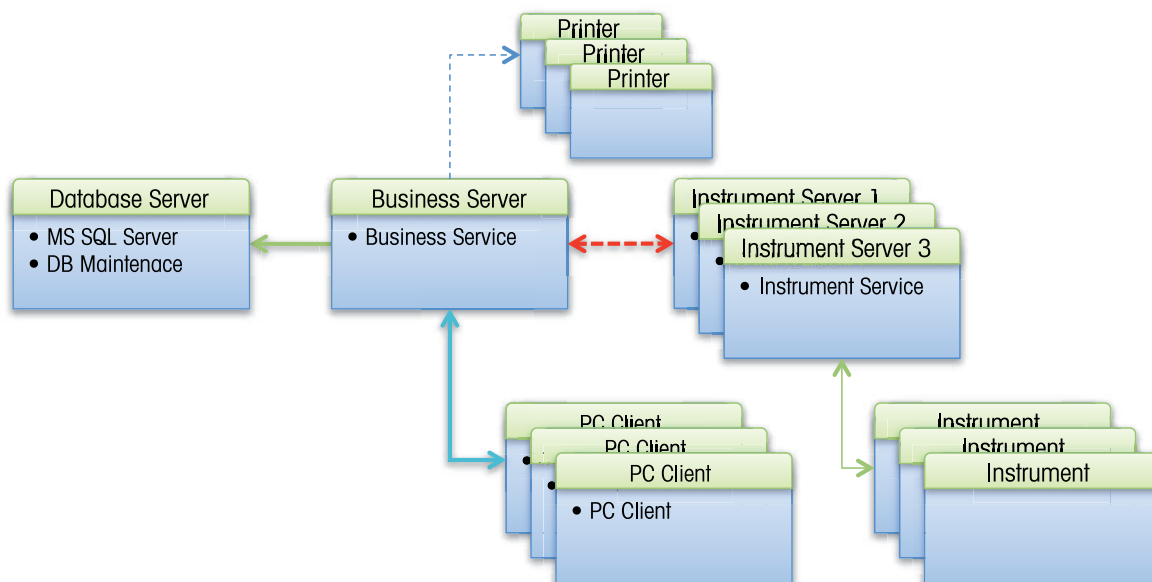
- Internet Explorer 9 and newer
- Firefox 35 and newer
- Chrome 40 and newer
- Edge 77 and newer

7 System dimension and scalabilities

Dimensioning the system

LabX is by design a highly reliable and scalable system. It can be run on a single PC hardware or in distributed environments with multiple servers. This chapter will support you by identifying and choosing the installation type which best fits your requirements.

Comparing to the general requirements in the previous chapter, installing the LabX system in a distributed mode requires some additional effort. The following diagram shows how the system should be set up in the distributed mode.



Running LabX in the distributed mode requires two high end servers, one for the database and one for the Business Server. Additional standard servers for connecting instruments can be used as instrument servers. As PC clients, standard computers can be used.

It is essential to choose the right environment to run LabX. Please answer the check question in the table below and find straight away the recommended solution:

LabX setup

No.	Check Question	Answer	Single PC	Distributed system
1	Number of instruments per LabX system		1...2 per cpu core	≥ 3 (system scales by number of instrument servers)
2	Maximum number of instruments per instrument server		1...2 per cpu core	System scaling dependent on hardware resources
3	Connected devices via RS232		Multiple	Multiple
4	Connected devices via USB		Multiple	Multiple
5	Connected devices via Ethernet		Multiple IP v4	Multiple IP v4
6	Number of T90/T9 Titrators running two tasks in parallel per LabX system		1...2	≥ 2 (system scaling by number of instrument servers)

All values are recommendations based upon best practices and experience.

Database selection and dimensioning

No.	Check Question	SQL Server Express	SQL Server Standard/ Enterprise
1	Distributed System	Yes	Yes
2	Number of instruments to be connected	2...3	>=3
3	Archiving	LabX DB Maintenance	LabX DB Maintenance
4	Archiving interval	6 to 12 month depending on workload	not required
5	DB Backup/Restore	LabX DB Maintenance	Professional Backup tool or LabX DB Maintenance ¹⁾
6	Thermal Value and Density instrument videos ²⁾	<= 150	> 150

1) It is recommended to use LabX DB Maintenance to restore backups that were created with an older version of LabX.

2) The max. number of stored videos can be limited over a Thermal Value and Density instrument specific settings in LabX.

All values are recommendations based upon best practices and experience.

8 Typical installation / Preparing the installation

8.1 Single PC

8.1.1 Introduction

On a single PC deployment, all LabX components are installed on a single workstation. This scenario is applicable for small installations with low data volume.

8.1.2 System requirements

The following table gives the minimal and the optimal hardware requirements for running a LabX system. If the CPU supports Hyper-Threading, you can double the available cores when calculating the hardware requirements. A Dual Core CPU would therefore be counted as a Quad Core.

Stand alone PC (For 2-3 instruments)

	Minimal (1 instrument only)	Optimal
CPU	2 GHz Dual Core	3 GHz Quad Core
RAM	4 GB	8 GB
Ethernet	100 Mbit/s	100 Mbit/s
Display Resolution	1280 × 800	1920 × 1080
Hard Disk	30 GB free space, 5400 rpm	60 GB free space
Operating system	Windows 10	Windows 10
USB port	For installation	For installation

8.1.3 Operating systems

The following list shows the supported operating systems of LabX Version 11. To operate LabX we recommend using **Windows 10** as client operating system.

Operating systems

Name	Service pack / Version	Editions	32 bit	64 bit
Windows 8.1	-	Standard, Pro, Enterprise		•
Windows 10	B 1903	Pro, Enterprise		•
Windows 10 LTSC	B 1903	Long Term Service Branch LTSC		•
Windows Server 2012	-	Foundation, Essentials, Standard, Datacenter		•
Windows Server 2012 R2	-	Foundation, Essentials, Standard, Datacenter		•
Windows Server 2016	-	Standard, Essentials, Datacenter		•
Windows Server 2019	-	Standard, Essentials, Datacenter		•

8.1.4 Database server

The following list shows an overview over the supported Microsoft SQL Server Editions. During the installation of LabX Version 11, the setup offers to install a **Microsoft SQL Server 2017 Express Edition**. You can install LabX on a **Microsoft SQL Server 2017 Full Edition** to avoid size limitations and other performance restrictions.

SQL Servers

Name	Service Pack	Editions
SQL Server 2014	SP3	Express and Standard/Enterprise
SQL Server 2016	SP2	Express and Standard/Enterprise
SQL Server 2017	CU13	Express and Standard/Enterprise

8.1.5 Additional software

Fingerprint reader

Fingerprint readers can be used for authentication as an alternative to password entry. In contrast to a conventional login with a user name and password, the user simply places a finger on the fingerprint reader. If the fingerprint is recognized, the user is authenticated in the same way as entering a user name and password. Fingerprint readers can be used for the following actions.

- Logging on to LabX
- Releasing a screen lock

- Signing various objects

USB drivers

- For connecting Density Refractometry, Titration Excellence, UV/VIS Excellence and SevenExcellence instruments, additional device specific USB drivers must be installed on the corresponding PCs. Install the USB drivers (can be found on the LabX USB flash drive) using an administrator account.

8.1.6 Connected instruments

LabX Version 11 supports the following instruments with the corresponding software versions.

Balance

Model	Terminal	Bridge	USB	Serial	Network
XP / XS Precision	5.00 / 5.10 / 5.20 / 5.30 / 5.40 / 5.50 / 5.61	4.24 / 4.25 / 4.30 / 4.40 / 4.41 / 4.42		•	•
XP / XS Analytical	5.00 / 5.10 / 5.20 / 5.30 / 5.40 / 5.50 / 5.61	4.24 / 4.25 / 4.30 / 4.40 / 4.41 / 4.42		•	•
XP / XS Micro	5.00 / 5.10 / 5.20 / 5.30 / 5.40 / 5.50 / 5.61	1.00 / 1.10 / 1.20		•	•
XPE / XSE Precision	1.10 / 2.00 / 2.01 / 2.11 / 2.20 / 2.21 / 2.22 / 2.23	1.00 / 1.10		•	•
XPE / XSE Analytical	1.10 / 2.00 / 2.01 / 2.11 / 2.20 / 2.21 / 2.22 / 2.23	1.10		•	•
XPR / XSR	2.0.201 / 2.0.202 / 2.0.203	1.0.202 / 1.0.203 / 1.0.204 / 2.0.202 / 2.0.203	•		•

Quantos

Model	Terminal	Bridge	USB	Serial	Network
XPE Analytical	2.00 / 2.01 / 2.11 / 2.20 / 2.21 / 2.22 / 2.23	1.10			•

Titration Excellence

Model	Firmware	USB	Serial	Network
G20 *	2.0.1 / 2.0.2 / 2.0.3	•		•
V20 / V30	3.0.1 / 3.0.2 / 3.0.3	•		•
C20 / C30	3.0.1 / 3.0.2 / 3.0.3	•		•
T50 / T70 / T90	4.0.1 / 4.0.2 / 4.0.3	•		•
G20 S *	5.3.0	•		•
V20 S / V30 S	5.3.0	•		•
C20 S / C30 S	5.3.0	•		•
T5 / T7 / T9	5.3.0	•		•

* Compact Titration G20 / G20 S not in combination with the option **Regulation**.

Density Refractometry

Model	Firmware	USB	Serial	Network
DM40 / DM45 / DM50 / DX40 / DX45 / DX50	2.6.0 / 2.6.1 / 2.6.2	•		•
RM40 / RM50 / RX40 / RX50	2.6.0 / 2.6.1 / 2.6.2	•		•
D4 / D5 / D6	1.0.0	•		•
R4 / R5 / RX4 / RX5	1.0.0	•		•

Thermal Value Excellence

Model	Firmware	USB	Serial	Network
MP70 / MP80 / MP90	2.10 / 2.11 / 3.00 / 3.01			•

SevenExcellence

Model	Firmware	USB	Serial	Network
SevenExcellence	4.2.1	•		•

UV/VIS Excellence

Model	Firmware	USB	Serial	Network
UV7 / UV5 / UV5Bio / UV5Nano	3.0.0	•		•

8.1.7 Network and firewalls

Firewall settings are set and unset in the current Firewall Profile.

A connection with a latency (RTT) of less than 50 ms is required.

	Port (Defaults)	Purpose
SQL Server		
Sqlbrowser.exe		Process which belongs to the Microsoft SQL Server and provides browsing services.
Sqlservr.exe		Main executable relating to Microsoft's SQL Server Suite. This server application provides SQL server services.
Programs		
LabXHost.exe		Incorporates the LabXHostService which hosts an instrument server and a business server component.
LabXPcClient.exe		The LabX UI application.
LabXDBMaintenance.exe		DB Backup/Restore Utility.
Default Ports TCP protocol		
Instrument Server	51154	Responsible for instrument communication and workflow execution.
Integration Service	51155	Part of the application programming interface (API).
Integration Meta Service	51156	Part of the application programming interface (API).
Business Server	51153	The LabX business logic.
Doorbell Service	51152	Handles the component communication within the LabX system.

For connecting instruments using a computer network to the LabX system, all firewalls need to be configured correctly. The firewall configuration on the computer side is performed by the LabX installation. The configuration on routers and firewalls have to be done manually.

The following list shows the instruments that can be connected by what transport mechanism. Listed are the TCP/IP ports that are needed by the Network and USB connections.

Model	Instrument Port *	USB	Serial	Network
XP/XS Precision	8014		•	•
XP/XS Analytical Bridge	8014		•	•
XP/XS Micro Bridge	8014		•	•
XPR/XSR balances	8014	•		•
Quantos balances	8014			•
QD205DR / QD206DR / XP205				
DM / RM / DX / RX	8014	•		•
MP70 / MP90	8014			•
SevenExcellence	8014	•		•
UV7 / UV5 / UV5Bio / UV5Nano	8014	•		•

* Default port on the instrument side, the instrument port can be changed anytime on the instruments.

8.1.8 Security and backup

The installer of the LabX system requires administrator privileges on all LabX computers and on the database system. For creating a backup or maintaining the LabX database, administrator or DB owner privileges are required as well. Standard PC-Client users or users on the instrument do not require any additional rights.

A backup system should be available, which supports a periodical backup of the SQL database. If no such tool is available, the built in LabX DB Maintenance tool can be used to perform a backup, but using a professional backup tool is also recommended.

Note

- It is recommended to use LabX DB Maintenance to restore backups that were created with an older version of LabX.

8.1.9 Checklist single PC

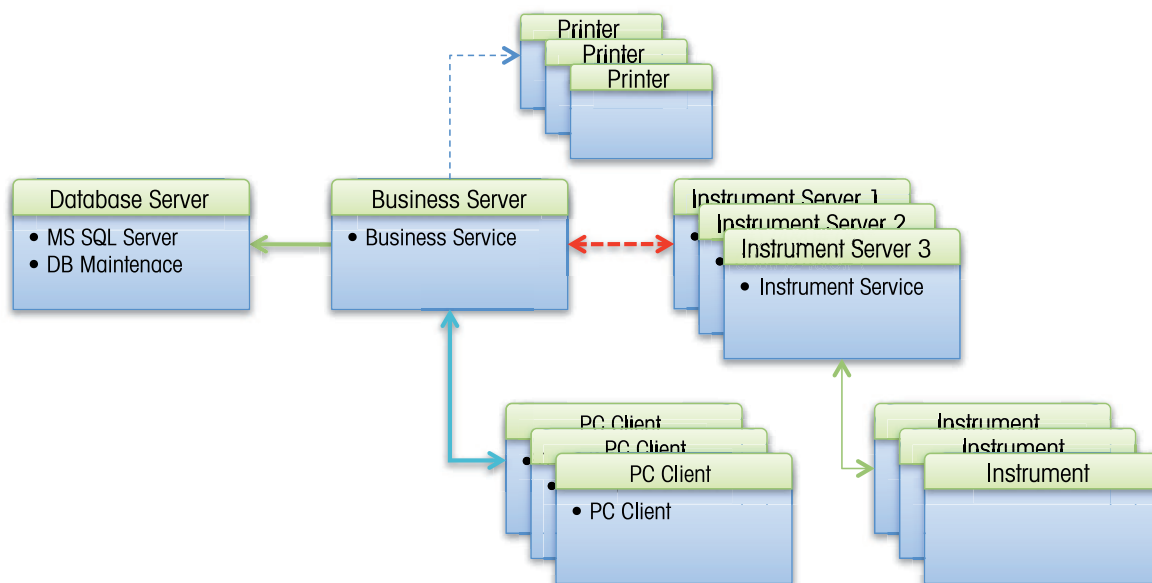
Single PC

No.	Description	Criterion	Pass	N/A
System requirements				
1	CPU	2 GHz Dual Core	<input type="checkbox"/>	<input type="checkbox"/>
2	RAM	4 GB	<input type="checkbox"/>	<input type="checkbox"/>
3	Ethernet	100 Mbps	<input type="checkbox"/>	<input type="checkbox"/>
4	Display Resolution	1280 × 800	<input type="checkbox"/>	<input type="checkbox"/>
5	Hard Disk	30 GB free space	<input type="checkbox"/>	<input type="checkbox"/>
6	USB port	For installation	<input type="checkbox"/>	<input type="checkbox"/>
Operating systems				
7	Windows 8.1	-	<input type="checkbox"/>	<input type="checkbox"/>
8	Windows 10	B 1903	<input type="checkbox"/>	<input type="checkbox"/>
9	Windows 10 LTSC	B 1903	<input type="checkbox"/>	<input type="checkbox"/>
10	Windows Server 2012	-	<input type="checkbox"/>	<input type="checkbox"/>
11	Windows Server 2012 R2	-	<input type="checkbox"/>	<input type="checkbox"/>
12	Windows Server 2016	-	<input type="checkbox"/>	<input type="checkbox"/>
13	Windows Server 2019	-	<input type="checkbox"/>	<input type="checkbox"/>
Database Mangement Server System (DBMS)				
14	SQL Server 2014	SP3	<input type="checkbox"/>	<input type="checkbox"/>
15	SQL Server 2016	SP2	<input type="checkbox"/>	<input type="checkbox"/>
16	SQL Server 2017	CU13	<input type="checkbox"/>	<input type="checkbox"/>
DB backup				
17	LabX DBMaintenance		<input type="checkbox"/>	<input type="checkbox"/>

8.2 Distributed System

8.2.1 Introduction

With the increasing size of the system, it is advisable for performance reasons to install certain components on separate computers. For example, the Business Server and the database server can be installed on a dedicated computer.



8.2.2 Additional software

Fingerprint reader

Fingerprint readers can be used for authentication as an alternative to password entry. In contrast to a conventional login with a user name and password, the user simply places a finger on the fingerprint reader. If the fingerprint is recognized, the user is authenticated in the same way as entering a user name and password. Fingerprint readers can be used for the following actions.

- Logging on to LabX
- Releasing a screen lock
- Signing various objects

USB drivers

- For connecting Density Refractometry, Titration Excellence, UV/VIS Excellence and SevenExcellence instruments, additional device specific USB drivers must be installed on the corresponding PCs. Install the USB drivers (can be found on the LabX USB flash drive) using an administrator account.

8.2.3 Connected instruments

LabX Version 11 supports the following instruments with the corresponding configuration. The instruments have to fulfill the requirements to operate with LabX.

Balance

Model	Terminal	Bridge	USB	Serial	Network
XP / XS Precision	5.00 / 5.10 / 5.20 / 5.30 / 5.40 / 5.50 / 5.61	4.24 / 4.25 / 4.30 / 4.40 / 4.41 / 4.42		•	•
XP / XS Analytical	5.00 / 5.10 / 5.20 / 5.30 / 5.40 / 5.50 / 5.61	4.24 / 4.25 / 4.30 / 4.40 / 4.41 / 4.42		•	•
XP / XS Micro	5.00 / 5.10 / 5.20 / 5.30 / 5.40 / 5.50 / 5.61	1.00 / 1.10 / 1.20		•	•
XPE / XSE Precision	1.10 / 2.00 / 2.01 / 2.11 / 2.20 / 2.21 / 2.22 / 2.23	1.00 / 1.10		•	•
XPE / XSE Analytical	1.10 / 2.00 / 2.01 / 2.11 / 2.20 / 2.21 / 2.22 / 2.23	1.10		•	•

Model	Terminal	Bridge	USB	Serial	Network
XPR / XSR	2.0.201 / 2.0.202 / 2.0.203	1.0.202 / 1.0.203 / 1.0.204 / 2.0.202 / 2.0.203	•		•

Quantos

Model	Terminal	Bridge	USB	Serial	Network
XPE Analytical	2.00 / 2.01 / 2.11 / 2.20 / 2.21 / 2.22 / 2.23	1.10			•

Titration Excellence

Model	Firmware	USB	Serial	Network
G20 *	2.0.1 / 2.0.2 / 2.0.3	•		•
V20 / V30	3.0.1 / 3.0.2 / 3.0.3	•		•
C20 / C30	3.0.1 / 3.0.2 / 3.0.3	•		•
T50 / T70 / T90	4.0.1 / 4.0.2 / 4.0.3	•		•
G20 S *	5.3.0	•		•
V20 S / V30 S	5.3.0	•		•
C20 S / C30 S	5.3.0	•		•
T5 / T7 / T9	5.3.0	•		•

* Compact Titration G20 / G20 S not in combination with the option **Regulation**.

Density Refractometry

Model	Firmware	USB	Serial	Network
DM40 / DM45 / DM50 / DX40 / DX45 / DX50	2.6.0 / 2.6.1 / 2.6.2	•		•
RM40 / RM50 / RX40 / RX50	2.6.0 / 2.6.1 / 2.6.2	•		•
D4 / D5 / D6	1.0.0	•		•
R4 / R5 / RX4 / RX5	1.0.0	•		•

Thermal Value Excellence

Model	Firmware	USB	Serial	Network
MP70 / MP80 / MP90	2.10 / 2.11 / 3.00 / 3.01			•

SevenExcellence

Model	Firmware	USB	Serial	Network
SevenExcellence	4.2.1	•		•

UV/VIS Excellence

Model	Firmware	USB	Serial	Network
UV7 / UV5 / UV5Bio / UV5Nano	3.0.0	•		•

8.2.4 Network and firewalls

Firewall settings are set and unset in the current Firewall Profile.

A connection with a latency (RTT) of less than 50 ms is required.

	Port (Defaults)	Purpose
SQL Server		
Sqlbrowser.exe		Process which belongs to the Microsoft SQL Server and provides browsing services.
Sqlservr.exe		Main executable relating to Microsoft's SQL Server Suite. This server application provides SQL server services.
Programs		
LabXHost.exe		Incorporates the LabXHostService which hosts an instrument server and a business server component.
LabXPcClient.exe		The LabX UI application.
LabXDBMaintenance.exe		DB Backup/Restore Utility.
Default Ports TCP protocol		
Instrument Server	51154	Responsible for instrument communication and workflow execution.
Integration Service	51155	Part of the application programming interface (API).
Integration Meta Service	51156	Part of the application programming interface (API).

	Port (Defaults)	Purpose
Business Server	51153	The LabX business logic.
Doorbell Service	51152	Handles the component communication within the LabX system.

For connecting instruments using a computer network to the LabX system, all firewalls need to be configured correctly. The firewall configuration on the computer side is performed by the LabX installation. The configuration on routers and firewalls have to be done manually.

The following list shows the instruments that can be connected by what transport mechanism. Listed are the TCP/IP ports that are needed by the Network and USB connections.

Model	Instrument Port *	USB	Serial	Network
XP/XS Precision	8014		•	•
XP/XS Analytical Bridge	8014		•	•
XP/XS Micro Bridge	8014		•	•
XPR/XSR balances	8014	•		•
Quantos balances	8014			•
QD205DR / QD206DR / XP205				
DM / RM / DX / RX	8014	•		•
MP70 / MP90	8014			•
SevenExcellence	8014	•		•
UV7 / UV5 / UV5Bio / UV5Nano	8014	•		•

* Default port on the instrument side, the instrument port can be changed anytime on the instruments.

8.2.5 Security and backup

The installer of the LabX system requires administrator privileges on all LabX computers and on the database system. For creating a backup or maintaining the LabX database, administrator or DB owner privileges are required as well. Standard PC-Client users or users on the instrument do not require any additional rights.

A backup system should be available, which supports a periodical backup of the SQL database. If no such tool is available, the built in DBMaintenance tool of LabX can be used to perform a backup, but using a professional backup tool is highly recommended.

Note

- It is recommended to use LabX DB Maintenance to restore backups that were created with an older version of LabX.

8.2.6 Windows Time Service

Note

- LabX requires an infrastructure which ensures that the time on all components is correct. Ensure that the Windows Time Service are configured correctly for all involved components.
 - ▶ [http://technet.microsoft.com/en-us/library/cc773013\(v=ws.10\).aspx](http://technet.microsoft.com/en-us/library/cc773013(v=ws.10).aspx)

8.2.7 Client

8.2.7.1 System requirements

The following table gives the minimal and the optimal hardware requirements for running a **LabX Version 11** system.

If the CPU supports Hyper-Threading, you can double the available cores when calculating the hardware requirements. A Dual Core CPU would therefore be counted as a Quad Core.

PC Client

	Minimal	Optimal
CPU	2 GHz Single Core	3 GHz Quad Core
RAM	4 GB	8 GB
Display Resolution	1280 × 800	1920 × 1080
Hard Disk	10 GB free space	10 GB free space
Operating system	Windows 10	Windows 10
Installed LabX Components	PC Client	PC Client

8.2.7.2 Operating systems

The following list shows the supported operating systems of **LabX Version 11**. To operate LabX we recommend using **Windows 10** as client operating system.

Operating systems

Name	Service pack / Version	Editions	32 bit	64 bit
Windows 8.1	-	Standard, Pro, Enterprise		•
Windows 10	B 1903	Pro, Enterprise		•
Windows 10 LTSB	B 1903	Long Term Service Branch LTSB		•
Windows Server 2012	-	Foundation, Essentials, Standard, Datacenter		•
Windows Server 2012 R2	-	Foundation, Essentials, Standard, Datacenter		•
Windows Server 2016	-	Standard, Essentials, Datacenter		•
Windows Server 2019	-	Standard, Essentials, Datacenter		•

8.2.7.3 Checklist

Client PC

No.	Description	Criterion	Pass	N/A
System requirements				
1	CPU	2 GHz Single Core	<input type="checkbox"/>	<input type="checkbox"/>
2	RAM	4 GB	<input type="checkbox"/>	<input type="checkbox"/>
3	Ethernet	100 Mbps	<input type="checkbox"/>	<input type="checkbox"/>
4	Display Resolution	1280 × 800	<input type="checkbox"/>	<input type="checkbox"/>
5	Hard Disk	10 GB free space	<input type="checkbox"/>	<input type="checkbox"/>
6	USB port	For installation	<input type="checkbox"/>	<input type="checkbox"/>
Operating systems				
7	Windows 8.1	-	<input type="checkbox"/>	<input type="checkbox"/>
8	Windows 10	B 1903	<input type="checkbox"/>	<input type="checkbox"/>
9	Windows 10 LTSC	B 1903	<input type="checkbox"/>	<input type="checkbox"/>
10	Windows Server 2012	-	<input type="checkbox"/>	<input type="checkbox"/>
11	Windows Server 2012 R2	-	<input type="checkbox"/>	<input type="checkbox"/>
12	Windows Server 2016	-	<input type="checkbox"/>	<input type="checkbox"/>
13	Windows Server 2019	-	<input type="checkbox"/>	<input type="checkbox"/>

8.2.8 Server

8.2.8.1 System requirements

If the CPU supports Hyper-Threading, you can double the available cores when calculating the hardware requirements. A Dual Core CPU would therefore be counted as a Quad Core.

Business Server

	Minimal	Optimal
CPU	2 GHz - 10 instruments or active users / core	3 GHz - 5 instruments or active users / core
RAM	4 GB	8 GB
Display Resolution	1280 × 800	1280 × 1024
Hard Disk	3 GB free space	10 GB free space
Operating system	Windows 10	Windows Server 2016
Installed LabX Components	Business Service (runs under LabX Service Account).	Business Service (runs under LabX Service Account).

Instrument Server

	Minimal	Optimal
CPU	2 GHz - 4 running tasks / core	3 GHz - 2 running tasks / core
RAM	4 GB	8 GB
Display Resolution	1280 × 800	1280 × 1024
Hard Disk	3 GB free space	10 GB free space
Operating system	Windows 10	Windows Server 2016
Installed LabX Components	Instrument Service (runs under LabX Service Account)	Instrument Service (runs under LabX Service Account)

8.2.8.2 Operating systems

The following list shows the supported operating systems of **LabX Version 11**. To operate LabX we recommend using **Windows Server 2016** as server operating system.

Operating systems

Name	Service pack / Version	Editions	32 bit	64 bit
Windows 8.1	-	Standard, Pro, Enterprise		•
Windows 10	B 1903	Pro, Enterprise		•
Windows 10 LTSB	B 1903	Long Term Service Branch LTSB		•
Windows Server 2012	-	Foundation, Essentials, Standard, Datacenter		•
Windows Server 2012 R2	-	Foundation, Essentials, Standard, Datacenter		•
Windows Server 2016	-	Standard, Essentials, Datacenter		•
Windows Server 2019	-	Standard, Essentials, Datacenter		•

8.2.8.3 Database server

The following list shows an overview over the supported Microsoft SQL Server Editions. During the installation of LabX Version 11, the setup offers to install a **Microsoft SQL Server 2017 Express Edition**. It is recommended to install LabX on a **Microsoft SQL Server 2017 Full Edition** to avoid size limitations and other performance restrictions.

SQL Servers

Name	Service Pack	Editions
SQL Server 2014	SP3	Express and Standard/Enterprise
SQL Server 2016	SP2	Express and Standard/Enterprise
SQL Server 2017	CU13	Express and Standard/Enterprise

Database Server

	Minimal	Optimal
CPU	2 GHz Dual Core	3 GHz Quad Core
RAM	4 GB	16 GB
Display Resolution	1280 × 800	1280 × 1024
Hard Disk	30 GB free space	100 GB free space
Operating system	Windows 10	Windows Server 2016

	Minimal	Optimal
SQL Server	MS SQL Server 2014 SP3	MS SQL Server 2017 CU13

8.2.8.4 Checklist

Server PC

No.	Description	Criterion	Pass	N/A
System requirements				
1	CPU	2 GHz Dual Core	<input type="checkbox"/>	<input type="checkbox"/>
2	RAM	8 GB	<input type="checkbox"/>	<input type="checkbox"/>
3	Ethernet	100 Mbps	<input type="checkbox"/>	<input type="checkbox"/>
4	Display Resolution	1280 × 800	<input type="checkbox"/>	<input type="checkbox"/>
5	Hard Disk	10 GB free space	<input type="checkbox"/>	<input type="checkbox"/>
6	USB port	For installation	<input type="checkbox"/>	<input type="checkbox"/>
Operating systems				
7	Windows 8.1	-	<input type="checkbox"/>	<input type="checkbox"/>
8	Windows 10	B 1903	<input type="checkbox"/>	<input type="checkbox"/>
9	Windows 10 LTSC	B 1903	<input type="checkbox"/>	<input type="checkbox"/>
10	Windows Server 2012	-	<input type="checkbox"/>	<input type="checkbox"/>
11	Windows Server 2012 R2	-	<input type="checkbox"/>	<input type="checkbox"/>
12	Windows Server 2016	-	<input type="checkbox"/>	<input type="checkbox"/>
13	Windows Server 2019	-	<input type="checkbox"/>	<input type="checkbox"/>
Database Mangement Server System (DBMS)				
14	SQL Server 2014	SP3	<input type="checkbox"/>	<input type="checkbox"/>
15	SQL Server 2016	SP2	<input type="checkbox"/>	<input type="checkbox"/>
16	SQL Server 2017	CU13	<input type="checkbox"/>	<input type="checkbox"/>
DB backup				
17	LabX DBMaintenance		<input type="checkbox"/>	<input type="checkbox"/>

8.3 Virtualized environment

Running LabX in a virtual machine (VM) requires specialized skills to set up and manage the virtualized environment. In particular, the performance of LabX can be affected by the activity of other VMs running on the same infrastructure, as well as how you configure the LabX VM itself.

Recommendations

The following recommendations come from our experience in running and testing LabX in virtualized environments.

- Know your platform. Consult the documentation for your operating system and your chosen virtualization technology, for details on setting up a reliable VM (virtual machine) image.
- Allocate enough memory. Ensure that your VM images have enough physical memory allocated to run LabX without swapping.
- Handle high I/O. Under normal usage, LabX requires a significant number of input/output (I/O) operations to the database and for each request. Ensure that you use the correct drivers and consider how you make storage available to your VMs to optimize this access.
- Handle peak CPU and memory usage. For certain operations LabX requires a significant amount of CPU and memory. Ensure that your virtualization infrastructure has the flexibility and capacity to deal with peak load, not just idle load.
- Synchronize time correctly. Some customers have had problems with time synchronization between the VM and the host system. This causes problems in LabX due to irregularities in the execution of scheduled tasks. We strongly recommend checking your VM time sync if you have issues with scheduled tasks in a virtualized environment.

9 METTLER TOLEDO support

METTLER TOLEDO Service knows exactly on what the fulfilment of your specific company's demands depend. Profit from the market leader's experience and guarantee by us the best possible availability, achievement and conformance of your instruments and equipment.

METTLER TOLEDO Service recommends you to consider the following key elements before finalizing a services program:

- You need your equipment to be up and running all the time.
- You want to maintain the accuracy and functionality of your equipment, regardless of circumstances and usage, for many years of dependable operations.
- You want optimal instrument configuration for your environment and applications that save you time and money.
- You are concerned with staying compliant to your quality requirements, applicable laws and regulations and you need to pass any audit flawlessly.
- Your operators and technical staff need to be safe and productive. They need to know how to operate and maintain your instruments.

Please find your country and the corresponding Service & Support here:

► <http://www.mt.com/contact>

10 Appendix

10.1 Compatibility matrix

Balances

Type / LabX version	2010	2012	2012 FR2	2013	2014	2014 FR2	2016	2017	2018	2019	V11
Balance											
XP / XS	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
		5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10
			5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20
					5.30	5.30	5.30	5.30	5.30	5.30	5.30
						5.40	5.40	5.40	5.40	5.40	5.40
								5.50	5.50	5.50	5.50
									5.61	5.61	5.61
XPE / XSE					1.02	1.10	1.10	1.10	1.10	1.10	1.10
							2.00	2.00	2.00	2.00	2.00
							2.01	2.01	2.01	2.01	2.01
								2.11	2.11	2.11	2.11
								2.20	2.20	2.20	2.20
									2.21	2.21	2.21
											2.22
											2.23
XPR / XSR									2.01	2.0201	2.0201
									2.02		2.0202
											2.0203

Quantos

XP / XS				1.0.2	1.0.2	1.0.2					
XPE							2.00	2.00	2.00	2.00	2.00
							2.01	2.01	2.01	2.01	2.01
								2.11	2.11	2.11	2.11
								2.20	2.20	2.20	2.20
									2.21	2.21	2.21
											2.22
											2.23

Instruments

Type / LabX version	2010	2012	2012 FR2	2013	2014	2014 FR2	2016	2017	2018	2019	V 11
Thermal Value Excellence											
MP70 / MP80 / MP90		1.20	1.30	1.30	1.30	1.30	1.30	1.30	2.10	2.10	2.10
			1.32	1.32	1.32	1.32	1.32	1.32		2.11	2.11
										3.00	3.00
											3.01
Density Refractometry											
DM40 / DM45 / DM50 / DX40 / DX45 / DX50 / RM40 / RM50 / RX40 / RX50	1.0.1	1.0.1	2.0.0	2.0.0	2.0.0	2.6.0	2.6.0	2.6.0	2.6.0	2.6.0	2.6.0
				2.0.1	2.0.1	2.6.1	2.6.1	2.6.1	2.6.1	2.6.1	2.6.1
									2.6.2	2.6.2	2.6.2
D4 / D5 / D6 / R4 / R5 / RX4 / RX5										1.0.0	1.0.0
Titration Excellence											
G20					2.0.0	2.0.1	2.0.1	2.0.1	2.0.1	2.0.1	2.0.1
								2.0.2	2.0.2	2.0.2	2.0.2
									2.0.3	2.0.3	2.0.3

Type / LabX version	2010	2012	2012 FR2	2013	2014	2014 FR2	2016	2017	2018	2019	V 11
V20 / V30					3.0.0	3.0.1	3.0.1	3.0.1 3.0.2	3.0.1 3.0.2 3.0.3	3.0.1 3.0.2 3.0.3	3.0.1 3.0.2 3.0.3
C20 / C30					3.0.0	3.0.1	3.0.1	3.0.1 3.0.2	3.0.1 3.0.2 3.0.3	3.0.1 3.0.2 3.0.3	3.0.1 3.0.2 3.0.3
T50 / T70 / T90					4.0.0	4.0.1	4.0.1	4.0.1 4.0.2	4.0.1 4.0.2 4.0.3	4.0.1 4.0.2 4.0.3	4.0.1 4.0.2 4.0.3
G20 S							5.0.0	5.1.0	5.2.0	5.3.0	5.3.0
V20 S / V30 S							5.0.0	5.1.0	5.2.0	5.3.0	5.3.0
C20 S / C30 S							5.0.0	5.1.0	5.2.0	5.3.0	5.3.0
T5 / T7 / T9							5.0.0	5.1.0	5.2.0	5.3.0	5.3.0
SevenExcellence											
Seven-Excellence							3.0.4	4.0.1	4.1.4	4.2.0	4.2.1
UV/VIS Excellence											
UV7 / UV5 / UV5Bio / UV5Nano							1.0.0 1.0.1	1.1.0	2.0.0	2.0.1	3.0.0

Client operating system

Name / LabX Version	Bit	2013	2014	2014 FR2	2016	2017	2018	2019	V 11
Windows XP (Professional Edition)	32 / 64	SP3							
Windows Vista (Ultimate, Business, Enterprise)	32 / 64	SP2	SP2						
Windows 7 (Ultimate, Professional, Enterprise)	32 / 64	SP1 / SP1	SP1 / SP1	SP1 / SP1	SP1 / SP1	- / SP1	- / SP1	- / SP1	
Windows 8 (Standard, Pro, Enterprise)	32 / 64		• / •						
Windows 8.1 (Standard, Pro, Enterprise)	32 / 64			• / •	• / •	- / •	- / •	- / •	- / •
Windows 10 (Pro, Enterprise)	64				•	B 1511	B 1607	B 1709	B 1903
Windows 10 (Long Term Service Branch LTSB)	64				•	•	B 1607	B 1607	B1903

Server operating system

Name / LabX Version	Bit	2013	2014	2014 FR2	2016	2017	2018	2019	V 11
Windows Server 2003	32 / 64	SP2							
Windows Server 2003 R2	32 / 64	SP2							
Windows Server 2008	32 / 64	SP2	SP2	SP2					
Windows Server 2008 R2	64	SP1	SP1	SP1	SP1	SP1	SP1	SP1	
Windows Server 2012 (Foundation, Essentials, Standard, Datacenter)	64		•	•	•	•	•	•	•
Windows Server 2012 R2 (Foundation, Essentials, Standard, Datacenter)	64			•	•	•	•	•	•
Windows Server 2016 (Standard, Essentials, Datacenter)	64						•	•	•
Windows Server 2019 (Standard, Essentials, Datacenter)	64								•

SQL Servers

MS SQL Server / LabX version	2010	2012	2012 FR2	2013	2014	2014 FR2	2016	2017	2018	2019	V11
2005	SP2 / SP3	SP2 / SP3	SP4								

MS SQL Server / LabX version	2010	2012	2012 FR2	2013	2014	2014 FR2	2016	2017	2018	2019	V11
2008	SP1	SP1 / SP2	SP2	SP3	SP3						
2008 R2		•	•	SP2	SP2	SP2	SP2	SP3	SP3		
2012				•	SP1	SP1	SP1	SP3	SP3	SP4	
2014						•	•	SP1	SP1	SP2	SP3
2016									•	SP1	SP2
2017										•	CU13

10.2 Accessories

In addition the instruments that can be connected to LabX, the following accessories are supported by LabX.

10.2.1 Fingerprint Reader

The fingerprint reader can be used to authenticate a user by using a fingerprint.

Model
digitalPersona (Driver version 2.3.1.767)

10.2.2 Barcode Reader

The barcode reader can be used to start methods, sample series and products.

Model
Any windows compatible barcode reader Support linear barcodes: 25, 39, 93, 128 A/B/C, EAN 5/8/13, GS-128 ¹⁾

¹⁾ ► <http://www.activebarcode.de/codes/>

10.2.3 Label Printer

The following label printers are supported by LabX.

Model
Zebra TPL-2844

10.3 Security and rights

The installer of the LabX system requires administrator privileges on all LabX computers and on the database system. For creating a backup or maintaining the LabX database, administrator or DB owner privileges are required as well. Standard PC-Client users or users on the instrument do not require any additional rights.

LabXServiceAccount

The services of LabX run by default under the internal "Network Service" user which has extended rights on the computer. When LabX is printing on network printers or the LabX system is in installed in distributed mode, a user "LabXServiceAccount" should be created to run the LabX services. The "LabXServiceAccount" requires the following permissions.

For "LabXServiceAccount" used in connection with Active Directory authentication see [Configuring Single Sign-On (SSO) ► Page 32].

The service account requires read rights for users and computers in Active Directory.

File system Permissions

The "LabXServiceAccount" requires to read all files in the installation directory of LabX. Also it must be able to write on several files as shown in the following list:

Location		Permission	Applies to server
LabX\	Dir	Read / Execute / Write	Business server/Instrument server
- Log\	Dir	+ Write	Business server/Instrument server
- Licensing\	Dir	+ Write	Business server
- Lffm.dat	File	+ Write	Business server
Export Directories	Dir	+ Write	Business server
Import Directories	Dir	+ Write	Business server

Windows Permission

Additional to the file permission the "LabXServiceAccount" has to be a member of the windows domain. The user has to be able to access the printers that will be used in LabX and needs the "Logon as Service" privilege.

Machine Key Store Permissions

As the LabX system encrypts data, the "LabXServiceAccount" requires access to the given Machine Key Store. You will find more information on that topic under:

► [https://msdn.microsoft.com/en-us/library/windows/desktop/bb204778\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/windows/desktop/bb204778(v=vs.85).aspx).

Location	Permission	Applies to server
Keystore "SequoiaPasswordContainer" (2d38db507644999e24add5e4b60f96c1 _xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxxxx)	Read	Business server

http Namespace Permissions

The "LabXServiceAccount" does also require permission on the following http namespaces to create the needed services. Default ports 51112 and 51155 on the LabX system can be changed during installation.

Location	Permission	Applies to server
http://servername:51153/LabX/BusinessService/meta	Generic All	Business server
http://servername:51112/LabX/DoorBellService	Generic All	Business server
http://servername:51156/LabX/SystemIntegrationService	Generic All	Business server
http://servername:51156/LabX/BasicSystemIntegrationService	Generic All	Business server

Database Permissions

During installation, the installer offers to either install an SQL Server Express Edition or to use an existing database server. In the latter case, the database administrator is responsible to prepare the database server for LabX by creating the database and granting permissions.

The administrator installing LabX on a dedicated SQL database server, is ideally owner of the LabX database. The "LabXServiceAccount" should have reading and writing permissions within the LabX database. This is configured by the LabX installer.

10.3.1 Configuring Single Sign-On (SSO)

Description for Windows Security, Kerberos Authentication. This description is valid only if the Single Sign-On function is used, and the LabX business server is not operated using the Network Service account.

▶ <https://technet.microsoft.com/en-us/library/hh831553.aspx>

The SPN (service principal name) service is used to authenticate Single Sign-On users in LabX.

▶ [https://msdn.microsoft.com/en-us/library/ms677949\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/ms677949(v=vs.85).aspx).

Before the Kerberos authentication service can use an SPN to authenticate a service, the SPN must be registered on the account object that the service instance uses to log on. For LabX, the SPN must be registered for the LabX business service user.

There are two options to register a SPN:

1. Domain account

To register the SPN to the service account using the Setspn tool, the caller must have write-access to the servicePrincipalName attribute of the target account.

▶ [https://technet.microsoft.com/en-us/library/cc731241\(ws.10\).aspx](https://technet.microsoft.com/en-us/library/cc731241(ws.10).aspx)

Typically, write access is granted by default only to domain administrators.

▶ [https://msdn.microsoft.com/en-us/library/ms676922\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/ms676922(v=vs.85).aspx)

2. Network service or Local System user

For local services, the system allows a service to run under the LocalSystem account to register its own SPNs on the computer account of the service's host. In this case, the caller does not require write-access to the servicePrincipalName attribute of the target account.

▶ [https://msdn.microsoft.com/en-us/library/ms676922\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/ms676922(v=vs.85).aspx)

Impact on the installation of LabX

No additional action are to be considered if the LabX business server is operated using the network service credentials. Otherwise the following manual steps are required to secure the Active Directory authentication:

- Define a unique SPN
(ex. LabX/\$LabXBusinessServerDNSName\$)
- ▶ [https://msdn.microsoft.com/en-us/library/ms677949\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/ms677949(v=vs.85).aspx).
- Register the SPN for the LabX service account using Setspn
(ex. setspn.exe -U -A LabX/\$LabXBusinessServerDNSName\$ DOMAIN\SERVICEACCOUNT)

▶ [https://technet.microsoft.com/en-us/library/cc731241\(ws.10\).aspx](https://technet.microsoft.com/en-us/library/cc731241(ws.10).aspx)

By default the caller requires to be a member of the domain administrators.

▶ [https://msdn.microsoft.com/en-us/library/ms676922\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/ms676922(v=vs.85).aspx)

- On all LabX client machines edit the configuration file of the PC Client. (\$LabXInstallationDirectory\$\LabXClient.exe.config)

Remove the following line:

```
<endpoint name="ActiveDirectoryAuthenticationService"
binding="netTcpBinding"
bindingConfiguration="ActiveDirectoryAuthenticationBinding"
contract="MT.Sequoia.Platform.Business.Contracts.IActiveDirectory
AuthenticationService"/>
```

Insert the following line:

```
<endpoint address="net.tcp://localhost:8701/LabX/ActiveDirectory
AuthenticationService"
name="ActiveDirectoryAuthenticationService"
binding="netTcpBinding"
bindingConfiguration="ActiveDirectoryAuthenticationBinding"
contract="MT.Sequoia.Platform.Business.Contracts.IActiveDirectory
AuthenticationService">
  <identity>
    <servicePrincipalName value="LabX/$LabXBusinessServerDNSName$"/>
  </identity>
</endpoint >
```

10.4 Handling of passwords in LabX

Transmission of passwords between instrument and LabX server

Public key cryptography (RSA with a key length of 1024 bit) is used to secure the transmission of passwords in LabX.

This mechanism is applied for transferring all kind of passwords, independent if Active Directory credentials or the LabX internal credentials for authentication are configured.

Limitation: In the current version of LabX, instruments do not validate the authenticity of the LabX server with the effect that there is no man-in-the-middle (MITM) protection available. If enabling the Active Directory authentication, we recommend connecting the instruments via an isolated network to the LabX system and prevent physical access to it.

Transmission of passwords between PC Client and the server

- If Active Directory credentials are used in combination with Single Sign-On (SSO), the Microsoft Windows internal (Kerberos) transmission method is used. In this mode LabX does not transfer any password over the wire.
- If the LabX internal credentials or the Active Directory credentials are used for authentication without Single Sign-On (SSO), public key cryptography (RSA with a key length of 1024 bit) is used to secure the transmission of passwords in LabX.

Limitation: In the current version of LabX the PC clients do not validate the authenticity of the LabX system with the effect that there is no man-in-the-middle (MITM) protection available. If enabling the Active Directory authentication, we recommend to activate the Single Sign-On (SSO) feature.

Storing of passwords

- If internal authentication is configured, the salt (cryptography) and the password are processed with a cryptographic hash function, and the resulting output is stored in a database. To generate hash values, the SHA-1 algorithm is used with a hash size of 160 bit.
- If Active Directory authentication is configured, no password related data is stored in the database.

See also

- RSA ► [https://en.wikipedia.org/wiki/RSA_\(cryptosystem\)](https://en.wikipedia.org/wiki/RSA_(cryptosystem))
- SSO ► https://en.wikipedia.org/wiki/Single_sign-on
- Kerberos ► [https://msdn.microsoft.com/en-us/library/windows/desktop/aa378747\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/windows/desktop/aa378747(v=vs.85).aspx)
- SHA-1 ► [https://msdn.microsoft.com/en-us/library/system.security.cryptography.sha1\(v=vs.110\).aspx](https://msdn.microsoft.com/en-us/library/system.security.cryptography.sha1(v=vs.110).aspx)

10.5 Service dependencies

The LabXHost service depends on the following services.

Windows Windows 8.1 and 10

- DHCP
- RPCSS
- Sens
- Winmgmt
- SQL Server (only if locally installed)

Although **LabXHostService** service has no direct dependency on the Firewall Service, it must be enabled during the installation to be capable to change the FW settings.

Note

A correct WinHTTP Proxy (proxycfg.exe) configuration is necessary, otherwise the LabXService cannot start. Alternative: Disable Root Certificat Update in Add/Remove Windows Features.

10.6 Network performance

In general, the network connection between all components requires low latency and low packet loss rates. All following figures are indicative only. The effective link speed depends heavily on the type of instrument, the kind of measurement and running report generations. Titrators generally require more bandwidth than balances. Balance interval weighing measurements require more bandwidth than single weight measurements.

Required link speed between PC clients and business server

As a base value, 0.2 Mbit/s is required for each open workbench (T9 and T90 count double to visualize the data in "real time". In addition, high peak loads depend on the user's actions, e.g. opening the result set of an extensive task. The network infrastructure must be appropriately dimensioned to achieve good system performance.

Required link speed between instrument server and connected instruments

As a base value, 0.2 Mbit/s is required for each running task.

Required link speed between instrument server and business server

As a base value, 0.2 Mbit/s is required for each running task. In addition, high peak loads depend on user actions, e.g. viewing results of extensive tasks on the instrument. The network infrastructure must be appropriately dimensioned to achieve good system performance.

Required link speed between the business server and the database

As a base value, 0.4 Mbit/s is required for each running task. In addition, high peak loads depend on the performed actions of all connected users. The network infrastructure must be appropriately dimensioned to achieve good system performance.

10.7 Arithmetic model

Calculations in LabX are performed according to IEEE-754-2008. The IEEE 754 standard requires support for a number of operations. These include arithmetic operations such as add, subtract, multiply, divide, square root, conversion operations, scaling, and comparisons. The results of these operations are to be the same for all implementations of the standard, for a given format and rounding mode.

10.7.1 Computations and accuracy

LabX performs each of the computational operations that return a numeric result by using the maximum available accuracy and then performs the rounding as the last step, according to the settings in the result calculations if necessary.

Example

Where N is a number and R a result.

- Result R1 to be presented to the nearest 3 decimal points.

N1		1.123456
N2	+	1.1234567
R1 without rounding	=	2.2469127
R1 with rounding		2.247

- Result R2 to be presented to the nearest 4 decimal points.

- $N3 = 2.21311$

- $R2 = R1 + N3$

R1		2.247
N3	+	2.21311
R2 without rounding	=	4.46011
R2 with rounding		4.4601

Note

For R2 the available accuracy regarding R1 is three decimals and not the full accuracy, according to the settings in the result calculations.

10.7.2 Infinity and NaN

- For both "NaN" and "Infinity", LabX indicates all result states as **Not OK**.
- LabX preserves all representations of "NaN" and "Infinity" numbers upon importing and exporting data.

10.7.3 Rounding

LabX is applying the default rounding of the IEEE-754 for all computations. Negative and positive numbers are treated the same way by "Round half to even". This procedure treats positive and negative values symmetrically, and is free of sign bias.

Examples

Number	Number rounded
+ 13.5	+ 14
+ 14.5	+ 14
- 13.5	- 14
- 14.5	- 14

All numbers are rounded to +14 or - 14 because it is an even number. All other numbers which are not ending in 0.5 round to nearest digit as usual.

Further examples

Number	Number rounded
+ 13.6	+ 14
- 13.4	- 13
+ 6.6	+ 7
+ 6.4	+ 6

 **Note**

- Results of piece counting in LabX may differ slightly from stand-alone balances because different types of rounding are applied. LabX uses "Round half to even" for all calculations. Balances on the other hand use "Round half away from zero".

10.7.4 Trailing zeroes in calculations and results

LabX adds trailing zeros according to the settings in the result calculations.

Example

Where N is a number and R a result.

N1 entered as 1.2		1.2
R2 is defined to 2 decimal places	+	1.23
R3 is defined to 4 decimal places	=	2.4300

10.7.5 Significant digits

LabX is using fix point arithmetic based on the "Microsoft .NET data type decimal". For database persistence reasons LabX supports 14 digits before and after the decimal separator.

99999999999999 . 99999999999999
14 digits 14 digits

Significant digits

99999999999999 . 99999999999999
14 digits 14 digits
←—————→
15 digits

When using the calculation functions the significant digits are limited to 15. This is related to the internal Microsoft .NET data type double conversion. At the end a decimal is used to store the data. Because of the floating point behaviour, the decimal point is not fix.

1. In
2. logb
3. log
4. ND
5. NDn-1
6. Pow
7. RSD
8. RSDn-1
9. Sqrt
10. SD
11. SDn-1

See also

Microsoft .NET data type decimal ► [https://msdn.microsoft.com/en-us/library/system.decimal\(v=vs.110\).aspx](https://msdn.microsoft.com/en-us/library/system.decimal(v=vs.110).aspx)

10.7.6 Standard deviation

LabX statistic calculations follow the Bessel's correction. For sample standard deviation $n - 1$ is used, where n is the number of observations in a sample. This corrects the bias in the estimation of the population variance, and some of the bias in the estimation of the population standard deviation.

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