FORCAM™ FORCE

Version 5.10
System Requirements
Manual

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Content

1   Minimum Technical Requirements

Architecture required for Basic Functionality

2-Tier Architecture

Database
Server

Application Server
with Data Acquisition
Server

MongoDB Server

If Track and Trace is used, MongoDB on an additional
server (on-premise) is required.

2 Recommended Technical Requirements

Architecture required for Productive Use

3-Tier Architecture

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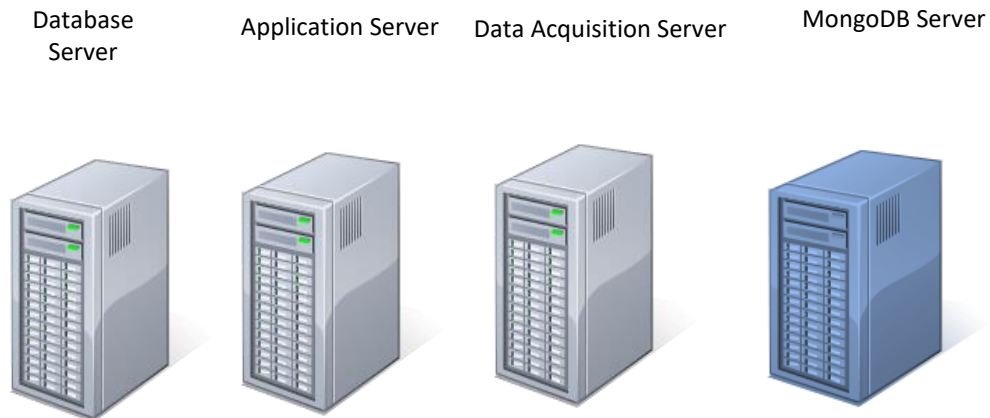
It is recommended to run the Data Acquisition Server on premise.

If Track and Trace is used, MongoDB on an additional server (on-premise) is required.

3 Comparing 2/3-Tier Architecture

Difference between 2-Tier and 3-Tier Architecture:

2-Tier

- Sufficient for test systems or early pilot phases for projects
- Lower performance due to DCU server running parallel on the application server
- Upgrade to 3-tier recommended after test/pilot
- A MongoDB on additional server (on-premise) is required if Track & Trace is used

3-Tier

- Required for productive systems
- Recommended for use with the Edge server
- Provides high performance for timely signal processing
- Physical proximity to machine parks is advantageous depending on number and frequency of signals
- Maintains network security (integrity) for machine parks in case of separated LAN networks (VLAN)
- A MongoDB on additional server (on-premise) is required if Track & Trace is used

4 Database Server

Overall Server Requirements

- 1 Server (physical or virtualized environment) dedicated only for use with FORCAM FORCE™
- 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 have to be strictly followed, for **Microsoft TechNet Anti-Virus Exclusion List** (or more up to date)

Specific Database Server Requirements

- SQL Server 2014, SQLServer 2016, SQL Server 2017 or Oracle 12c
- 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

Recommendations for Memory Space of the SQL Instance

- 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

For example, if you have a 32 GB RAM Database Server, then memory to be given to the Operating System would be as follows:

- 1 GB, the minimum allocation
- + 3 GB, since 16 GB – 4 GB = 12 GB; 12 GB divided by 4 GB (each 4 GB gets 1 GB) is 3 GB
- + 2 GB, as 32 GB – 16 GB = 16 GB; 16 divided by 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.

5 Application Server

Overall Server Requirements

- 1 Server (physical or virtualized environment) dedicated only for use with FORCAM FORCE™ (without preceding loadbalancer)
- CPU with at least Haswell technology (e.g. Intel Xeon E5) or higher, clocked with > 2 GHz
    - 4 Cores for up to 150 Workplaces
    - + 2 Cores per additional 100 Workplaces
- 22 GB RAM + 50 MB per Workplace for a Basic Setup
    - + 2 GB for every additional Module (fftracing, ffdnc, ffscheduler, ffwebservices…)
    - Basic Setup includes: ffruntime-ignite, ffruntime, ffworkbench, ffworker, ffnewoffice (Modeller+Visualisation), ffnewoffice-background, DCU/DACQ
- Operating System: Windows Server 2012 (R2) or Windows Server 2016
- Microsoft .NET-Framework Version 3.5 must be installed
- Regarding Anti-virus software:
    - The recommendations of the OS vendor have to be strictly followed, for **Microsoft TechNet Anti-Virus Exclusion List** (or more up to date)
    - The FORCE directory and its subfolders must be excluded from the AV scan. If this is not possible for security reasons, the scan of this directory should only be performed sporadically at low-operational times, otherwise the performance of the application will be considerably reduced.
- For information regarding required ports, please refer to Chapter x inside this document.

Specific Application Server Requirements

- HDD RAID system (for physical devices), best practice: RAID Level 1
  1 partition physically separated from the OS containing 250 GB exclusive use for FORCAM FORCE™
- OpenJDK (JDK and JRE), 64 Bit. If 2 tier Architecture is being used, please install 32 Bit JDK also.
- Recommended are the browsers Google Chrome and Microsoft Edge
- Open Office needs to be installed if export of pdf files is needed

6 Data Acquisition Server

Overall Server Requirements

- 1 Server (physical or virtualized environment) dedicated only for use with FORCAM FORCE™
- CPU with at least Haswell technology (e.g. Intel Xeon E5) or higher, 4 Cores, clocked with > 2 GHz
- 12 GB RAM + 0,5 GB RAM per additional DCU
- At least 100 GB of available Disk Space
- Operating System: Windows Server 2012 (R2) or Windows Server 2016
- Regarding Anti-virus software:
    - The recommendations of the OS vendor have to be strictly followed, for Microsoft TechNet Anti-Virus Exclusion List (or more up to date)
    - The FORCE directory and its subfolders must be excluded from the AV scan. If this is not possible for security reasons, the scan of this directory should only be performed sporadically at low-operational times, otherwise the performance of the application will be considerably reduced.
- For information regarding required ports, please refer to Chapter x inside this document.

Specific Data Acquisition Server Requirements

- Only required for 3 Tier Architecture
- OpenJDK (JDK), 32 and 64 Bit, latest versions

7 MongoDB (for Track and Trace and Energy Data)

Overall Server Requirements

- One Server for a "Single Instance" Installation dedicated only for use with FORCAM FORCE™
- CPU with at least Haswell technology (e.g. Intel Xeon E5) or higher, 4 Cores, clocked with > 2 GHz
- 16 GB RAM (To extend depending on expected volume of data)
- Operating System: Windows Server 2012 or Windows Server 2016
- Distribution - MongoDB 3.6 Enterprise or MongoDB 4.0 Enterprise
- HDD – separated from the OS containing 500 GB

The best resource for MongoDB is the "docs.mongodb.com" website. Here is an installation guide.
https://docs.mongodb.com/getting-started/shell/tutorial/install-mongodb-on-windows/

8   Network

Overall Network Requirements

- 2x 1 Gbit NIC1 per server in failsafe-/load balancing mode
- Database-, Application- and Data Acquisition Servers connected to Switched LAN (1 Gbit or better)
- Shop floor network connected with at least 100 Mbit uplink to office network.
  Best practise: Use LAN instead of WLAN to avoid problems with electro-magnetic interferences)
- For use in dedicated environments: Optical (fibre) connections to reduce latency

9 Clients

Overall Client Requirements

- Windows 7, Windows 8, Windows 8.1, Windows 10
- Supported Browsers: Google Chrome and Microsoft Edge
- In general, no Java 8 (JRE) needed due to HTML5 technology.

    Exceptions: Use of PDM/DNC, ffscheduler and client-side programs e.g. UDP-Scanner and Printers the "Client Side Connector" program is needed, which requires an installation of JRE.

10 Additional Third Party Software

The following Software is used during the Installation and Maintenance of FORCAM FORCE™:

- BareTail Pro
- 7-Zip
- Notepad ++
- WinMerge
- WSCC

- MCIS RDPTest
- ProcessExplorer
- SerialReaderService
- SQLDeveloper
- TeamViewer Quick Support

The following chapters describe the Firewall Requirements.

11   System Architecture

System Architecture – 3 Tier Architecture Example

Company WAN

ERP System

FORCAM FORCE Application Server

Database Server (ie: SQL, Oracle, Mongo)

Facility LAN

Data Acquisition Server

Office Client

ShopFloor LAN

Worker Client

Legacy Machines / Intelligent Cell Machines
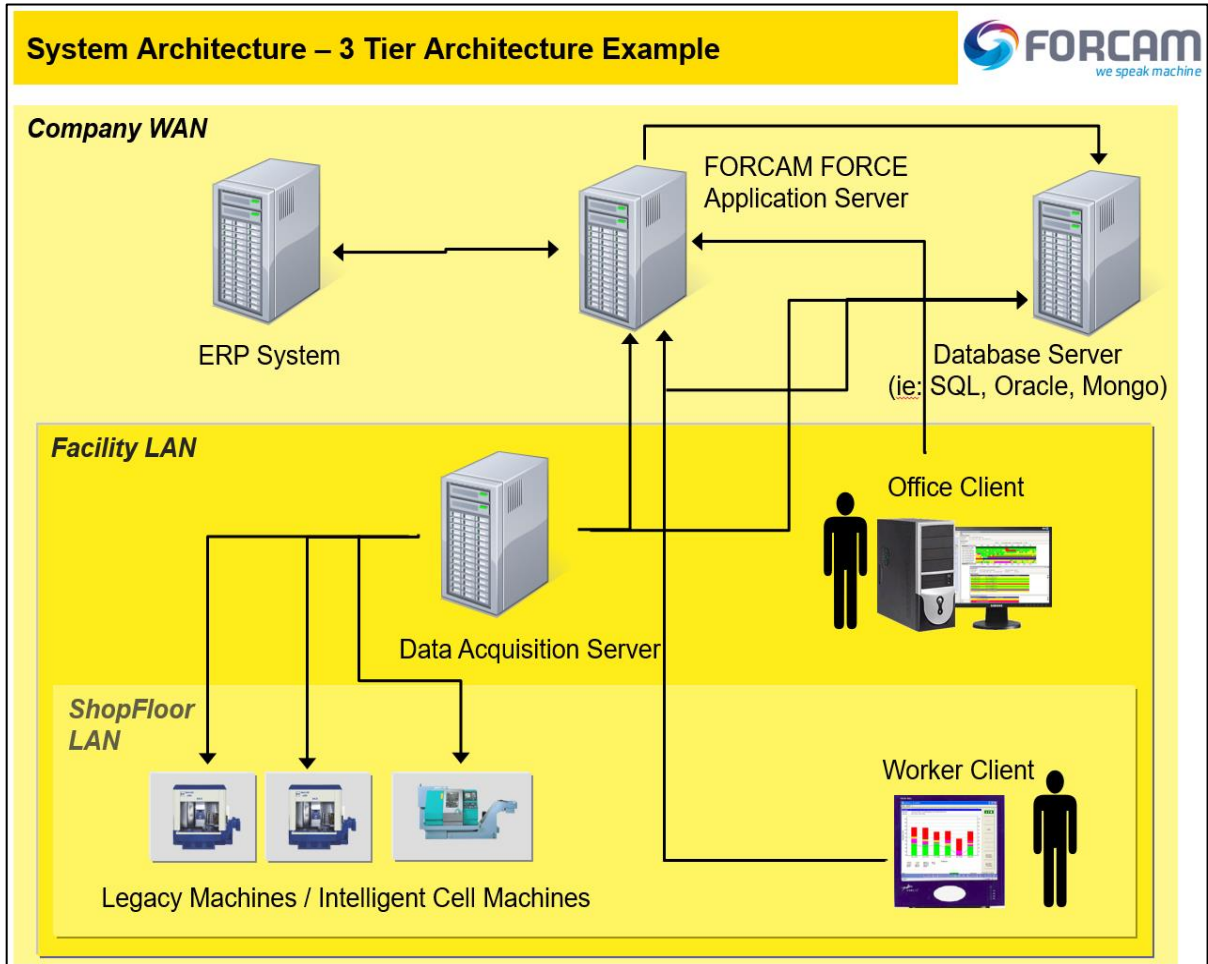
ⓘ All ports requested are to allow return traffic.

12 IT Infrastructure Isolation

Source	Description	Destination	Port	Protocol	Comment
Office PCs	Access to FORCAM FORCE™ Office Client	Forcam Application Server	19080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Workbench	Forcam Application Server	15080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ MDESimulator	Forcam Application Server	16080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Shop Floor Terminal	Forcam Application Server	11080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Detailed Scheduler	Forcam Application Server	21080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ webservices	Forcam Application Server	24080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Authorization	Forcam Application Server	25080	TCP	Configure in server.xml
Office PCs (secured)	Access to FORCAM FORCE™ Office Client	Forcam Application Server	19443	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Workbench	Forcam Application Server	15443	TCP	Configure in server.xml
	Access to FORCAM FORCE™ MDESimulator	Forcam Application Server	16443	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Shop Floor Terminal	Forcam Application Server	11443	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Detailed Scheduler	Forcam Application Server	21443	TCP	Configure in server.xml
	Access to FORCAM FORCE™ webservices	Forcam Application Server	24443	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Authorization (prefer)	Forcam Application Server	25443	TCP	Configure in server.xml
Application Server	SQL Server database connections	Forcam Database Server	1433	TCP	Database configuration

Source	Description	Destination	Port	Protocol	Comment
	Mongo connections	Forcam Mongo Server	27017 or 27024 or 37028	TCP	Configure on Mongo install
	Mongo Apache Drill component	Forcam Mongo Server	2181, 31010	TCP	configure in tool install
	Emailing reports and alerts (AutoReporting)	Company Mail Server	25	TCP	Configure in context.xml
	Access to ActiveMQ	Forcam Application Server	61616	TCP	If seperated, not likely
	Access to artifactory	Forcam Application Server	8081	TCP	If seperated, not likely
	Ignite	Forcam Application Runtime Ignite	48100, 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
	rmi/exporter/server/port	Forcam Application Runtime	1299	TCP	Configure in context.xml
	Detailed Scheduler RMI	Forcam Application Server	1998	TCP	Configure in context.xml

13 DNC Server Isolation (i.e.: on DCU/DACQ Server)

Source	Description	Destination	Port	Protocol	Comment
DNC Server	SQL Server database connections	Forcam Database Server	1433	TCP	Database configuration
	ActiveMQ	Forcam Application Server	61616	TCP	Activemq configuration
	Ignite	Forcam Application Runtime Ignite	48100, 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
	rmi/exporter/server/port	Forcam Application Runtime	1299	TCP	Configure in context.xml
	ffdnc WorkBench General Configuration	Forcam Application Server	14080-14084	TCP	Configure in workbench
	Machine Access	Machines…	Varies by machine	TCP	See list below
Application Server	ffdnc Java JMX remote access	Forcam DNC Server	8092	TCP	Configure on install
	ffdnc server.xml access	Forcam DNC Server	14005, 14009, 14080, 14443	TCP	Configure in server.xml
	ffdnc WorkBench General Configuration	Forcam DNC Server	14080-14084	TCP	Configure in workbench

14 Tracing Acquisition Server Isolation (i.e. on DCU/DACQ Server)

Source	Description	Destination	Port	Proto-col	Comment
Tracing Server	SQL Server database connections	Forcam Database Server	1433	TCP	database configuration
	Mongo DB	Forcam Mongo Database Server	27017 or 27024 or 37028	TCP	configure in context.xml
	ActiveMQ	Forcam Application Server	61616	TCP	ActiveMQ configuration
	Artifactory	Forcam Artifactory	8081	TCP	configure in context.xml
	Ignite	Forcam Application Runtime Ignite	48100, 48506, 48507	TCP	configure in context.xml
	http/remote/runtime/server/port	Forcam Application Runtime	10080	TCP	configure in context.xml
	influxdb/db/port	Influx DB Server	25086	TCP	configure in context.xml
	Emailing	Company Mail Server	25	TCP	configure in context.xml
	Machine Access	Machines…	Varies by ma-chine	TCP	See list below. Is this needed?

Source	Description	Destination	Port	Proto-col	Comment
Application Server	ffacquisition Java JMX remote access	Forcam Tracing Server	18091	TCP	configure on install
	ffacquisition server.xml access	Forcam Tracing Server	17005, 17009, 17080, 17443	TCP	configure in server.xml
	ffprocessing Java JMX remote access	Forcam Tracing Server	18095	TCP	configure on install
	ffprocessng server.xml access	Forcam Tracing Server	18005, 18009, 18080, 18443	TCP	configure in server.xml

15 Data Acquisition Server (DCU/DACQ) Isolation

Source	Description	Destination	Port	Proto-col	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	

16   Shop Floor Isolation

Source	Description	Destination	Port	Proto-col	Comment
Shop Floor Terminals	Access to FORCAM FORCE™ Shop Floor Terminal	Forcam Application Server	11080	TCP	Configure in server.xml
	Access to FORCAM FORCE™ Shop Floor Terminal	Forcam Application Server	11443	TCP	Configure in server.xml
Data Acquisition Server	Allen Bradley/Rockwell (EtherNet/IP™, new)	Machines with …	44818	TCP/UDP	
	Allen Bradley/Rockwell (PLC5E, SLC5/05, old)	Machines with …	2222	TCP/UDP	
	Allen Bradley/Rockwell (Peer to Peer)	Machines with …	4000	TCP/UDP	
	Fanuc FOCAS 1&2 / Ethernet	Machines with …	8193	TCP	Configure on controller
	Fanuc CIMPLICITY i CELL	Machines with …	8192	UDP	
	Fanuc FOCAS2/Ethernet	Machines with …	8195	UDP	
	Fanue Unsolicited Message Server	Machines with …	8196	TCP	
	Heidenhain (for newer controls, TNC640)	Machines with …	19003	TCP	
	Heidenhain (for older controls, iTNC530)	Machines with …	19000	TCP	
	Heidenhain (NFS)	Machines with …	111	TCP	
	Heidenhain (SMB)	Machines with …	445	TCP	
	Heidenhain (default)	Machines with …	5000	TCP	
	Heidenhain (LSV2, for serial COM)	Machines with …	9000	TCP	
	IBH-Link S5++ (IBHNet, read/write)	Machines with …	2002	TCP	
	IBH-Link S5++ (Programming Unit - PU)	Machines with …	10010	TCP	
	IBH-Link S5/S7 RFC1006	Machines with …	102	TCP	
	IBH-Link S7 Standard	Machines with …	1099	TCP	
	IBH-Link S7++ (Search for IBHLink device)	Machines with …	25383, 25384	UDP	

Source	Description	Destination	Port	Proto-col	Comment
	Makino MML	Machines with …	8193 or 11212	TCP	
	MCIS-RPC	Machines with …	3010	TCP	Host port
	MCIS-RPC	Machines with …	3011	TCP	Machine (listening) port
	MOXA telnet communication	Machines with …	23	TCP	
	MOXA Web UI	Machines with …	80	TCP	
	MOXA Data port	Machines with …	950-965	TCP	
	MOXA Command port (for transferring data)	Machines with …	966-981	TCP	
	MOXA Data port (for transferring data)	Machines with …	4001	TCP	
	MOXA Broadcast search	Machines with …	4800	UDP	
	MOXA Firmware Upgrade	Machines with …	4900	TCP	
	MQTT.fx server	Machines with …	2783	TCP	
	MQTT (default)	Machines with …	1883, 1885	TCP	
	MQTT (SSL/TLS)	Machines with …	8883	TCP	
	MTConnect Agent	Machines with …	5000, custom	TCP	Configurable
	MTConnect Adapter	Machines with …	7878	TCP	Configurable
	Okuma THINC Listening	Machines with …	8888	TCP	
	Omron (FINS)	Machines with …	9600	UDP	
	OPC DA (Binary/DCOM, read)	Machines with …	5000	TCP	
	OPC DA (Binary/DCOM, write)	Machines with …	6000	TCP	
	OPC DA-XML	Machines with …	80	TCP	
	OPC DA-XML (HTTPS)	Machines with …	443	TCP	
	OPC UA (SOAP-XML)	Machines with …	80	TCP	
	OPC UA (SOAP-XML, HTTPS)	Machines with …	443	TCP	
	OPC UA (Binary)	Machines with …	4840, 4843	TCP	
	OPC UA (Binary, DataFEED OPC)	Machines with …	4980	TCP	
	OPC UA (SOAP-XML, KEPServerEX)	Machines with …	49320	TCP	

Source	Description	Destination	Port	Proto-col	Comment
	OPC-Server (DCOM, Service Contr. Manager)	Machines with …	135	TCP	
	Siemens Control with CP (IPS7Link/RFC1006)	Machines with …	102	TCP	
	Siemens MCIS-RPC (RPC, Host)	Machines with …	13010	TCP	
	Siemens MCIS-RPC (RPC, Machine)	Machines with …	3011	TCP	
	Simatic S7 IPS7LNK	Machines with …	502, 2000	TCP	
	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	

17   External Access

Source	Description	Destination	Port	Proto-col	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, 21080, 21443, 24080, 24443, 25080, 25443	TCP	Customer defined Access Runtime Worker Client WorkBench MDESimulator Office Client Scheduler Webservices Authentication
		Forcam Database Server	80, 443, custom		Customer defined Access
		Forcam Data Acquistion Server	80, 443, custom		Customer defined Access
ERP System	ERP "Download" interface	Forcam Application Runtime	10080	TCP	Configure in server.xml
	ERP secured "Download" interface	Forcam Application Runtime	10443	TCP	Configure in server.xml
	ERP "Upload" interface from Application Server	ERP - System	8002	TCP	Configurable

18 Document History

Version	Date	Name	Lifecycle	Reason for change	Status
1.0	2020-04-29	Sascha Pukownick	Design	Initial Document creation	In Review