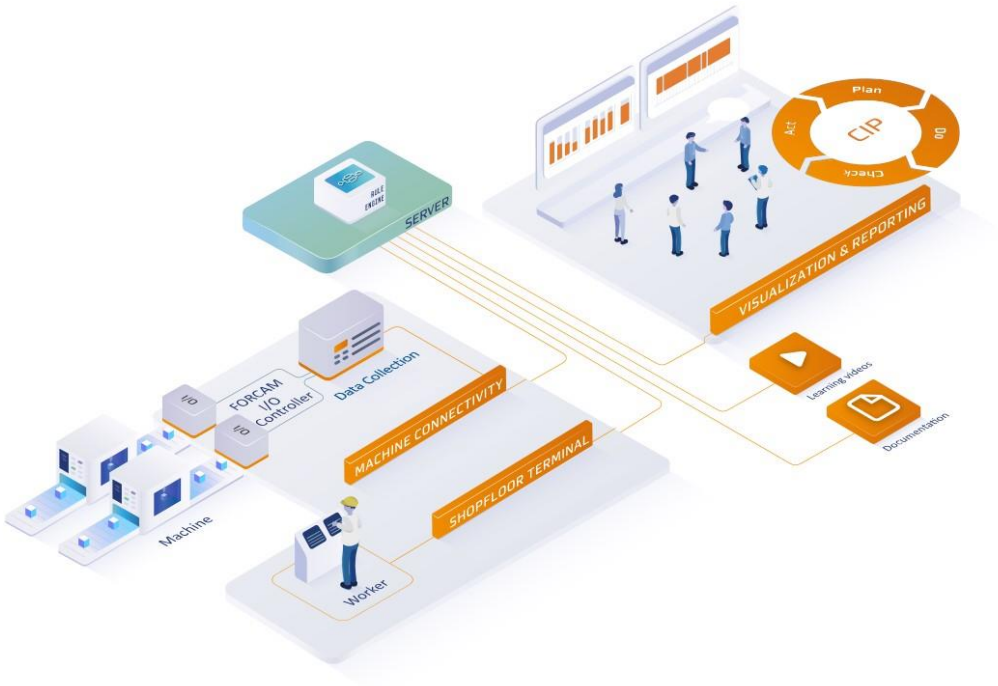

FORCE MES LITE

“Availability” package

Version 5.12

Product Description

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Introduction

This document describes the scope of services and the added value of the FORCE MES LITE application (hereafter simply referred to as MES LITE) in combination with the **Availability** package. The package contains the machine connection via I/O controller and the evaluation processes.
After installation by FORCAM, the machine connection is completely preconfigured in MES LITE. This allows machines to be connected to the system quickly and easily. Additional machines can be connected at any time.
The documentation and the basic structure are designed as a ready-to-run standard product, enabling the customer to perform the rollout in production almost independently. The scope of delivery also contains a quick-start guide ("*FORCE MES LITE Quick Start*"), the installation with machine connection can therefore be carried out by the customer in a guided and target manner. In case of further demand and expansion, an upgrade to MES FLEX is possible at any time.

Glossary

Term	Description	Notes
License model	The license model is an on-premise model. The required hardware is provided by the customer, according to FORCAM's system requirements (see “System requirements”). The reference values for licensing are the number of workstations and the released packages for the MES LITE version.	We offer the *Purchase plus maintenance* licensing variant.
Workplace	A workplace corresponds to a machine, in this case in a 1: 1 relationship.	
Operating state	Machine state in production (**running**) or stoppage (**not running**) with reason for the cause.	
Data Collection Server	Device that connects the production network (LAN) to the application server	FORCAM I/O controllers send data to this device for normalization/standardization and, finally, for data transfer to the application server.
FORCAM I/O Controller	Device to be installed in a control cabinet for tapping the electrical machine signals	For rail mounting refer to the manual *“Connecting a FORCAM I/O Controller”*.
Office Client	Web application for displaying manufacturing data as reports, visualizations and dashboards	
Shopfloor Terminal (SFT)	Browser-enabled hardware on the machine for interaction initiated by the worker. It is supplied by the customer.	See “System requirements”

Scope of functions

The standard MES LITE scope of functions is comprised of the items listed below.

Software and hardware

- **MES LITE software license** according to the commercial list in the offer
  Installation is done by FORCAM once the customer has provided the hardware or the virtual environment (see chapter “System requirements”).

- The **hardware** specified in the offer is supplied as standard.
  It is the stated number of **FORCAM I/O controllers**

Any further infrastructure (servers, networks, etc.) must be provided and operated by the customer.

Machine connection

Machine connection is standardized in MES LITE. There are four digital signals in the standard (**machine on**, **automatic ON/OFF**, **machine producing**, **machine stoppage**).
Fewer signals can be used, depending on the customer's requirements.
The customer is responsible for connection on machine side, including the connection of the supplied I/O controller to the production network (LAN/Ethernet).
The corresponding manual *“RCE MES LITE Quick Start*” is included in the scope of delivery.

System architecture

- **Application server** (MES LITE)
- **Data Collection Server (**MES LITE Data collection and communication system**)**
- **Database server (Microsoft SQL Server)**
- FORCAM I/O Controller in production
- Shopfloor Terminal
  (hardware provided by customer, see “System requirements” in the annex)

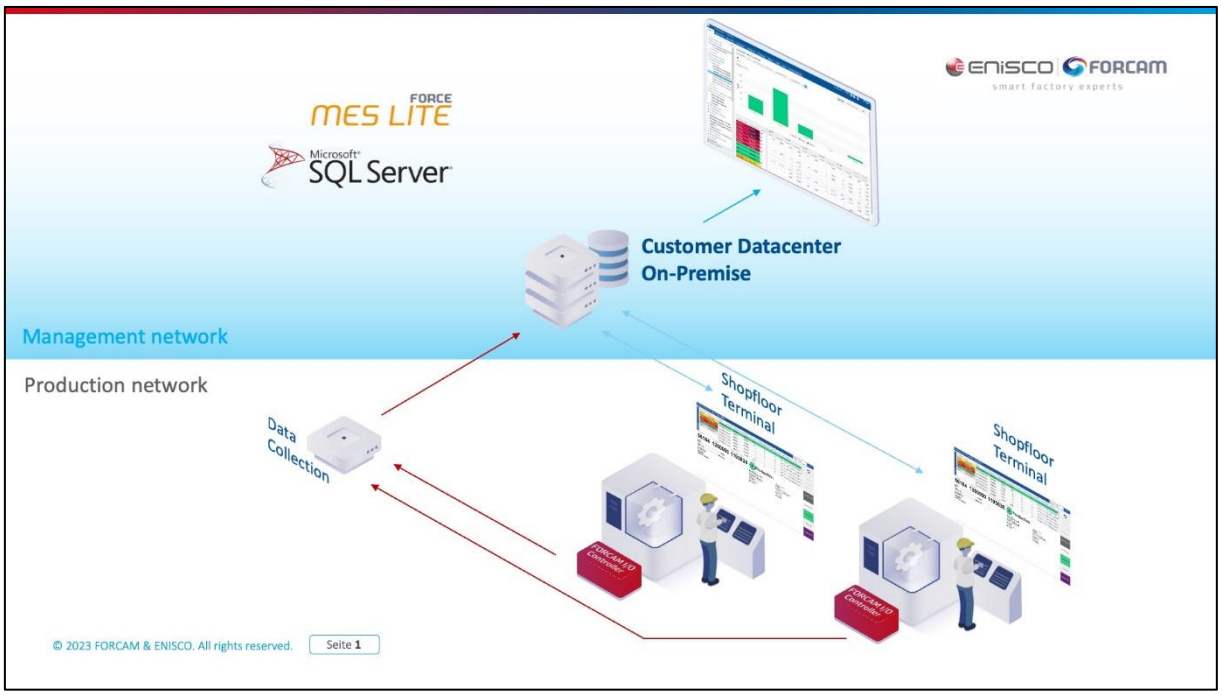


Figure 1: MES LITE system architecture

Hardware scope of delivery

FORCAM I/O Controller

The FORCAM I/O Controller is used to tap the machine signals and to convert these signals into network information. This information is transmitted to the Data Collection Server for further processing. The FORCAM I/O Controller must be connected to the machine and to an existing network connection by the customer. Connection instructions are included in the scope of delivery (see "*FORCE MES LITE Quick Start Guide*").

Data Collection Server

- The Data Collection Server is installed by FORCAM with the basic installation and must be integrated into the production network by the customer.
- HW installation (network & power supply) must be done by the customer.

Software scope of delivery

The system will be installed by FORCAM based on a checklist, which must be completed in advance by the customer. The provision of the hardware or virtual devices is the responsibility of the customer.
The MES LITE installation is then pre-configured and includes the following components:

Access to Shopfloor Terminals via a link

- A web interface enables employees to access the shopfloor terminals at the respective machine.
- Only a browser is needed for displaying the data (see "System requirements" in the annex). The relevant end devices are not included in the scope of delivery (see "System requirements" in the annex), they must be provided by the customer.
- The shopfloor terminals are delivered with a basic configuration for the machine workplaces.
- The MES LITE implementation model does not allow for customization.

Access to Office Client via a link

- The system will provide the reports, dashboards and visualizations mentioned in chapter "Performance analysis". The customer can edit these objects to adapt them to company-specific requirements.
- Only a browser is needed for displaying the data (see "System requirements" in the annex). The relevant end devices are not included in the scope of delivery.

Machine Data Collection

- Machine data acquisition is the active component in MES LITE for collecting machine signals.
- A preconfigured FORCAM I/O Controller is included in the delivery.
  In the software, FORCAM does the pre-parameterization of the machines to be connected.
  The parameters are based on the customer data sheet "FORCAM MES LITE - Machine List", filled out in advance by the customer.
- The required signals (**machine switched on**, **automatic ON/OFF**, **machine producing**, **machine stopped**) are provided by the customer by connecting the machine controller to the production network (or by connecting an I/O controller to the machine and to the network).
  The MES LITE scope of functions does not include any services for preparing the signals on the machine side, neither does it cover the resulting costs.

Master data configuration

- FORCAM takes care of the pre-parameterization of the necessary master data in the system.
  This includes shifts, workstations, time bases, operating states and status details.
  Workplaces are preset based on the customer data sheet “FORCE MES LITE - Machine List”, filled out by the customer.
  After the initial implementation, the defined shifts, operational states and status details as well as the workplace hierarchies area (such as descriptions and groupings) can be changed by the customer as needed.
- The system's processing logic is predefined.
- Required hierarchies are created based on the completed customer data sheet 5“FORCE MES LITE machine list”.

ⓘ Instructions on how to customize shifts, operating states and status details can be found in the provided “*Manual - FORCE MES LITE*”.

Corrections

- MES LITE allows for later correction of operating states and shifts
  (e.g. by the foreman).

MES LITE (Availability) - Module overview

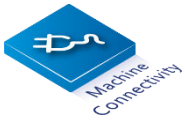
Figure 2: MES LITE module overview

The **machine data collection (availability)** in MES LITE provides data and information about the current state of a workplace (machine or plant). The MDC recording enables analyzing developments and trends in a differentiated way and comparing different workplaces with each other.
The worker at the machine is able to qualify unfounded stoppages by the actual reason. The supervisor/foreman can also still make corrections. Together with the shift maintenance (nominal state), the actual machine availability can be determined objectively.

Added value

- The actual time availability of a workplace (machine or plant) is shown objectively and transparently.
- The frequency and duration of the various operating states and their causes provide important information for optimizing production and maintenance.
- The current operating states of all workplaces (machines or systems) can be seen at a glance.
- Based on machine availability, stoppage and maintenance times can be determined and optimized.
- Objective calculation of machine hourly rates are based on real data.

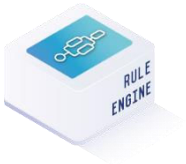
Machine Connectivity (MDC)



The MES LITE **Machine Connectivity** captures the machine/plant signals and derives one of the following operating states:

- **Plant is running** (production)
- **Plant is not running** (stoppage) with reason (cause)
- **No connection** (operating state unknown/no network connection)

Rule Engine



The **Rule Engine** is the central component from the MES FLEX IIoT platform, on which the offered MES LITE solution is based.
It is responsible for the plausibility check of the machine states using the manufacturing data model (logic). This is done based on the use case-specific booking logic. The booking logic for MES LITE is predefined.

Shopfloor Terminal

The **Shopfloor Terminal** is used for visualizing and specifying or qualifying the operating states. It is the link between the machine data collection and the worker at the machine.

Shopfloor Terminal functions

- Occurred operating states are mapped chronologically up to the current time and can be displayed corresponding to shifts when a shift system is set. A standardized shift model is preconfigured in the base configuration.
- Workers can specify the operating state **undefined stoppage** via the Shopfloor Terminal by specifying a status detail. Operating states are preconfigured in the basic configuration.
- The **setup** operating state is a special state: The Setup is activated via the Shopfloor Terminal and remains active until it is deactivated again at the terminal. During setup, the system completely suppresses the recorded machine states.
- An online report and the list of past operating states are displayed in the Shopfloor Terminal **Machine Data Collection**.

ⓘ Instructions on how to configure operating states, shift models and reports can be found in the provided “Manual - FORCE MES LITE”.

Figure 3: Start page of the Shopfloor Terminal

The figure above shows a sample terminal with configured buttons that the worker can use, for example, to make bookings or change statuses.
The actual delivery may differ from this example.

Reporting processes and functions

The browser-based Shopfloor Terminal enables the user to perform the following functional processes:

- Start setup
- End setup
- Call up selected reports
- Change or qualify operating conditions (e.g., qualify **undefined stoppage** as a specific malfunction such as **mechanical malfunction**)

Performance analysis

The FORCAM **Performance Analysis** application consists of **reporting**, **visualization** and **dashboard**.
The basic configuration is part of the scope of supply and can be customized by the customer.

The following reports are available for evaluating the machine data collection:

- Operating state timeline (workplace)
- Operating state log (workplace)
- Messages
- Availability (overall view)
- Operating state class report (workplace)
- Operating state class development (workplace)
- Operating State Report (Workplace)
- Operating State Development (Workplace)
- Hitlist Operating States (Workplace)
- Scheduled Operating Time
- Shift schedule
- Malfunction reason history

The following dashboards are preconfigured:

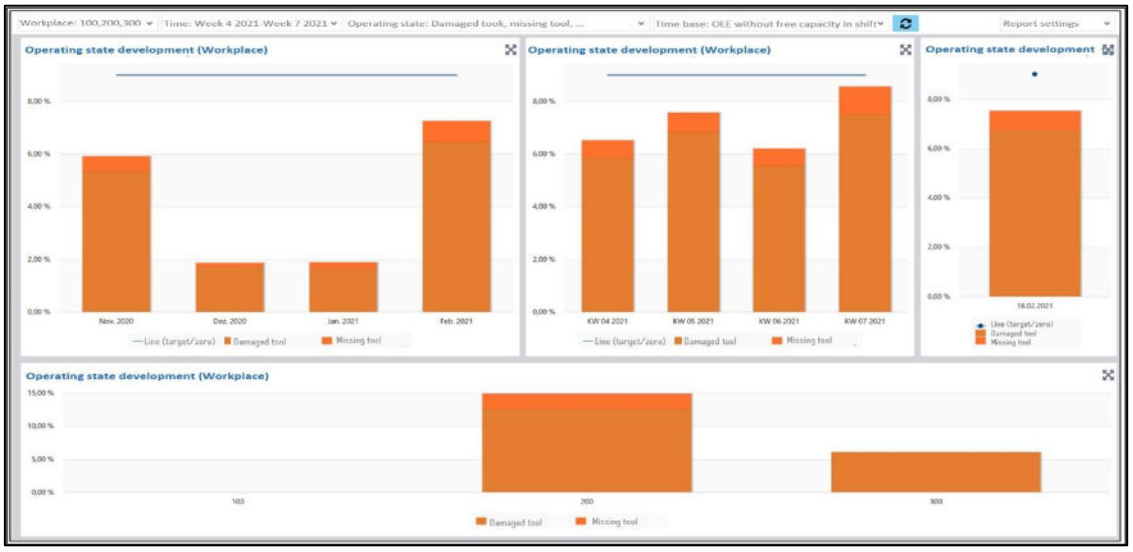


Figure 4: Stoppage development displayed in a dashboard with multiple reports

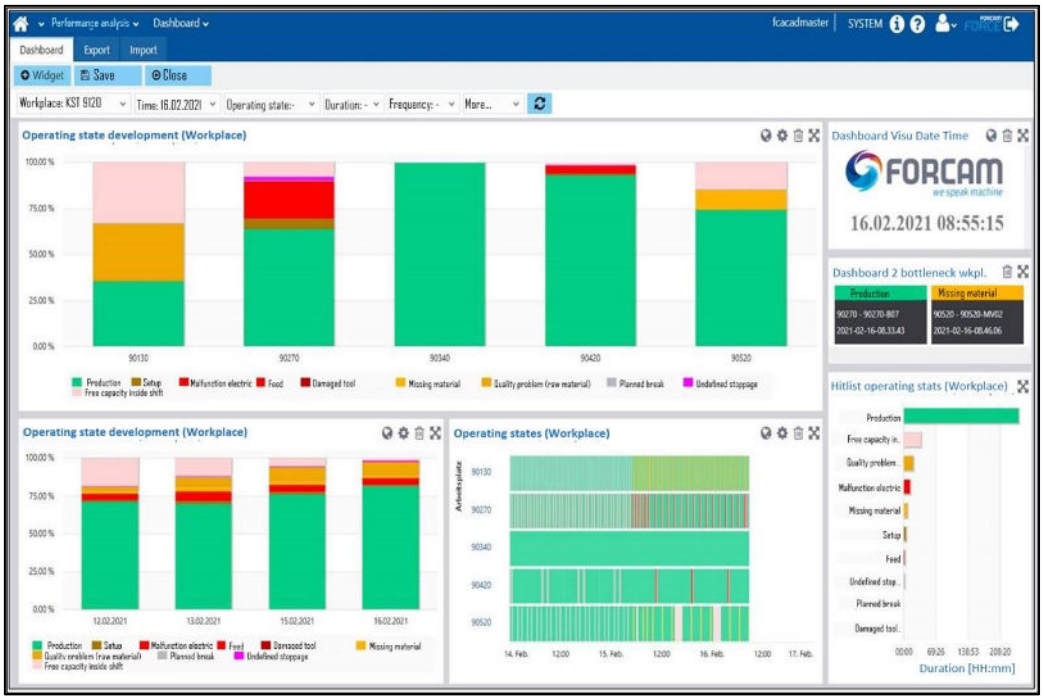


Figure 5: Dashboard displaying operating states

The following visualization is preconfigured:

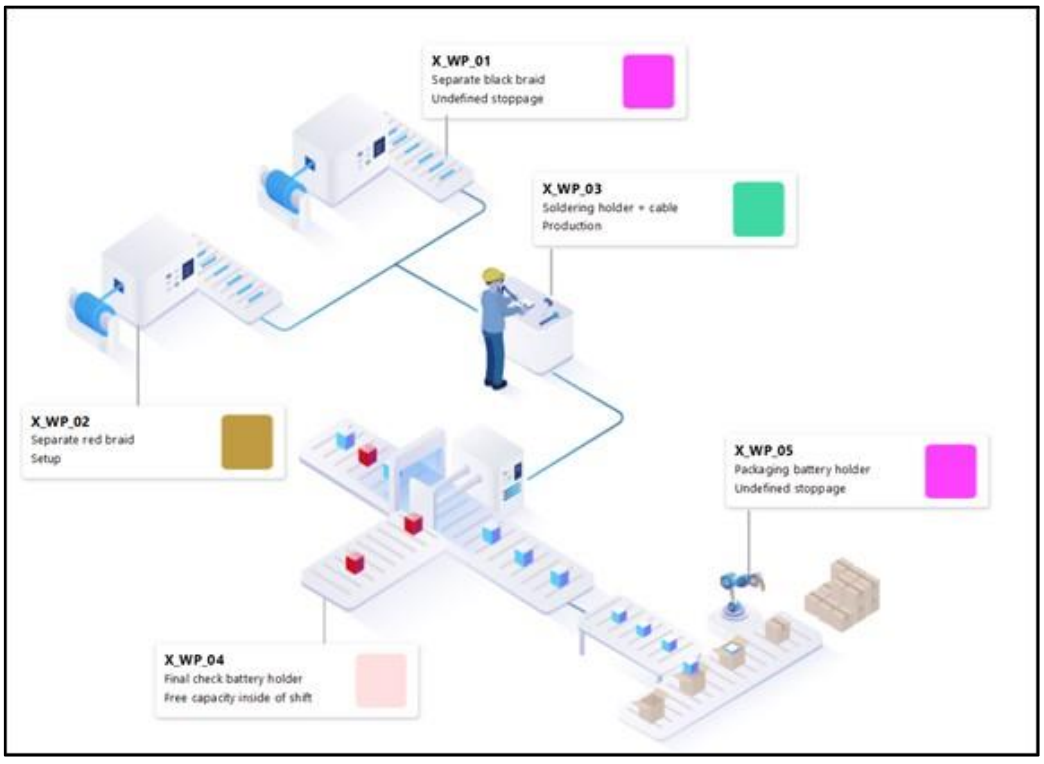


Figure 6: Visualization to display production facilities with workplaces

Annex

Service and support

Reference is made to FORCAM's General Terms and Conditions, which can be found at ***www.forcam.com***.

System requirements

Software system requirements

FORCAM MES LITE		Comment
Operating System	Windows Server 2016 Windows Server 2019 Windows Server 2022	
Database	MS SQL Server 2016 MS SQL Server 2019	Recommended version, “EXPRESS Edition” can be used.
Java	Java 11 (OpenJDK)	Long Term Version
Browser	Google Chrome MS Edge Chromium	Recommended - current versions

The system requirements of the servers depend on the number of workplaces and the number of events received from production. The requirements must therefore be regarded as recommendations.

System requirements for application server

- A server (physical or virtualized environment) intended to be used with MES LITE only
- CPU with at least Intel Haswell microarchitecture (e.g., Intel Xeon E5) or higher, 4 cores, clocked > 2 GHz
- 32 GB RAM or more, depending on the number of workplaces and events per 8-hour shift
- At least 250 GB of available hard disk space
- Microsoft .NET Framework version 3.5 pre-installed
- Operating system: Windows Server
- OpenJDK 11 (JDK and JRE), 64 Bit
- Windows server user for FORCAM must have extended (admin) rights

System requirements for database server

- The operating system and HW requirements of the MS SQL Server should be obtained from Microsoft.
- The user of the MS SQL server for FORCAM must also have extended rights (DB owner).

System requirements for Data Collection Server

- CPU (e.g., Intel Xeon E5) or higher, 4 cores, clocked at > 2 GHz
- 12 GB RAM + 0,5 GB RAM per machine
- At least 100 GB of available hard disk space
- Windows server user for FORCAM must have extended (admin) rights.

On request, the “Data Collection” software package can also be installed on the application server. In this case, the system requirements of both software components must be taken into account.

Example: 1 to 50 workplaces/machines

- **Database and MES LITE can be run on the same server or virtual machine (consider system requirements).**
- RAM 48 GB – MES LITE and database
- 500 GB storage capacity (hard disk space)
- CPU (physical/logical) > 2 GHz, 8 cores

Example: More than 50 workplaces/machines

- **Separation of MES LITE application server and database server required one virtual machine each or own hardware**
- Application server:
  RAM 48 GB – MES LITE
  250 GB storage capacity (hard disk space)
  CPU (physical/logical) > 2 GHz, min. 4 cores
- Database server:
  RAM 16 GB – MES LITE
  500 GB storage capacity (hard disk space)
  CPU (physical/logical) > 2 GHz, 4 cores

System requirements for clients

- Windows 10, Windows 11
- Supported browsers: Google Chrome and Microsoft Edge with Chromium engine

Preparation for final commissioning by the customer

Directly on the machines

- Providing the required hardware for the SFTs (see “System requirements”)
- Installing the FORCAM I/O Controller in the control cabinet of the respective machine and connecting it to the power supply system
- Preparing the signals on the machine side for connecting the I/O controller
- Connecting the I/O controllers and SFTs to the network

In the office or IT room

- Provision of a server infrastructure according to the “System requirements”.

Abbreviations and terms used

Abbreviation/term	Description
API	Application Programming Interface (interface for programming applications)

AVO	Operation
BI	Business Intelligence (Application software to fetch, analyze, transform and report data)
PDA	Production data acquisition
CAQ	Computer-aided quality assurance
ERP	Enterprise Resource Planning (software solution for resource planning in a company)
HTTP	Hypertext Transfer Protocol (stateless protocol for transmitting data on the application layer via a computer network)
IDoc	Intermediate Document (SAP Document format)
CIP	Continuous improvement process
NC	Numerical Control
OEE	Overall Equipment Effectiveness (measured effectiveness calculated from availability, performance, and quality)
OLE	Overall Labor Efficiency (personnel productivity)
OPE	Overall Process Efficiency (the product of the key figures production process ratio, performance rate and quality)
PDCA	Plan Do Check Act (iterative four-phase process for learning and improvement)
Shopfloor Terminal	Terminal located at the place of value creation/at the machine for information flow and data recording on the shopfloor and interaction with ERP systems. Central source of information and recording unit of operating states for the production personnel. Runs on browser-enabled devices.
SPS	Programmable Logical Control
SQL	Structured Query Language (standardized query language for databases)
TDM	Tool data management
XML	Extensible Markup Language (markup language for representing hierarchically structured data)