



FORCE MES LITE

System requirements

Version 5.12



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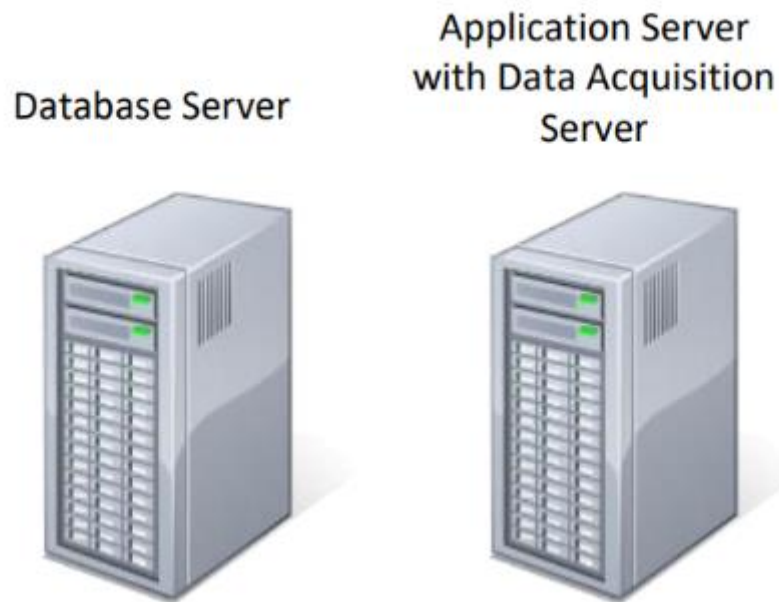
1 Updates and discontinuation

FORCE MES LITE	5.11	5.12	Note
Operating System	Windows Server 2012 (R2) Windows Server 2016 Windows Server 2019	Windows Server 2012 (R2) Windows Server 2016 Windows Server 2019 Windows Server 2022	Not supported anymore (Restricted)
Database	MS SQL Server 2016 MS SQL Server 2019	MS SQL Server 2016 MS SQL Server 2019	Recommended
Java	Java 11 (OpenJDK)	Java 11 (OpenJDK)	Long Term Version
Browser	Google Chrome MS Edge Chromium	Google Chrome MS Edge Chromium	Recommended – current versions

2 Infrastructure

2.1 Multi-tier architecture

Minimum: Two-tier architecture



Picture 1: Two-tier architecture (minimum requirement)

Recommended: Three-tier-architecture

We recommend using a three-tier architecture. i.e., separating database, application, and data acquisition:

Database Server

Application Server

Data Acquisition Server



It is recommended to run the Data Acquisition Server on premise.

Picture 2: Three-tier architecture (recommended)

Background information: two-tier vs. three-tier architecture

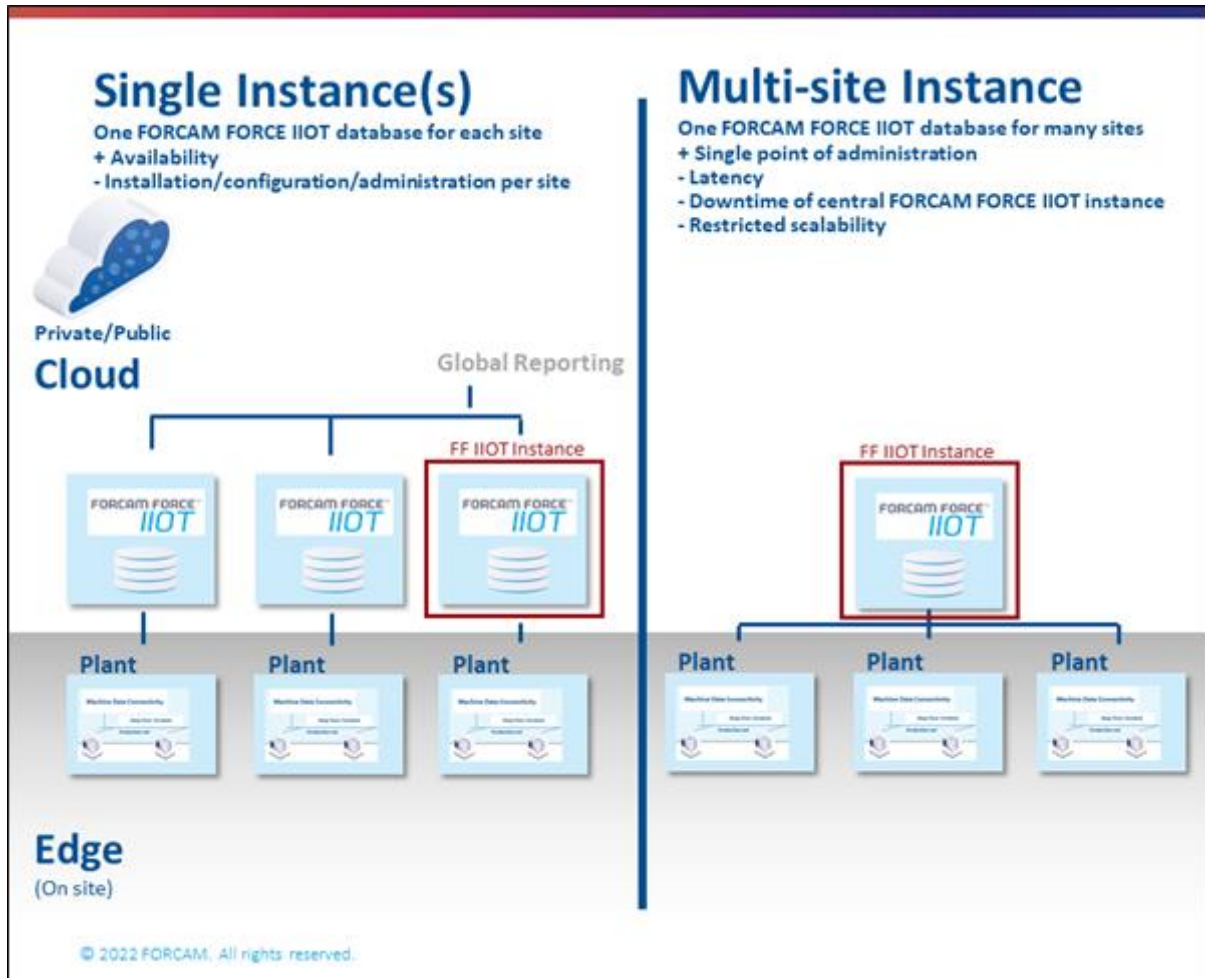
When taking architectural decisions, take the following differences into account:

Two-tier Architecture	Three-tier architecture
<ul style="list-style-type: none"> - Sufficient for small installations or early pilot phases for projects - Lower performance because DCU server runs in parallel on the application server - 	<ul style="list-style-type: none"> - Provides high performance for timely signal processing - Physical proximity to the machine parks can be an advantage, depending on the number and frequency of signals - Maintains network security (integrity) for machine parks in case of separated LAN networks (VLAN)

2.2 Limitations for one instance (single/multi-site)

To ensure a performant operation, the following system limits should not be exceeded.

- ⚠ The recommendations are based on empirical values from various FORCAM FORCE installations and should therefore be adhered to, if possible.



Picture 3: Single / multi-site instance

Limitation for each instance:

(1 Instance = 1 dedicated FORCAM FORCE MES LITE server + 1 dedicated database server)

500 workplaces and 300.000 events per shift

(for regular 8 hour shift)

2.3 TLS/SSL certificate for HTTPS

Customer responsibilities

- **Creation of SSL certificates**
- **Update of expired SSL certificates**

General information on certificates

To create an encrypted connection between a web server and a client, an SSL certificate for the web server is required. An SSL certificate is a file that contains information on the identity of the web server and the organization hosting it. Additionally, it contains cryptographic key material that is used for securing the communication channel between server and client.

How to obtain a certificate

The certificate needs to be obtained by the organization hosting the web server (i.e., the hostname needs to be in a domain owned by the organization) and is digitally signed by a certificate authority (CA). The clients connecting to FORCE MES LITE need to accept certificates signed by the CA in use as root of trust for successfully creating connections to the server. This is usually achieved by obtaining certificates signed by a CA that is considered trustworthy by the vendor of the web browser in use. The hostname referenced in the certificate needs to be the fully qualified domain name of the server in use. It needs to be possible for client machines to resolve it via the domain name service (DNS). Every instance of FORCE MES LITE needs to have its own certificate matching its host name.

- Certificates that are used and valid within the customer's IT infrastructure (as described above) need to be obtained from the customer's IT department.
or
- If the IT department does not maintain its own CA for internal use, a valid certificate should be obtained from a third-party certificate provider.

Technical requirements for certificates

- The hostname in the certificate needs to match the DNS host name of the FORCE MES LITE system.
- The expiration date of the certificate needs to be in the future, but not more than one year.
- The certificate should be created for web server use.
- The certificate should use a minimum key length of 2048 bits for RSA or 256 bits for ECDSA.
- The certificate signature algorithm should be SHA-256 or better.
- The certificate and key need to be available in the PKCS #12 file format and file extension "pfx".
- Password of certificate files should be provided to FORCAM.

3 Database server

MS SQL server license

For productive system environments, a Microsoft license for “SQL Server Standard Edition” (minimum) is required.

Options:

- License for each core
- or
- License for at least 1 CAL (Client Access License)

Overall server requirements

- 1 Server (physical or virtualized environment), intended for exclusive use with FORCE MES LITE
- CPU with at least Haswell technology (e.g, Intel Xeon E5) or higher, 4 cores, clocked with > 2 GHz
- 16 GB RAM
- Operating system: Windows Server or Unix, Linux
- Regarding anti-virus software, the recommendations of the OS vendor must be strictly observed, for Microsoft TechNet, observe the anti-virus exclusion list
- Server time zone must be UTC to cover the change to Daylight Saving Time
- Windows-Server user for FORCAM must have extended rights
- User of MS SQL server for FORCAM must also have extended rights (DB owner)

Specific database server requirements

- SQL Server 2016 or SQL Server 2019 or Oracle 12.2/19c
- HDD Raid Level 1, no striping (for physical devices)
- Best practice: 3 physically separated disks with
 - 100 GB + 1 GB per workplace for data,
 - 100 GB for log space,
 - 100 GB for tempdb and backups

3.1 Memory space of the SQL instance (recommendations)

- 1 GB of memory reserved for the operating system
- 1 GB each for every 4 GB of RAM after the initial 4 GB, up to 16 GB of RAM
- 1 GB each for every 8 GB in more than 16 GB of RAM

Example

If a 32 GB RAM database server is used, memory should be assigned to the operating system as follows:

- 1 GB, the minimum allocation
- + 3 GB, since $16\text{ GB} - 4\text{ GB} = 12\text{ GB}$; $12\text{ GB} \div 4\text{ GB}$ (each 4 GB gets 1 GB) is 3 GB
- + 2 GB, as $32\text{ GB} - 16\text{ GB} = 16\text{ GB}$; $16 \div 8$ (each 8 GB after 16 GB gets 1 GB) is 2 GB

In total, for a server with 32 GB of RAM, 7 GB will be reserved for the operating system.

The maximum memory allocated to the SQL server should be 25 GB.

For a 64 GB server, 10 GB should be reserved for the operating system and 54 GB should be allocated for the SQL server.

4 Application server

Overall Server Requirements

- 1 Server (physical or virtualized environment) dedicated only for use with FORCE MES LITE (without preceding load balancer)
- CPU (e.g. Intel Xeon E5) or higher, clocked with > 2 GHz
 - 4 cores for up to 150 workplaces
 - + 2 cores per additional 100 workplaces
- 32 GB RAM + 50 MB per workplace for a basic setup
 - Basic setup includes:
ffruntime-ignite, ffruntime, ffworkbench, ffworker, ffnewoffice , ffnewoffice-background, DCU/DACQ, FFauth
- Microsoft .NET-Framework version 3.5 must be installed
- Regarding anti-virus software:
 - The recommendations of the OS vendor must be strictly followed, for Microsoft TechNet Anti-Virus exclusion list (or more up to date)
 - The FORCE directory, its subfolders and FORCE Services must be excluded from the AV scan. If this is not possible for security reasons, the scan of this directory must only be performed sporadically at low-operational times, otherwise the performance of the application will be considerably reduced.
- Server time zone must be UTC to cover the change to Daylight Saving Time
- Windows-Server user for FORCAM must have administration rights
- If a FORCAM online license is used, an internet connection to the FORCAM license system is required.

 – For information on required ports, please refer to chapter 8.

Specific application server requirements

- Read/Write speed must be > 250 MB/sec.
- RAID system (for physical devices), best practice: RAID Level 1
- 1 partition physically separated from the OS containing 250 GB for exclusive use with FORCE MES LITE
- OpenJDK 11 (JDK and JRE), 64 Bit. If 2-tier architecture is being used, please install 32 Bit JDK also.

5 Data acquisition server

Overall Server Requirements

- 1 Server (physical or virtualized environment), intended for exclusive use with FORCE MES LITE
- CPU (e.g. Intel Xeon E5) or higher, 4 cores, clocked with > 2 GHz
- 12 GB RAM + 0,5 GB RAM per additional DCU¹
- At least 100 GB of available disk space
- Operating system: Windows Server 2016 or Windows Server 2019
- Regarding anti-virus software:
 - The recommendations of the OS vendor must be strictly followed, for Microsoft TechNet Anti-Virus exclusion list (or more up to date)
 - The FORCE directory, its subfolders and FORCE Services must be excluded from the AV scan. If this is not possible for security reasons, the scan of this directory must only be performed sporadically at low-operational times, otherwise the performance of the application will be considerably reduced.
- Server time zone must be UTC to cover the change to Daylight Saving Time
- Windows-Server user for FORCAM must have administration rights
- Should be very close to the Shopfloor – No Wireless (WAN) data communication

 – For information on required ports, please refer to chapter 8.

Specific data acquisition server requirements

- Only required for three-tier architecture
- OpenJDK 11 (JDK), 32 and 64 Bit, latest versions

¹ Depending on the load of this server (which depends on the number of configured machines/signals and the DACQ scripts and whether process data shall be collected), it might be necessary to equip the server also with additional compute cores.

6 Network

Overall network requirements

- 2x 1 Gbit NIC1 per server in failsafe-/load balancing mode
- Database server, application server and data acquisition server connected to Switched LAN (1 Gbit or better)
- Shopfloor network connected with at least 100 Mbit uplink to office network
- Best practice: Use LAN instead of WLAN to avoid problems with electro-magnetic interferences)
- For use in dedicated environments: optical (fibre) connections to reduce latency

7 Clients

Overall client requirements

- Windows 10, Windows 11
- Supported browsers: Google Chrome and Microsoft Edge with Chromium engine
- In general, no Java 11 (JRE) needed due to HTML5 technology
-

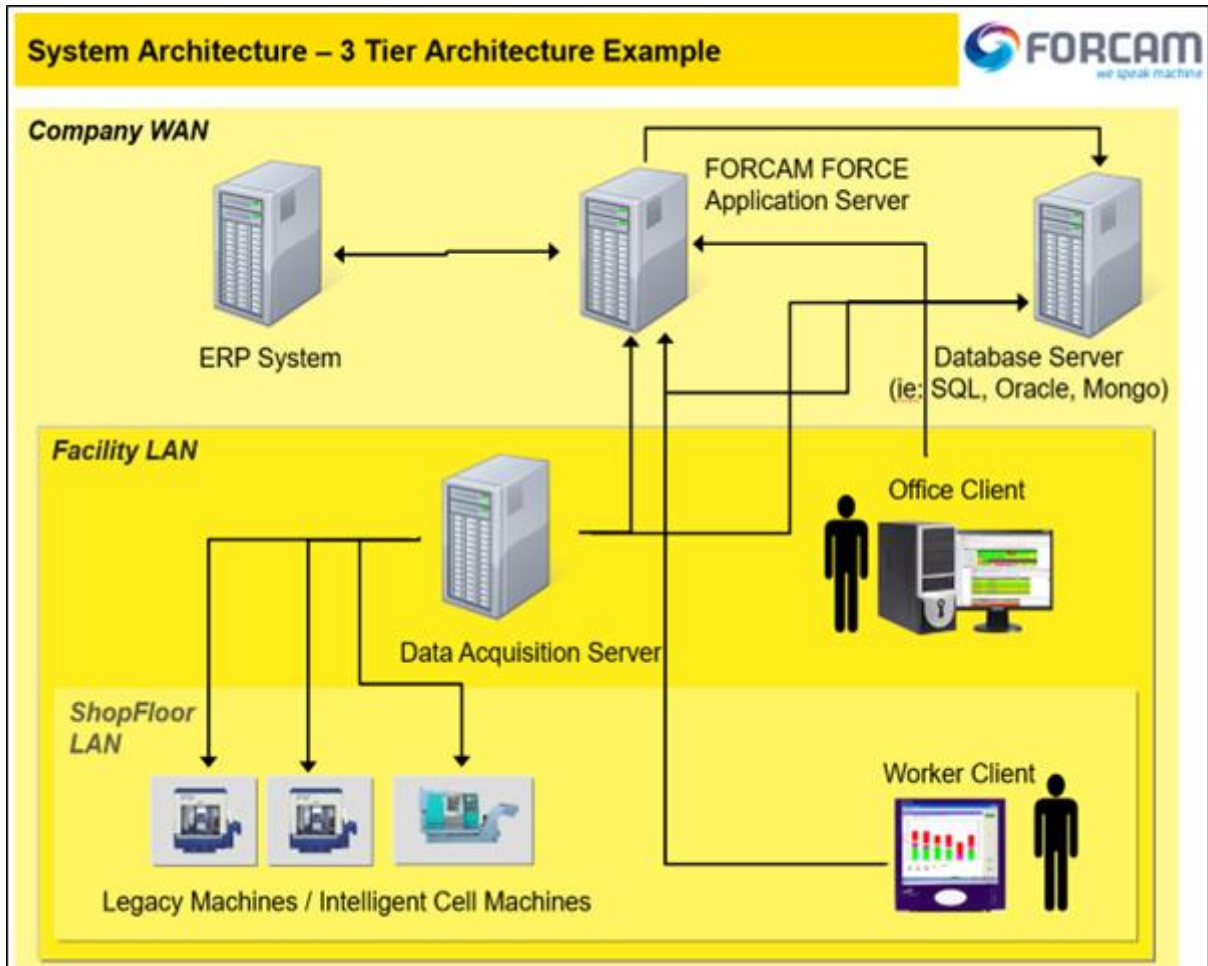
Hardware

- Minimum screen resolution: **1280 x 720 pixels**

8 Firewall

8.1 System architecture and overall recommendations

Note the overall system architecture when setting up the firewall:



Picture 4: System network architecture

- i All ports requested are to allow return traffic.
- ⚠ For the ports listed in the following chapters, port scan must be disabled, as a scan can drastically reduce the system performance and may cause serious problems.
- ⚠ To avoid exposing port 1099/TCP to the network, we recommend filtering it in the firewall setup.

8.2 IT infrastructure isolation

Source	Description	Destination	Port	Protocol	Comment
Office PCs	Access to FORCE MES LITE Office Client	FORCAM Application Server	19080	TCP	Configure in server.xml
	Access to FORCE MES LITE Workbench	FORCAM Application Server	15080	TCP	Configure in server.xml
	Access to FORCE MES LITE MDESimulator	FORCAM Application Server	16080	TCP	Configure in server.xml
	Access to FORCE MES LITE Shopfloor Terminal	FORCAM Application Server	11080	TCP	Configure in server.xml
	Access to FORCE MES LITE FFSetup	FORCAM Application Server	22080	TCP	configure in server.xml
	Access to FORCE MES LITE webservices	FORCAM Application Server	24080	TCP	Configure in server.xml
	Access to FORCE MES LITE Authorization	FORCAM Application Server	25080	TCP	Configure in server.xml
Office PCs (secured)	Access to FORCE MES LITE Office Client	FORCAM Application Server	19443	TCP	Configure in server.xml
	Access to FORCE MES LITE Workbench	FORCAM Application Server	15443	TCP	Configure in server.xml
	Access to FORCE MES LITE Shopfloor Terminal	FORCAM Application Server	11443	TCP	Configure in server.xml
	Access to FORCE MES LITE webservices	FORCAM Application Server	24443	TCP	Configure in server.xml
	Access to FORCAM FORCE MES LITE Authorization	FORCAM Application Server	25443	TCP	Configure in server.xml
Application Server	SQL Server database connections	FORCAM Database Server	1433	TCP	Database configuration
	Emailing reports and alerts (AutoReporting)	Company Mail Server	25	TCP	Configure in context.xml
	Access to ActiveMQ	FORCAM Application Server	61616	TCP	If separated, not likely
	Ignite	FORCAM Application Runtime	48100 to 48500	TCP	Configure in context.xml
	http/remote/runtime/server/port	FORCAM Application Runtime	10080	TCP	Configure in context.xml
	rmi/remote/server/port	FORCAM Application Runtime	1199	TCP	Configure in context.xml

Source	Description	Destination	Port	Protocol	Comment
	rmi/exporter/server/ port	FORCAM Application Runtime	1299	TCP	Configure in context.xml

8.3 Data acquisition server (DCU/DACQ) isolation

Source	Description	Destination	Port	Protocol	Comment
Data Acquisition Server	SQL Server database connections	FORCAM Database Server	1433	TCP	Database configuration
	ActiveMQ	FORCAM Application Server	61616	TCP	ActiveMQ configuration
	http/remote/runtime/server/port	FORCAM Application Runtime	10080	TCP	Configure in server.xml/javis.ini
	rmi/remote/server/port	FORCAM Application Runtime	1199	TCP	Configure in context.xml
	rmi/exporter/server/port	FORCAM Application Runtime	1299	TCP	Configure in context.xml
	Internal DACQ to DCU on server	FORCAM Data Acquisition Server	8765	TCP	Only if separate services
	Remote Restart of DACQ-scripting	FORCAM Data Acquisition Server	8775	TCP	

8.4 Shopfloor isolation

Source	Description	Destination	Port	Protocol	Comment
Shopfloor Terminals	Access to FORCE MES LITE Shopfloor Terminal	FORCAM Application Server	11080	TCP	Configure in server.xml
	Access to FORCE MES LITE Shopfloor Terminal	FORCAM Application Server	11443	TCP	Configure in server.xml
Data Acquisition Server	WAGO http access	Machines with ...	80	TCP	WAGO configuration page
	WAGO https access	Machines with ...	443	TCP	WAGO configuration page
	WAGO CodeSys Software	Machines with ...	2455	TCP	
	WAGO Controller - FORCAM I/O-Box	Machines with ...	3002	UDP	
	WAGO (Modbus, polling/send)	Machines with ...	502	UDP/TCP	

8.5 External access

Source	Description	Destination	Port	Protocol	Comment
External access	Access for: 1. Customer system for support 2. Customer access GUIs 3. Cloud environment	FORCAM Application Server	80, 443, 1998, 3389, custom, 10080, 10443, 11080, 11443, 15080, 15443, 16080, 16443, 19080, 19443, 24080, 24443, 25080, 25443	TCP	Customer defined Access Runtime Worker Client Workbench MDESimulator Office Client Scheduler Webservices Authentication
		FORCAM Database Server	80, 443, custom	TCP	Customer defined Access
		FORCAM Data Acquisition Server	80, 443, custom	TCP	Customer defined Access
ffERP	ERP "Download" interface	FORCAM Application Server	26080	TCP	
	ERP secured "Download" interface	FORCAM Application Server	26443	TCP	