

FACTORY AUTOMATION

# Mitsubishi Electric 3D Simulator MELSOFT Gemini

*e-Factory* MELSOFT

How would you like to perform  
pre-verification in a digital space?



# 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 due to problems upon launch of line and equipment at production sites.

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.

## 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.




## Mitsubishi Electric 3D Simulators Are Ideal for Users with the Below Types of Concerns.

**Concern 1**

Want to build a highly productive line.




Productivity can be verified in advance and easy to understand the result with visualizations before the actual operation.




**Enable to build a highly productive line!**

**Concern 2**

Actual on-site adjustment takes a huge amount of time which majorly delays launch.




Pre-verification of mechanical operations in a digital space is possible with a control program.




**Shorter on-site adjustment period!**

**Concern 3**

Not possible to verify line/equipment defects during operation without visiting site.



Reproduce remote line/equipment conditions.

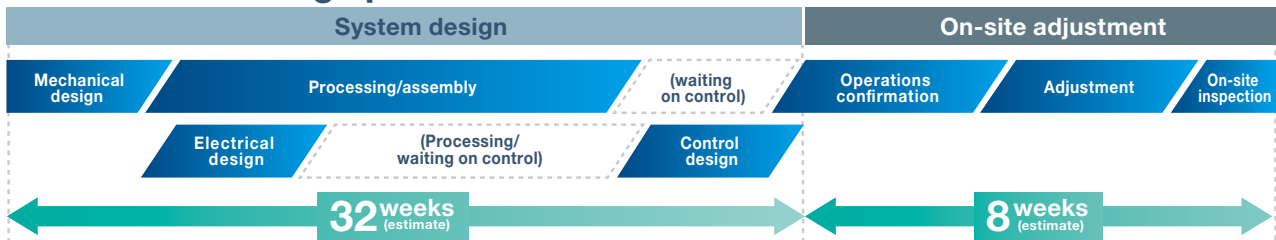


**Effective troubleshooting!**

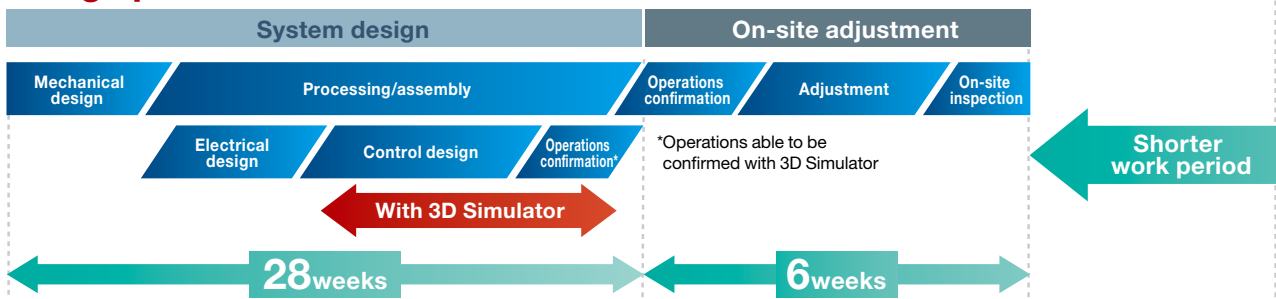


## Significantly reducing on-site adjustment time and cutting cost.

### Conventional design phase and work duration



### Design phase and work duration with 3D Simulator



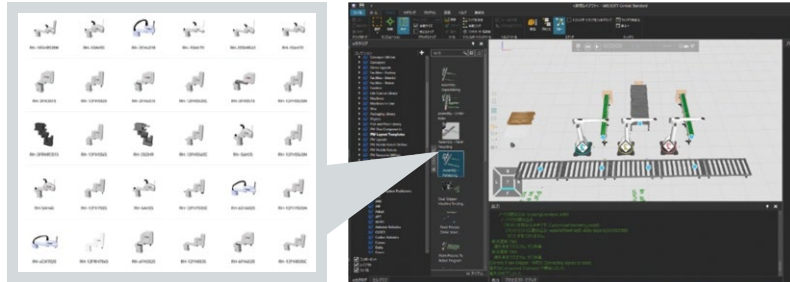
### Cost-effectiveness(e.g.)

Introduction costs	Build time	Introduction effects	Payback period
<b>MELSOFT Gemini</b> · Main unit cost · Training cost · Development-related labor costs upon utilization	<b>Approx. 6 weeks shorter</b> <small>*If SI cost per day is 80,000 yen, cost reduction for operation over 6 weeks at 5 days per week is 2.4 million yen.</small>	<b>6-weeks' worth of production profit due to the reduced installation period.</b> <small>*If daily production profit is 2.7 million yen, the profit increase for operation over 6 weeks at 5 days per week is 81 million yen.</small>	<b>Approx. 5 days</b> <small>*Assuming that the introduction cost is 15 million yen, cost reduction due to the reduced installation period is 2.4 million yen, and the introduction effect is 2.7 million yen per day.</small>

Feature  
**1**

**Simple equipment layout utilizing an abundant e-Catalog**

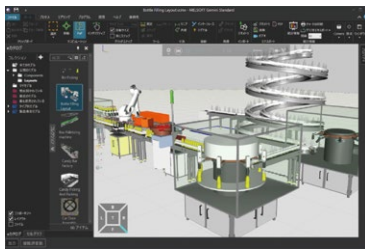
Contains all the parts necessary for line layout verification, including robots, conveyors, and machine tools (approx. 2800 parts). Mitsubishi Electric robots are also included in the lineup, with emphasis on the MELFA RH and RV Series. Layout is possible by dragging & dropping parts and performing simply settings.



Feature  
**2**

**Pre-verification of device operation and control program**

Control logic can be checked in 3D by synchronizing 3D Simulator and MELSOFT Simulator operations. This enables pre-verification without a machine.



**3D Simulator MELSOFT Gemini**

**MELSOFT iQ Works**  
**(Programming debugging)**  
MELSOFT Simulator (Control Design)

- Programmable controller simulator
- Motion controller simulator
- Robot simulator
- Display device simulator

Feature  
**3**

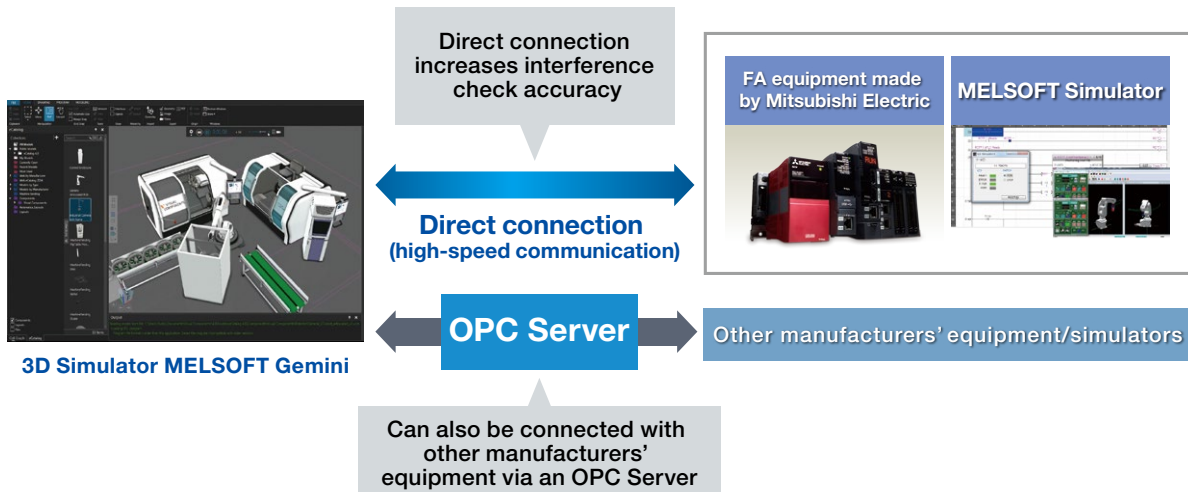
**Direct connection with Mitsubishi Electric's MELSOFT Simulator and the machine.**

There is no longer a need for OPC servers because 3D Simulator can be directly connected to various simulators and FA equipment made by Mitsubishi Electric.

This means higher mechanical interference check accuracy compared to OPC connection.

Also reduces the labor hours required for setting due to no longer requiring OPC servers.

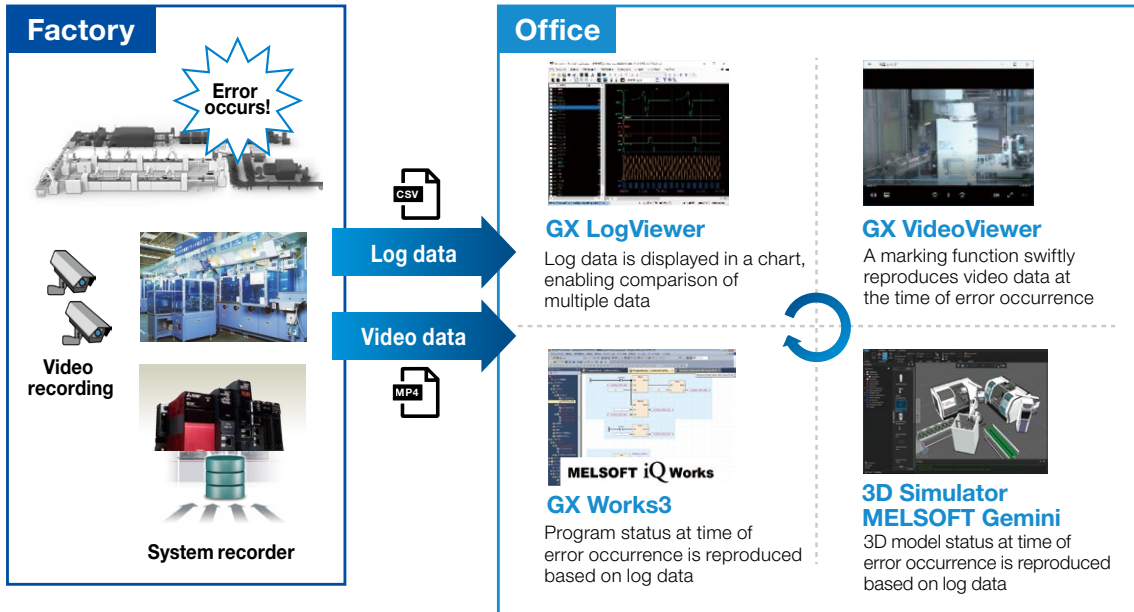
\* Use OPC server when connecting with devices made by other companies



Feature  
4

Fault reproduction function through system recorder linkage

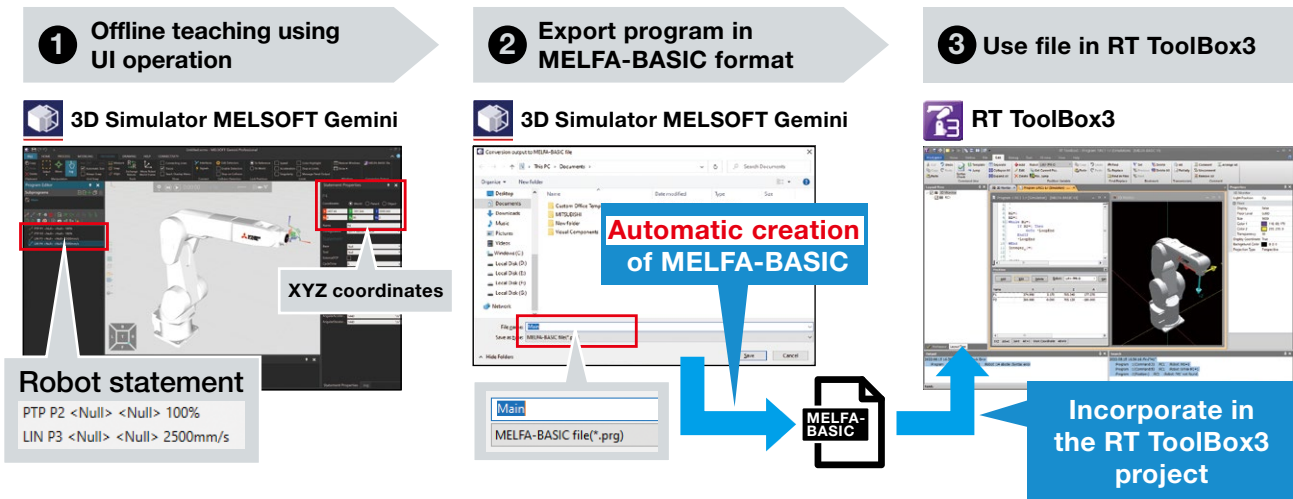
Able to compare operations using not only log data such as ladder monitor display and waveform display, and video display, but also 3D data. Troubleshooting can be performed swiftly by checking the status in detail when a fault occurs.



Feature  
5

MELFA-BASIC program conversion output function

A MELFA-BASIC program is automatically generated based on a robot statement of a Mitsubishi Electric-made robot for which teaching has been conducted in MELSOFT Gemini. Reduces time required to prepare control programs.



Product lineup

Greater freedom, operations by 3DCAD

**Professional** Supports equipment and line simulations

Basic version where customers can create new 3D models or set up operations using imported 3D CAD data.

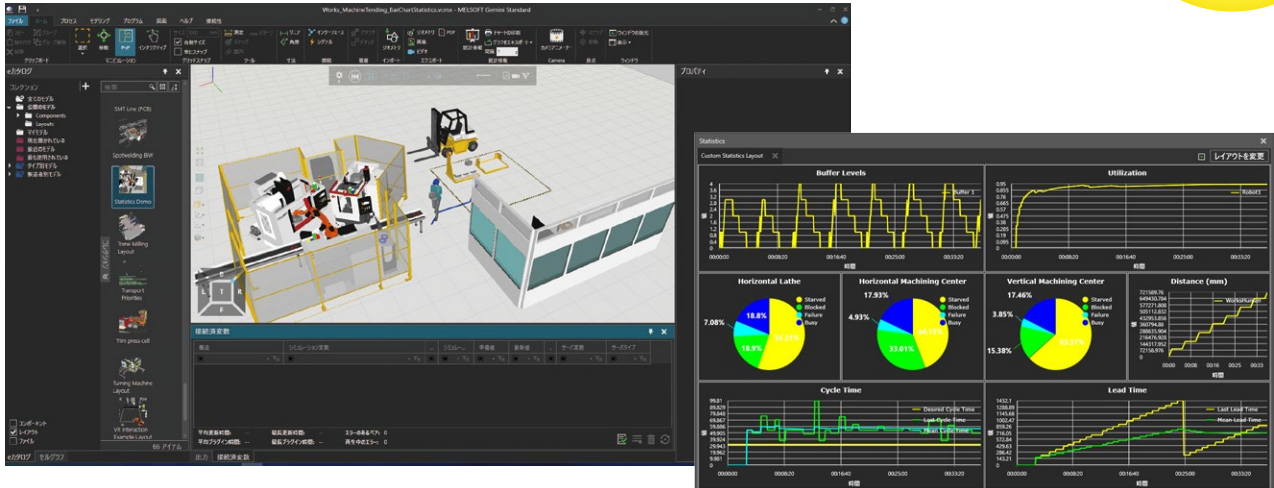
Can be used immediately, affordable

**Essentials** Supports line simulations

Simplified version where customers can use registered 3D models in product and fixed imported 3D CAD data.

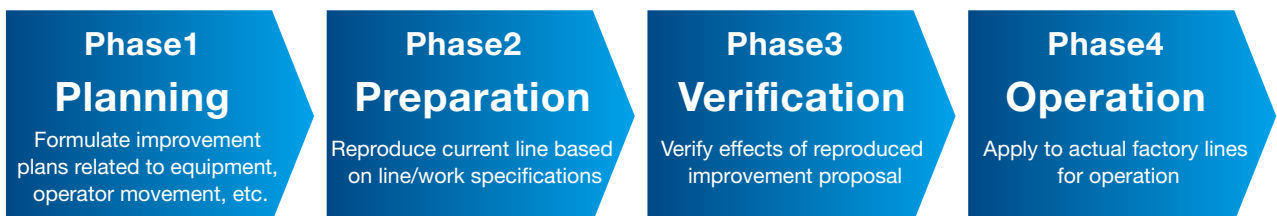
Constructed a system to increase production and reduced cycle time from **128 minutes per unit to 92 minutes per unit!** (actual operation)

**36**  
minute  
reduction



The system enables the construction of a line by placing 3D models from an extensive library of approximately 2,800 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

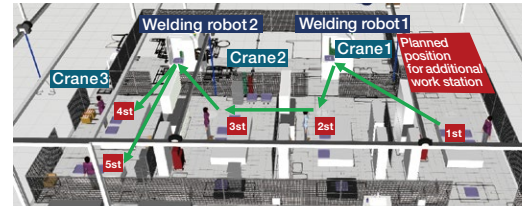
■ Work station/5 locations (5 operators) ■ Overhead crane/3 units ■ Welding robot/2 units

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

# Utilization flow

## Phase1 Planning

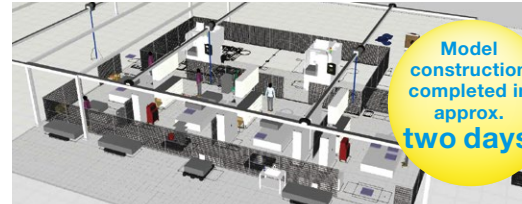
We wanted to increase the number of work stations from the current five to six and achieve a cycle time of 103 minutes/unit. However, it was difficult to conduct preliminary verification, including detailed loss analysis, and using conventional Excel-based calculations.



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

## Phase2 Preparation

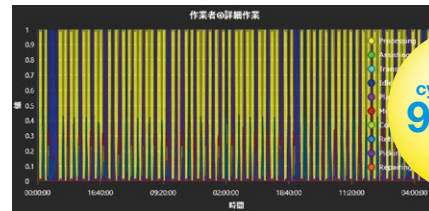
MELSOFT Gemini was used to reproduce the current line based on line specifications (station layout, individual work time, etc.) Current model construction was completed in around two days due to the abundance of 3D models already set up in the e-catalog.



Model construction completed in approx. two days!

## Phase3 Verification

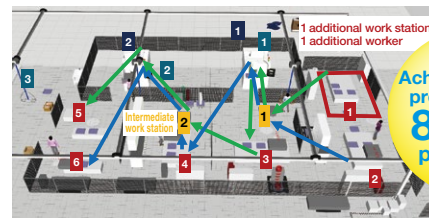
Cycle time was reduced to 99 min/unit with one additional work station and one additional operator. A graph function detected idling losses that were previously unnoticeable, and the installation of an intermediate work station eliminated these losses. In actual operation, cycle time was reduced to 92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



Reduced cycle time by 92 minutes per unit!

## Phase4 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 be easily modified, allowing for rapid verification of improvements in multiple patterns.

**02 | Review is easy with visualization of improvement measures**  
Observation of process waste in 3D, screen recording during simulation, and graphs of operating rates, etc. are utilized.

**03 | Prevents lost time due to need for rework**  
If the actual production line is modified based on Excel, the improvement measures may have to be reconsidered, which creates time loss.

**Productivity improvement**

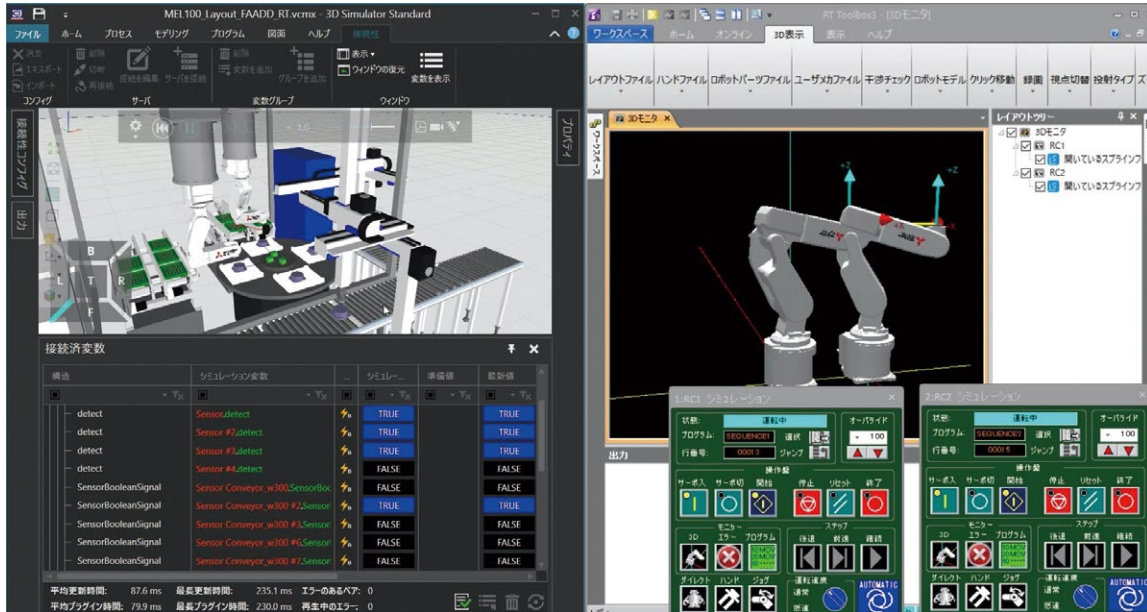
**Cost reduction**

**Work time reduction**

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 interference 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 + interference check

### Verification items ③

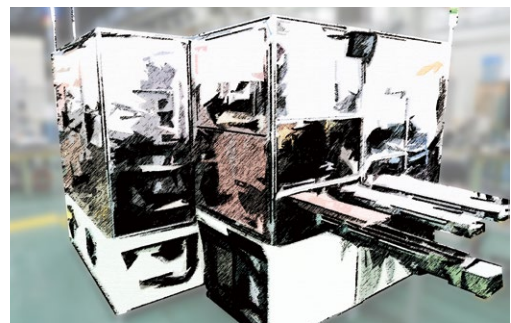
Program verification for cycle time reduction

## 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!**

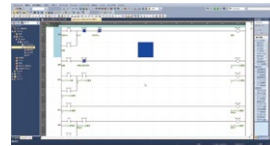




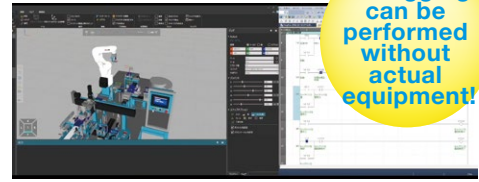
# Utilization flow

## 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!

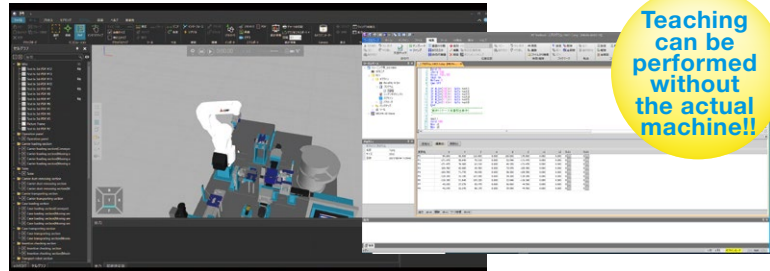


After

By using MELSOFT Gemini, the user can visually check operation, and the response is close to that of the actual equipment, which increases ladder debugging accuracy.

## Verification 2 Teaching + interference check

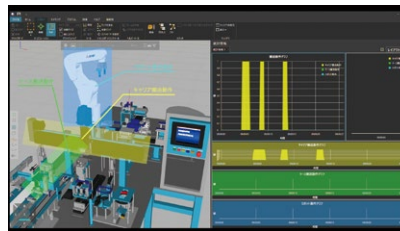
MELSOFT Gemini is used to perform teaching work and faithfully simulate actual robot operations such as paths and range of motion. This means that teaching and interference check can be completed in advance without actual machine.



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 interference check

Linkage with "RT ToolBox" prevents equipment damage due to interference 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 reduction



Reduced on-site adjustment time



Cycle time reduction

Program debugging and accurate interference check without actual equipment. Defects and waste are detected at the design stage,

**reducing cycle time before on-site adjustments!**

## Other Features

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

### 1 / Layout Configuration

Compatible software types  
Professional Essentials

Swift layout is possible by dragging parts directly from the e-catalog to the settings screen and connecting components. By using the property editing function, it is possible to use pre-set component parameters such as dimensions, speed, and color.

### 3 / CAD Import

Compatible software types  
Professional Essentials

CAD files can be directly imported. 3D Simulator MELSOFT Gemini supports CAD file types of many major CAD vendors, therefore files created using common software applications such as Autodesk, Dassault, and PTC can be easily imported.

### 5 / Graph/statistics feature

Compatible software types  
Professional Essentials

Visualizes simulation statistics using line graphs, area charts, bar graphs, and pie charts. Bottlenecks can be identified and changes in operating ratio can be confirmed. If more detailed analysis is required, it is possible to easily export simulation data as PDF or Microsoft Excel files.

### 2 / Process Modeling

Compatible software types  
Professional Essentials

With a visual workflow of part operation sequence, it is possible to perform settings where points are linked. Programming necessity can be set to the minimum with work content by line part/product flow or individual location.

### 4 / File Generation in Various Formats

Compatible software types  
Professional Essentials

It can output in a variety of formats for use in technical and marketing materials. Some examples of available formats are static images, 3D PDFs, and 2D drawings.

### 6 / Component Modeling

Compatible software types  
Professional

Mechanisms and operations can be set in the imported 3D CAD files. The motions of workpieces and equipment parts can be consistently reproduced in 3D Simulator.

## License Types

### 1 Standalone

Node-locked; one license fixed per computer. Perpetual and limited duration licenses are available.

### 2 Network

The software is licensed on the server. Client PCs\* can use MELSOFT Gemini simultaneously as the number of licenses allows on the server.

\*Installation of MELSOFT Gemini is required.

## Product list: Software Licenses and Maintenance Services

Usage	Product name (MELSOFT Gemini OO)	Term of License	Term of Maintenance Contract	Model name	Price
Standalone	Professional Standalone	Perpetual	1 year	SW1DND-3DSIMR-MQ12	Open price
	Essentials Standalone	Perpetual	1 year	SW1DND-3DSIME-MQ12	Open price
Standalone Maintenance contract renewal	Professional Standalone Annual maintenance	—	1 year	SW1DND-3DSIMR-MHQ12	Open price
	Essentials Standalone Annual maintenance	—	1 year	SW1DND-3DSIME-MHQ12	Open price
Network	Professional Network	Perpetual	1 year	SW1DND-3DSRK-MQ12	Open price
	Essentials Network	Perpetual	1 year	SW1DND-3DSEK-MQ12	Open price
Network Maintenance contract renewal	Professional Network Annual maintenance	—	1 year	SW1DND-3DSRK-MHQ12	Open price
	Essentials Network Annual maintenance	—	1 year	SW1DND-3DSEK-MHQ12	Open price

Usage	Product name (MELSOFT Gemini OO)	Term of License	Term of Maintenance Contract	Model name	Price
Standalone Limited time only	Professional Standalone Limited time only (6 months)	6 months	6 months	SW1DND-3DSRT-MQ06	Open price
	Professional Standalone Limited time only (12 months)	12 months	12 months	SW1DND-3DSRT-MQ12	Open price
	Essentials Standalone Limited time only (6 months)	6 months	6 months	SW1DND-3DSET-MQ06	Open price
	Essentials Standalone Limited time only (12 months)	12 months	12 months	SW1DND-3DSET-MQ12	Open price
Network Limited time only	Professional Network Limited time only (6 months)	6 months	6 months	SW1DND-3DSRKT-MQ06	Open price
	Professional Network Limited time only (12 months)	12 months	12 months	SW1DND-3DSRKT-MQ12	Open price
	Essentials Network Limited time only (6 months)	6 months	6 months	SW1DND-3DSEKT-MQ06	Open price
	Essentials Network Limited time only (12 months)	12 months	12 months	SW1DND-3DSEKT-MQ12	Open price

\*Professional: A basic version that allows customers to create new 3D models and set up operations on their own based on imported 3DCAD data.

\*Essentials: A simplified version that allows only imported 3DCAD fixed data and 3D models already registered in the product to be used.

\*Maintenance Services: Provides software updates, version upgrades, and technical support through a dedicated point of contact. (Continuation after the service agreement expires is optional)

## Operating Environment (recommended configuration)

Item	Content
CPU	Equivalent to/greater than Intel 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 Windows 10*

\*Not dependent on Windows language.

# 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.



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