MANUFACTURO®

MANUFACTURO INTEGRATION

Manufacturing systems integration that propels operational excellence

HOLISTIC INTEGRATION AND CONNECTORS FOR MANUFACTURING ENVIRONMENTS

The integration of key systems is crucial in technology-driven, data-based modern manufacturing. As manufacturers embrace the era of Industry 4.0, **manufacturing software** integrations allow for the creation of a seamlessly connected production ecosystem that is responsive, agile, and poised for continuous improvement.

Whether you use Manufacturing Operations Management (MOM) applications, Product Lifecycle Management (PLM) and Enterprise Resource Management (ERP) solutions, or Manufacturing Execution Systems (MES), you need the right connectors for effective manufacturing systems integrations.

From the shop floor to the boardroom, **manufacturing data integration** plays a pivotal role in optimizing production processes, enhancing shop-floor collaboration, and driving productivity. Here is a brief overview of the key areas where manufacturing systems integration—like **MES integration with ERP** or PLM systems—makes a transformative impact to help you achieve manufacturing excellence.

Shop-floor operations

MES integration can effectively streamline shop-floor activities, providing real-time visibility into process planning and production workflows. This connectivity synchronizes machines, operators, and processes to ensure minimized downtime and maximized efficiency.

Inventory management

Seamlessly connecting MES with inventory management systems ensures that raw materials, work-in-progress, and finished goods are monitored and tracked with precision. Accurate inventory data translates to optimized resource allocation, reduced waste, and responsive supply chain management.

Quality management

Integrating MES with quality management applications is paramount for manufacturers in highly regulated industries. Automated **manufacturing data integration** enables real-time information exchange that ensures immediate detection and resolution of quality issues to meet all ISO 9001 or AS9100 standards.

Tools maintenance

Linking MES with tools maintenance systems ensures that equipment and machinery are well maintained and kept in prime condition. Predictive maintenance schedules and real-time monitoring help prevent frequent breakdowns while optimizing overall equipment effectiveness (OEE).

ERP integration

MES and ERP integration is in many ways one of the most strategic manufacturing systems integrations. MES integration with ERP is often considered the heartbeat of an interconnected, digitalized manufacturing enterprise. It enables seamless data flow between the shop floor and business operations, fostering accurate demand forecasting, data-driven resource planning, and informed decision-making.

PLM integration

MES and PLM integrations effectively narrow the gap between design and production. The successful connection between the two systems ensures that changes in product designs are seamlessly communicated, reducing time-to-market and fostering innovation through a cohesive product development lifecycle.

Business intelligence

MES integrations with business intelligence (BI) systems transform data into actionable insights. Real-time analytics provide a full and holistic view of operations, empowering stakeholders to make data-based decisions backed by insights needed to optimize processes, decrease costs, increase productivity, and enhance overall performance.

IoT connectivity

Ensuring swift MES integrations with the Internet of Things (IoT) devices is a must for smart manufacturing companies. Insights gathered from IoT devices, which collect and analyze data from connected devices, enable data-driven decision-making that fosters a proactive and adaptive approach to manufacturing.

INTEGRATE MANUFACTURO WITH OTHER SYSTEMS TO STREAMLINE OPERATIONS

The successful interaction between manufacturing software and various third-party solutions is even more important in complex industries where stakes and costs are higher. Integrating systems like MES, ERP and PLM, supplier portals, or accounting software is not just a technological choice but a strategic imperative.

Manufacturo, our manufacturing software built and deployed in Azure Cloud, molds into your business model to become the central nervous system for your organization, orchestrating shop-floor activities, improving inventory and nonconformance management, and ensuring real-time visibility into production workflows. However, you can truly capitalize on the groundbreaking capabilities that Manufacturo provides if you integrate our cloud manufacturing software with:

01 ERP SYSTEMS

real-time data exchange enables accurate demand forecasting, efficient resource allocation, and responsive decision-making, transforming your organization into an agile and adaptive business that effectively gains a competitive advantage

02 PLM SYSTEMS

downstream and upstream data collection ensures that product design, development, and production phases are all interconnected, allowing for changes in product designs to be successfully translated into actionable instructions on the shop floor.

03 SUPPLIER PORTALS

streamlined communication with external partners improves collaboration and creates a transparent, responsive supply chain that allows for reducing lead times, minimizing disruptions, and optimizing costs, all while making suppliers integral contributors to the manufacturing process

04 HR SOFTWARE

a transparent flow of information between manufacturing operations and human resources (HR) allows the right personnel to access real-time production data and workforce information, leading to faster hiring decisions and improved workforce allocation

05 ACCOUNTING SOFTWARE

synchronizing production data with accounting systems facilitates a real-time understanding of costs, revenue, and profitability, which not only ensures accurate and timely financial reporting but also simplifies strategic financial decision-making
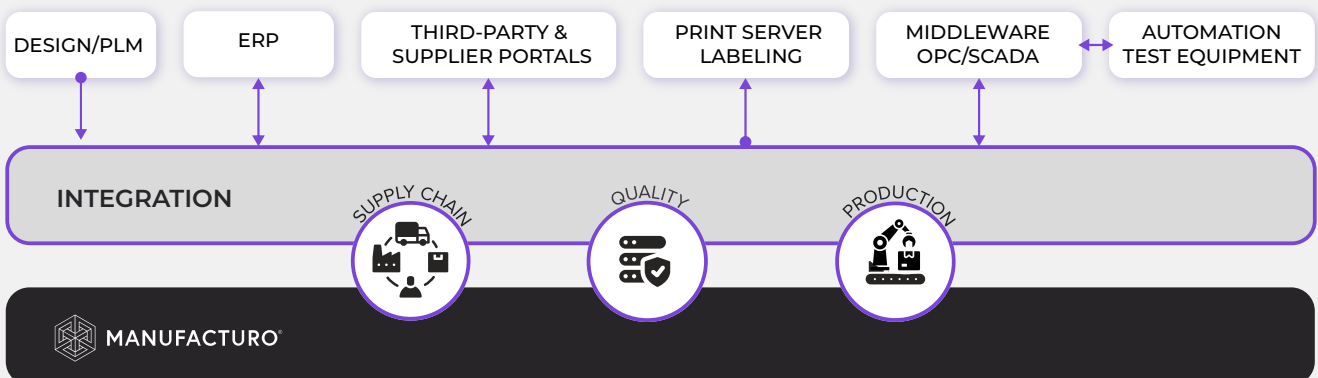
06 AUTOMATION LAYERS

connecting manufacturing software with automation layers, like SCADA or OPC UA, facilitates the exchange of real-time data between production equipment and a manufacturing platform to provide a complete view of the entire manufacturing process

Our **manufacturing system integration** with ERP, PLM, supplier portals, HR and accounting software, and automation layers empowers you to quickly create and maintain a modern, efficient production environment so crucial for emergent high-tech manufacturers. You instantly gain the ability to seamlessly exchange data across diverse internal and external solutions already in place.

By interlinking Manufacturo with third-party systems you nearly immediately start reaping the rewards of manufacturing data integration to effectively increase production control, decrease operational costs, and ultimately reduce time-to-market.
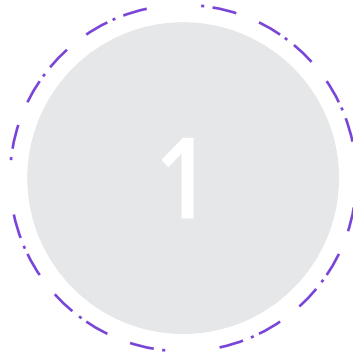
YOUR INTEGRATION OPTIONS

THE FACTORY

| DESIGN/PLM | ERP | THIRD-PARTY & SUPPLIER PORTALS | PRINT SERVER LABELING | MIDDLEWARE OPC/SCADA | AUTOMATION TEST EQUIPMENT |

INTEGRATION

SUPPLY CHAIN   QUALITY   PRODUCTION

MANUFACTURO®

HOW TO INTEGRATE MANUFACTURO

ALL IT TAKES ARE THREE STEPS

1

Establishing seamless connections

Configure API to interlink ERP, PLM, automation layers, and Manufacturo

Utilize the 100+ APIs in Manufacturo to create an uninterrupted connection and integrate with external solutions. This first step establishes a network that enables smooth upstream and downstream data flow among diverse systems.

2

Crafting intelligent business flows

Implement actions and business logic triggered by API data

Maximize Manufacturo's potential by creating dynamic business flows. Develop intelligent actions and business logic that respond to information received via the API, ensuring optimized, efficient, and responsive manufacturing processes

3

Migrating data with security and confidence

Transfer data securely, easily, and effortlessly

Safeguard your information during the data migration process. Make seamless transfers with confidence, ensuring the integrity and security of your manufacturing data as it moves between third-party systems and Manufacturo

WHAT YOU NEED TO KNOW ABOUT MANUFACTURO AND PUBLIC API

Think of APIs as digital bridges that allow for fluid communication between Manufacturo and external systems. This two-way data exchange effectively transforms your manufacturing ecosystem into a fully interoperable and connected network.

By utilizing our manufacturing software's public APIs, you not only gain a technological edge but also position your organization at the forefront of Industry 4.0. The availability of these APIs, coupled with comprehensive documentation, empowers you to drive digital transformation that ultimately leads to manufacturing excellence.

THE SIGNIFICANCE OF PUBLIC APIS

Public APIs are crucial for manufacturers, enabling integration, interoperability, and extensibility across different systems and platforms. They facilitate innovation by enabling you to build upon existing functionalities to accelerate growth and ensure scalability.

PUBLIC APIS OFFER

OPEN CHANNELS OF COMMUNICATION

Public APIs provide open and standardized channels where data can smoothly flow between manufacturing software and third-party applications. This open communication architecture prevents information silos, ensuring a holistic view of your operations. Manufacturo also allows defining and deploying custom APIs embedded inside of the framework to streamline integration and migration

FLEXIBILITY IN INTEGRATION

Well-documented APIs enable developers and system integrators to tailor integrations to the specific needs of your manufacturing environment. Whether interfacing with ERP systems, PLM platforms, supplier portals, or accounting software, these APIs provide the flexibility you need to create connections customized for efficiency

REAL-TIME DATA EXCHANGE

The upstream and downstream data exchange happens in real time. Bidirectional and up-to-date communication ensures that changes and crucial information are disseminated instantly, fostering a dynamic and responsive manufacturing environment

SCALABILITY AND FUTURE-PROOFING

As your manufacturing processes change, so do the demands on system connectivity. Public APIs help make manufacturing software scalable and future-proof by enabling easy adaptation to emerging technologies and evolving business requirements. This adaptability ensures you remain agile in the Industry 4.0 era

THE IMPORTANCE OF COMPREHENSIVE DOCUMENTATION

At Manufacturo, we understand that successful integration can only happen when you have comprehensive and clear documentation. The Public APIs come with detailed, user-friendly documentation, providing your developers with the guidance needed for hassle-free, successful integration.

COMPREHENSIVE DOCUMENTATION INCLUDES

ENDPOINT DETAILS

Clearly defined endpoints ensure that data can be accurately sent and received, leaving no room for ambiguity or even worse—misdelivery

DATA FORMATS AND STRUCTURES

Understanding how data is structured and formatted and being able to follow those specific formats and structures is key for successful communication

USE CASES AND BEST PRACTICES

Practical use cases and best practices help expedite the integration process by offering insights into optimal configurations and strategies for a smooth connection.

API ACCESS AND MANAGEMENT

Manufacturo offers robust features for accessing and managing APIs, facilitating effective integration between manufacturing software and external solutions. Key API access and management capabilities include:

Over 80 public APIs can be used for MES integration with ERP and PLM and the automation layer.

Full monitoring of API calls to see what was sent and received, and which calls failed, ensuring there are no lost transactions or events

API key management used to generate unique access keys leveraged to control what applications are talking to Manufacturo and what are their permission and scope

Ability to create custom API endpoints to accept and expose data in a specific format and streamline integration and transactions.

STANDARD APIs FOR ERP INTEGRATION

Manufacturo **MES integration with ERP** is possible via a large number of available APIs. The following are just selected examples:

MASTER DATA

- Products
- Work Centers
- Locations
- BOMs
- Warehouses
- Users
- Skills and Roles

ORDERS

- Production Orders (or Planned Orders) and routings
- Repair Work Orders
- Purchase Orders (Inbound Deliveries)
- Shipping Orders (Outbound Deliveries)

LABOR TRACKING

- Clock In into Step (Complex Shopfloor Orders)
- Clock Out into Step (Complex Shopfloor Orders)

OUTGOING INTERFACES

The outgoing interfaces are triggered by certain transactions executed in Manufacturo and can be customized in the integration application. To learn more about the Integrator module and its features, underline visit the application's web page.

Following is a sample of transactions that can be triggered from Manufacturo to ERP:

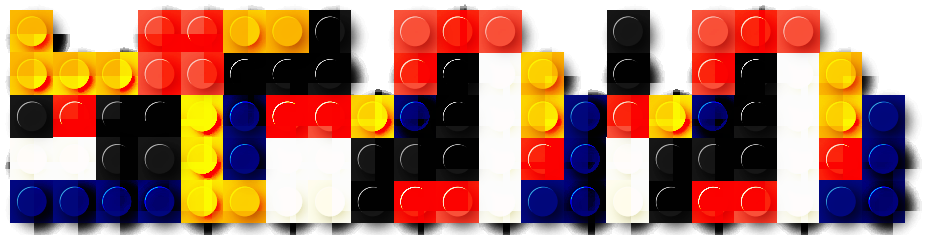|	
Production Order status change	Inventory status change
Production Operation Completion and Report Production	Inventory Adjustments either Ad-Hoc for fed from a cycle count
Labor Results	Picking for Shipping and Shipping Confirmation
Inventory produced against a Production Order	Process Plan Status Change
Inventory consumed against a Production Order	Rollback Order
Miscellaneous inventory adjustments (increase/decrease/edit trace)	Work Order Completion
Inventory movements between areas tracked in ERP or inventory status change	Work Order Creation or Update
Inventory received against a Purchase Order	Return to Vendor

INTEGRATOR MODULE

Manufacturo Integrator simplifies the setup of connections between Manufacturo and third-party platforms, enabling the seamless exchange of data with external systems and the automated run of actions based on detected triggers or timestamps. Integrator bridges the gap between rigid, difficult-to-customize systems and fully customizable solutions, empowering customers and service integrators to autonomously navigate their system journey.

INTEGRATOR MODULE

To best describe the module's purpose and functionality think of a brick wall and a LEGO block wall—the former hard-to-customize and out-of-the-box solution whereas the latter is fully customizable and easy to build on your own.

TRIGGER TYPES

Triggers serve as extension points embedded within every core module of Manufacturo. The Integrator module identifies these triggers and can assign custom logic to them. This custom logic is referred to as actions. There are five trigger types available in Manufacturo.

ASYNC TRIGGERS

SAMPLE USE CASES INCLUDE
- need to send Finished Goods receipt when work is complete
- need to put Work Order on hold in ERP on containment event
- send move/adjust to Oracle from Manufacturo

HOW
- actions called by event published/called by applications
- facilitates integration with external and internal systems
- implementation of webboks (custom callbacks)
- called from our "gateway"

SAMPLE AVAILABLE TRIGGERS
- direct Receiving (triggered when performed PO receive operation in Inventory Operation module)
- adjust Inventory (triggered when performed Adjust Inventory operation in Inventory Operation module—either by changing the quantity of inventory or creating a new one)
- send move/adjust to Oracle from Manufacturo

SYNC TRIGGERS

SAMPLE USE CASES INCLUDE
- a need to check a third-party methodology solution on tool usage
- prevent receiving parts when Expiry Date or Production Date exceeds 70 percent

HOW
- additional validation called to replace built-in logic with custom ones
- called in real time via application triggers

TRIGGER TYPES

TRIGGER TYPES

ENDPOINTS TRIGGERS

SAMPLE USE CASES INCLUDE
- production order download
- get welding/print summary data for the day

HOW
- accept and expose data in a custom format (creates custom API endpoints)
- calls custom actions
- properly invoke business logic in Manufacturo

FILE TRIGGERS

SAMPLE USE CASES INCLUDE
- mass Import locations in new Warehouse/Area
- rename all Machines/Tools to the new company standard
- create Process Plan from PowerPoint

HOW
- handle custom file import into Manufacturo in any custom format
- mass upload of data

SAMPLE USE CASES INCLUDE
- product Import (triggered when performing File Import in Master Data with Product_Import scheme)
- purchase Order Import (triggered when performing File Import in Master Data with Purchase_Order_Import scheme)
- locations Import (triggered when performing File Import in Master Data with Locations_Import scheme)

RECURRING JOB TRIGGERS

SAMPLE USE CASES INCLUDE
- batch upload of all unsent labor tickets to ERP for performance
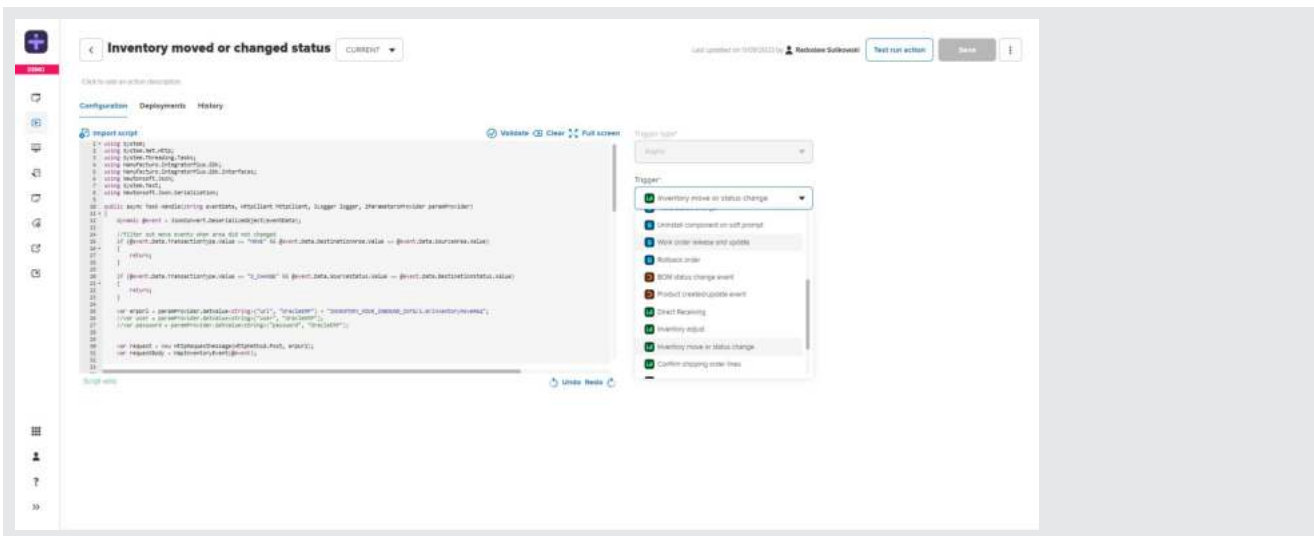- put all expired products on hold/in containment and send reports

HOW
- perform actions on recurring jobs

SELECTED AVAILABLE TRIGGERS INCLUDE
- expend Inventory—Status to On Hold (triggered in a specified cycle pattern)
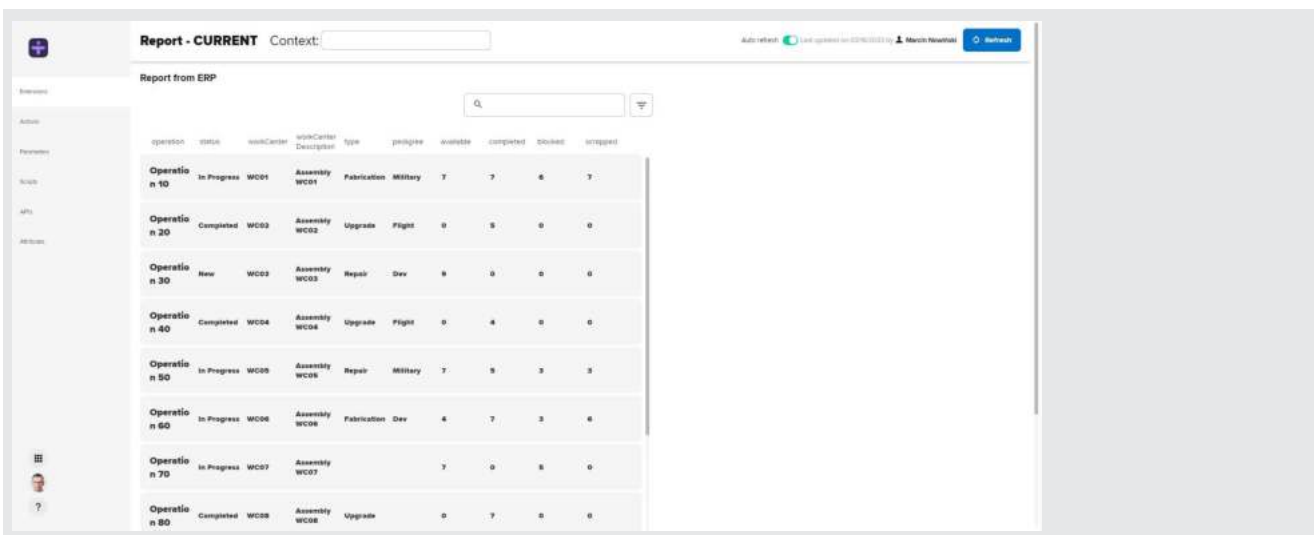
ACTIONS

Actions, a plugin-like solution for customization and integration, provides extensions done with C# scripts and our own SDK for common tasks and API access. The Actions solution comprises three tabs and can be configured by entering a script together with a trigger definition.

OTHER AVAILABLE CUSTOMIZATION OPTIONS

The Integrator module allows for other, optional customization options in Manufacturo. You can easily embed custom screens or introduce modifications to existing ones. Following is a customized report from ERP.
Sample use cases include:
custom operator portal, replacement or extension of standard screens.

REAL-LIFE USE CASES

Manufacturo has a proven track record of successful manufacturing systems integrations between our manufacturing software and third-party solutions. Following are examples of our real-life use case.

ERP

Seamlessly connect Manufacturo with your ERP system to provide real-time insights into production status, inventory transactions, and quality issues. Make data-driven decisions with instant feedback, enhancing your ability to respond swiftly to operational challenges.

ORACLE NETSUITE

A comprehensive cloud-based solution offering integrated financial and accounting tools, inventory and customer relationship management, and e-commerce capabilities.

EPICOR

A modular, industry-specific software with tools for manufacturing, distribution, retail, and services to manage finances, human resources, customers, and supply chain.

SAP

A market-leading system providing end-to-end business solutions for various industries, with modules for finance, supply chain, and human resources, among others.

Dynamics 365

Microsoft's suite of cloud-based applications designed to streamline business processes and enhance customer engagement.

odoo

An open-source platform offering a wide range of integrated configurable applications, customizable to fit diverse business needs and objectives.

Deltek.

Software for enterprises and small project-based businesses, offering solutions for project accounting, resource management, and project management.

infor

Industry-specific enterprise software with advanced analytics and flexible deployment options including on premises or as a service.

PLM/DESIGN

Integrate Manufacturo with your PLM system to ensure up-to-date Bills of Materials (BOMs) and products with continuously improving designs. Stay ahead with dynamic updates and streamline your design processes.

3S SOLIDWORKS

Easy-to-use software accessible to any business, known for its 2D and 3D modeling capabilities, widely used in engineering and product design.

TEAMCENTER

Software offering product lifecycle management solutions that automate design, simulation, manufacturing, data management, and engineering change.

arena

A cloud-based platform providing product development teams with a single source of truth for collaboration, change management, and regulatory compliance.

duro

An intuitive cloud-native platform that enables hardware teams to make timely decisions and build disruptive products while remaining agile.

SIEMENS NX — PLM Software

Integrated PLM and CAD software for organizations of all sizes, providing comprehensive tools for product design, engineering analysis, and manufacturing.

SUPPLIER PORTAL

Use Manufacturo to enhance collaboration by exchanging data seamlessly through your supplier portal. Streamline Purchase Order processes and simplify returns to vendors for smoother operations.

DATUM — LOGIC BASED SOURCING

A procurement management platform enabling hardware companies to improve purchasing processes, supplier management, and supply chain operations.

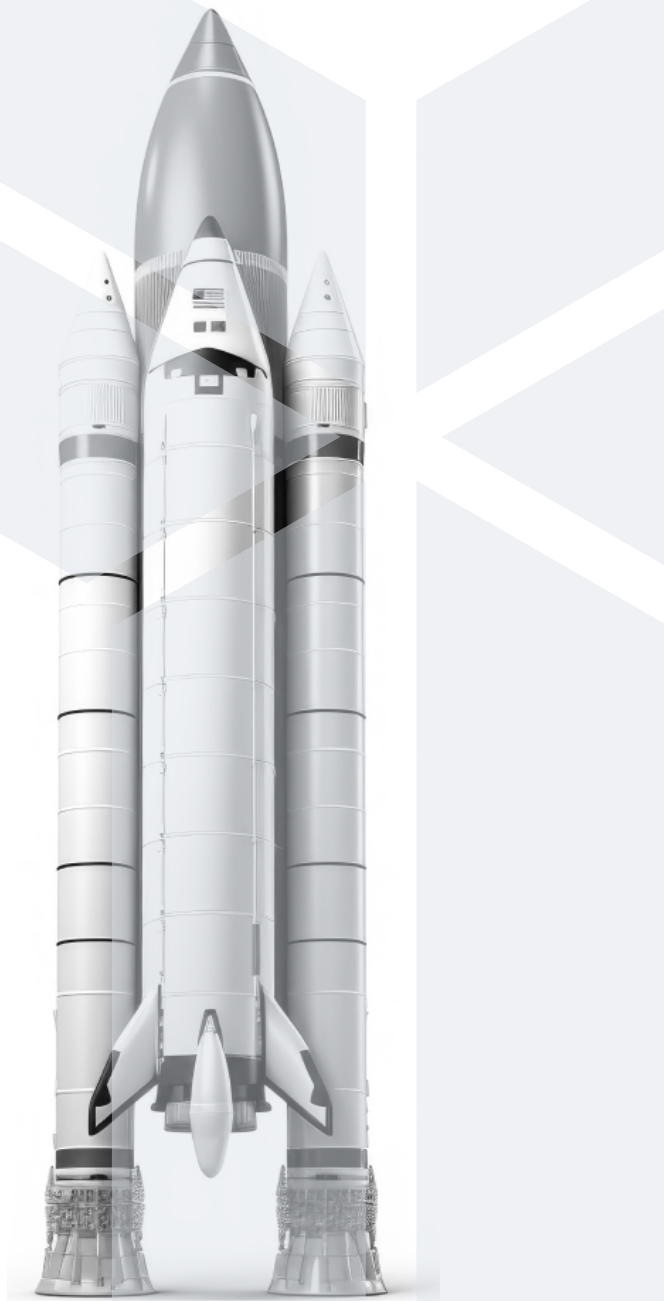## ACCOUNTING SOFTWARE

Connect Manufacturo with accounting software to efficiently send operational cost data. Perfect for clients who prefer dedicated accounting solutions, offering flexibility while maintaining data accuracy and integrity.

INTUIT quickbooks

A popular accounting software for small and mid-size businesses, offering tools for invoicing, expense tracking, and financial reporting.

POTENTIAL BENEFITS AND IMPROVEMENTS

Based on feedback from our clients, there are various improvements and benefits you can expect during and after implementing integrations between Manufacturo and external systems you already use. Here are selected advantages:

The ability to integrate with nearly any software platform allows for building a productive ecosystem linked with all other software applications already in place, ensuring seamless data exchange.

The PLM, **MES and ERP integration** process, which includes working with your current systems providers, is almost always ahead of schedule and smoothly molds into your and your vendors' business models.

MES integration with ERP and PLM systems provides a real-time view of what the as-designed product should look like, the updated information on the supply chain's capabilities, and the up-to-date inventory status, allowing for a real-time evaluation of the production's progress

An all-in-one integrated **manufacturing software** for planning, designing, and building very complex products ensures manufacturing **data integration** across all systems throughout a company, such as MES, ERP, PLM, and many other systems that Manufacturo ties into one

Successful manufacturing systems integration, including **MES integration with ERP** and PLM solutions, even when they are not instantly compatible and require finetuning a lot of different technical attributes and keying.

MANUFACTURO

EMPOWERING YOUR VISION, ENHANCING YOUR PROCESS.

GET ACCESS TO API DOCUMENTATION

MANUFACTURO

IS YOUR SOFTWARE MISSING FROM THE LIST?

At Manufacturo, we understand that every organization operates with its unique set of tools and software preferences. Are you using software or third-party systems that are not included in any of the previous sections? It's totally fine, our integration capabilities go beyond the list, offering you the flexibility to link our manufacturing software with any system or solution of your choice.

UNIVERSAL CONNECTIVITY THROUGH APIs	Manufacturo is designed with flexibility in mind, ensuring the power of our public APIs extends beyond the integrations listed in our documentation. If your preferred solution comes equipped with an API, we can successfully establish a connection. The universal language of APIs enables Manufacturo to communicate effectively with a wide array of third-party systems to make certain that your specific software requirements are met.

If Manufacturo lacks a readily available API or needs a customized connection, we ensure flexibility and can develop custom APIs based on your individual needs. Our team of experts will collaborate with you to better understand your software architecture and create tailored integrations that support your unique manufacturing processes.	TAILORED INTEGRATIONS ON REQUEST

YOUR CURRENT SOFTWARE STACK	We understand that your software stack has been carefully selected and built to meet your unique business requirements. Whether you're using a proprietary solution, a custom-made application, or industry-specific software, Manufacturo enables you to integrate it into the broader software framework. This useful adaptability ensures that you're not limited to a set of predetermined manufacturing systems integrations but have the flexibility to optimize your software ecosystem with the preferred tools that drive your processes and operations.

| STREAMLINED COLLABORATION REGARDLESS OF SOFTWARE | We always strive to create a cohesive and collaborative manufacturing environment. Manufacturo's Chief Product Officer James Montgomery best describes our main objective by saying: "Our mantra is: We try really hard for the system to mold to your process, not the other way around." By extending manufacturing systems integration capabilities beyond the defined list, we eliminate barriers and enable a fully interconnected ecosystem.

Your software may not be on the list, but our commitment to universal connectivity ensures that it can effectively become a part of your integrated manufacturing environment. Our goal is to make sure you can reap the benefits of streamlined collaboration, manufacturing data integration, and enhanced productivity, regardless of the software choices you make. |
|---|---|

BEST PRACTICES AND FREQUENTLY ASKED QUESTIONS

If you develop the right integration strategies and follow best practices, integrating Manufacturo with other systems should be a seamless process. To facilitate your integration experience, we have compiled a set of answers to frequently asked questions (FAQ). The following best practices and FAQs comprise various aspects of manufacturing systems integration, including ERP, BOM, logic, and inventory.

GOAL & MEANS TO THE GOAL

GOAL	MEANS TO THE GOAL
Keep ERP as simple as possible while limiting customization and complexity	Standardize business processes across departments to limit complexity and eliminate the need for customization
Let ERP do what ERP is designed to do—manage resources and demand	Choose an ERP system that aligns with your business needs and processes out of the box, without extensive customization.
Keep inventory in large buckets (such as building or area	Let MES/WMS handle the granularity. ERP is updated by MES on an as-needed basis.
Keep the logic simple	Try to limit logic in ERP whenever possible. Turning on logic often has (major) ripple effects
Keep the structure simple	Don't use routings on work orders, simple inspection, receiving logic, etc. Use MES to do this.
Keep serials and genealogy out of ERP	Keep lots in ERP for traceability and costing purposes. As-builts can be stored in MES saving you effort, as there's no need to develop another API connection, simplifying data management and integration.
Understand the impact of revision-controlled parts	Is this needed? What are other options? Can these be different part numbers?
Keep units of measure (UOM) consistent and limited	UOMs can get out of control (each vs. piece). Need to handle UOM for "packs" and "box" for all items. Need to think about how to issue components.

GOAL & MEANS

Bill of materials (BOM) management should be a clean flow but watch out for bottlenecks	Some processes can block planning while waiting for BOM to be released in ERP. Consider releasing to MES at the same time.
Try to keep ERP off the floor	MES solutions are tailored to streamline manufacturing processes and offer more intuitive interfaces, enhancing user satisfaction and productivity.
Loosely integrate with ERP	Don't tie yourself down with real-time calls where is ERP is down you are down (think month-end/year-end). Use async calls or integration.
Do not turn off modules you need	Try not to use as little as you can in ERP to get what you need
Revision control	Is it needed? Consider if you really need revision control or a revision track.
Routing in production	Using them is great but be prepared for the cost.
Serialization—plan from the start.	This effects everywhere.

CONCLUSION

In the era of Industry 4.0, manufacturers more than ever need smooth and efficient interconnectivity across manufacturing processes, and therefore software integrations increasingly serve as the backbone of an interconnected manufacturing ecosystem

Manufacturo stands at the forefront of this revolution, offering highly configurable applications tailored to the needs of emergent high-tech manufacturers. With its cloud-based architecture and extensive API capabilities, our manufacturing software enables users to integrate seamlessly with diverse external systems, including ERP, PLM, supplier portals, HR tools, and accounting software. The result is a cohesive and agile manufacturing environment with smooth upstream and downstream data flow, ensuring streamlined shop-floor collaboration, optimized production processes, real-time inventory management, and data-driven decision-making.

As you embark on your digital transformation journey, remember that Manufacturo is more than just a manufacturing software platform—we're a team of people, first and foremost, and a partner committed to your success.

MANUFACTURO®

THE FUTURE WHERE MANUFACTURING THRIVES ON INTEGRATION AND INTERCONNECTIVITY IS HAPPENING NOW.

BE PART OF IT!

BOOK A DEMO