FORCAM FORCE BRIDGE

Version 5.11

Product Description

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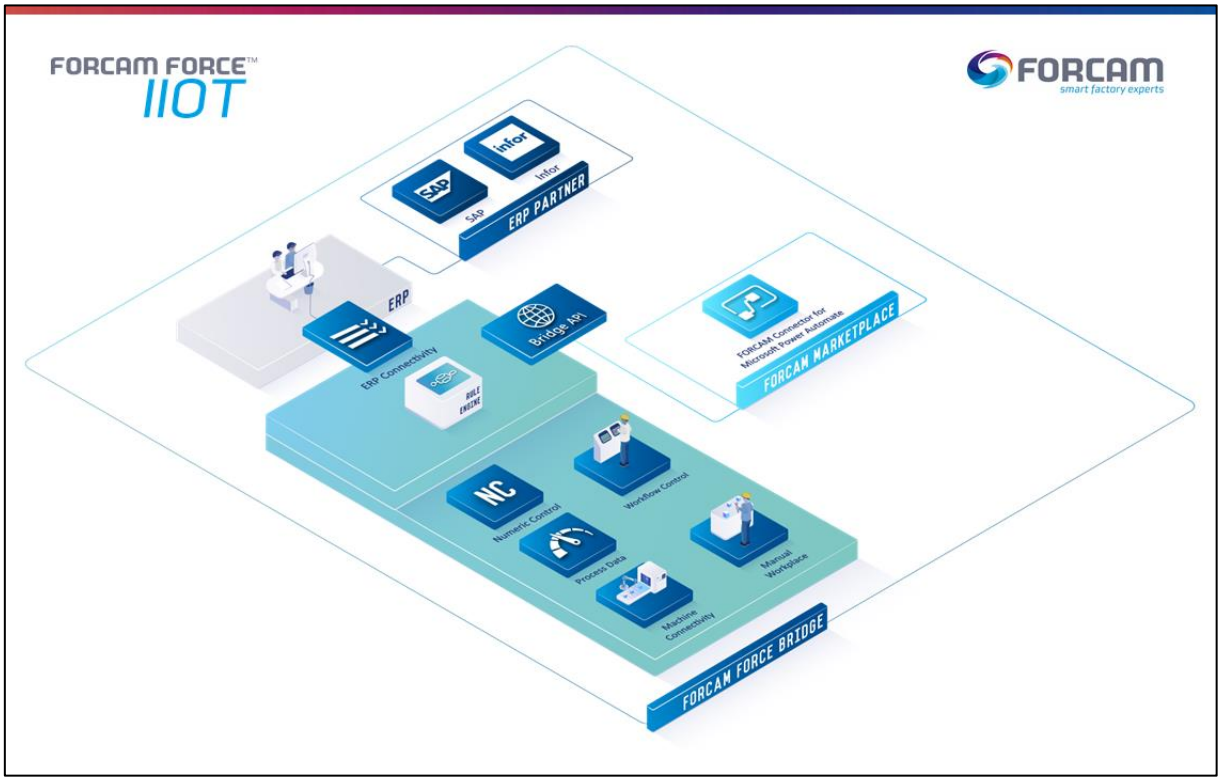
Content

* Overview

FORCAM provides companies with all the necessary information to control and optimize their production. The modular IIoT solution FORCAM FORCE IIOT is as flexible as the needs of the customers. Through a variety of production apps, FORCAM helps companies make their processes more transparent and improve their workflows. This way, companies create the basis for optimizing measures and sustainable success, thus ensuring their competitiveness.

FORCAM FORCE BRIDGE is the platform on which all FORCAM apps are built upon. It offers the basic prerequisite of various extensions and thus provides the foundation of your Industrial Internet of Things.

This document gives you information about the components of FORCAM FORCE BRIDGE, covering each extension individually. The scope of functions at the end of the document summarizes all features conclusively.

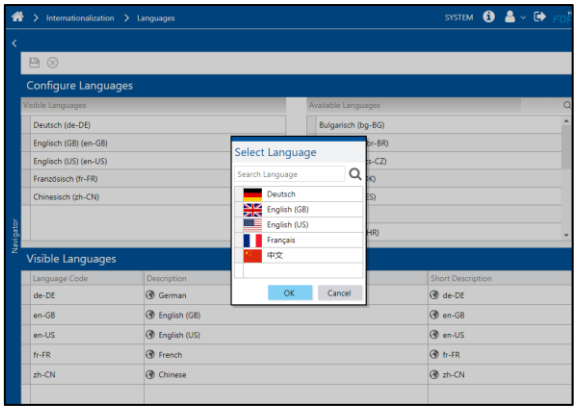


* For better readability, we generally use the generic masculine in the text. These formulations, however, are equally inclusive of all genders and address all equally.

Basic package: Core, Collaboration, Connectivity

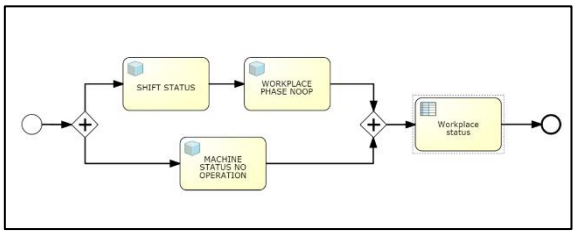
The basic FORCAM FORCE BRIDGE package allows you to use FORCAM FORCE IIOT as your new manufacturing and information hub. You will receive workplace licenses for the following basic functions:

System localization



FORCAM FORCE IIOT is delivered in four main languages by default: English, French, German and Chinese. The integrated Literal Manager also gives you the option of adding additional languages directly via a user-friendly interface. It is also possible to export all literals in CSV format.
For a successful localization, you can choose from different time zones to accommodate the times you need.

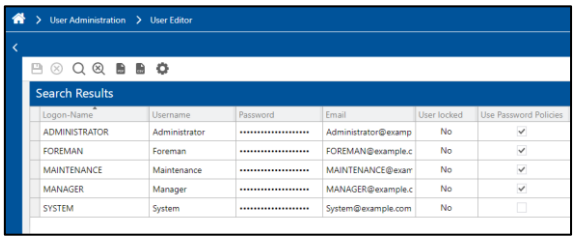
Rule Engine



FORCAM gives you access to the Rule Engine. This is where you can map your own business logic (business or accounting logic) in a graphical editor. The processing of incoming events (manually generated messages or automated machine signals) is modeled as a logical process. Within this process, condensed information is generated from elementary events in the form of states and more complex events.

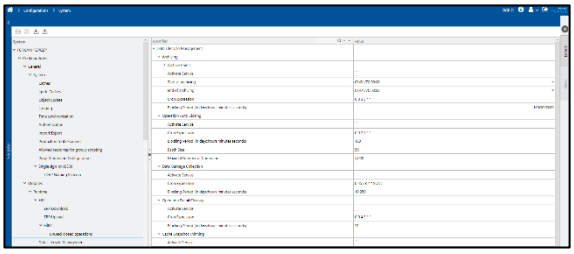
ⓘ The Rule Engine is a complex tool and operating it improperly can have system-wide consequences. We recommend modeling the business logic only in cooperation with FORCAM. FORCAM does not provide a manual for the Rule Engine.

User administration



You will be given full admin rights to create and manage user accounts for FORCAM FORCE IIOT. This will enable you to configure your company's own password policies.
FORCAM also offers you the possibility of defining rights and roles in order to manage the access rights of your users. This way, you ensure that users can only access and edit the areas that have been approved for them, thus increasing your data protection.

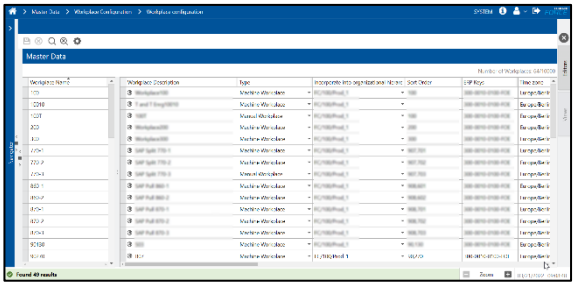
Configuration



By purchasing the basic package, comprehensive configurations of various apps and scope in FORCAM FORCE IIOT are made available to you. The scope depends on the apps you purchased. As an example, the following configurations are possible:

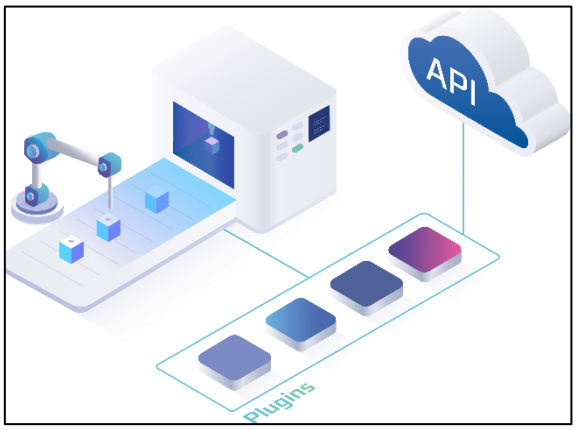
- Logon screen:
  Your own logo as well as an info area for a news ticker
- System configuration:
  Technical aspects such as cache, authentication, data garbage collection, etc.
- Shopfloor Terminal:
  Compile terminals from configured templates and profiles
- Licenses:
  Direct insight into purchased licenses and easy management of license keys and files

Master data



Specially predefined configuration pages so you can manage all your **master data** in FORCAM FORCE IIOT.
Customize workplaces or entire hierarchies in the workplace configuration and assign groups of status details, for example. It is possible to create reusable templates for similar workplaces to avoid having to configure them from scratch repeatedly.
The shift definition is available to map your individual **shifts**. Shift types and teams can also be created freely.
The **Production data acquisition** is where you define, among other things, phases, status and status details (reasons for malfunctions). A status detail tree is also available for this purpose, which can organize details into further sub-levels as required and display them in a tree view.
Quality types (yield, scrap, rework) and details can also be defined in the Production data acquisition.
The configuration page of the **personnel data** can be referred to for mapping personnel hierarchies and cost centers.

BridgeAPI



FORCAM **BridgeAPI** is the interface between the objects of the production environment and the IT infrastructure of a production site. The API is the bridge between the real production site and the IT systems and applications used for effective and efficient organization. It connects an IIOT platform with applications.

The API provides a complete digital image of a production plant with its relevant objects including their states. The objects consist of real-world entities, such as personnel, machines, or tools, as well as abstract entities, such as production orders or operations.
The RESTful API ensures organizational interoperability of people, production equipment and IT systems of a production facility in terms of maximizing resource effectiveness and process efficiency.

Purchasing the basic FORCAM FORCE BRIDGE package gains you access to the standard BridgeAPI interfaces. This is a write-protected interface for reading prepared information from FORCAM FORCE IIOT, such as the machine status or created operations, orders, tickets, etc. The available information is continuously updated.
The standard interface also gives you access to the **Tool data management**. This is a specific, restricted interface to the tool management of TDM Systems for matching tool information (supplied by TDM) and order reference (supplied by FORCAM).
Please note that a comparison of planned/actual service life is not included.
Another component of the standard interface is **Analytics**. Analytics is a write-protected interface for providing selected information from FORCAM FORCE IIOT to an external reporting/BI tool. Any other use of the interface outside of this purpose is not permitted.
As another part of the standard interface, FORCAM offers **CAQ** , which is an API for the integration of quality management systems. The integration logic is not included as a component and is always done via custom composition using a low-code platform.
Finally, the **Ticket API** provides access to FORCAM PDCA/CIP ticketing.

BridgeAPI Extension

This extension provides the option to exchange and influence data bidirectionally with the FORCAM FORCE IIOT platform. This is done by using a specific, restricted interface for third-party applications to remotely control predefined Shopfloor Terminal functions in background operation. This enables sending commands, for example, to send quantity messages or status changes of operations to FORCAM FORCE IIOT. The extension allows you the flexibility of using your own terminal. Then using the API to submit the information from your terminal.

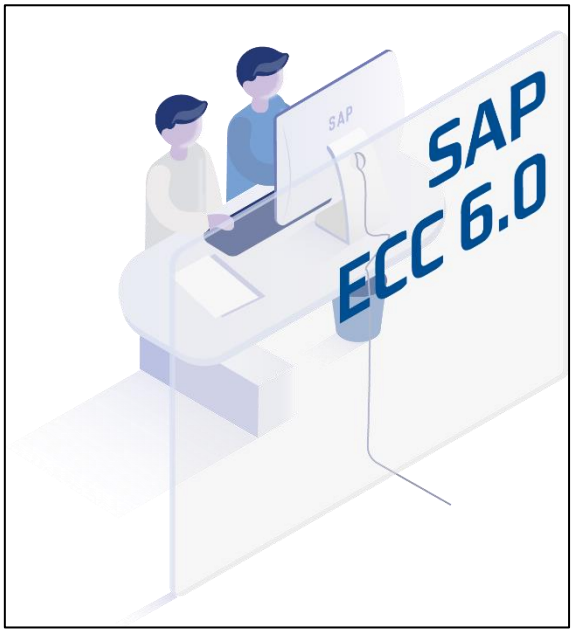
Microsoft Power Automate Connector

Microsoft Power Automate is a platform for automating processes. Power Automate lets you automate business processes, send reminders, or move business data between systems based on a schedule, among other things. It can also connect to more than 500 data sources or all publicly available APIs (see **documentation from Microsoft**).
The FORCAM Connector for Microsoft Power Automate provides a seamless and standardized connection to the Microsoft Power Platform and its ecosystem of over 400 apps.

Workflows can be easily created without complicated coding, thus quickly digitizing processes. Example: A worker determines that there is insufficient or defective material for a current production order. With one click at the terminal, the worker can send an email, a Microsoft Teams message, or an online ticket (JIRA, Trello, etc.) to members of a logistics team. They are called to an ad hoc meeting. The automated message therefore transmits all relevant information such as required material, order, machine as well as location to the right group of people in realtime. This saves valuable time. The logistics team can directly initiate measures to remedy the current material bottleneck and avoid future material shortages.
Machines can also set workflows in motion. For example, suppose a tool breaks on a machine during production. A Trello ticket is now automatically created for maintenance. In addition, persons directly involved are again notified, making fast and target-oriented action possible. Result: Stoppages are reduced.

Connectivity ERP

SAP ECC/ERP 6.0



This extension purchases the FORCAM **Adapter for SAP ECC (ERP 6.0)**.
The FORCAM Adapter for SAP is an add-on certified by SAP and developed in the standard SAP ABAP programming environment for connecting the SAP ERP with the production data acquisition in production.
The FORCAM Adapter for SAP helps to make production orders created in SAP ERP available in production and to integrate messages entered in production into a system environment running SAP applications with SAP NetWeaver 7.01. The data exchange between the connected systems takes place via IDoc communication based on SAP standard XML methods.

The FORCAM Adapter for SAP ERP 6.0 has these advantages:

- Easy installation:
  The installation is done with SAP standards.
- Flexible integration:
  The adapter for SAP enables simple and logical integration of new functions, programs and tables into the SAP standard.
- Configurable connection:
  The SAP connection is configurable. It transfers data in realtime and avoids unnecessary data streams between SAP and FORCAM FORCE IIOT.
- Realtime communication:
  The adapter enables an immediate and easy data transfer via RFC (remote function call), HTTP XML communication and web services (IDoc communication framework).
- Consistent data:
  The integrated revision module ensures efficient data processing and avoids unnecessary duplicate maintenance.
- Reports for monitoring:
  User actions are only required for IDoc monitoring, therefore there are separate FORCAM reports available for optimized IDoc monitoring.
- Reports for troubleshooting:
  FORCAM reports for simplified error analysis and correction via IDoc monitoring
- Continuous processing:
  IDocs for the same operation are processed in batch mode.

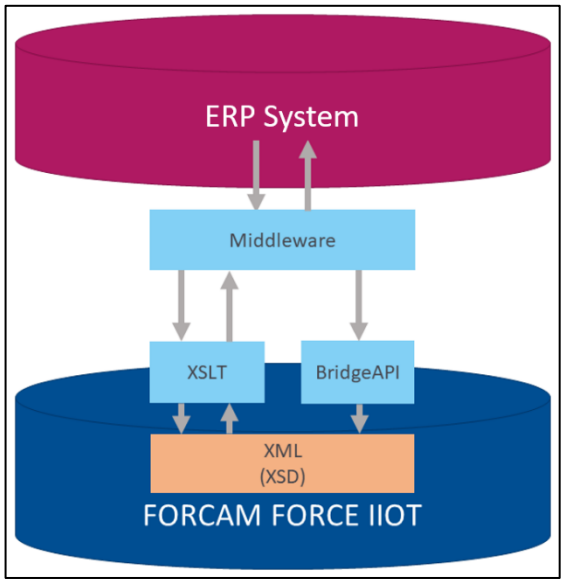
SAP S/4HANA

This extension contains the FORCAM Adapter for SAP, which specifically supports SAP's new **S/4HANA** ERP software solution.
The FORCAM Adapter for SAP S/4HANA fits seamlessly into the HANA environment. It is adapted to the increased in-memory requirements of HANA, while the functionality remains the same: automatic feedback of production orders (status changes, times and production quantities). Communication takes place securely via IDoc.

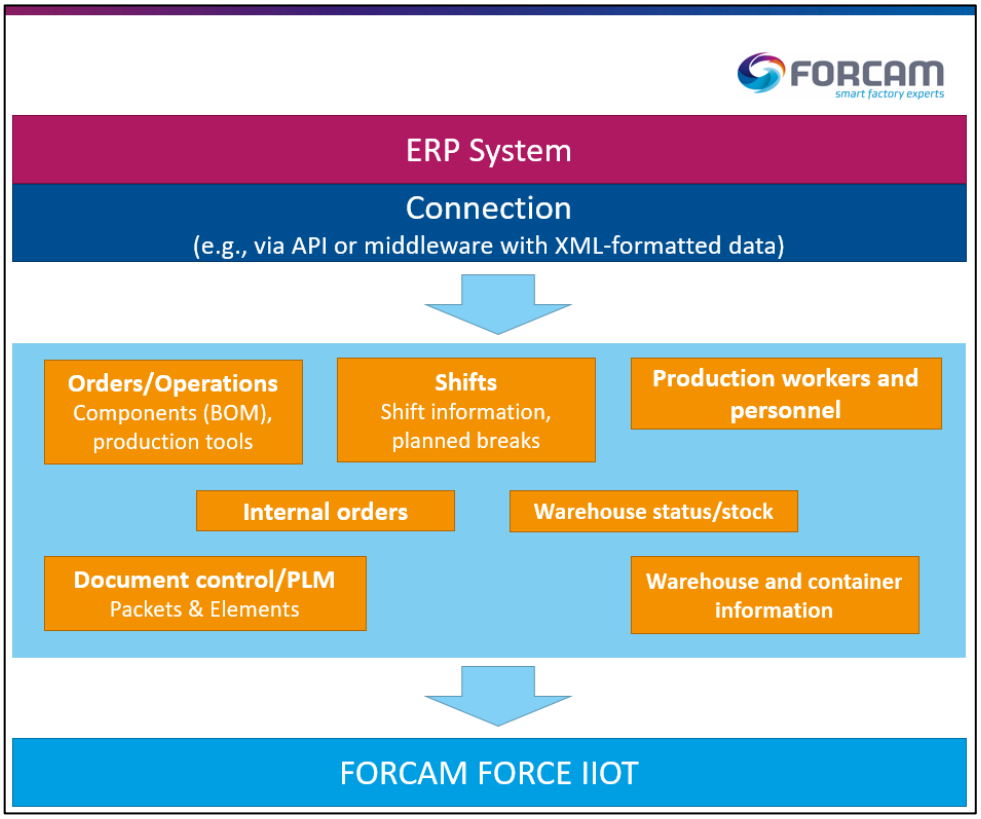
The FORCAM Adapter for SAP S/4HANA has the following advantages:

- Easy installation:
  The installation is done with SAP standards.
- Flexible integration:
  The adapter for SAP enables simple and logical integration of new functions, programs and tables into the SAP standard.
- Configurable connection:
  The SAP connection is configurable. It transfers data in realtime and avoids unnecessary data streams between SAP and FORCAM FORCE IIOT.
- Realtime communication:
  The adapter enables an immediate and easy data transfer via RFC (remote function call), HTTP XML communication and web services (IDoc communication framework).
- Consistent data:
  The integrated revision module ensures efficient data processing and avoids unnecessary duplicate maintenance.
- The use of SAP-specific business processes typical for the industry:
  Embedded AI, analytics, and intelligent process automation available within SAP by utilizing standard SAP tools.
- Gain in performance through optimized data basis:
  Prepared database views via preselected data from SAP tables (no longer selection from database tables).
- Automated message correction:
  All successfully booked messages can be corrected automatically.
- Reports for monitoring:
  User actions are only required for IDoc monitoring, therefore there are separate FORCAM reports available for optimized IDoc monitoring.
- Reports for troubleshooting:
  FORCAM reports for simplified error analysis and correction via IDoc monitoring.
- Continuous processing:
  IDocs for the same operation are processed in batch mode.
- Flexible implementation:
  On-premise, public/private cloud or hybrid implementation.

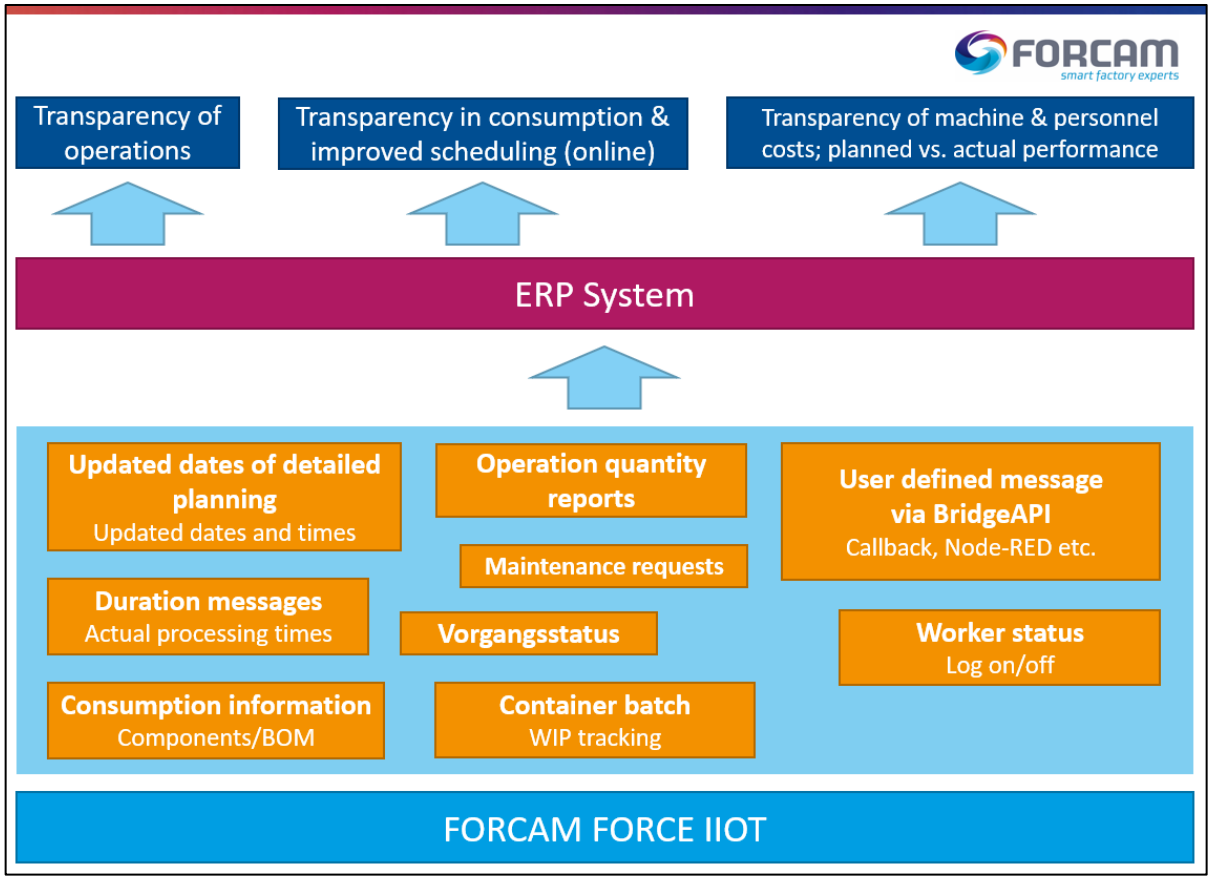
Generic (XML web services)



FORCAM FORCE BRIDGE offers the possibility of sending and receiving data and events via **XML** . Data records are exchanged by way of XML via the HTTP or HTTPS protocol. It uses an HTTP POST request with the XML datasets as payload.
In addition, it is also possible to use middleware such as Infor ION or Microsoft BizTalk to connect to the ERP. The functionality available there can be used to transform the required datasets into the FORCAM internal XML structure in advance.
A download and upload data service is available for communication between FORCAM FORCE IIOT and the connected ERP system. The download service is used to supply the Rule Engine with master data and order data. The incoming data (data message stream) is processed asynchronously. The upload data service is used for the confirmation of quantities, times and states (status messages) of orders (event message stream). Here, for durations and quantities, the absolute values are transmitted in addition to the relative changes.
The following diagram represents the different master and order data that can be transmitted in the download service.



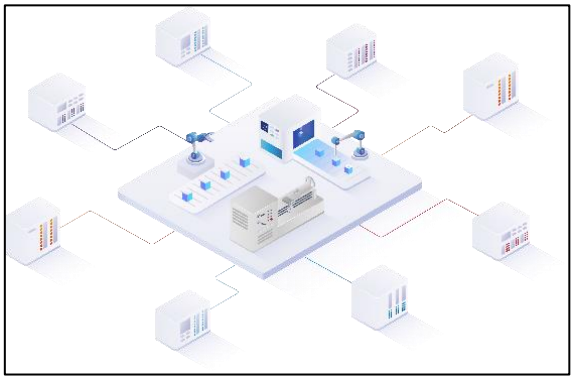
The following diagram illustrates the upload options:



Connectivity Shopfloor

The connectivity extension **Shopfloor Machine/Manual Workplace** is the machine interface of FORCAM FORCE IIOT. It helps to automatically record stroke signals, quantity messages, machine status and status details of various plants and machines. The recorded data can then be qualified in more detail in FORCAM's Shopfloor Terminal, i.e. machine stoppages or scrap and rework quantities can be justified.
The recorded data is condensed into meaningful information by other FORCAM apps, evaluated and reported back to the leading ERP system. In FORCAM FORCE IIOT, it is also possible to subsequently correct the recorded quantities and operating states as part of data maintenance. Plugins for the connection of different controllers allow flexible integration of heterogeneous machine parks.

Plugins

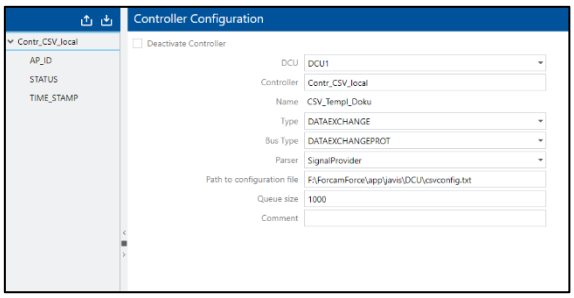


FORCAM FORCE IIOT supports a wide range of plugins that can be used to connect your machines and thus digitize your equipment. Among them are the most popular suppliers such as Siemens, MAZAK or Moxa. Your FORCAM service representative will provide you with a list of all supported as well as unsupported plugins upon request.
The control-specific plugins are configured via the user interface of FORCAM FORCE IIOT. Different parameters can be set depending on the control. A comprehensive script language is available for normalizing the input signals.
The user interface also lets you create templates for workplaces (machines and plants). This means that only one template needs to be created or edited for a machine type.

Communication and data normalization

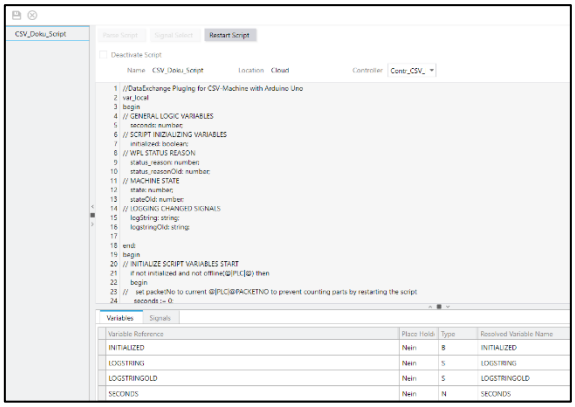
Modern production facilities usually have an Ethernet port that allows them to be connected to a Local Area Network (LAN), which can then be used to read out the relevant machine data using fieldbus protocols. If this is not the case, it is usually possible to install so-called communication processors or adapters. Digital and analog signals can also be recorded directly via fieldbus controllers.
The actual communication with the plant controllers takes place via the FORCAM Data Collection Unit (DCU), which can be adapted to the various processor and fieldbus variants using plugins. DCUs act as "middleware" between machines and the FORCAM Rule Engine (runtime environment). They ensure that only currently relevant data is transmitted based on event-controlled differential telegrams.

DCU



Depending on the control and fieldbus type, DCUs can operate up to 100 controllers of different types simultaneously without special requirements on the PC hardware on which they are installed.
To increase the availability of such a system, two DCUs can be configured simultaneously to monitor each other. If one DCU of the pair were to fail, the DCU that is still functional then automatically takes over the tasks of the failed DCU (failover). If a superordinate system itself were to fail, the Data Acquisition Unit (DACQ) downstream of the DCU buffers the acquired data.

DACQ

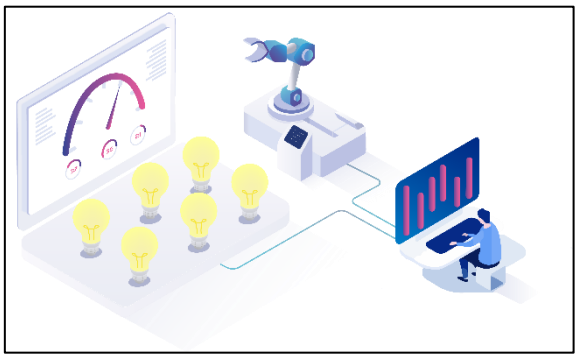


Any machine data can be converted (normalized) to standardized information in the DACQ via a fast formula interpreter (DACQ scripting), for instance to quantities, operating states such as "production", "setup", "malfunction", etc. Only this information, which is obtained independently of the type and characteristics of the machine is transmitted to the superordinate system where it is further processed and usually stored in the database of the system. The so-called alarm mapping (Error Code Mapping) enables the simple allocation of fault signals of the plants to status details and their classification in a single-level hierarchy.

Normalized machine messages

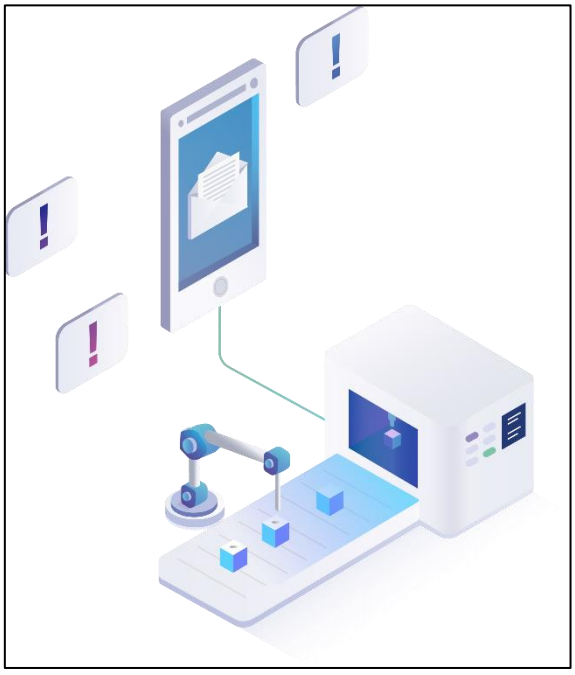
Messages	Function
Counter	Incrementing the machine counter by a certain number with indication of the counter number
Strokes	A number of machine cycles, pulses, or strokes that is multiplied by the quantity factor per machine cycle or by the stroke factor or cavity to determine the produced quantity. This factor is usually stored with the operation.
Quantities	A production result qualified by the machine or system itself as yield, scrap, or rework quantity
Status	Message of a machine status (production or stoppage)

Process data acquisition



FORCAM FORCE IIOT can continuously record relevant process data (energy, water, pressure, temperature, etc.) for a workplace. The process data acquisition serves as a basis for the enrichment of trace and energy data, which are prerequisites for the FORCAM apps **Track & Trace** and **Sustainability**. In contrast to Track & Trace, process data is recorded continuously without reference to the product. The Track & Trace and Sustainability apps can be purchased separately.

The data can be stored as long-term process data in a document-oriented database, although this does not have archiving status. To cover your exact database requirements, please contact us.
In order to use short-term stored data for reporting, FORCAM uses a table-oriented SQL database.



FORCAM presents the recorded process data in reports. These are evaluations and visualizations of the collected data combined with the possibility of exporting them via a file export or customer-specific web services. You can also use process data as triggers for automated processes via the FORCAM BridgeAPI, for example with Microsoft Power Automate.

Process data can be configured with warning and intervention limits for the currently running process to inform about critical values quickly and without delay. Notifications can be displayed to the worker directly in the Shopfloor Terminal or sent by email to a desired person or group.

Scope of functions

Core, Collaboration, Connectivity

- FORCAM FORCE IIOT in the core languages English, German, French and Chinese with an option of customized localization
  - Possibility to configure your own languages via the FORCAM Literal Manager
  - Selection of desired time zones
- Access to the Rule Engine to model your business logic
- Administration of users
  - Create and manage user accounts for FORCAM FORCE IIOT
  - Implementation of your company's individual password policies
  - Define rights and roles to manage the access rights of users
- Comprehensive configurations for various apps and scopes in FORCAM FORCE IIOT (depending on the apps purchased). Example:
  - Logon screen: Your own logo as well as an info area for a news ticker
  - System configuration: Technical aspects such as cache, authentication, data garbage collection, etc.
  - Shopfloor Terminal: Compile terminals from configured templates and profiles
  - Licenses: Direct insight into purchased licenses and easy management of license keys and files
- Management of master data
  - Workplace: Configuration of multiple workplaces or entire hierarchies and assignment of status details
  - Shifts: Definition of specific shifts, shift types and shift teams
  - Production data acquisition: Definition of phases & status, status details (reasons for malfunctions), quality types (yield, scrap, rework), etc.
  - Personnel data: Definition and administration of qualifications, cost centers and personnel hierarchies
- BridgeAPI standard interface
  - Reading of prepared information from FORCAM FORCE IIOT
  - Access to tool data management for tool management of TDM systems
  - Provision of information to an external reporting/BI tool
  - CAQ interface for quality management
  - Access to the PDCA/CIP ticketing of FORCAM

BridgeAPI Extension

- Access to the full functionality of FORCAM BridgeAPI to bridge between the real production site and the IT systems and applications of your organization
- Organizational interoperability of people, production plants and IT systems of a production plant in terms of maximizing resource effectiveness and process efficiency
- Complete digital image of your production plant with relevant objects, including their states
  - Real world entities such as personnel, machines or tools
  - Abstract entities such as production orders or operations
- Usage and display of events in FORCAM FORCE IIOT, e.g. machine status, created operations, orders, tickets, etc.
- Interface for third-party applications for remote control of predefined Shopfloor Terminal functions in background mode
  - Sending of commands, for example, to send quantity messages or status changes of operations to FORCAM FORCE IIOT
- Possibility of using your own terminal

Microsoft Power Automate

- Easy and standardized connection to the Microsoft Power Platform and the ecosystem of over 400 apps
- Connection to more than 500 data sources and all publicly available APIs
- Quick digitization of processes via easily created workflows without complicated coding
- Start workflows on the Shopfloor Terminal, e.g. to send emails if there is insufficient or faulty material
- Transmittal of all relevant information in the workflow, such as required material, order, machine and location
- Automated start of workflows on the machine if a tool breaks, for example

Connectivity ERP

SAP ERP/ECC 6.0

- Add-on certified by SAP and developed in the standard SAP ABAP programming environment for connecting the SAP ERP with the production data acquisition in production
- Supports the provision of production orders created in SAP ERP to production
- Supports integration of messages recorded in production into a system environment running SAP applications with SAP Net Weaver 7.01
- The data exchange between the connected systems takes place via IDoc communication, based on SAP's standard XML methods
- Easy installation with SAP standards
- Simple and logical integration of new functions, programs and tables into the SAP standard
- Realtime data transfer to avoid unnecessary data streams between SAP and FORCAM FORCE IIOT
- Immediate and easy data transfer via RFC (remote function call), HTTP XML communication and web services (IDoc communication framework)
- The integrated revision module ensures efficient data processing and avoids duplicate maintenance

SAP S/4HANA

- Add-on certified by SAP that specifically supports SAP's new S/4HANA ERP software solution
- Adapted to the increased in-memory requirements of HANA with consistent functionality: automatic confirmation of production orders (status changes, times and production quantities)
- Communication remains via IDocs
- Support of all benefits of S/4HANA:
    - Embedded AI, analytics and intelligent process automation
    - Prepared database views via preselected data from SAP tables
    - Automated message correction of all successfully booked messages
    - Serialized processing of IDocs for the same operation
    - On-premise, public/private cloud or hybrid implementation
- FORCAM reports for optimized IDoc monitoring
- FORCAM reports for determining order numbers in the IDoc error pool

Generic (XML web services)

- Sending data and events via XML
  - Data records are exchanged using XML via the HTTP or HTTPS protocol
  - HTTP POST request with the XML datasets as payload
- Possibility of using middleware for connection to the ERP, e.g. Infor ION or Microsoft BizTalk
- Download and upload data service for communication between FORCAM FORCE IIOT and the connected ERP system for supplying the Rule Engine with master data and order data
  - Asynchronous processing of incoming data (Data Message Stream)
  - The upload data service is used for the confirmation of quantities, times and states (status messages) of orders (event message stream).
  - In addition to the relative changes, absolute values for durations and quantities are also transmitted

The matrix below highlights the different functionalities of FORCAM ERP adapters.

Direction	Function	SAP ECC/ERP 6.0	SAP S/4HANA	Generic XML
Download	Order data (header, operation, components, production resources and tools)	X	X	X
	Personnel master record (basic information)	X	X	X
	Shifts (shift schedule, breaks)	X	X	X
	Internal orders/overhead costs	X	-	X
	Information about storage containers	-	-	X
	Information about inventory data	-	-	X
Upload	Order confirmations (Status, quantities & actual times)	X	X	X
	Order management data	-	-	X
	Employee attendance messages (coming/going)	X	-	X
	Component consumption messages	-	-	X
	Maintenance request	X	-	X

Connectivity Shopfloor Machine/Manual Workplace

- Automated mapping of machine alarms to single-level operating states (error code mapping)
- High performance despite low processor requirements (up to 100 machines per acquisition computer)
- High scalability with almost unlimited number of acquisition computers (DCUs)
- Server-based with parameterization in the browser
- Plugin concept for different control and protocol types
- High availability through failover concept
- High data security through consistent queuing
- Flexible combination of equipment control signals for determining machine status through DACQ scripting
- Direct readout of control signals via the supported protocols without an intermediary (e.g. OPC Server or MT Connect)
- Reading data from the supported controllers
- Convert and link data via a formula interpreter
- Event-controlled transmittal of data to the superordinate system
- Configuration of evaluable, "normalized" operating states
- Alarm mapping for easy allocation of plant fault signals to status details and their classification in a single-level hierarchy
- Continuous recording of relevant process data (energy, water, pressure, temperature, etc.) for a workplace
    - In contrast to Track & Trace, process data is recorded without reference to the product
- Storage of data in databases
- FORCAM reports for the evaluation and visualization of process data
- Warning and intervention limits for prompt notification of critical values

Abbreviations

Abbreviation	Meaning
API	Application programming interface
BI	Business intelligence (business analytics)
BOM	Bill of materials (list of components)
CAQ	Computer-aided quality assurance
CSV	Comma-separated values (structure of a text file for storage or exchange of simply structured data)
DACQ	Data acquisition unit (data interpretation unit)
DCU	Data collection unit
ERP	Enterprise resource planning (resource planning of the company)
HTTP	Hypertext transfer protocol
CIP	Continuous improvement process
LAN	Local area network (local computer network)
PDCA	Plan, do, check, act (iterative four-phase process for learning and improvement)
PLM	Product life-cycle management
RFC	Remote function call (umbrella term for SAP's own protocols and interfaces for handling function calls up to their implementation)
SFT	Shopfloor Terminal
TDM	Tool data management
UI	User interface
WIP	Work in progress
XML	Extensible markup language