

**Enclosure 2 to Quotation No. OPP-XXXXXX Version 1**  
**Product Description, Reference: R2021.3**



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# 1 FASTSUITE Product Packaging - Introduction

The software modules of FASTSUITE are available in different pre-configured packages in order to provide all necessary functions for dedicated use cases in simple, unmistakable packages.

The typical user roles that are addressed by the FASTSUITE packages are:

- Concept planner
- Offline programmer
- Automation engineer
- System integrator

For a necessary technical differentiation, there are different configuration level available per user role:

- Standard
- Advanced
- Premium

The number of available add-on modules was significantly reduced. The following matrix shows the individual content of each configuration:

	Concept Planner	Advanced Concept Planner	Offline Programmer	Advanced Offline Programmer	Premium Offline Programmer	Automation Engineer	Integrator **	Advanced Integrator **	Premium Integrator **	Concept Presenter
FASTSUITE Edition 2 Base incl. STEP, IGES, JT, AML import	X	X	X	X	X	X	X	X	X	
Motion Simulator	X	X	X	X	X	X	X	X	X	X
Tool Path Programmer	X	X	X	X	X	X	X	X	X	
Layout Builder, incl. 3Dpdf export	X	X		X	X	X	X	X	X	
Resource Builder		X				X	X	X	X	
OLP			X	X	X		X	X	X	
Controller Library (all available controllers)			X	X	X		X	X	X	
Downloader Library (all available pre-configured downloaders)			X	X	X		X	X	X	
Technology Library (all available pre-configured technologies)			X	X	X		X	X	X	
Robot Team			X	X	X		X	X	X	
Surface Option (incl. all available pre-configured surface technologies)					X				X	
Automation Builder						X		X	X	
Connector Library (all available connectors)						X		X	X	
Fixtrue Builder incl. STEP export				X				X	X	
<b>Available Add-ons</b>										
Fixture Builder	o	o	o		o	o	o	o	o	
Surface Option (incl. all available pre-configured surface technologies)				o*			o			
All Format Importer	o	o	o	o	o	o	o	o	o	
CAD Exporter, per Format	o	o	o	o	o	o	o	o	o	
PLM Connector, per PLM system	o	o	o	o	o	o	o	o	o	
Controller Connector, per Controller			o	o	o		o		o	
Uploader, pre-configured, per Uploader			o	o	o		o	o	o	
Process Models, per Process Model			o	o	o		o	o	o	

\* The surface option is required to support side-tangent operations

\*\* For each „Integrator role“ license, a system integrator will get up to 5 free „Concept Presenter“ licenses

## 2 FASTSUITE Edition 2 Base

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FASTSUITE Edition 2 Base provides software infrastructure foundations and kernel modules for all the other FASTSUITE Edition 2 products and applications, including the user interface and 3D viewer.

FASTSUITE Edition 2 Base also provides basic CAD import as well as resource and workpiece definition options to load CAD data, and to use them in layout studies. For advanced resource definitions, including kinematics and behavior definitions, the Fixture Builder and Resource Builder modules are available.

### E2 Kernels

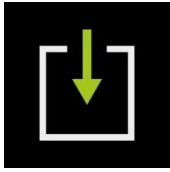
- E2 application kernel
- Layout kernel
- Polygonal geometry kernel
- Exact geometry kernel (Parasolid)
- 3D graphics

### Main Functionalities

- CAD data preparation
  - Simplify geometries in order to prepare them for the usage as resources or work pieces
- Import 3D CAD data (standard formats)
  - Parasolid
  - IGES, STEP, Jt
  - AML, Collada
  - STL, VRML
- Resource and workpiece definition
  - Definition of workpiece objects and of basic (static) resources
  - Definition of frames and adapters on resources
  - Geometrical comparison of different workpiece versions
  - Definition and management of workpiece states and workpiece assemblies
- Graphical user interface
  - 3D modelling and simulation environment, including support of VR devices
  - Context-driven online help (F1 hotkey on objects, commands and manipulators)
- Measurement functionality

### 3 Native CAD Importer Add-on

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The following native CAD importers are available for FASTSUITE Edition 2 in order to load external CAD data and to convert it into the internally used Parasolid format. Due to the fact that the source CAD systems have release cycles, and since some CAD systems are using features and functions which have no equivalence in Parasolid, the import might be restricted to a dedicated release level of the CAD system, and it might also be restricted regarding the supported geometrical features to be imported (reference: Hoops Exchange R2020).

- Acis 2020
- AutoDesk Inventor 2021
- CATIA V5-6 R2020
- Creo V7
- I-Deas
- IFC
- JT 10.3
- Parasolid V32
- PDF
- PRC
- Pro/Engineer
- REVIT 2020
- Rhino
- Siemens PLM NX (v1872, v1899, v1926)
- Solid Edge 2020
- Solid Works 2020
- Stereo Lithography STL
- U3D
- VDA-FS
- ASCII PointCloud
- Stanford Triangle Format
- PointCloud to Hull

A special import option is available to import point clouds (\*.pts), and to create a mesh object from this import. This mesh object can be used in downstream processes, e. g. as workpiece or as collision element.

FASTSUITE Edition 2 also provides import interfaces to load 2D geometries, such as floor-plans etc. the following 2D CAD formats are supported:

- DWG
- DXF

## 4 CAD Exporter Add-on

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The following CAD export options are available for FASTSUITE Edition 2.

- Parasolid
- STEP (BREP/exact and tessellated geometry)
- JT (BREP/exact and tessellated geometry)
- STL (tessellated geometry)
- VRML (tessellated geometry)
- 3DPDF (static and animated)

## 5 Motion Simulator

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The Motion Simulator module is providing functionalities for dynamic process simulations and process validations with FASTSUITE Edition 2 layouts. The simulation infrastructure for actuators and sensors is completely signal-based, ensuring a realistic, non-scripted simulation of motions and signals.

For the kinematic simulation of resources, and a generic motion planning of robots and machines, the Simulation Monitor provides a generic controller that can be connected to different inverse kinematics solvers. This enables reachability checks and layout validations. To enable offline-programming projects in conjunction with the Toolpath Programmer and OLP module, a controller connection infrastructure is also available to replace the generic controller with specific motion controllers that are available as add-on modules.

### Main Functionalities

- Signal-based simulation technology (actuators and sensors)
- Collision solver
  - Support of different collision groups
  - Detection of near-miss situations and collisions
- TCP trace
- Simplified cable simulation on robot arms (if defined in robot resource model)
- Simulation monitor dashboard
  - Alpha-numerical display of simulation values
  - Dynamic display of joint/axis values and limits
- Generic controller
  - generic motion planning
- Connector infrastructure to enable the use of controller connectors



## 6 Toolpath Programmer

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The Toolpath Programmer module provides the infrastructure for the virtual teaching and geometry-based path planning of resources (robots and machines).

A basic technology package for point and curve motions provide a parametric trajectory planning and toolpath discretization for robot operations, including linear and circular interpolations and approach-/retract motions. This enables quick case studies and dynamic reachability checks of even complex robot operations and trajectories without the need for comprehensive process detailing. To enable application-specific offline-programming projects, and to customize technology integrations to specific robot cells, dedicated applications technologies are available as add-on options.

### Main Functionalities

- Programming infrastructure
  - Create and manage toolpath operations
  - Toolpath dashboard
- Definition or import of process geometries (points and curves)
- Geometry-based programming with generic point and curve technologies, and virtual teaching of robot trajectories
- Support of both, fixed TCP (fixed tool) and dynamic TCP programs
- Support of static and dynamic base frames
- Support of external axis
  - positioner axis
  - interpolated axis
- Toolpath optimizations
  - modification and interpolation of normal, tangent and offset vectors
  - external axis support for workpiece positioners, conveyors and rails (positioner axes and coordinated motions)
- Build-in events
  - basic handling (grasp, release)
  - I/O signals
  - motion profiles

## 7 Surface Option

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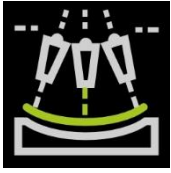
The Surface Option is an add-on to Toolpath Programmer module, enhancing the functionalities with surface-based operations.

### Main Functionalities

- Surface-based trajectory planning
- Linear and circular interpolation of trajectories
- Geometry-based programming with generic surface technology
- Extended toolpath optimizations
  - surface-based interpolation rules

## 8 Offline Programmer

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The Offline Programmer module is providing the infrastructure to use technology packages for advanced, process-oriented programming of manufacturing processes as well as the infrastructure to download the simulation result (download translator required).

Robot or machine programs can also be uploaded to re-create toolpath operations and events from existing programs (upload translator required).

### Main Functionalities

- Offline-programming infrastructure for rule-based toolpath programming by using technology packages
- Calculation of swept volumes, and export of swept volumes in JT or STL format
- Capabilities to customize technology packages
- Download infrastructure
- Upload of operations from XML

## 9 Robot Team Support

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This add-on module enables the efficient and safe programming and simulation of robot teams, especially of robot cells where multiple robots are working simultaneously on workpieces that are dynamically moved by workpiece positioners. Each robot can be programmed independently, then the trajectories and motions of robots and workpiece positioners will be synchronized in definable synchronization zones.

### Main Functionalities

- Support of several work cell types and robot cell configurations with up to 16 robots
- Synchronization of robot motions within defined synchronization zones by using specific synchronization events
- Automatic distribution of external axes positions from leading robot to following robots for coordinated movements
- Toolpath enhancements to include the synchronization commands for downloading

## 10 Motion Controller

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FASTSUITE motion controller modules are required to teach, program and simulate robots and/or machines, using control specific settings to enhance user comfort and simulation accuracy.

### Main Functionalities

- Control-specific motion planning
- Inverse kinematic support
- Control specific configuration and turn handling
- Control specific program download
- Control specific program upload
- Connection infrastructure to connect external motion planners (Connector required)

### Motion Planning

A control and kinematic specific motion planner emulates robot/machine motions. The motion planner takes into account speeds, feeds, acceleration and deceleration and events, such as flyby, exact stop, etc. to ensure that the motion behavior and cycle time is as accurate as possible. In case the accuracy of the FASTSUITE Edition 2 control specific motion planner is not sufficient, the motion planner can be replaced by a control vendor specific virtual controller (if available). For this purpose, each motion controller is providing the infrastructure to connect external motion planners via connector modules, which are available as add-on modules for selected controllers.

### Configuration and Turn Handling

A controller module ensures the exact configuration and turn behavior in simulation as the one on the real robot. This allows the visualisation in the GUI, of the specific configuration labels for the used robot model. The experienced robot user can directly program configurations as he is used to do on the real controller.

### Program Download

A controller module provides a control specific method to download all operations and corresponding events into FASTSUITE Edition 2 neutral xml-format. This format can be translated into the robot control specific language (NRL) using a control specific FASTSUITE Edition 2 download translator.

### Program Upload

The controller module provides a control specific upload method, which will read-in FASTSUITE Edition 2 neutral xml-format into OLP operations. In combination with the used OLP technology, the upload method will support all control and technology specific events. After upload, the created operations can be modified and interpolated using the OLP functionalities.

## 11 Logic Controller

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FASTSUITE Logic Controller modules are required to simulate the work cell logic and procedure.

### Main Functionalities

- Provision of logic controller objects to correctly build up the controller structure of robot cell layouts
- Connection infrastructure to connect external logic controllers (Connector to logic control or to PLC programming studios required)

## 12 Standard Download Translators

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Downloaders for the different robot and/or machine controllers translate the neutral FASTSUITE Edition 2 XML-format, created by the different controller modules, into native robot language, which can directly be loaded and used on real robot controls.

Standard downloaders provide a set of default functionalities and default output syntax. Adaptations to project-specific output structures, integration of external axis and technology-specific enhancements in context with technology packages are subject to customization services.

### Main Functionalities

- Parsing of FASTSUITE Edition 2 XML programs
- Translating FASTSUITE Edition 2-XML programs into native robot programs
- Default functionality:
  - Positioning and motion commands (pt-to-pt, linear, circular)
  - Motion profiles (speed, accuracy)
  - Basic signals and trigger (wait signal, distance trigger, time trigger)

### Available standard download translators for robot controllers

- ABB S4
- Cloos Qirox, Rotrol controller
- Denso RC8, RC7N
- DUERR EcoPRC, EcoPRC2
- EPSON RC+7.0
- FANUC R-30iA, R-30iB
- JARI
- Kawasaki E40, E42, E44
- Kobelco CB
- KUKA KRC4
- Mitsubishi CR750-Q, CR750-D, C2RQA, CR2DA
- Nachi FD11, CFD, AX37
- OTC Daihen FD11
- Panasonic GIII, WGIII
- Reis RS5
- Stäubli CS8C
- Universal Robots CB3, URScript and URP
- Yaskawa DX100, DX200, FS100, NX100

### Available standard download translators for CNC controllers

- Siemens Sinumerik 840D
- Prima RML+, P20L, P30L
- Laserdyne S94P

## 13 Uploader

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Uploaders for the different robot and/or machine controllers translate native robot language, created by the different controller modules, into neutral FASTSUITE Edition 2 XML-format, which can directly be used for simulation. Due to the huge variety of program structures and programming methods, this requires a project-related specification and customization of the upload translator.

### Main Functionalities

- Parsing of native robot language
- Translating native robot programs into FASTSUITE Edition 2-XML format

### Available pre-configured upload translators for CNC controllers

- TRUMPF (Siemens 840D with lasercutting process parameters)
- PRIMA (P20L/P30L program syntax with lasercutting process parameters)

### Available pre-configured upload translators for importing CAM operations

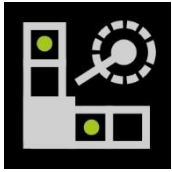
For some complex robot operations it might be required to use a dedicated CAM software to compute the toolpath that shall be executed by a robot. This CAM toolpath can be imported into FASTSUITE Edition 2 by using a dedicated uploader. Once the toolpaths are imported, they can be modified and enhanced (e.g. definition of tangent orientation etc.), simulated and exported as a robot program. The following pre-configured upload / CAM import options are available:

- CATIA CAM toolpath export to FASTSUITE Edition 2 (CATIA postprocessor to generate the FASTSUITE Edition 2 XML-Format)
- APT upload option (APT syntax subject to customization)



## 14 Layout Builder

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Layout Builder is providing functions to create 3D layouts of automation cells and production lines for validation, programming and commissioning. It contains functionalities to load available Edition 2 resources and position them in space, by simply drag components and drop them at their desired position within the production layout. Based on the different resource types, such as production resources (robots, machines), controllers and workpieces, and the mechanical and electrical connection of adapters the composed production layouts will directly be ready to be used as simulation layouts.

A resource library with a comprehensive list of validated models for robots and controllers as well as with sample resources for auxiliary components is available. Project-specific (static) resources can be added via CAD data import by using the functions of FASTSUITE Edition 2 Base. For adding project-specific simulation resources, the fixture builder or resource builder module can be used (add-on modules).

The port mapping capability is to prepare the electrical connections of a layout for signal-based process simulations and commissioning projects by correctly mapping the I/O ports of the simulation components (resources with controllers and controllers with controllers).

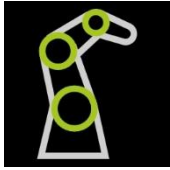
Layouts can be exported as 3D geometry or 3Dpdf (export interface add-on is required).

### Main Functionalities

- Access to resource files (robots, machines, equipment)
  - Resource models of robots and NC machines
  - Sample models of auxiliary devices (rails, workpiece positioners, gantry, ...)
  - Sample models of tools (weld guns, torches, spindles, gripper, ...)
  - Sample models of jigs (clamps, ...)
  - Sample models of accessories (fences, tables, conveyors, shelves, ...)
- Layout creation
  - quick drag&snap of resources in 3D
  - grid mode for fast positioning and alignment of resources in 3D on a customizable point grid
  - precise positioning of resources by using the 3D manipulator
  - definition of mechanical and electrical connections
- Controller ports dashboards
  - automatic automatic port mapping between resources and controllers, and controller-to-controller
  - user-definable mapping
- Controller settings for current layout
  - Project-specific mapping of tool frames and base frames
  - Alignment of controller capabilities with workcell capabilities (suppression of commands and features that are not supported with current workcell)
  - Selection of downloader and program directory path

## 15 Resource Builder

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The Resource Builder is designed to create and maintain mechatronic simulation resources and components, including their mechanical and signal-driven behaviour. The simulation behaviour of resources can be defined by using standard behaviour models.

### Main Functionalities

- Modelling of resources
- Modelling of motion controllers and logic controllers
- Definition of simulation behaviours

### Creation of simulation resources

- Resource classification
- Definition of frames (root frame, base frame, tool frame,...)
- Kinematics definition
  - driven and undriven joints
  - axis limits
- Geometry attachment to kinematic joints
- Definition of adapters
  - Mechanical adapters
  - Electrical adapters
- Definition of sensors
  - Light barrier sensor
  - Proximity sensor
- Setting of signal-driven actuator technology
  - standard port and behavior models according to resource and joint classification
  - driven axes of main devices
  - synchronous axes, connected to motion planner
  - asynchronous axes, controlled by float or boolean signals
  - Acceleration, deceleration of axis
  - grab, attach and release behavior for parent adapters

### Creation of controllers

- General controller information
- Assignment of motion planner
- Downloader assignment
- Definition of adapters
  - Mechanical adapters
  - Electrical parent adapter
  - Electrical child adapter

## 16 Automation Builder

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The Automation Builder is providing all necessary functions, infrastructure extensions and module enhancements for the definition and use of a FASTSUITE layout with external controllers, especially for controller validation and virtual commissioning projects.

Also an option to define source and sink objects to any simulation resource is available to enable material handling operations which require the creation and remove of simulation material respectively workpieces. In conjunction with a PLC program definition, an endless simulation loop for pick & place scenarios is now available.

### Main Functionalities

- Resource Builder extension to define additional, extended behaviour models
  - add/remove of ports
  - connection edit between input ports and actors by using logic blocks and branching / condition terms
  - definition of source and sink objects for material flow simulations

## 17 Fixture Builder

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Fixture Builder is designed to create special holding fixtures, used i.e. in laser cutting prototype manufacturing. In addition, the fixture builder license also includes the necessary resource builder functionalities to create production fixtures from CAD data.

### Main Functionalities

- Fixture Design
- Fixture Output Creation
- Resource Builder functions for fixtures

### Fixture Design

- Definition of base plate and support plate positions
- Modify base plate in 3D, including split base plate, engraving and fixing holes
- Add, move or delete support plates in 3D
- Calculation of fixture geometry
- Creation of contour reliefs and weight reliefs
- Creation of mechanical adapters
  - fixture child adapter
  - work piece child adapter

### Fixture Output

- Unfolding of 3D fixture plates into 2D
- Simple nesting of fixture plates
- 2D dxf export for external processing
- 2D tool path creation to cut fixture plates
- 3D export in STEP format (STEP export option required)

### Resource Builder functions for production fixtures

- Kinematic definitions for clamps
- Adapter definitions
- Setting of home positions (signal-based fixture states, such as open/close)

## 18 OPC-UA Connector

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OPC-UA connectors are available to connect the simulation layout of FAST-SUITE Edition 2 with external software or hardware controllers, using the standard OPC-UA communication protocol. This applies for both, logic controllers and motion controllers. Technically, the OPC-UA connector provides and manages an embedded OPC-UA client instance that can be connected with an existing OPC-UA server.

**This OPC-UA connector was successfully tested with the following controllers**

- OMRON NJ PLC controller
- 3S-Smart CODESYS V3.5 virtual logic controller
- Beckhoff TwinCAT 3 virtual logic controller
- Mitsubishi PLC controller and virtual logic controller
- B&R
- Allen Bradley

## 19 Asynchronous DOF Connector

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This specific connector is supporting main axis (driven axis) and external axis positions (synchronous axis positions) with simulation values which are defined in a csv structure that defines the joint values per time increment. Thanks to this “generic” option it is possible to include as a bypass the dynamic simulation behavior of those resources where no virtual controller is available, or connectable.

## 20 ABB Robot Studio VRC Connector

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The ABB VRC connector is available to connect the simulation layout of FAST-SUITE Edition 2 with ABB RobotStudio as virtual controllers for a realistic motion planning of ABB robots.

## 21 DENSO ORiN2 Connector

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The DENSO ORiN2 connector is available to connect the simulation layout of FASTSUITE Edition 2 with the VRC of DENSO thru the ORiN2 interface for a realistic motion planning of DENSO robots.

## 22 FANUC RoboGuide Connector

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The FANUC RoboGuide connector is available to connect the simulation layout of FASTSUITE Edition 2 with FANUC Roboguide V7, V8 and V9 as virtual controllers or with the FANUC R-30iA, FANUC R30-iB and FANUC R30iB Plus robot controls for a realistic motion planning of FANUC robots.

## 23 Kawasaki VRC Connector

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The Kawasaki VRC connector is available to connect the simulation layout of FASTSUITE Edition 2 with the VRC of Kawasaki (K-Roset) for a realistic motion planning of Kawasaki robots.

## 24 KOBELCO VRC Connector

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The KOBELCO VRC connector is available to connect the simulation layout of FASTSUITE Edition 2 with the VRC of KOBELCO for a realistic motion planning of KOBELCO robots.

## 25 KUKA OfficeLite Connector

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The KUKA OfficeLite connector is available to connect the simulation layout of FASTSUITE Edition 2 with KUKA OfficeLite as virtual controllers for a realistic motion planning of KUKA robots.

## 26 Nachi VRC Connector

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The Nachi VRC connector is available to connect the simulation layout of FASTSUITE Edition 2 with the virtual controller software from Nachi (FD On Desk) for a realistic motion planning of Nachi robots.

## 27 PRIMA P30L Connector

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The PRIMA controller connector is available to connect the simulation layout of FASTSUITE Edition 2 with the virtual controller of PRIMA POWER for a realistic motion planning of 3D laser machines that are operated with a P30L control.

## 28 SIEMENS VNCK Connector

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The SIEMENS VNCK connector is available to connect the simulation layout of FASTSUITE Edition 2 with the virtual SINUMERIK CNC control for a realistic motion planning of NC machines and robots that are operated with a 840D control.

## 29 SIEMENS PLCSim

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The PLCSim connector is used to connect the simulation model of FASTSUITE Edition 2 and a virtual programmable logic controller (PLC) of the S7-300/400 controller series.

## 30 SIEMENS PLCSim Advanced Connector

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The PLCSim Advanced connector is used to connect the simulation model of FASTSUITE Edition 2 and a virtual programmable logic controller (PLC) of the controller series S7-1500.

## 31 Yaskawa VRC Connector

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The Yaskawa VRC connector is available to connect the simulation layout of FASTSUITE Edition 2 with the virtual controller software from Yaskawa (Motosim) for a realistic motion planning of Yaskawa Motosim robots.

## **32 Application Technology Packages - General**

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FASTSUITE provides a set of additional pre-configured technologies for a large variety of applications that can be used as a foundation for further cell-specific and project-specific customization.

By default, a generic point-based, curve-based and surface-based technology is available with every toolpath programmer license. They can be used to easily and quickly generate robot paths for layout concepts and reachability checks etc.

For real offline programming projects, however, these generic technologies are missing additional process-specific parameter sets and controller commands. In order to provide a quick start into offline programming, FASTSUITE includes a set of pre-configured technologies that already provide typical parameter sets and commands for typical robot applications. These pre-configured technologies can be customized and extended at any time – either as a support service, or by the user. Please refer to “Technology Customization Enablement” for details.

## **33 Spot Welding Technology**

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The spot welding technology of FASTSUITE Edition 2 can be individually adapted for stationary, robot-operated welding guns as well as for body-in-white systems with flexible joining cells. In contrast to manual teaching, the software supports the creation of complete programs including all bypass movements and process-specific control commands.

### **Technical Information**

#### **Main Functionalities**

- Transfer of fasteners and joint planning from design and process planning.
- Support in the selection and protection of welding guns (accessibility, collision avoidance).
- Automatic path planning including approach and retract movements
- Automatic creation of technology parameters (stack thickness, locking times, etc.) and process events (speeds, synchronization commands, I/O signals, etc.).
- Generation and simulation of clamp compensation.
- Interpolations for global and local optimization of the robot path (collision avoidance, continuous movements, etc.).
- Integrated teach-in functions for easy definition of bypass points, handling tasks, tool changes, etc.
- Cycle programming and simulation for servo weld guns, servo-pneumatic weld guns and pneumatic weld guns



## 34 Laser Cutting Technology

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FASTSUITE Offline Programming Add-ons are available for many trimming and cutting technologies, used with robots and machine-tools. This includes sheet-metal parts in prototyping and serial production as well as composite parts and other materials.

The trimming technology packages of FASTSUITE are able to cope with the different requirements from machine- and robot-based applications.

### Technical Information

#### Main Functionalities

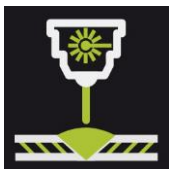
For 3D laser machines, FASTSUITE Edition 2 also provides the following functions:

- Manifold CAD interfaces for data import
- Automatic, rule-based toolpath programming, including support of geometry macros and regshapes
- Support of different linking types between operations and operation groups (linear link, circular link, link with head-down motion, ...)
- Pre-set and re-use of program parameters and technology tables
- Full control to optimize the machine motions: C-axis optimization, axis interpolations
- Local optimizations for springback compensation, collision avoidance etc.
- Integration of auxillary devices into the program structure and process simulation: rotary chucks, rotary table, clamps etc.
- Partial or full simulation of single geometries, geometry groups and complete programs
- Automatic tube cutting option for machines with rotary axis

In case the surface option is available, it is possible to define “side tangent” process geometries for cutting materials with thickness. After programming, the toolpath orientation is not normal to the top surface but a tangent orientation to the lateral cutting face.

## 35 Laser Welding Technology

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Laser welding with robots comes along with a broad range of requirements. FASTSUITE Edition 2 is the ideal tool to support all of them – from single weld robots up to complex welding cells.

### Technical Information

#### Main Functionalities

- CAD-to-path algorithms for easy weld line definitions directly from 3D CAD data, including automatic approach and retract motions
- Customer-specific process settings for welding start and end with complete laser parameter set from expandable tables.

- Fast pre-selection and adjustment of process parameters such as weld seam thickness, weld path distance and welding head positioning to the workpiece by predefined welding methods:
  - Normal weld
  - Tack weld
  - Welding of inner corners
  - Seam search (e.g. Teachline)
  - Inert gas and wire feed (e.g. Fusionline)
- Customizable welding recipes to control the welding parameters for I-seam, fillet seam and corner seam as well as focus distance for normal or heat conducting seam
  - Parametric control of tool inclination and rotation for optimum welding results
- Parametric control of tool inclination and rotation for optimum welding results:
  - Perfect part orientation
  - Solution of accessibility problems

## 36 Arc Welding Technology

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Arc welding with robots places the most diverse demands on programming software: complex system kinematics with external axes and workpiece positioners, highly specific welding technology with sophisticated process parameters, process-related requirements for component positions and difficult accessibility are just a few of the points that have to be mastered. The FASTSUITE Edition 2 offers a comprehensive and scalable solution for the implementation of simple welding robots up to complex welding cells with a multitude of components and offers a very high degree of automation which makes it possible to achieve consistently high welding results.

### Technical Information

#### Main Functionalities

- Simple CAD-based weld path generation (CAD-to-path algorithms), including automatic approach and retract strategies.
- Easy adjustment of process parameters: Weld seam thickness, weld path distance and welding head positioning to the workpiece, using adaptable welding parameter sets.
- Support of various welding methods
  - continuous weld
  - stitch weld
  - multi-layer welding
  - pendulum welding / weave welding
- Interpolated control of the tool axis for optimum welding results and automatic adjustment of the welding torch in box corners and edges.
- Automatic positioning and interpolation of external axes and workpiece positioners for optimum workpiece orientation.

## 37 Roller Hemming Technology

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In order to achieve a perfect processing result with robot-based roller hemming, efficient offline programming is indispensable. The right programming software helps to create the entire process very efficiently and target-oriented and to adapt it quickly to the actual component situation, so that the programming times for new components can be reduced from several days to a few hours - with a simultaneously better process result.

### Technical Information

#### Main Functionalities

- Algorithms for geomodular path planning, based on mathematical CAD data. This also includes the calculation of circular movements for uniform and thus continuous tool-paths along complex 3D paths.
- Support of various hemming heads - pneumatic, servo-controlled or with additional 7th axis, as well as static or dynamic positioning tables by powerful interpolation functions.
- Automatic generation of multiple paths in only one operation, including approach and retract paths, rework paths, etc.
- Parametric modification of the travel paths for fine adjustment during commissioning.
- Efficient local and global offset interpolation to compensate for the unavoidable deviations between the theoretical CAD data and the real component geometry or sheet thickness.
- Support of all functions of the robot cell, including positioning table, clamp, loading operations, tool change etc.

## 38 Sealing/Gluing Technology

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Manual teaching of sealing and gluing operations is very time consuming, the right offline programming software helps to create the entire process very efficiently. No matter if multi-robot sealing stations or gluing stations with a fixed application tool are concerned, this special technology package can speed up the programming process significantly - with a simultaneously better process result in terms of smooth robot trajectories and sealant seam quality.

### Technical Information

#### Main Functionalities

- Control over Robot motion types, accuracy, offsets, translations, speeds
- Simple CAD-based path generation (CAD-to-path algorithms), including automatic approach and retract strategies.
- Easy adjustment of process parameters:
  - Glue on: distance, gun number, check pressure
  - Glue off: distance, End Measurement, Change Doser
- Interpolated control of the target points for optimum sealing results

- Automatic positioning and interpolation of external axes and workpiece positioners for optimum workpiece orientation
- Spray process model for coverage simulation

## 39 NTD Technology

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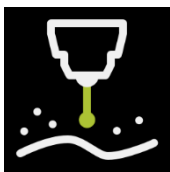
Robot systems for Ultrasonic scanning or other non-destructive testing methods very often require a specific path planning, and in case of double-robot setups, even a coordinated motion control between the robot arms. The pre-configured NDT technology takes care of both, accurate trajectory planning as well as perfect control on all process parameters within the robot program. Also, thanks to smart gap avoidance options, the need for time-consuming preparation of the CAD data (fill holes, close surface gaps etc.) before programming can be reduced significantly.

### Main Functionalities

- Process control parameters: Scan speed, TCP accuracy, Scanning activation by triggers, Channel bitmask
- Approach and retract strategies
- Toolpath creation based on:
  - track distance
  - guiding curve
  - track and area extension
- Gap avoidance strategies
- automatic creation of path linking motions (linear, circular)
- new off-process tool path sections: lead-in, lead-out and track link

## 40 Other Pre-configured Point- and Curve-based Technologies

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FASTSUITE provides a set of additional pre-configured technologies for point-based and curve-based applications that can be used as a foundation for further cell-specific and project-specific customization.

The following additional technologies are available with each offline programming license bundle (separate licenses required until R2020.5, included with OLP bundles from R2020.6 on):

- Inspection Technology
- Drilling/Riveting
- Waterjet cutting
- Ultrasonic cutting
- Plasma cutting
- Deburring
- Friction stir welding
- Routing

## **Technical Information**

- Control over Robot motion types, accuracy, offsets, translations, speeds
- Quick and simple geometry-based path generation (CAD-to-path algorithms), including automatic approach and retract strategies.
- Automatic adjustment of process parameters: Tool on/off
- Interpolated control of the target points for smooth robot motions and optimal process results
- Automatic positioning and interpolation of external axes and workpiece positioners for optimum workpiece orientation

## **41 Spraying Technology**

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This surface-based technology is available for all spraying-like processes. It is a pre-customized technology that enables surface-based trajectory planning, it and also includes the physical process simulation "Spray coverage". In addition, advanced surface programming capabilities are provided.

### **Technical Information**

Dedicated process dashboard to control all process-related parameters.

- multi path calculation, based on surfaces, including parametric control of stepover, path extensions etc.
- automatic creation of path linking motions (straight, circular)
- flexible event rule selection, e.g. to automatically trigger "process on/off" events
- new off-process tool path sections: lead-in, lead-out and track link

In order to visualize the expected process result even during the offline programming and optimization phase, the spray coverage display during simulation is available. This feature is part of the spraying technology package.

Advanced process simulations (such as paint deposit simulation or shotpeening ALMEN process model, for instance), can be provided as option or as project-specific customization.

### **Technical Information**

- Process model configuration for tool resources
- Process simulation object definition on workpiedes
- Dashboard to analyzing the process coverage result.
- Like all other technology packages, this pre-customized technology can be individually customized and adjusted to meet project-specific requirements

## **42 Support Services for FASTSUITE Implementations**

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For a user training as well as for successful implementation and process-specific customization of the software, especially in context of offline programming projects, some essential project steps are necessary. In order to provide full budget control and to reduce cost risks, we offer service and support activities as a standardized and proven implementation project at a fixed price for different level of complexity.

### **Basic Training Workshop for OLP Users**

This training workshop is providing the necessary software foundation skills and basic knowledge for OLP users. By using standardized training examples (common robots/machines, common technologies), the users will learn how to use FASTSUITE Edition 2 across the complete OLP process:

- Import of CAD data (workpiece geometry and fixtures) into the OLP layout
- Workpiece preparation, definition of process geometries
- Programming of operations (by using technology packages, and by virtual teaching)
- Simulation, validation and optimization
- Download of OLP program

Project-specific training on customer parts and customer workcells as well as hands-on support are subject to extended support agreements.

### **Implementation Packages for OLP Workcells**

We offer implementation projects at a fixed price for different level of complexity:

- single-robot cell, incl. workpiece positioner
- multi-robot cells with workpiece positioner and/or rail axis

These fixed price packages include project preparation activities (to be done in house at CENIT) as well as on-site activities at the customer location. Typical activities are:

- Data gathering
- Layout creation
- Software and license installation
- Layout calibration
- Downloader customizing
- Technology package customizing
- Project approval
- Project documentation

## **Simplification of Simulation Data**



The standard simulation components of the FASTSUITE library are already simplified to a great extent for getting better loading and simulation performances, and to reduce the file size of project data.

In addition to standard components, many simulation projects are consisting of customer-specific workcell layouts that are build from native CAD data. In order to achieve the same advantages, CENIT offers a data simplification service on request.

## **Technology Customization Enablement**



Even existing robot workcells are constantly developed, enhanced and adapted to new application technologies and process parameters. For customers who want to independently adapt the existing software solution and especially the technology packages to changed project conditions, we offer a special customization workshop that teaches the basics of technology customization for FAST-SUITE Edition 2.

- Customization training workshop
  - Customizing of technology packages with Python (use of PG parameters in operations, creation of events, manage approach/retract, create own parameters, rule-based events)
  - XML capabilities (sequencing of parameters, default value definition of operations and parameters, hide/show of parameters)
  - NLS support for user customizations
- API documentation for technology packages

## 43 Virtual Training Environments

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We offer virtual training environments to support FASTSUITE training and evaluation workshops. For using these virtual environments, an office computer with HD display, 3 button mouse and a good internet connection is sufficient. However, we also strongly recommend an external monitor for displaying the FASTSUITE application itself and the training documentation and user tutorials at the same time.

Thanks to virtual training environments, FASTSUITE trainings and evaluations can be done with virtually no administration and installation effort, and with no licensing limitation, no matter how many users shall access to these environment.

Our concept includes 3 training plans

- Virtual classroom training, instructor-led
  - a training class has access to an instructor-led training with a fixed training schedule
  - applicable for on-site trainings (to avoid a time-consuming preparation and installation of the training workstations) as well as for remote trainings for users in homeoffice
  - during the training session, the trainer is available via video and audio chat
- Self-paced training
  - for individual trainings at own pace we are offering a self-paced training option with a give time contingent to access to the training environment
  - to monitoring the learning progress, and for answering upcoming questions, it is recommended to agree on regular review sessions which can be done via web conference
- Long-term evaluation
  - for a long-term evaluation it is possible to install a customer-specific installation, and to make it available for remote access
  - The advantage is that any hardware investment and installation efforts only occurs after a positive evaluation and purchase decision

There are flexible rates and different plans available for the virtual training environments. Please ask your CENIT salescontact for details.