

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

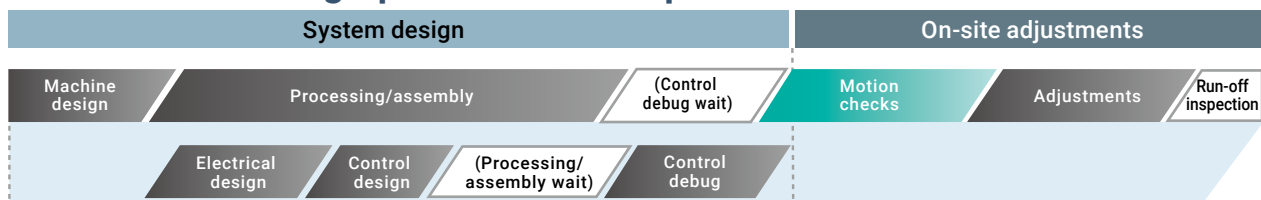
What is a 3D Simulator?

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.

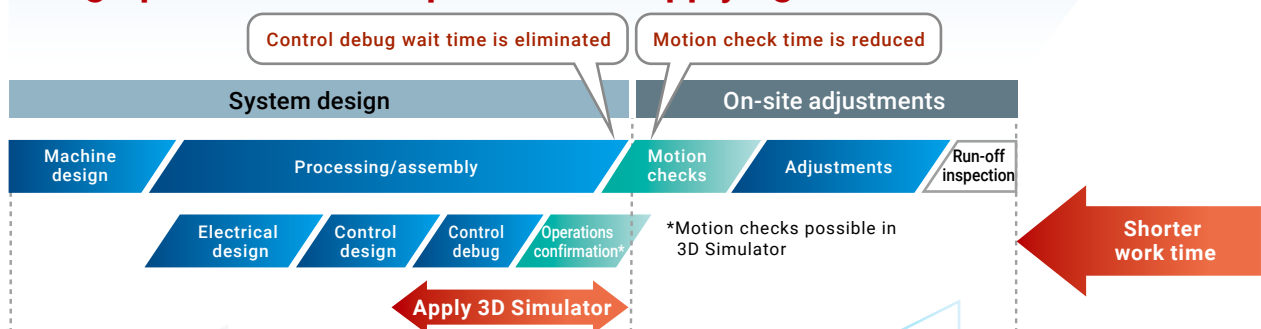


Achieved reduction of work period by front-loading

Conventional design phase and work period



Design phase and work period after applying 3D Simulator





3D Simulator has a variety of different usages.

Designer



Use Case 1

Unable to estimate cycle time

Simulate machines, workers, and material flow.

Improve production and material flow!

Use Case 2

Risk of overlooking collisions

Detect collisions through simulation.

Prevent design errors!

Use Case 3

Unable to debug without physical equipment

Validate operations in a virtual environment.

Reduce startup issues and rework!

Service and maintenance



Use Case 4

Unable to identify where problems occur

Reproduce issues in a 3D model using log data.

Enable faster recovery from production issues!

Sales



Use Case 5

Difficult to communicate proposals effectively

Visualize and reproduce operations in 3D simulation.

Enhance proposal effectiveness!

Business owner



Use Case 6

Difficulty in making investment decisions

Visualize KPIs such as throughput and cycle time

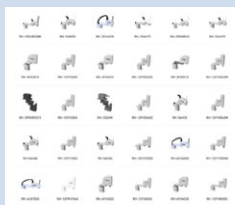
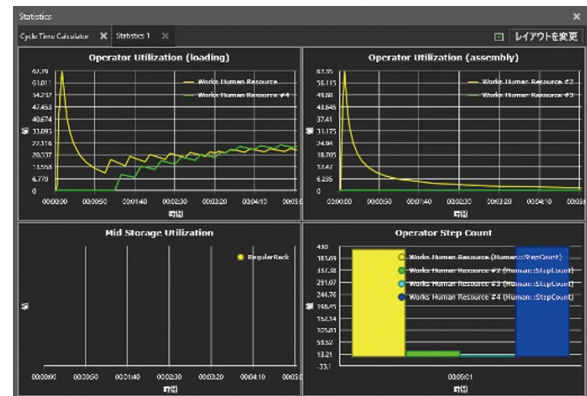
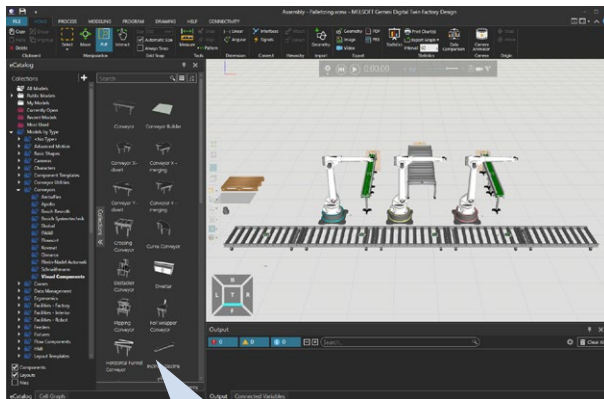
Support data-driven decision making!

Front-loading

Use Case 1 Line Layout and Process Validation

Layout Design & Validation / Graph & Statistical Analysis

Create production line layouts by simply dragging and dropping equipment based on drawings or production concepts. Simulate the movements of workers and robots to quickly evaluate productivity. Analyze cycle time and utilization through simulation results to support process improvement and identify bottlenecks across the entire production line.



eCatalog

A comprehensive library of simulation-ready equipment and components. With preconfigured motion settings, users can easily create production lines by simply dragging and dropping the required 3D models.

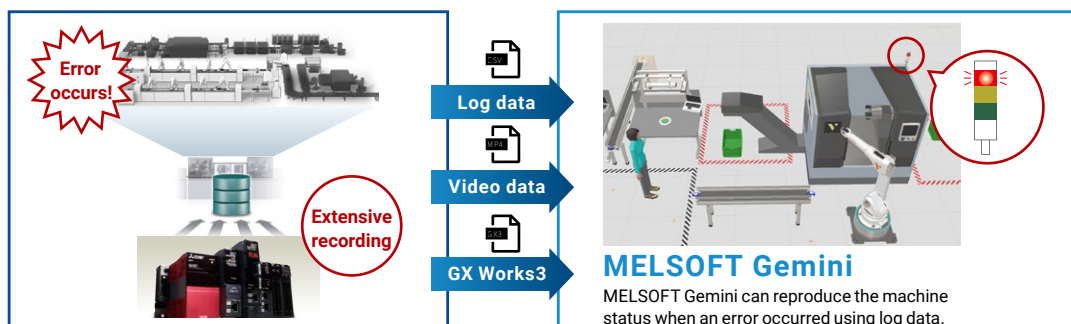


With an extensive eCatalog and a statistical analysis function, you can easily **build and verify a highly productive line.**

Maintenance

Use Case 4 Error reproduction and analysis

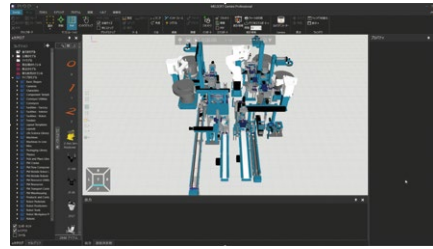
MELSOFT Gemini can reproduce the machine status when an error occurred in a 3D model using log data. Swifter troubleshooting is possible by combining ladder monitor display, waveform display, and image data display.



MELSOFT Gemini can reproduce machine operation using log data, enabling troubleshooting without the actual equipment and **supporting faster on-site recovery.**

Use Case 2 Pre-verification of machine operation (collision and operation check)

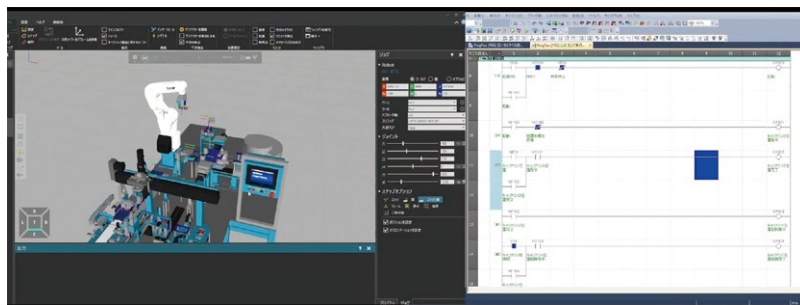
Import 3D CAD data, configure kinematics, and verify machine operations with simple mouse-based settings. Validation can begin even before PLC ladder programs are completed, enabling mechanical designers to reduce reliance on 2D drawings and timing charts and streamline the design process.



Visualize and share machine operations to **reduce miscommunication** and **dramatically cut rework**.

Use Case 3 Control program verification (pre-debugging)

Direct connectivity with our simulators and FA devices improves the accuracy of mechanical collision detection. Third-party devices and simulators can also be connected either directly or via OPC Server, enabling control logic validation regardless of equipment or vendor.



Improve control logic before on-site commissioning and **reduce commissioning time**.

Communication support

Use Case 5 Communication support (consensus building)

When proposing in-house developed machines or systems to customers, demonstrating their operation with a 3D simulator can help you gain a competitive edge and move negotiations forward smoothly.



Share ideas with 3D, VR, and animations to **achieve better understanding** and **accelerate business discussions**.

Support for equipment investment cost estimation

Use Case 6 Support for estimating investment costs for equipment and workforce

When installing new production equipment or expanding existing production lines, you can evaluate multiple scenarios in advance to determine the required number of robots, processing machines, AGVs, and workers, and estimate the optimal investment amount.



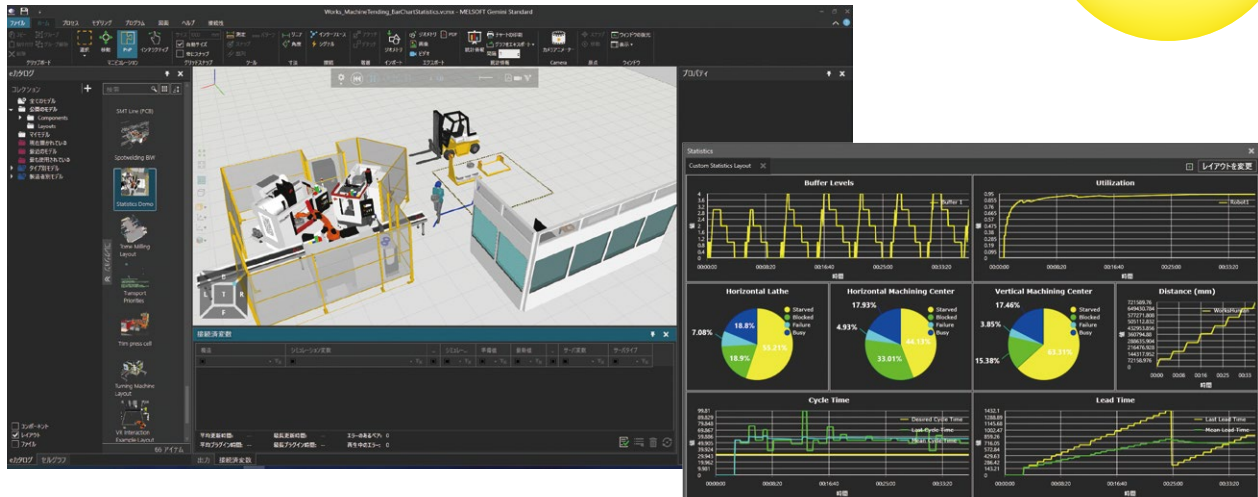
Automating transport tasks that were previously performed manually improves work efficiency.



Estimate investment costs and **make better investment decisions**.

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

Phase 1 Planning

Formulate improvement plans related to equipment, operator movement, etc.

Phase 2 Preparation

Reproduce current line based on line/work specifications

Phase 3 Verification

Verify effects of reproduced improvement proposal

Phase 4 Operation

Apply to actual factory lines for operation

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

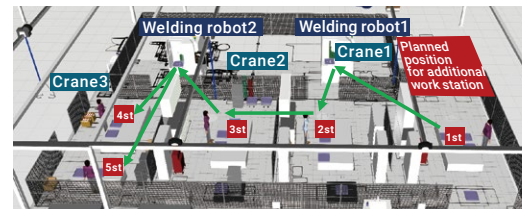
■ Work station/5 locations (5 operators) ■ Overhead crane/3 units ■ Welding robot/2 units

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.



■ Manual work station ■ Crane ■ Welding robot ← Product flow

Phase 2 Preparation

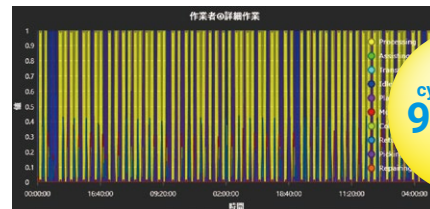
MELSOFT Gemini was used to reproduce the current line based on line specifications (station layout, individual work time, etc.) Current model construction was completed in around two days due to the abundance of 3D models already set up in the eCatalog.



Model construction completed in approx. **two days!**

Phase 3 Verification

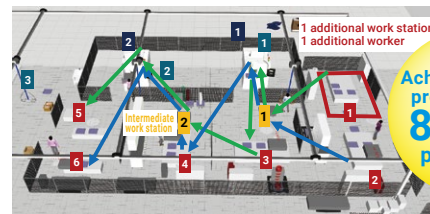
Cycle time was reduced to 99 min/unit with one additional work station and one additional operator. A graph function detected idling losses that were previously unnoticeable, and the installation of an intermediate work station eliminated these losses. In actual operation, cycle time was reduced to 92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



Reduced cycle time by **92 minutes per unit!**

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.



Achieved target production of **80 units per month!**

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



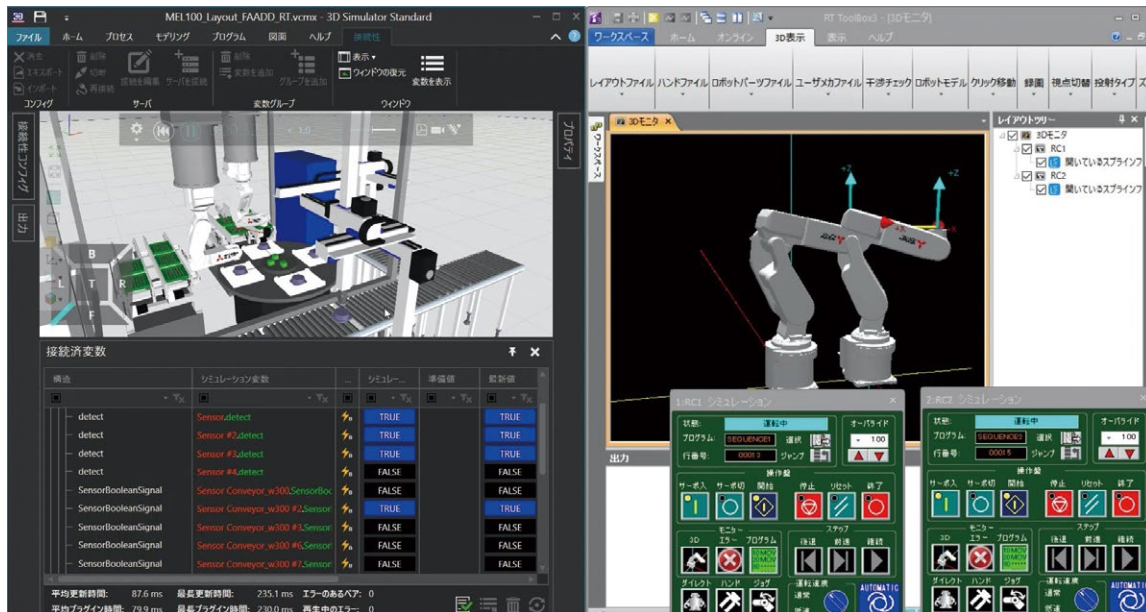
Less labor time

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

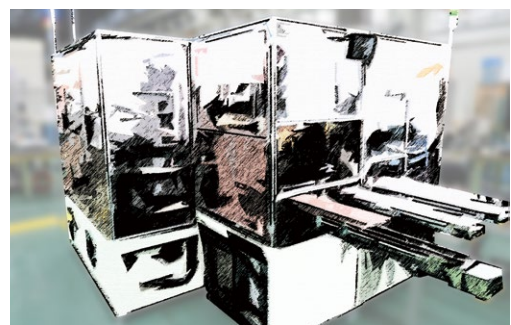
Verification items ③

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!

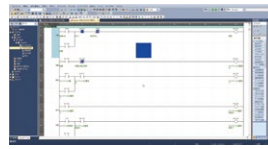


Utilization flow

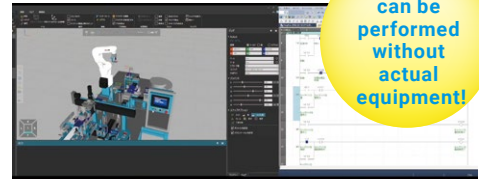
Verification 1

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



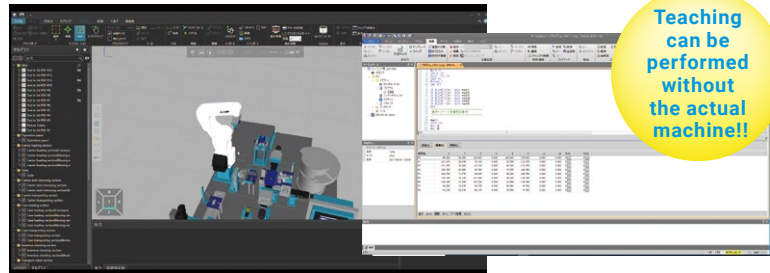
After

Debugging can be performed without actual equipment!!

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.

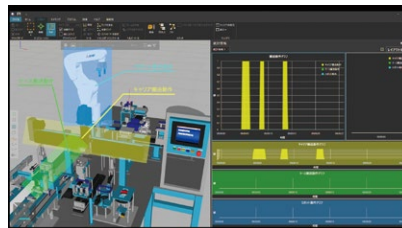


Teaching can be performed without the actual machine!!

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 *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.	6-weeks' worth of production profit by reducing start-up time *If daily production profit is 1.6 million yen, profit increase is 48 million yen for 6 weeks x 5 working days.	Approx. 5 days *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.

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 front-loading development

Product Lineup

Choose the optimal package to suit your needs.

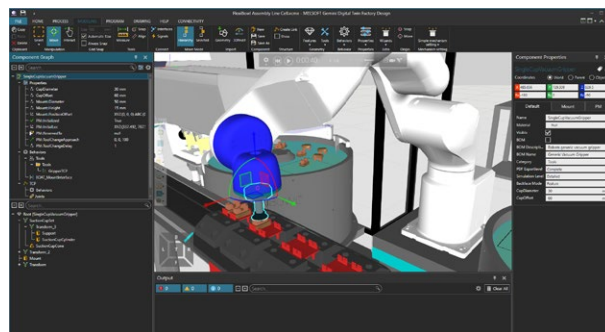
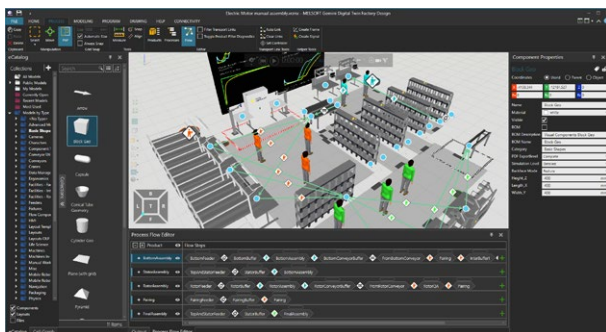
Digital Twin Factory Design	Runtime
Overall verification, including process, workers, and equipment - Comprehensive evaluation of workers, equipment, robots, and transportation - Support for factory-level investment decision-making / Promotion of DX and overall optimization	Result sharing and on-site utilization - On-site utilization of design and verification results - Connecting the digital twin with on-site operations - Decisions based on real-time data
Machine Design Robotics Operation verification of equipment, including robots - New introduction of robot cells - Human-robot layouts - Robot motion and reachability	
Machine Design Verification of standard equipment operation and control - Detailed design of dedicated machines and semi-custom equipment - Cycle time and process feasibility - Control program debugging	
Product Line Design Production line development and layout evaluation - Planning a new production line - Optimizing required resources such as AGVs and workers - Comparison of multiple alternatives before equipment investment - Understanding of line balance and capacity	

	Issues / What you want to achieve	Product Line Design	Machine Design	Machine Design Robotics	Digital Twin Factory Design	Runtime
Equipment designer	Evaluating cycle time of a production line, including equipment, workers, and transportation	✓			✓	
	Checking robot motion range and collision in advance		✓	✓	✓	
Control designer	Checking machine operation in advance		✓	✓	✓	
	Verifying operation, including PLC control in advance		✓	✓	✓	✓
	Identifying issues before startup and reducing troubles		✓	✓	✓	✓
	Verifying coordinated operation between robots and peripherals		✓	✓	✓	
Manufacturing engineer	Verifying workability and human motion	✓			✓	
	Verifying collaboration among multiple robots and workers	✓			✓	
	Reproducing and analyzing an error cause		✓	✓	✓	✓
	Sharing the same ideas with customers and on-site workers to build consensus	✓	✓	✓	✓	✓
Production engineer	Comparing multiple alternatives for optimal investment decisions	✓	✓	✓	✓	✓
	Evaluating the entire production line, including equipment, workers, and transportation	✓			✓	
	Improving the accuracy of cycle time and process design				✓	
	Starting with small-scale equipment first	✓	✓			

Features

What MELSOFT Gemini can offer

Production design



Process modeling

Manufacturing process flows can be created with intuitive operation and minimal programming.

\ Point /

Transportation can be simulated simply by connecting the flows.

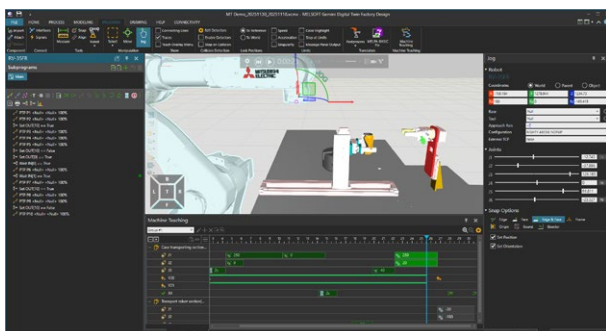
Component modeling

Machine and robot mechanisms, sensors, robot hands, etc. can be configured.

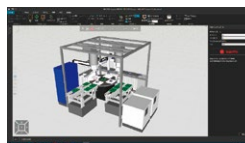
\ Point /

Our unique data-lightening architecture enables smoother operation.

Equipment and control design



MELSOFT Gemini



MELSOFT Mirror



Machine teaching feature

Configure machine operation sequences with simple mouse actions and validate machine behavior through realistic continuous simulation while generating accurate timing charts.

\ Point /

Visually design and verify machine operations with precise timing.

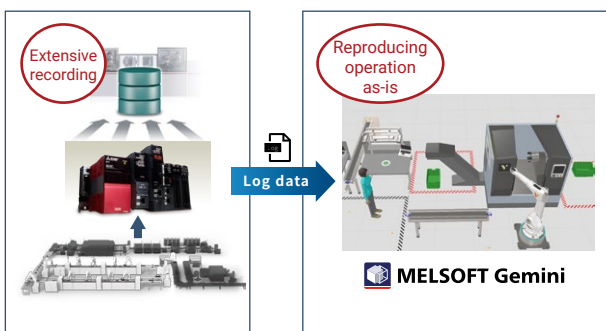
FMU time synchronization feature

Gemini synchronizes simulation time with PLC programs via MELSOFT Mirror using FMI/FMU technology. This will solve the performance issue during virtual commissioning.

\ Point /

Time synchronization enables highly accurate simulation.

Service and maintenance



System recorder integration

MELSOFT Gemini can reproduce machine operation using log data.

\ Point /

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



VR

You can experience production simulations based on design data in VR. Training and maintainability check can be performed in a virtual environment.

\ Point /

VR enables intuitive understanding of spaces that are difficult to grasp from drawings alone.

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 updates 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
- 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 i7 12th generation
Memory	16GB or more
Hard Disk	15GB 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 Windows 11, version 21H2 or later

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 MELSOF Gemini simultaneously on as many client PCs* as the number of licenses on the server.

*MELSOF Gemini must be installed

Academic

Network license for educational institutions. Available for educational purposes.

Software Licenses and Fee-based Maintenance Service

Edition	Overview	Usage	Term of License	Term of Maintenance Contract	Model name ^{*1}	Price
Production Line Design	Production line development and layout evaluation	Standalone	Perpetual	1 year	SW1DND-3DS2-MDQ12	Open price
			6 months	6 months	SW1DND-3DS2T-MDQ06	
			12 months	12 months	SW1DND-3DS2T-MDQ12	
			-	1 year	SW1DND-3DS2-MHQ12	
		Network	Perpetual	1 year	SW1DND-3DS2K-MDQ12	
			6 months	6 months	SW1DND-3DS2KT-MDQ06	
			12 months	12 months	SW1DND-3DS2KT-MDQ12	
			-	1 year	SW1DND-3DS2K-MHQ12	
Machine Design	Verification of standard equipment operation and control	Standalone	Perpetual	1 year	SW1DND-3DS3-MDQ12	
			6 months	6 months	SW1DND-3DS3T-MDQ06	
			12 months	12 months	SW1DND-3DS3T-MDQ12	
			-	1 year	SW1DND-3DS3-MHQ12	
		Network	Perpetual	1 year	SW1DND-3DS3K-MDQ12	
			6 months	6 months	SW1DND-3DS3KT-MDQ06	
			12 months	12 months	SW1DND-3DS3KT-MDQ12	
			-	1 year	SW1DND-3DS3K-MHQ12	
Machine Design Robotics	Operation verification of equipment, including robots	Standalone	Perpetual	1 year	SW1DND-3DS4-MDQ12	
			6 months	6 months	SW1DND-3DS4T-MDQ06	
			12 months	12 months	SW1DND-3DS4T-MDQ12	
			-	1 year	SW1DND-3DS4-MHQ12	
		Network	Perpetual	1 year	SW1DND-3DS4K-MDQ12	
			6 months	6 months	SW1DND-3DS4KT-MDQ06	
			12 months	12 months	SW1DND-3DS4KT-MDQ12	
			-	1 year	SW1DND-3DS4K-MHQ12	
Digital Twin Factory Design	Overall verification, including process, workers, and equipment	Standalone	Perpetual	1 year	SW1DND-3DS5-MDQ12	
			6 months	6 months	SW1DND-3DS5T-MDQ06	
			12 months	12 months	SW1DND-3DS5T-MDQ12	
			-	1 year	SW1DND-3DS5-MHQ12	
		Network	Perpetual	1 year	SW1DND-3DS5K-MDQ12	
			6 months	6 months	SW1DND-3DS5KT-MDQ06	
			12 months	12 months	SW1DND-3DS5KT-MDQ12	
			-	1 year	SW1DND-3DS5K-MHQ12	
		Academic ^{*2}	Perpetual	1 year	SW1DND-3DS5A-MDQ12	
			12 months	12 months	SW1DND-3DS5AT-MDQ12	
			-	1 year	SW1DND-3DS5A-MHQ12	
			-	1 year	SW1DND-3DS5A-MHQ12	
Runtime	Result sharing and on-site utilization	Standalone	6 months	6 months	SW1DND-3DS1T-MDQ06	
			12 months	12 months	SW1DND-3DS1T-MDQ12	
		Network	6 months	6 months	SW1DND-3DS1KT-MDQ06	
			12 months	12 months	SW1DND-3DS1KT-MDQ12	

*1 The listed model names refer to products provided in physical form without media.

*2 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.



Industrial Computer



Controllers



Computerized Numerical Controllers



Drive Products



Human Machine Interfaces



Robots



Low-voltage Power Distribution Products



Medium-voltage Power Distribution Products



Energy Saving Supporting Devices



Processing Machines: EDM, Lasers



Engineering and Solution Software

Mitsubishi Electric's FA division provides robust support for our customers' manufacturing needs. We offer a vast array of FA products, including industry-leading PLCs, control devices, drive devices, energy efficiency support equipment, power distribution control equipment, and industrial mechatronics. Our presence on every type of production floor enables us to assist in labor-saving initiatives and quality improvements, helping customers achieve sustainable manufacturing. We also address challenges such as decarbonization and labor shortages through the utilization of automation technology.

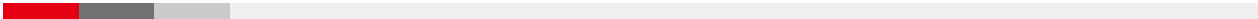
Additionally, by leveraging synergies among FA technologies, manufacturing expertise, and digital innovations, we aim to streamline the construction of systems for data collection, accumulation, and analysis. This contributes to reducing manufacturing and quality losses.

We enable flexible manufacturing processes that respect legacy systems while embracing innovations to drive optimization. As your solution partner, Mitsubishi Electric FA delivers high-performance, high-quality products that enhance your competitiveness.

Let's automate the world together!

Mitsubishi Electric 3D Simulator

MELSOFT Gemini



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.



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