

FACTORY AUTOMATION

Mitsubishi Electric 3D Simulator MELSOFT Gemini



Manufacturing with Visible "Results" Before Launch.

Amidst the digital transformation trend, a demand has emerged to speed up the process from product planning to commercialization, however there are hurdles to this, such as an increase in the labor time required for rework and on-site adjustment due to problems during equipment development and upon launch of lines, and delays in decision-making as it is difficult to visualize the effects of investment.

Mitsubishi Electric dramatically improves this problem with a 3D simulator that can verify line equipment in a digital space. Before launching, we can make "results" visible.



MELSOFT Gemini

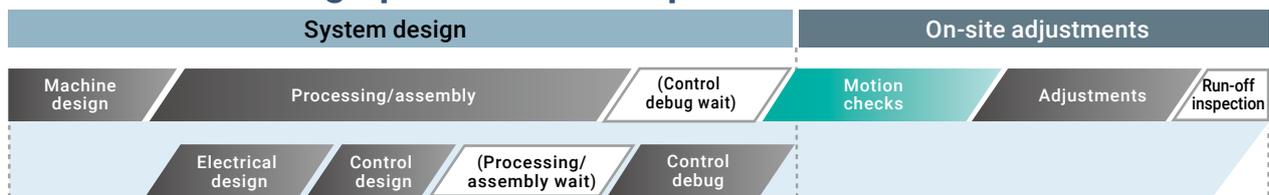
What is a 3D Simulator?

Pre-verification is performed in the digital space of a virtual factory or equipment line. This significantly reduces cost and time during the design phase.

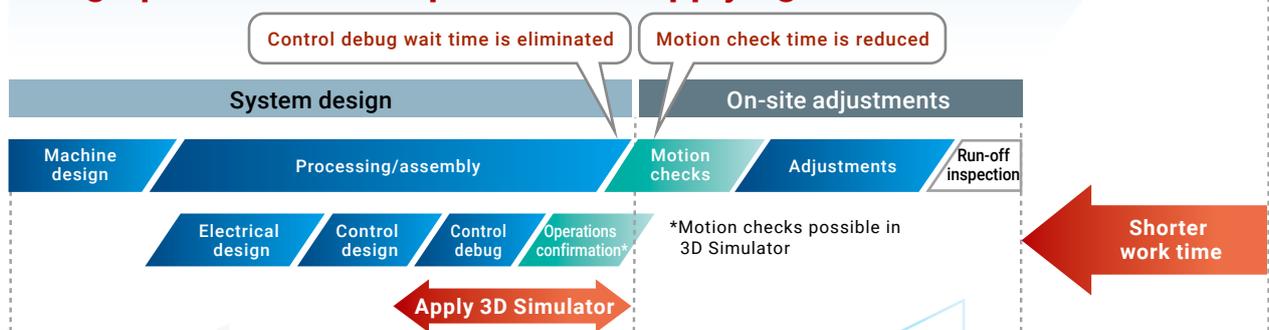


Achieved reduction of work period by front-loading

Conventional design phase and work period



Design phase and work period after applying 3D Simulator





3D Simulator has a variety of different usages.

Utilization Method **1**

Production design

To build a line with high productivity



Line layout verification

Able to verify and visualize productivity before actual operation



Possible to build a line with high productivity!

Utilization Method **2**

Machine design

To prevent rework due to miscommunication between machine design and control design



Machine specification verification

Able to create models for simulation from 3DCAD and share machine operations in animation form



Significant reduction of labor time for rework and better DR efficiency!

Utilization Method **3**

Pre-adjustment/confirmation

On-site machine adjustment takes an exponential amount of time and start-up is significantly delayed



Control program verification

Able to verify mechanical operations in a digital space in advance using a control program



Shorter on-site adjustment period!

Utilization Method **4**

Service & maintenance

To swiftly recover from equipment faults



Problem verification

Able to reproduce the status of lines and machines remotely



Swift shop floor recovery is possible!

Utilization Method **5**

Sales

To convey the value of the equipment we make to customers



Communication support

Able to show how products work in various forms (3D, VR, animation)



Smooth mutual understanding and speedy business talks!

Utilization Method **6**

Management

To increase return-on-investment (ROI) when installing new production equipment or expanding



Support for trial calculation of investment cost for equipment/workers

Able to trial calculate investment cost required for equipment and workers based on simulation results



Optimal investment is possible!

Usages of 3D Simulator MELSOFT Gemini

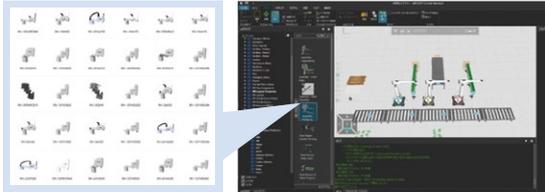
Utilization Method

1

Line layout verification

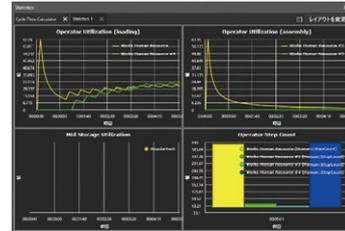
Build & verify layouts from the eCatalog

Layouts can be built and verified by simply dragging and dropping the necessary parts for line verification from the library and performing easy settings.



Visualize & analyze using a chart/statistics function

Simulation results can be visualized and analyzed to identify bottlenecks and changes in operating ratio.



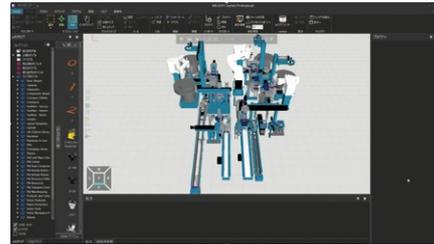
Productive line set up and verification is made easy through arranging models from an abundant eCatalog and utilizing a statistical analysis function

Utilization Method

2

Machine Specification Verification

Operations can be set up by importing 3DCAD data, setting up the mechanism, then using the script in MELSOFT Gemini. This makes it possible to create and simulate machine operations even if ladders and other programming are incomplete. This streamlines the task of alignment conventionally using 2D drawings and timing charts.



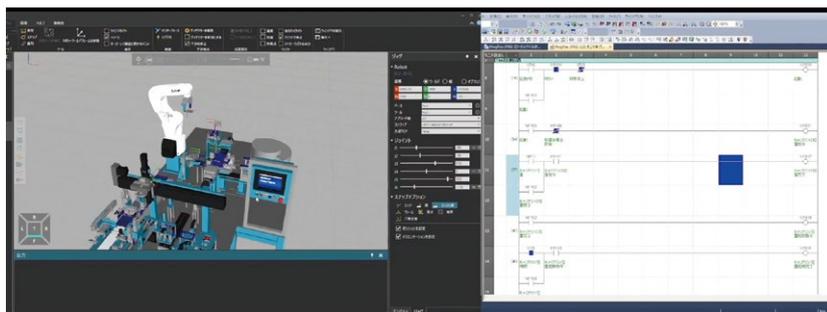
“Significant reduction of labor time for rework” is possible by sharing machine operations and reducing miscommunication between designers

Utilization Method

3

Control program verification

Direct connection to various simulators and FA equipment made by Mitsubishi Electric improves the accuracy of mechanical collision checks. Through connection to other companies' equipment and simulators via an OPC Server, control logic verification is possible regardless of the equipment or machine.



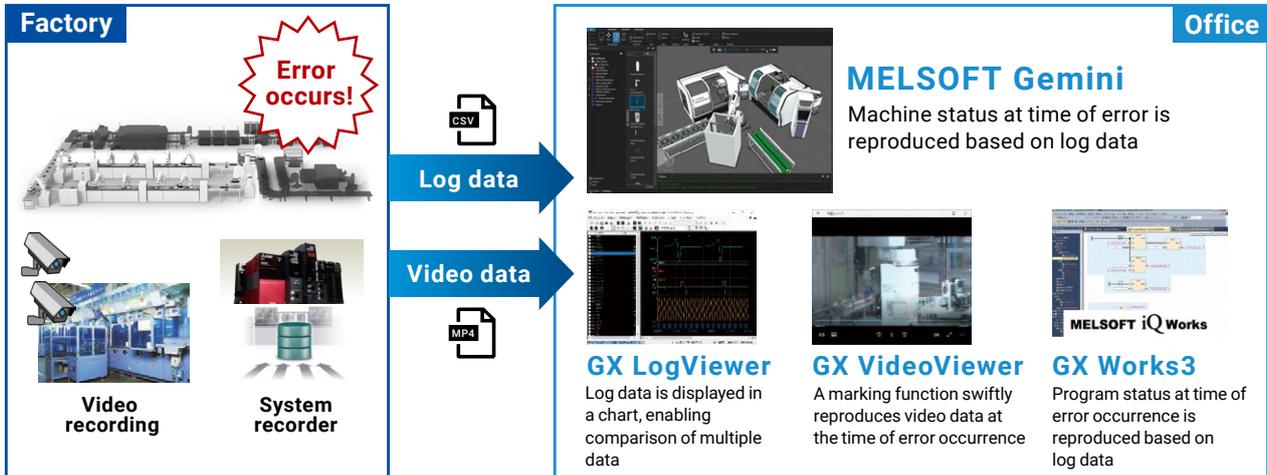
“Reduced on-site adjustment time” by improving the level of control logic completeness beforehand

Utilization Method **4**

Problem verification

Status at time of error is reproduced as a 3D model based on log data.

Swifter troubleshooting is possible by combining ladder monitor display, waveform display, and image data display.



Equipment operations can be reproduced in MELSOFT Gemini based on log data and troubleshooting can be performed remotely, thereby making **early shop floor recovery possible**

Utilization Method **5**

Communication support

When proposing machines and systems developed in-house to customers, by showing them how products work on 3D Simulator, information can be shared without misunderstanding.

“Smooth mutual understanding and speedy business talks” are possible by showing how products work in various forms (3D, VR, animation)



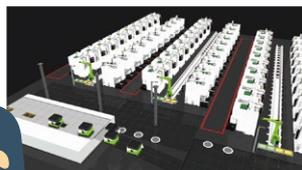
Utilization Method **6**

Support for Trial Calculation of Investment Cost for Equipment/Workers

When installing new production equipment or expanding existing lines, verification via simulation of multiple patterns makes it possible to grasp the necessary number of robots, processing machines and AGVs, as well as the necessary number of workers, thus enabling the trial calculation of optimal investment cost.

How many robots and workers are needed?

Pre-verification of optimal resource allocation

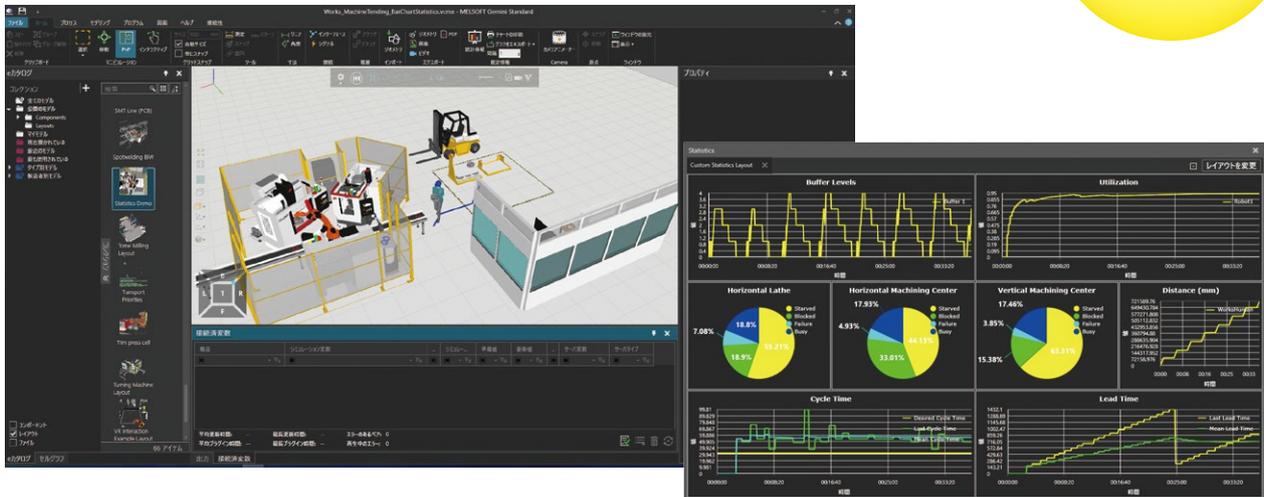


3 robots and 4 workers are perfect!
So the investment cost is XXX and profit is XXX.

Optimal investment is possible! by trial calculating investment cost required for equipment and workers based on simulation results

Constructed a system to increase production and reduced cycle time from **128 minutes per unit to 92 minutes per unit!** (actual operation)

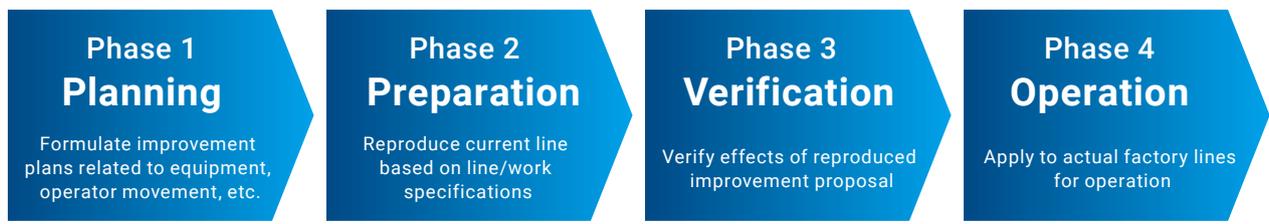
Approximately **30% reduction**



The system enables the construction of a line by placing 3D models from an extensive library of approximately 3,000 types of conveyors, robots, AGVs, personnel, etc., to perform optimal layout verification prior to actual line construction or modification.

In addition, the system can visualize the operating ratio for each process and piece of equipment in graph form, making it easy to identify areas for improvement during line modification and to compare the effects of each improvement measure.

Utilizing the line simulation function to easily perform pre-verification



Issue

The current production line could not keep up with the increase in demand, so there was an urgent need to increase production capacity. The customer urgently needed to increase its production capacity therefore considered adding a manual work station however wants to verify the line change in advance and build a system to increase production without any need for rework.



Example: Assembly line of Nagoya Works, Mitsubishi Electric

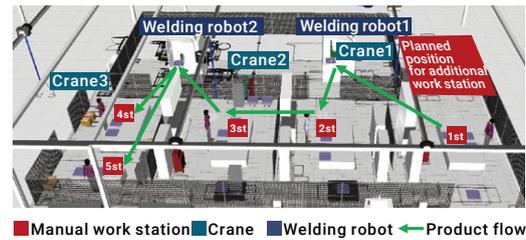
■ Work station/5 locations (5 operators) ■ Overhead crane/3 units ■ Welding robot/2 units

Current	Unit production: 69 units/months	Cycle time: 128 min/unit
Target	Unit production: 80 units/months	Cycle time: 103 min/unit

Utilization flow

Phase 1 Planning

We wanted to increase the number of work stations from the current five to six and achieve a cycle time of 103 minutes/unit. However, it was difficult to conduct preliminary verification, including detailed loss analysis, and using conventional Excel-based calculations.



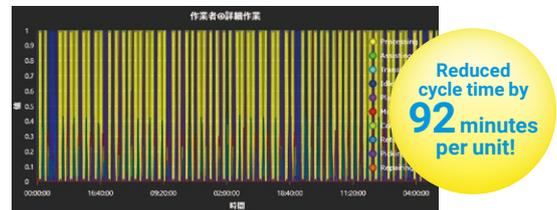
Phase 2 Preparation

MELSOFT Gemini was used to reproduce the current line based on line specifications (station layout, individual work time, etc.) Current model construction was completed in around two days due to the abundance of 3D models already set up in the eCatalog.



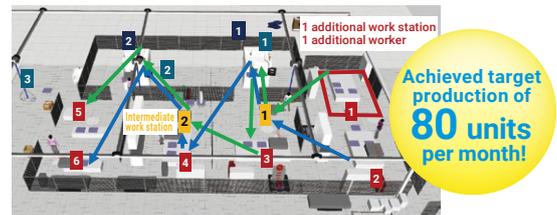
Phase 3 Verification

Cycle time was reduced to 99 min/unit with one additional work station and one additional operator. A graph function detected idling losses that were previously unnoticeable, and the installation of an intermediate work station eliminated these losses. In actual operation, cycle time was reduced to 92 min/unit, thus increasing production capacity.



Phase 4 Operation

Based on the simulation results of MELSOFT Gemini, the target production volume of 80 units/month was achieved. In addition, idling loss was eliminated by installing an intermediate work-in-process stand which saved approx. JPY600,000 annually. Due to the high accuracy of the preliminary verification, rework was reduced by redesign and additional work.



Benefits of introduction

- 01 | Able to verify improvement using multiple patterns**
 Simulations can easily be adjusted, therefore multiple improvement patterns can be swiftly verified.
- 02 | Easy to review due to visualization of improvements**
 Observe process waste in 3D, utilize screen recording, operating ratio chart, etc. during simulations.
- 03 | Prevent time loss due to rework**
 If the production line is actually modified based on Excel trial calculation values, there is a possibility that a study into the improvement method will need to be repeated.

Higher productivity

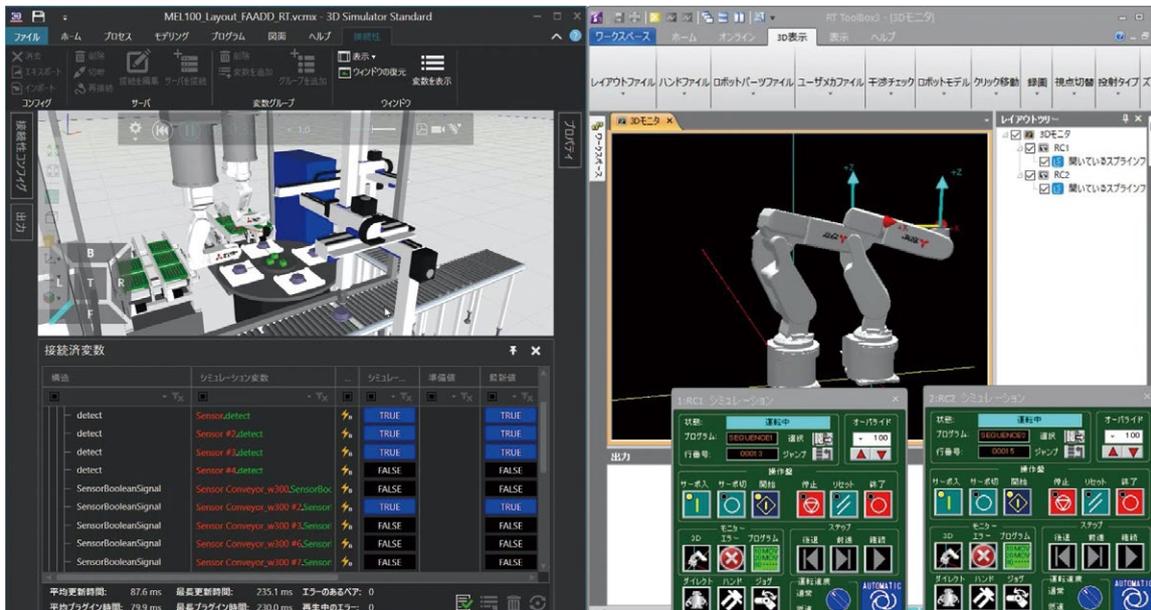
Lower cost

Less labor time

Verifies worker flow lines and line layouts of the assembly line in advance.
As a result, we were able to establish a system to increase production without rework!

Realizing front-loading in a digital space to reduce overall construction time from **40 to 34 weeks!**

Reduction of
6
weeks



Control logic can be verified in 3D operation by connecting to engineering tools such as programmable controllers and robots, as well as Mitsubishi Electric FA equipment.

By identifying problems in advance, such as mechanical collision and robot motion during control execution, the system greatly reduces on-site engineering labor time.

Direct connection to FA equipment and various tools for smooth collaboration

Verification items ①

Control program debugging

Verification items ②

Teaching + collision check

Verification items ③

Program verification for cycle time reduction

Issue

Delays in upstream mechanical design put pressure on the overall process schedule and did not allow enough time for debugging using actual equipment for downstream control design, which required a lot of on-site adjustment time.

We want to perform equipment simulation in advance to achieve front loading!

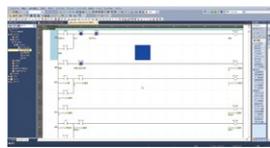


Utilization flow

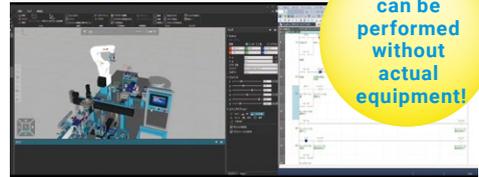
Verification 1

Control program debugging

Operations of the control program can be visually confirmed with a 3D model, and defects that were difficult to notice only in the program can be identified. Debugging of control programs without the use of actual equipment is now possible.



Before



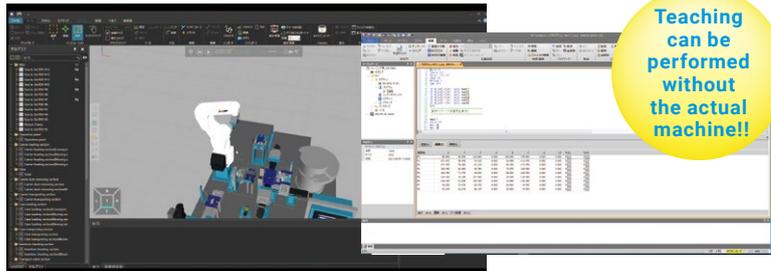
Debugging can be performed without actual equipment!

After

Verification 2

Teaching + collision check

MELSOFT Gemini is used to perform teaching work and faithfully simulate actual robot operations such as paths and range of motion. This means that teaching and collision check can be completed in advance without actual machine.



Teaching can be performed without the actual machine!!

Verification 3

Program verification for cycle time reduction

Carrier transfer is performed in parallel with robot operation, preventing operation loss. Because wasteful movements were identified and improved at the design stage, the cycle time was reduced by 30 seconds, from 1 minute and 20 seconds to 50 seconds.



Cycle time reduced by 30 seconds!!

Benefits of introduction

01

Reduced on-site engineering labor time

Because verification is possible with a 3D model, less time is required for debugging and on-site engineering.

02

Enables accurate and rapid collision check

Linkage with RT ToolBox3 prevents equipment damage due to collision and reduces on-site adjustment and start-up time.

03

Reduces cycle time before going to the production shop floor

Because wasteful movements were identified and improved at the design stage, cycle time was reduced before going to the production shop floor.

Cost-effectiveness(e.g.)

Introduction cost	Build period	Introduction benefit	Payback period
MELSOFT Gemini · License cost · Training cost · Labor cost for development upon utilization	Reduced by approx. 6 weeks <small>*If the daily SI cost is 80,000 yen, the cost reduction is 2.4 million yen for a 6-week x 5-day operation.</small>	6-weeks' worth of production profit by reducing start-up time <small>*If daily production profit is 1.6 million yen, profit increase is 48 million yen for 6 weeks x 5 working days.</small>	Approx. 5 days <small>*Assuming an introduction cost of approximately 10 million yen, a cost reduction of 2.4 million yen due to a reduced build period, and an introduction benefit of 1.6 million yen per day.</small>

Validate machine operation in virtual space and improve the validity of control logic before setting up in the field.

Achieve shorter set-up time by frontloading development

Product lineup

Use with greater freedom

Essentials

Basic version to create model data for simulations from 3DCAD data

Start immediately

Professional

Simplified version omitting some functions such as model data creation for simulations, etc.

Perform more advanced verifications

Premium

Ultimate version enabling virtual verification by connecting with various equipment and software

Features

Equipped with abundant functions and able to be utilized in a wide range of applications.

1 Layout Configuration

Compatible software types

Essentials Professional Premium

Intuitive operations for quick and easy layout.
Enables detailed parameter adjustment (dimensions, speed, color, etc.).



Layout configuration operation steps (from conveyor layout to workpiece supply)

2 eCatalog

Compatible software types

Essentials Professional Premium

Standard content consists of approx. 3,000 components able to be arranged with mouse operations.

Major components and quantity thereof

Robots*: 1773	Machine accessories (loaders/unloaders): 16
Robot tools: 91	Feeders: 20
Conveyors: 58	AGV/AMR: 45
Processing machines: 34	Facilities (desks, fences, racks, etc.): 122
	Layout samples: 54

*Major manufacturers: Mitsubishi Electric, FANUC, YASKAWA, KAWASAKI Robotics, KUKA, ABB, etc.

3 CAD Import

Compatible software types

Essentials Professional Premium

Standard function for importing CAD files of major CAD vendors (Autodesk, Dassault Systèmes, PTC).

*Please see specifications for supported versions and other details.

File types able to be imported

3D Manufacturing Format	CATIA V6	Robface
3D Studio	COLLADA	Rhino
ACIS	Creo	Solid Edge
ASCII Point Cloud file	GL Transmission Format	SolidWorks
Autodesk FBX	I-ideas	STEP
Autodesk Inventor	IFC2x	Stereo Lithography (ASCII and Binary)
Autodesk Naviswork	IGES	U3D
Autodesk RealDWG	Igrip/Quest/VNC	
Binary point cloud file	JT	Unigraphics (Siemens PLM software HQ)
CATIA V4	Parasolid	VDA-F5
CATIA V5	PRC	VRML
	Revit	Wavefront

4 Import 2D Drawings

Compatible software types

Essentials Professional Premium

Elaborate layout design is possible by arranging components on imported floor maps and other 2D drawings.

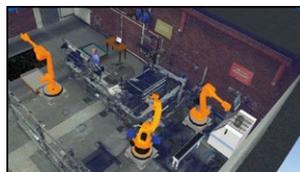


5 Point Cloud Data Import

Compatible software types

Essentials Professional Premium

Current facility layout is imported as point cloud data to enable verifications for layout change, etc.



6 Statistics

Compatible software types

Essentials Professional Premium

Displays simulation statistic results in various chart and analyze to confirm bottlenecks and changes in operational information. Data can be exported as either a PDF or Excel file.

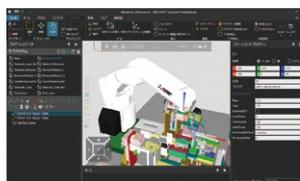


7 Robot Teaching

Compatible software types

Essentials Professional Premium

A simply, easy-to-use robot teaching tool makes it easy to define robot operations.

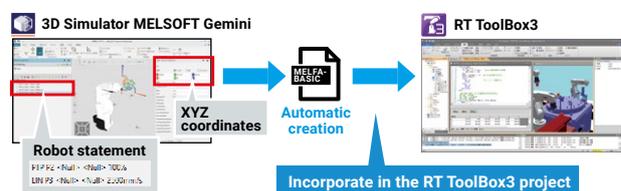


8 MELFA-BASIC Program Exporter

Compatible software types

Essentials Professional Premium

Possible to automatically generate a MELFA-BASIC program for a Mitsubishi Electric robot on which teaching has been completed in a 3D model.



9 Sales Content Creation (video, animation, 3D pdf)

Compatible software types
Essentials Professional Premium

Data can be exported in various formats including still images, 3D pdf, and 2D drawings for use as technical documents and presentation materials. Can also be reproduced as a video using free viewer software.



10 Animation VC Experience (free viewer/app)

Compatible software types
Essentials Professional Premium

Simulations can be shared and experienced in VR (virtual reality) or via smartphones.



11 Process modeling

Compatible software types
Essentials Professional Premium

Create workflows of manufacturing processes with intuitive operations. Component flow can be set with minimal programming.

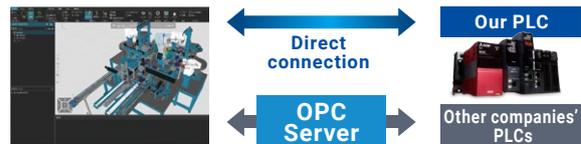


Process modeling operation steps (workpiece unloading by operator)

12 PLC Connectivity

Compatible software types
Essentials Professional Premium

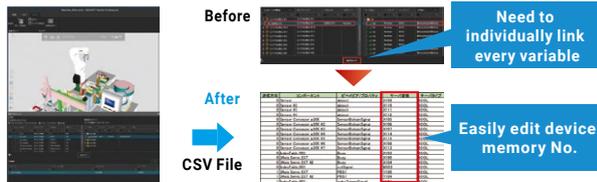
3D models can be directly connected to Mitsubishi Electric's PLC and even connected to other companies' PLCs via an OPC Server.



13 CSV Import/Export Connectivity Variable Pairing

Compatible software types
Essentials Professional Premium

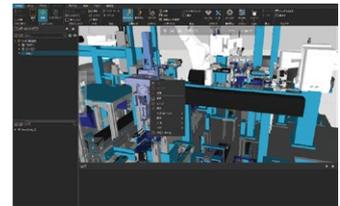
After exporting the 3D model variables and their links in the device memory of the connected Mitsubishi product (variable pair) to a CSV file, the entire file edited in Excel, etc. can be imported.



14 Component Modeling

Compatible software types
Essentials Professional Premium

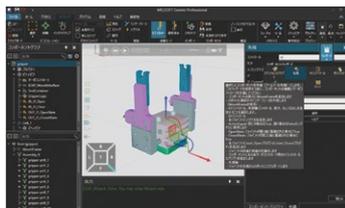
Imported 3DCAD data can be operated on Simulator after adding mechanisms and setting operations.



15 Wizards for Component Modeling

Compatible software types
Essentials Professional Premium

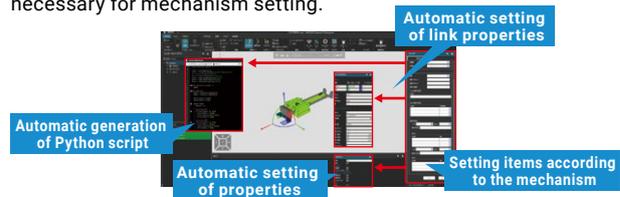
Easy wizard setup of operations for robot hands, conveyors, etc.



16 Wizards for Mechanism Setting

Compatible software types
Essentials Professional Premium

Wizards allow easy setup of properties, links, and Python scripts necessary for mechanism setting.



17 Basic Solid Geometry

Compatible software types
Essentials Professional Premium

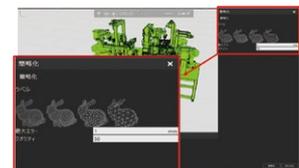
Basic solid geometry tools makes it possible to create 3D models and modify imported CAD data with ease.



18 Geometry Simplification

Compatible software types
Essentials Professional Premium

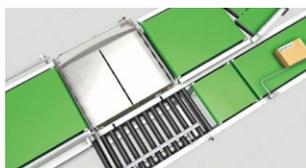
Reduces file size by simplifying models to enable light simulation operations.



19 Physics Simulation

Compatible software types
Essentials Professional Premium

Workpiece behavior is produced more realistically by simplified physical settings for contact, friction, repulsion, etc.



20 Robot/Advanced-PLCs Connectivity

Compatible software types
Essentials Professional Premium

Debugging and verification of control programs is possible by connecting 3D models to the actual robot controllers*1, PLCs*2, and simulators of various manufacturers.



*1 KUKA, ABB, FANUC, UR, Stäubli, Doosan
*2 Siemens

Fee-based Maintenance Service

Reliable support assisting with verifications utilizing MELSOFT Gemini

Always offering the latest software

- Continuously expanding functions for efficient work
- Issuing a new product key for version update that require product key renewal

Always have the latest convenient functions and library!
(we plan to have several version update a year)

License maintenance

- Supporting license activation if using offline
- Supporting license deactivation in the event of issues such as computer damage

Reassuring support even in cases of offline usage or computer damage!

Dedicated technical support

- 3D Simulator engineers directly support customers via a dedicated service (phone/email)
- Solve technical uncertainties related to product use

Significantly reduces time required for problem solving!

Operating Environment (recommended configuration)

Item	Content
CPU	Equivalent to/greater than Intel® Core™ i7-8xxx processor
Memory	8GB
Hard Disk	3GB available space
Drive	-

Item	Content
Graphics Card	NVIDIA® GPU with at least 4GB dedicated memory (Equivalent to/greater than GeForce® GTX 1080)
Graphics display	1920×1080 (Full HD) or more
Mouse	3 buttons
Operating System	64-bit Microsoft® Windows® 10* Microsoft® Windows® 11*

*Not dependent on Microsoft® Windows® language.

License Types

Standalone

Node-locked; one license per PC. Perpetual buy-out and limited period licenses are available.

Network

License exists on the server. Users can use MELSOFT Gemini simultaneously on as many client PCs* as the number of licenses on the server.

*MELSOFT Gemini must be installed

Annual maintenance

We provide technical support through a dedicated contact desk and assist software/version updates.

Software Licenses and Fee-based Maintenance Service

Usage	Product name	Term of License	Term of Maintenance Contract	Model name	Price
Standalone	MELSOFT Gemini Essentials Standalone	Perpetual	1 year	SW1DND-3DSIME-MQ12	Open price
	MELSOFT Gemini Professional Standalone	Perpetual	1 year	SW1DND-3DSIMR-MQ12	
	MELSOFT Gemini Premium Standalone	Perpetual	1 year	SW1DND-3DSIMM-MQ12	
Standalone Annual Maintenance	MELSOFT Gemini Essentials Standalone Annual Maintenance	-	1 year	SW1DND-3DSIME-MHQ12	
	MELSOFT Gemini Professional Standalone Annual Maintenance	-	1 year	SW1DND-3DSIMR-MHQ12	
	MELSOFT Gemini Premium Standalone Annual Maintenance	-	1 year	SW1DND-3DSIMM-MHQ12	
Network	MELSOFT Gemini Essentials Network	Perpetual	1 year	SW1DND-3DSEK-MQ12	
	MELSOFT Gemini Professional Network	Perpetual	1 year	SW1DND-3DSRK-MQ12	
	MELSOFT Gemini Premium Network	Perpetual	1 year	SW1DND-3DSMK-MQ12	
Network Annual Maintenance	MELSOFT Gemini Essentials Network Annual Maintenance	-	1 year	SW1DND-3DSEK-MHQ12	
	MELSOFT Gemini Professional Network Annual Maintenance	-	1 year	SW1DND-3DSRK-MHQ12	
	MELSOFT Gemini Premium Network Annual Maintenance	-	1 year	SW1DND-3DSMK-MHQ12	
Standalone Time Limited	MELSOFT Gemini Essentials Standalone Time Limited (6 months)	6 months	6 months	SW1DND-3DSET-MQ06	
	MELSOFT Gemini Essentials Standalone Time Limited (12 months)	12 months	12 months	SW1DND-3DSET-MQ12	
	MELSOFT Gemini Professional Standalone Time Limited (6 months)	6 months	6 months	SW1DND-3DSRT-MQ06	
	MELSOFT Gemini Professional Standalone Time Limited (12 months)	12 months	12 months	SW1DND-3DSRT-MQ12	
	MELSOFT Gemini Premium Standalone Time Limited (6 months)	6 months	6 months	SW1DND-3DSMT-MQ06	
	MELSOFT Gemini Premium Standalone Time Limited (12 months)	12 months	12 months	SW1DND-3DSMT-MQ12	
Network Time Limited	MELSOFT Gemini Essentials Network Time Limited (6 months)	6 months	6 months	SW1DND-3DSEKT-MQ06	
	MELSOFT Gemini Essentials Network Time Limited (12 months)	12 months	12 months	SW1DND-3DSEKT-MQ12	
	MELSOFT Gemini Professional Network Time Limited (6 months)	6 months	6 months	SW1DND-3DSRKT-MQ06	
	MELSOFT Gemini Professional Network Time Limited (12 months)	12 months	12 months	SW1DND-3DSRKT-MQ12	
	MELSOFT Gemini Premium Network Time Limited (6 months)	6 months	6 months	SW1DND-3DSMKT-MQ06	
	MELSOFT Gemini Premium Network Time Limited (12 months)	12 months	12 months	SW1DND-3DSMKT-MQ12	
Academic *	MELSOFT Gemini Premium Academic	Perpetual	1 year	SW1DND-3DSAK-MQ12	
	MELSOFT Gemini Premium Academic Annual Maintenance	-	12 months	SW1DND-3DSAK-MHQ12	
	MELSOFT Gemini Premium Academic Time Limited (12 months)	12 months	12 months	SW1DND-3DSAKT-MQ12	
Upgrade	MELSOFT Gemini Upgrade (Essentials Standalone to Professional Standalone)	-	-	SW1DND-3DSUR-MQ12	
	MELSOFT Gemini Upgrade (Essentials Network to Professional Network)	-	-	SW1DND-3DSURK1-MQ12	
	MELSOFT Gemini Upgrade (Essentials Standalone to Premium Standalone)	-	-	SW1DND-3DSUM2-MQ12	
	MELSOFT Gemini Upgrade (Essentials Network to Premium Network)	-	-	SW1DND-3DSUMK2-MQ12	
	MELSOFT Gemini Upgrade (Professional Standalone to Premium Standalone)	-	-	SW1DND-3DSUM1-MQ12	
	MELSOFT Gemini Upgrade (Professional Network to Premium Network)	-	-	SW1DND-3DSUMK1-MQ12	
	MELSOFT Gemini Upgrade (Essentials Standalone to Essentials Network)	-	-	SW1DND-3DSUEK-MQ12	
	MELSOFT Gemini Upgrade (Professional Standalone to Professional Network)	-	-	SW1DND-3DSURK2-MQ12	
	MELSOFT Gemini Upgrade (Premium Standalone to Premium Network)	-	-	SW1DND-3DSUMK3-MQ12	
	MELSOFT Gemini Upgrade (Essentials Standalone to Professional Network)	-	-	SW1DND-3DSURK3-MQ12	
	MELSOFT Gemini Upgrade (Essentials Standalone to Premium Network)	-	-	SW1DND-3DSUMK5-MQ12	
	MELSOFT Gemini Upgrade (Professional Standalone to Premium Network)	-	-	SW1DND-3DSUMK4-MQ12	

* The package includes a "Network" license key that allows for simultaneous usage by up to 30 students. As this product is exclusively for educational institutions, please make sure to contact our sales representative before placing an order.

Creating Solutions Together.



Low-voltage Power Distribution Products



Transformers, Med-voltage Distribution Products



Power Monitoring and Energy Saving Products



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Servos, Motors and Inverters



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Edge Computing Products



Numerical Control (NC)



Collaborative and Industrial Robots



Processing machines: EDM, Lasers



SCADA, analytics and simulation software

Mitsubishi Electric's product lineup, from various controllers and drives to energy-saving devices and processing machines, all help you to automate your world. They are underpinned by software, innovative data monitoring, and modelling systems supported by advanced industrial networking and Edgecross IT/OT connectivity. Together with a worldwide partner ecosystem, Mitsubishi Electric factory automation (FA) has everything to make IoT and Digital Manufacturing a reality.

With a complete portfolio and comprehensive capabilities that combine synergies with diverse business units, Mitsubishi Electric provides a one-stop approach to how companies can tackle the shift to clean energy and energy conservation, carbon neutrality and sustainability, which are now a universal requirement of factories, buildings, and social infrastructure.

We at Mitsubishi Electric FA are your solution partners waiting to work with you as you take a step toward the realization of sustainable manufacturing and society through the application of automation. Let's automate the world together!

Mitsubishi Electric 3D Simulator MELSOFT Gemini

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Mitsubishi Electric's e-F@ctory concept utilizes both FA and IT technologies, to reduce the total cost of development, production and maintenance, with the aim of achieving manufacturing that is a "step ahead of the times". It is supported by the e-F@ctory Alliance Partners covering software, devices, and system integration, creating the optimal e-F@ctory architecture to meet the end users needs and investment plans.



MITSUBISHI ELECTRIC CORPORATION

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