MITSUBISHI ELECTRIC

Changes for the Better

Numerical Control (CNC)

User's Manual

NC Machine Tool Optimizer (Pro/Lite)

IB-1501672(ENG)-D

PRECAUTIONS FOR SAFETY

(Be sure to read before using this product.)
When using this product, read this manual and the related manuals introduced in this manual thoroughly, and pay full attention to safety to handle this product correctly.
The precautions shown in this manual are for this product only. For the safety precautions of the NC system, refer to the manual of the numerical controller to be used.

This section "Precautions for Safety" ranks the safety precautions into: " ⚠ WARNING" and " ⚠ CAUTION".

⚠ **WARNING**	**Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.**

⚠ **CAUTION**	**Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.**

Note that even items ranked as " ⚠CAUTION", may lead to major results depending on the situation.
In any case, important information that must always be observed is described.
Keep this manual in a safe place for future reference and be sure to deliver it to the end user.

[Design Precautions]

⚠ WARNING

- **To perform control (data change, operation status change, etc.) on an device and equipment (numerical controller, PLC, servo, robot, server, etc.) that is in operation from an industrial personal computer equipped with this product, configure an interlock circuit outside the device and equipment so that the entire system always works on the safe side. Read the manual thoroughly and make sure it is safe before proceeding.**
  In particular, the above control for device and equipment from a remote location via a network may not be able to immediately deal with troubles on the device and equipment side due to abnormal data communication.
- **Configure a safety circuit outside of an industrial PC equipped with this product so that the entire system operates to the safely side even when a fault occurs in the computer.**
  Failure to do so may result in an accident due to an incorrect output or malfunction.

[Design Precautions]

⚠ CAUTION

- **While various settings are reflected, do not perform the operation that forces the power of the industrial personal computer equipped with this product to be turned OFF.**
  If you perform an operation such that the industrial personal computer equipped with this product is forcibly turned OFF during the reflection, the data becomes unstable and it needs to be reconfigured and re-reflected. It may also cause the product to malfunction.
- **To protect the availability, integrity and confidentiality of the NC system against cyber-attacks including unauthorized access, denial-of-service (DoS) (*1) attack, and computer virus from external sources via a network, take security measures such as firewall, VPN, and anti-virus software.**
  (*1) Denial-of-service (DoS) refers to a type of cyber-attack that disrupts services by overloading the system or by exploiting a vulnerability of the system.
- **Mitsubishi Electric assumes no responsibility for any problems caused to the NC system by any type of cyberattacks including DoS attack, unauthorized access and computer virus.**

[Operating Precautions]

⚠ CAUTION

- **The judgment result of the data diagnosis function does not guarantee the result. Before performing an operation that affects the target device with a device command or program execution, be sure to check the safety sufficiently.**

APPLICATION OF THIS SOFTWARE

Users must agree the following conditions for an unexpected software problem:
- Use the software in a way that the problem will not cause a serious accident.
- Functions for data backup and fail-safe need to be systematically implemented outside the device as preventive measures for the problem.

INTRODUCTION

This manual is for understanding the specifications, procedures before operation, and troubleshooting required to use this product.
Before using this product, read this manual and related manuals thoroughly to understand the functions and performance of the product to use the product properly.

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RELEVANT MANUALS

Manual name	Manual number
M800/M80/E80/C80 Series PLC Interface Manual	IB-1501272
M800/M80/E80 Series Instruction Manual	IB-1501274
NC Machine Tool Optimizer (Pro/Lite) Install Manual	IB-1501673
NC Machine Tool Connector User's Manual	IB-1501634

TERMS

Unless otherwise specified, this manual uses the following terms.

Terms related to Data Collector

Terms	Description
Fallback setting (value)	A function to return an arbitrary setting value without regarding the corresponding cycle as missing when missing occurs.

Terms related to MTConnect

Terms	Description
MTConnect	An open protocol for the purpose of monitoring the status of the NC machine tools defined by MTConnect Institute. Reference: http://www.mtconnect.org/
Agent	Converts the collected data of the NC device to the communication data format of MTConnect according to the schema definition, and returns it to the application.
Adapter	An application to collect the data from the NC device and notify the collected data successively to Agent according to the schema definition. Implemented depending on the NC device.
Schema	Data structure defined by XML. Schema is used for MTConnect communication

Terms Related to OPC UA

Terms	Description
OPC UA	An abbreviation for OPC Unified Architecture. OPC UA is a platform-independent and service-oriented architecture which has integrated all the functionality of the OPC (OLE for Process Control) Classic specifications into one extensible framework. Reference: https://opcfoundation.org/
OPC UA server	Software that returns the data collected from equipments, devices, and machines to the requests from OPC UA clients by OPC UA communication.
OPC UA client	Software (SCADA, MES, ERP, etc.) that accesses the OPC UA server to make data access via OPC UA communication.

Terms Related to Production

Terms	Description
Utilization	The ratio of operation time to planned operating time. The maximum planned operating time in NC Machine Tool Optimizer is 24 hours. (Operation time ÷ Planned operating time × 100) (*1)
Availability	The ratio of the time taken to produce the actual number of parts (availability time) to the actual operating time. Performance. (Actual number of parts produced × Cycle time ÷ Operating time × 100) (*2)
Planned operating time (Loading time)	The time per period unit during which the machine can operate, excluding planned downtime. The time during which the machine is powered on for production. Availability loss is included.
Operation time	The remaining time after subtracting availability loss from the planned operating time. Performance loss and quality loss are included.
Downtime (Availability loss time)	Loss time caused by small stops during the planned operating time. Times required for warming up, process (operator) wait, failure, repair, unplanned power outage, setup, adjustment, etc. are included.
Performance loss time	Loss time caused by decreased performance of the equipment such as idling, minor stoppages, reduced speed.
Quality loss time	Loss time caused by rework such as rectification.
Cycle time	The time required to produce one production unit (e.g. process, machining program).

(*1) It is calculated with the following formula in NC Machine Tool Optimizer.

Utilization [%] = operating time ÷ sum of operating status time × 100

(*2) It is calculated with the following formula in NC Machine Tool Optimizer.

Availability [%] = Σ run time ÷ Σ operating time × 100

Other Terms

Terms	Description
MQTT	An abbreviation for Message Queuing Telemetry Transport. MQ Telemetry Transport is a lightweight message queuing protocol using TCP/IP, publish-subscribe pattern. MQTT requires a message broker (MQ server). Clients can receive the messages selectively.
RDBMS	RDBMS (Relational Database Management System) is a software that manages a relational database (RDB) in a comprehensive way. RDB manages data in a table structure. SQL is the standard programming language used to access the database.

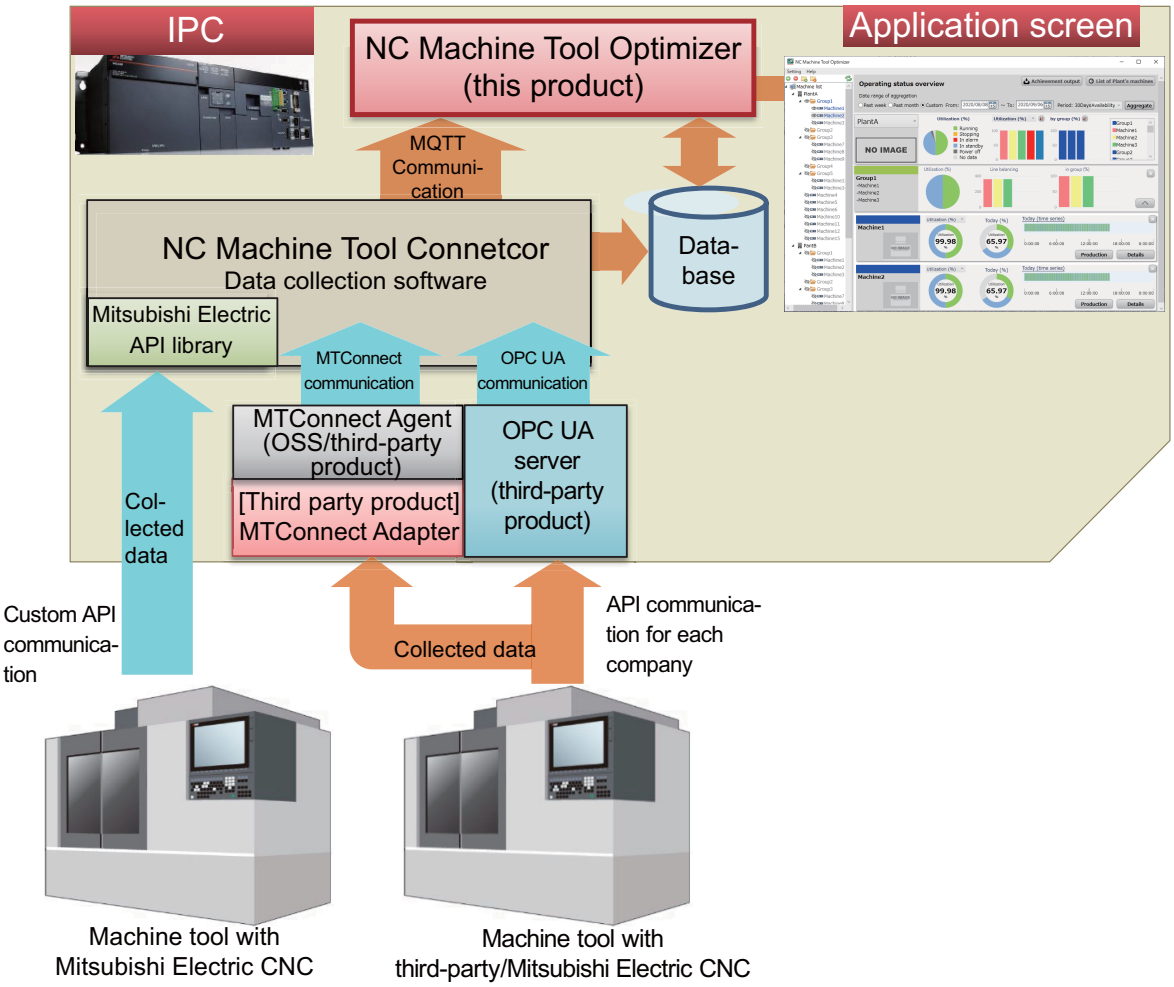
MEMO

1 OVERVIEW

NC Machine Tool Optimizer is a software that collects operation information from CNC machine tools and peripheral devices and uses various data from the production site for the visualization of operation status and data for analysis.
NC Machine Tool Optimizer can be used in the following situations.
- Improving the operation ratio for overall optimization
- Improving the production site for increasing productivity

NC Machine Tool Connector supports various communication protocols and can be used to connect and collect operation information from various equipment from any manufacturer at the production site. The collected operation information can be used to analyze the operation status.

[Outline of system configuration]



MEMO

2 SYSTEM CONFIGURATION

2.1 Connection Configuration

Refer to the following for an example of the connection configuration between devices.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

Configuration for monitoring plants

You can monitor the machines in a plant other than the base plant remotely on the Plant machines overview screen and Operating status overview screen of the base plant by installing NC Machine Tool Connector and PostgreSQL on a separate computer from the one with NC Machine Tool Optimizer in addition to setting up the database, etc. and then connecting it to the network.

(1) For information on how to set the database for a plant, refer to the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

(2) Use a secure network such as a dedicated line for the connection between plants.

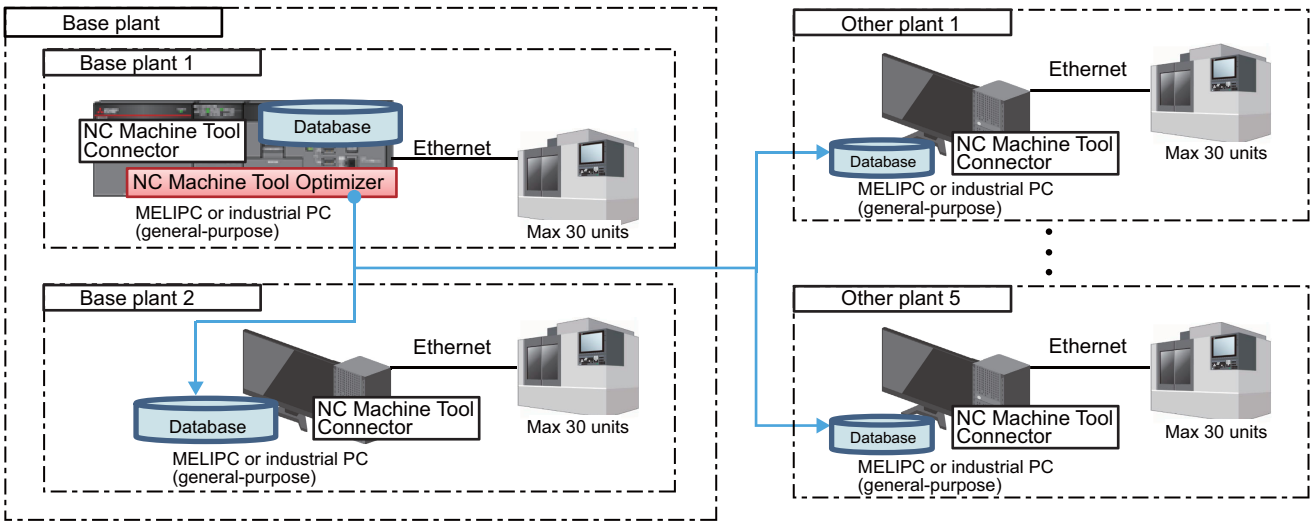
(3) In Pro version (*1), a maximum of seven plants which is connected a maximum of 210 units (*2) can be monitored (visualized) the machine operating status.

(*1) In Lite version, a maximum of one plants which is connected a maximum of 10 units can be monitored the machine operating status.

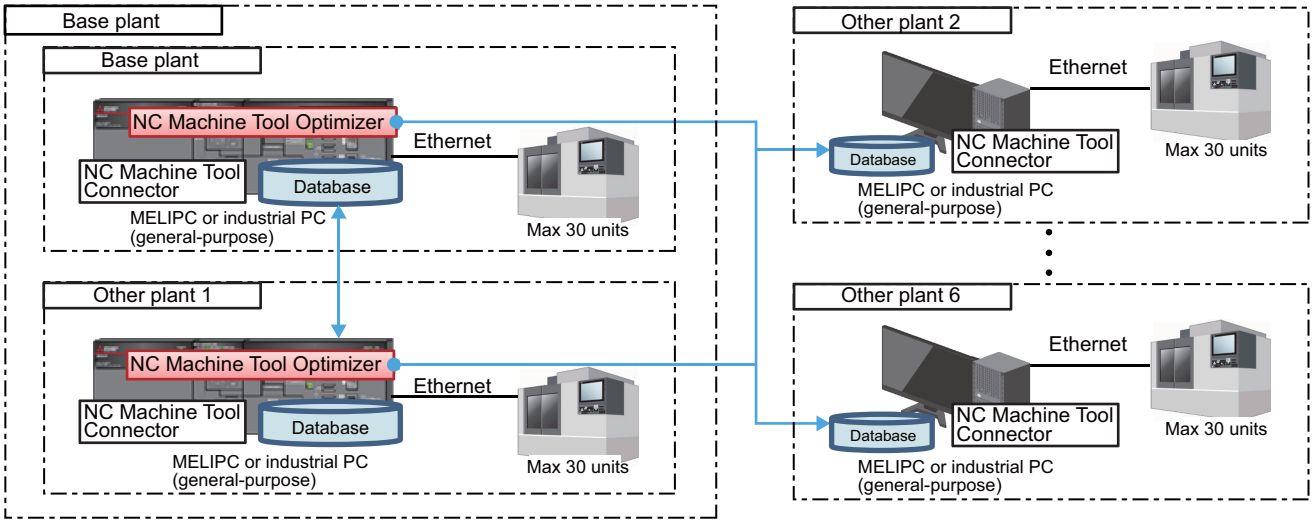
(*2) 210 units can be connected when a maximum of 7 plants is connected which is configured by 30 units per one plant. Machine operation data can be collected up to 30 units. Multiple machines with different communication method can be connected within the maximum number as shown below.

- A machine using Mitsubishi Electric Custom API library (max. 30 units)
- A Mitsubishi Electric machine using MTConnect communication (max. 30 units) (max. 10 when using Optimizer Setting Tool)
- Other manufacturer's machine using MTConnect communication (max. 10 units) (*3)
- Other manufacturer's machine using OPC UA communication (max. 10 units)

(*3) Other manufacturer's product may be restricted the maximum number. Note that the other manufacturer's machines with different communication method may not be connected.



(4) NC Machine Tool Optimizer can be installed in multiple plants as shown below. Note that the following restrictions apply.
- A license is required for each NC Machine Tool Optimizer
- NC Machine Tool Connector MQTT communication can only communicate with one NC Machine Tool Optimizer



2.2 Product That Can Be Connected

When connecting an MTConnect-compatible machine

If an MTConnect-compatible machine is connected, the following software is required.
For information about the machines that can be connected by NC Machine Tool Optimizer, refer to NC Machine Tool Optimizer Supported Machines.

(1) MTConnect agent

The following is the MTConnect agent recommended for NC Machine Tool Optimizer.

	Recommendation
1	Use MTConnect agent when connecting an MTConnect-compatible machine that cannot be connected using Mitsubishi Electric Custom API library. ■ Reference link C++ Agent issued by MTConnect Institute (Ver1.3.0.17 or newer, OSS) https://github.com/mtconnect/cppagent/blob/master/install/Windows/src/x32/agent.exe

(2) MTConnect adapter

MTConnect adapter is required for each MTConnect-compatible device to be connected.

	Acquisition method
1	Mitsubishi Electric product: Included in MTConnect Data Collector (FCSB1810W101). Other manufacturer's product: Contact the manufacturer of each machine.

When connecting an OPC UA-compatible machine

If an OPC UA-compatible machine is connected, the following software is required.

(1) OPC UA server

The following is the OPC UA server recommended for NC Machine Tool Optimizer.

	Recommendation
1	Use OPC UA server when connecting an OPC UA-compatible machine that cannot be connected using Mitsubishi Electric Custom API library. ■ Products of other manufacturers whose operation has been confirmed TAKEBISHI CORPORATION DeviceXPlorer OPC server silex technology, Inc. FBR-100AN

2.3 Operating Environment

The following operating environment is required for the Machine Tool Optimizer installation.

Processor	Intel Core-i3 2 cores or higher 64-bit architecture
Required memory	8 GB or more
Disk space (*1)	64 GB or more
Required external I/F	RJ-45 (Communications standard: Ethernet)
Display resolution	XGA (1024×768) or higher
OS (*2) (*3)	Supports 64-bit version of the following OS. Windows 10 Pro Windows 10 Enterprise Windows 10 IoT Enterprise
Required library	.NET Framework 4.5
Supported languages	Japanese / English / Chinese (Simplified, Traditional) / Korean

(*1) To monitor the machines in plants other than the base plant, larger disk space is required according to the number of plants to be connected and the number of the machines in the plants.

(*2) The following functions may not work correctly if used with NC Machine Tool Optimizer.
(a) Compatibility mode
(b) Fast user switching
(c) Windows touch or touch
(d) Hyper-V
(e) Virtual desktop
(f) Tablet mode
(g) Inactive or sleep (standby) of Windows
(h) Unified write filter
(i) A value other than 100% being set for "Change the size of text, apps, and other items" the OS version is earlier than 1703
(j) The screen resolution being changed while this software is running
(k) Multi-display being set
(l) Being used by an account other than a Standard user and an Administrator of Windows 10

(*3) While Remote desktop is supported, the specification is limited for the following.
(a) Screen update delay during monitoring or operation due to network environment (e.g. speed and load).
(b) Truncation of texts or windows due to the screen settings of Remote desktop.

3 SPECIFICATIONS

3.1 Product Specifications

The product specifications are shown below. For the technical data of the related products, refer to the manuals of each product.

Function classification				Details
Level 1	Level 2	Level 3		
Connected machine	Number of connectable units			(Pro) 210 / (Lite) 10 (*1)
	Machines that can be connected			Refer to "NC Machine Tool Optimizer Supported Machines" on the next page.
Communication specifications	MTConnect	Supported version		MTConnect Ver.1.3.1
		Agent (for reference)		CppAgent issued by MTConnect Institute (Ver1.3.0.17 or newer) (*2)
	OPC UA	Supported server		OPC UA server products of other manufacturers (OPC UA Ver.1.03 or newer recommended)
	MQTT	Supported version		Protocol Ver.3.1.1
		Broker		Eclipse Mosquitto 1.3.5
	Database			PostgreSQL Ver.16 / SQL99
Logging specifications	Collected data	Number of data collection settings (*3)	Mitsubishi Electric	30
			Other manufacturer	10 (Max number of connections via MTConnect agent)
				10 (Max number of connections via OPC UA server)
		Number of machines connected per data collection setting	Mitsubishi Electric	1
			Other manufacturer	3
		Supported data type		UInt16, Int32, String, Boolean
		Character code		UTF-8 (String type)
	Collection Interval			500 ms or longer (needs to be modified according to the configuration and the data to be collected)
	Custom setting	Number of operating states		5
		NC operation mode		3
		Number of part systems supported		3
		Number of operation detail states		7
Monitoring function	Number of monitoring settings (*3)	Number of plants monitored		7 (*4)
		Number of machine groups		5 (Max 6 units per group)
		Number of machines (machines only)		Pro: Max 210 (30 per plant simultaneously in plant machines overview; 15 simultaneously in operating status overview)(*5) Lite: Max 10 (10 simultaneously in plant machines overview; 10 simultaneously in operating status overview)(*5)
	Monitoring data	Utilization		Per plant, per group, per machine
		Operating status		Per machine (ratios of states, time series)
		Operating detail status		Per machine
		Production results		Number of parts produced (per machine) Production progress rate (per plant, per machine)
	Custom setting	Machine information		Machine name, machine description, machine image registration
		Group information		Group name, group description, machine enrollment
		Plant information		Plant name, plant description, plant image registration
		Operation information of machines in the plant		Production progress rate, number of parts produced, name of running program, total run time, total operating time

Function classification			Details
Level 1	Level 2	Level 3	
Aggregate function	Data to be aggregated	Utilization, operating status	Per plant, per group, per machine
		Utilization ranking	Within the machines in the plant, within the group
		Availability	Per machine
		Availability ranking	Within the machines in the plant
		Cycle time (CT)	Per machine
		Line balancing	Cycle time of each machine in the group
		Machining details	NC status, operation mode, machining program name, number of parts produced
		Operation detail time	Per machine (ratios of states, time series)
	Aggregate unit	Fixed period	Past month, past week
		Custom period	Max 30 days
Screen display	Supported language		Japanese, English, Chinese (Simplified, Traditional), Korean

(*1) The number of machines per NC Machine Tool Optimizer license

(*2) Any MTConnect-compatible agent, not limited to CppAgent, can be used for connection.

(*3) Per NC Machine Tool Connector license

(*4) Up to 6 remote plants can be set in addition to the base plant.

(*5) In NC Machine Tool Optimizer Pro, a maximum of 30 machines can be displayed simultaneously in the Plant machines overview screen, and a maximum of 15 machines can be displayed simultaneously in the Operating status overview screen.
In NC Machine Tool Optimizer Lite, a maximum of 10 machines can be displayed simultaneously in the Plant machines overview screen, and a maximum of 10 machines can be displayed simultaneously in the Operating status overview screen.

NC Machine Tool Optimizer Supported Machines

NC Machine Tool Optimizer is for the machines that can be connected using NC Machine Tool Connector.
The machines that can be connected by NC Machine Tool Optimizer are shown below.

Communication protocol	Machine type	Manufacturer	Supported product
Custom API	CNC	Mitsubishi Electric	M800V/M80V Series M800/M800LUC Series/E80 Series C80 Series (*1)
			M700V/M70V/M700/M70/E70 Series M700UM/M700BM Series
MTConnect or OPC UA			M700LC Series
	Processing machine (EDM, laser processing machine)		MTConnect/OPC UA-compatible model
	CNC machine tool	Other manufacturer	MTConnect/OPC UA-compatible model
	CNC controller	Other manufacturer	MTConnect-compatible model For details, contact the manufacturer of the product.
	Others	Mitsubishi Electric Other manufacturer	Ethernet-incompatible model

(*1) Can only be connected to the LAN interface on the C80 unit side.

3.2 Operational Specifications

Behavior at application startup

Messages at startup

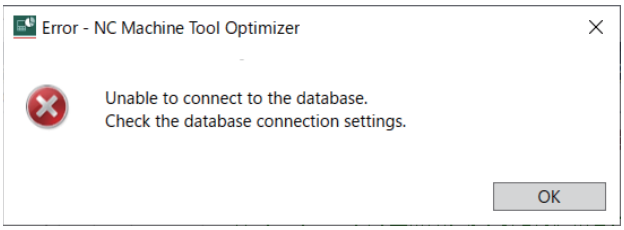
NC Machine Tool Optimizer requires the setting up of an application and a database. If they are set up using different versions of installer, the following messages may appear when the application starts up.

If the following messages appear immediately after NC Machine Tool Optimizer starts up, press OK to terminate the application. In this case, refer to the following manual to review the setup procedure.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

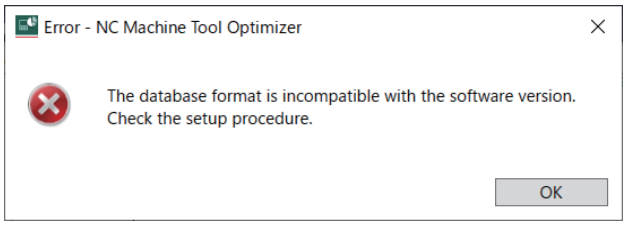
(1) Failed database connection

Review the setup procedure by referring to the procedure (Chapter 6) of the following manual.



(2) Incorrect database setup

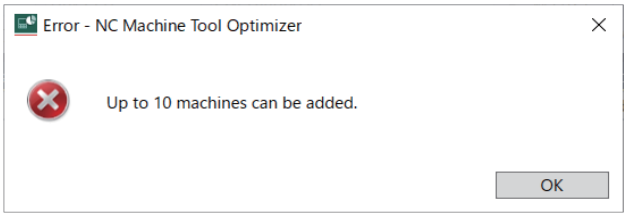
Review the setup procedure by referring to the procedure (Chapter 10.3) of the following manual.



(3) Exceeding of the maximum number of machines

If the total number of machines registered for all plants exceeds the maximum number of machines allowed across all plants, the following message appears. (Lite version: 10, Pro version: 210)

Review the setup procedure by referring to the procedure (Chapter 11.3) of the following manual.



NC Machine Tool Optimizer (Pro/Lite) Install Manual

Respond to errors

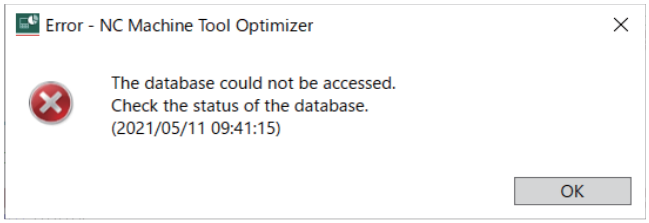
Database access error

If a database access error occurs while the application is in use, such as no response from the database, the following message appears. If it persists, refer to Chapter 14 of the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

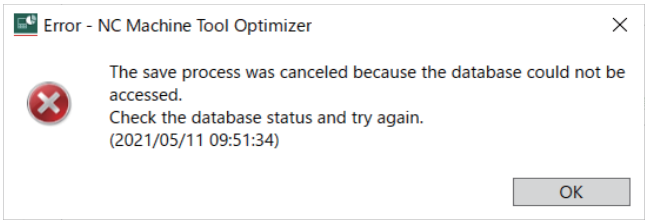
(1) During screen update (when manually refreshing the Plant machines overview screen)

If the following message appears, check the state of the database.

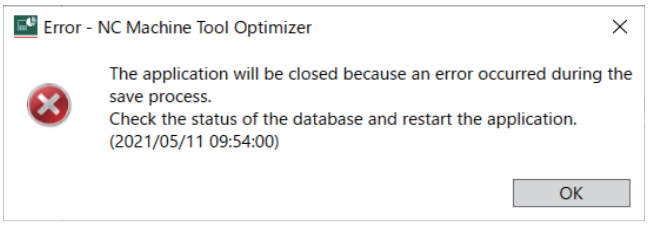


(2) During save operation

If database access fails during the save operation to the database when adding, deleting, and modifying the setting of a machine, group or plant, the following message appears. Check the state of the database and try again.

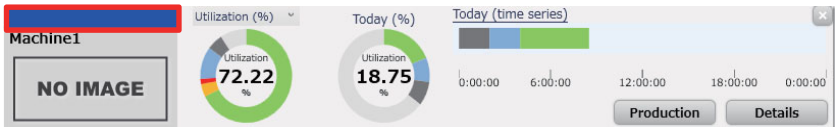


If the following message appears, press the [OK] button. The application is automatically terminated. Check the state of the database and restart the application.



Operating status indicator of connected machine

NC Machine Tool Optimizer indicates the operating status of the machine in the Machine view in the Operating status overview screen via MQTT data communication.
The figure below shows the location of the operating status indicator and the colors for the operating states.



Operating state	Color
No data	Blue
Running	Green
Stopping	Yellow
In alarm	Red
In standby	Light blue
Power off	Gray

4 FUNCTIONS

A list of the functions of the screens in NC Machine Tool Optimizer is shown below. For details of each screen, refer to the following pages.

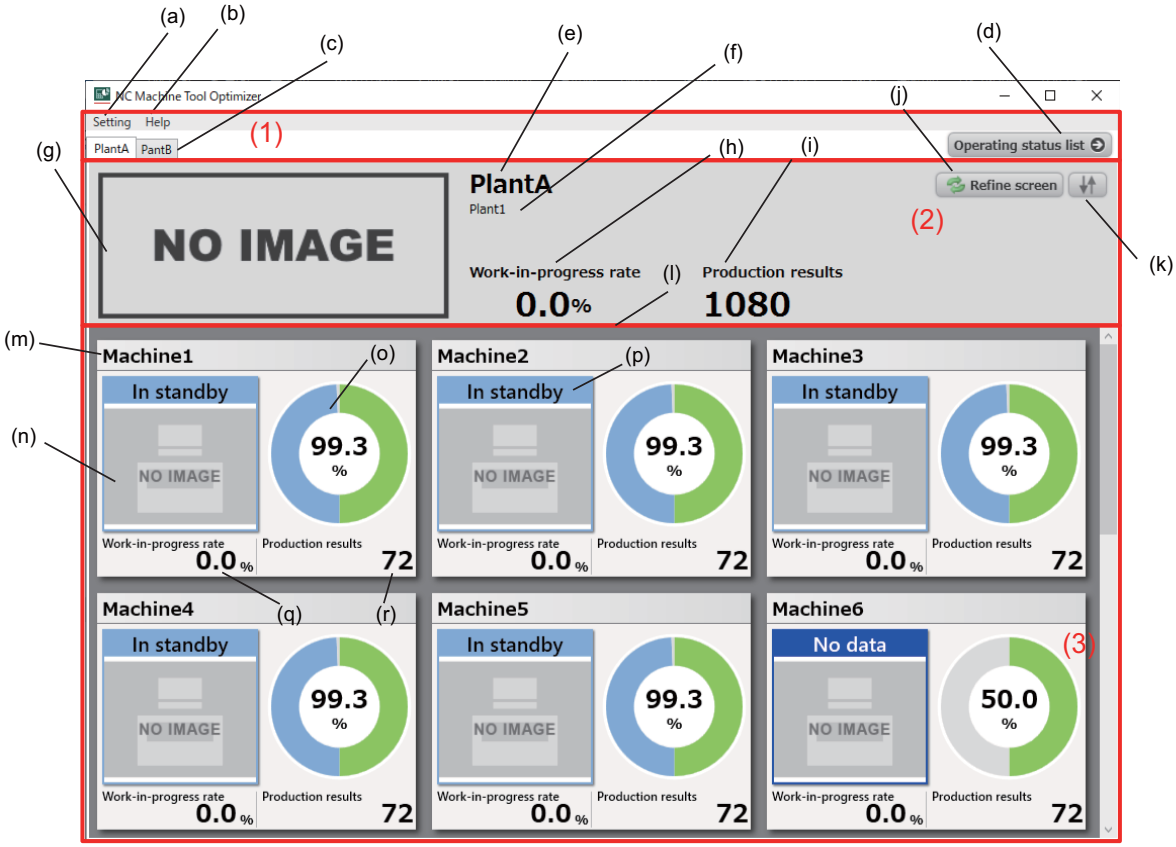
Function		Outline
Screen	Function classification	
Plant machines overview screen	(1) Plant monitoring settings	Add plant, set plant information, set reference of plants other than the base plant
	(2) Operation summary view	View the current day's utilization, operating time and percentage of completion per plant and per machine in the plant
Operating status overview screen	(1) Machine settings, group settings	Register, delete and edit machines and groups to be monitored. Operating status setting.
	(2) Machine list view	View the operating status of the machines and groups to be monitored in a tree view
	(3) Machine operation monitoring (real-time)	View the current day's machine donut chart and operating status time series
	(4) Machine operating status view	View the charts of machine utilization over a specific period by plant and by group
Operating details screen	(1) Period total view	View the percentages of operation detail states over the specified period in a donut chart
	(2) Daily details	View the change in the operation detail status over time in a Gantt chart
		View the total times of the operation detail states
	(3) Machining details	View the change in the machining-related data over time
Production results screen	(1) Period total view	View the total production results over the aggregation period
	(2) Production result timeline	View the planned and actual production for the planned production period in timeline charts
	(3) Machining details	View the details of actual daily production for the aggregation period
Achievement output screen	(1) Production results aggregation and output	View the production results summary of the machines in the plant over the aggregation period and export the data to a CSV file
	(2) Operation aggregation and output	View the operation summary of the machines in the plant over the aggregation period and export the data to a CSV file

4.1 Operating Status Monitoring

Plant machines overview screen

The Plant machines overview screen displays the summary of the operation of the machines in each plant. You must add plants to be monitored in this screen and register machines for each plant in the Edit machine screen.
The base plant (Plant name: Plant 1) is added by default.

The following shows the layout of the Plant machines overview screen.



The following describes what you can view and operate in the Plant machines overview screen.

Menu area	You can register the plants to be monitored and modify the settings from the menu. When a plant is added, a new plant tab is created. You can use the tabs to toggle which plant is displayed.
Plant view	You can view the operation summary (the current day's utilization and percentage of completion) of the plant that you selected to display using the plant tab. You can specify in the Edit plant screen which plant information to be displayed (plant name, short description, image). For information on how to edit and set plant information, refer to "Edit plant screen" (Chapter 4.1). You can open the Operating status overview screen by pressing the Operating status list button.
Plant machines overview	You can view the following operation summary of the machines registered for the plant. - The current operating status, the machine image, and the operating status donut chart of each machine registered in the Edit machine screen - The current day's percentage of completion, the number of parts produced, the name of the running program, the current day's run time and operating time are displayed depending on the settings in the Edit plant screen For details on the Edit plant screen, refer to "Edit plant screen" (Chapter 4.1). For details on how to register and edit machines in a plant, refer to "Edit machine screen" (Chapter 4.1).

Display items

The following table describes what is displayed in the Plant machines overview screen.

Position		Display items	Description	Remark
(1) Menu area	(a)	Setting menu	- Add plant - Plant setting - Display setting	For details on how to operate each menu, refer to "Menu operations" (described later in this chapter).
	(b)	Help menu	- Switch language (English / Japanese / Korean / Chinese (Simplified/Traditional)) - Software version	
	(c)	Plant tab	You can switch the plant to display. Each plant tab shows the operation summary of the machines in the plant. The plant tabs are arranged in the order that they are added. You cannot change the order.	One plant tab is added by default.
	(d)	Operating status list button	This button opens the Operating status overview screen.	For details, refer to "Operating status overview screen" (Chapter 4.1).
(2) Plant view	(e)	Plant name	Displays the plant name.	- If the size of the registered image is small, the image is aligned to the bottom right of the image area. - For information on how to register and edit plant information, refer to "Edit plant screen" (Chapter 4.1).
	(f)	Plant description	Displays the short description of the plant.	
	(g)	Plant image	Displays the image of the plant.	
	(h)	Work-in-progress rate	Displays the current day's percentage of completion of the plant. The percentage of completion of a plant is the average of the percentages of completion of all machines in the plant.	- The percentage of completion of a plant is the average of the values of all machines in the plant.
	(i)	Production results	Displays the current day's number of parts produced in the plant. The number is the sum of the numbers of parts produced by all machines in the plant.	
	(j)	Refresh button	You can refresh the contents in the plant tab to see the most current information.	Only the contents in the selected tab are updated.
	(k)	Sort button	You can toggle between ascending and descending sort orders for the utilization of the machines in the plant. As you press the button, the sorting order cycles through no sort, descending, and ascending.	In the case of no sort order, the data is shown in the order the machines were registered.

Position		Display items	Description	Remark
(3) Plant machines overview	(l)	Plant machine overview	Displays the overview of the operation summary of each machine in the plant.	The number of machines that can be displayed: Pro: 30, Lite: 10
	(m)	Machine name	Displays the names of the machines in the plant.	- If the size of the registered image is small, the image is aligned to the bottom right. - For information on how to register and edit machine information, refer to "Edit machine screen" (Chapter 4.1).
	(n)	Machine image	Displays the images of the machines in the plant.	
	(o)	The current day's machine utilization donut chart	Displays the current day's percentages of operating states of the machine in a donut chart. In the hole of the donut chart, the current day's utilization is indicated.	For details on the calculation of utilization, refer to "Operating status specification" (Chapter 4.1).
	(p)	Machine operating status	The border color changes according to the current operating status of the machine.	
	(q)	Custom display data 1	Displays the current day's operation data selected in the Edit plant screen. (*1)	- For information on how to set display data and on display conditions, refer to "Edit plant screen" (Chapter 4.1). - When only the 'Running' state is set as 'Operation' in the operating status setting tab in the Edit plant screen, (4) and (5) show the same value. - If the number of parts produced exceeds the maximum number allowed for aggregation, the production results and percentage of completion are shown as "---". In this case, the production results (i) is the sum of the numbers of parts produced by the machines excluding those of the machines exceeding the upper limit.
	(r)	Custom display data 2		

(*1)

	Caption	Description	Unit
(1)	Work-in-progress rate	The current day's percentage of completion of the machine The current day's number of parts produced ÷ (Number of parts planned ÷ Number of days in the planned production period)	%
(2)	Production results	The current day's number of parts produced by the machine	N/A
(3)	Program name	The number of the program that is running Only for O numbers, 9 digits from the beginning is displayed data.	
(4)	Daily total operation time	The current day's accumulated operating time of the machine The time is displayed as "hh:mm:ss".	
(5)	Daily total power on time	The current day's accumulated operating time of the machine The time is displayed as "hh:mm:ss".	

Menu operations

The following describes the menu items in the Plant machines overview screen.

Menu item		Function outline	Remark
Setting	(1) Add plant	Select this menu to display the Add plant screen. When a plant is added, a new plant tab is created in the Plant machines overview screen. To delete added plants, use the Plant setting menu.	Only plants other than the base plant can be added. Up to 6 plants can be added.
	(2) Plant setting	Select this menu to display the Edit plant screen. The Edit plant screen allows you to edit plant information and delete plants. The registered information is shown in the plant view in the Plant machines overview screen.	For details on the Edit plant screen, refer to "Edit plant screen" (Chapter 4.1).
	(3) Display setting	Set the auto-update interval for the Plant machines overview screen.	
Help	(4) Switching display language	Set the display language.	Default setting is English.
	(5) Software version	Displays the Software version screen.	

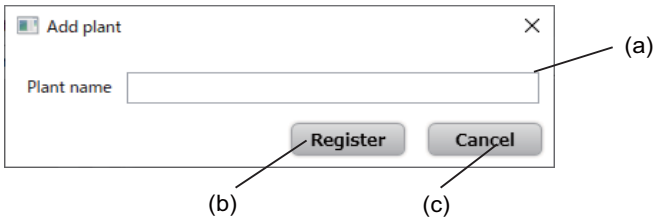
(1) Add plant

The operations in (i) to (iii) below describe how to add a plant by using menus.

(i) Select the [Setting] - [Add plant] menus in the Plant machines overview screen to display the Add plant screen (figure below).

(ii) Enter the plant name ((a) in the figure below). Then press the Register button ((b) in the figure below).

(iii) When the plant has been successfully registered, close the Add plant screen. A plant tab is added to the Plant machines overview screen.
(For information on how to edit the information of the added plant, refer to "Edit plant screen" (Chapter 4.1).)



Precautions

- If the maximum number of plants are already registered when the menu is pressed, an error message appears. Delete plants before adding the plant.
- Each plant name must be unique. If the plant name already exists among the registered plant names, an error message appears.
- If the total number of machines registered for all plants exceeds the maximum number of machines allowed across all plants, an error messages appears. (Lite version: 10, Pro version: 210).

Position	Setting item		Function outline
(a)	Text entry	Plant name	- Set the plant name to add. - The plant name can be up to 32 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters) - Up to 6 plants can be added. Each plant name must be unique.
(b)	Operation button	Register	This button adds a new plant tab with the name specified in (a) to the Plant machines overview screen and closes this screen. (The added plant tab is not selected after this operation.)
(c)		Cancel	Discards the settings and closes this screen.

(2) Plant setting

Select the [Setting] - [Plant setting] menus in the Plant machines overview screen to display the Edit plant screen, where you can edit plant information.

For information on how to edit plant information, refer to "Edit plant screen" (Chapter 4.1).

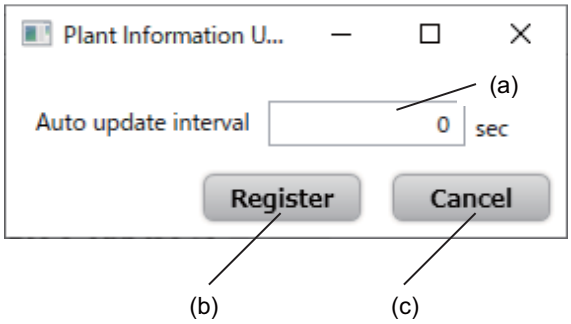
(3) Display setting

The operations in (i) to (iii) below describe how to set the auto-update interval for the Plant machines overview screen by using menus.

(i) Select the [Setting] - [Display setting] menus in the Plant machines overview screen to display the Plant Information Updating screen (figure below).

(ii) Enter the Auto update interval ((a) in the figure below). Then press the Register button ((b) in the figure below).

(iii) The plant view and plant machines overview in the Plant machines overview screen are automatically updated at the registered interval. (Only the selected tab is updated.)



Position	Setting item		Function outline
(a)	Text entry	Auto update interval	- Specify the auto-update interval for the Plant machines overview screen (the plant view and the plant machines overview) in seconds using a half-byte integer. - The value must be "0" or "between 10 and 300". (In increments of 10 seconds, default value: "0") - When "0" is set, auto-update is not performed.
(b)	Operation button	Register	This button commits the auto-update interval specified in (a) and closes the screen.
(c)		Cancel	Discards the settings and closes this screen.

Precautions

- If a database connection error occurs while the Plant machines overview screen is being automatically or manually updated, an error message may appear. In this case, the screen is updated after database connection is restored.

(4) Switching display language

You can switch the application display language between English, Japanese, Korean, and Chinese (Simplified, Traditional) from the [Help] - [Language] menus in the Plant machines overview screen. (Default: English)

After changing the display language setting, NC Machine Tool Optimizer needs to be restarted. The language used in some Windows-specific screens such as calendar and file selection dialog follows the language setting of Windows.

Even after the display language is switched, the language that the data collected from machines is in remains the same. For details on the data to be collected, refer to Chapter 11.1 of the following manual.

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(5) Software version

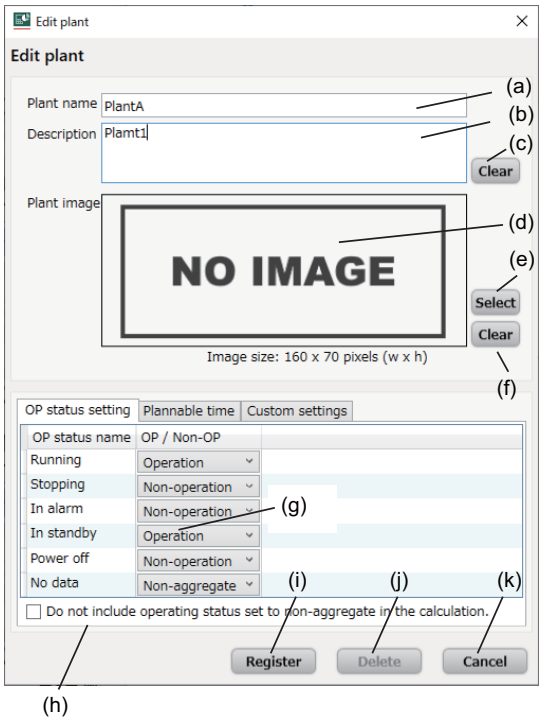
Select the [Help] - [Software version] menus in the Plant machines overview screen to display the Software version screen.

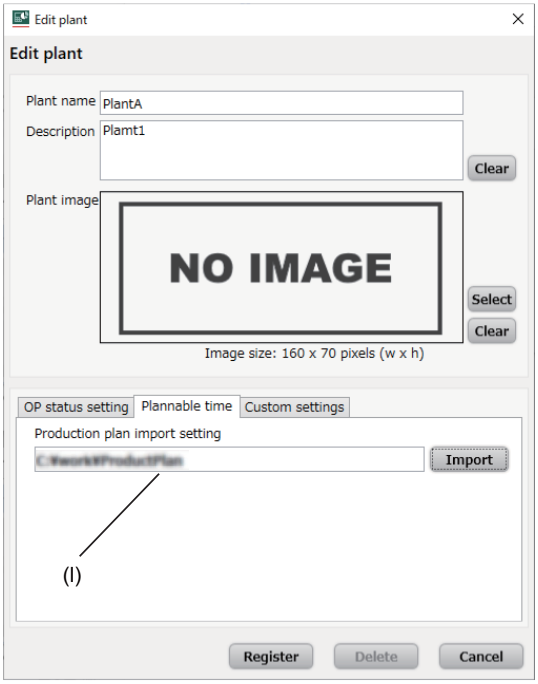
Edit plant screen

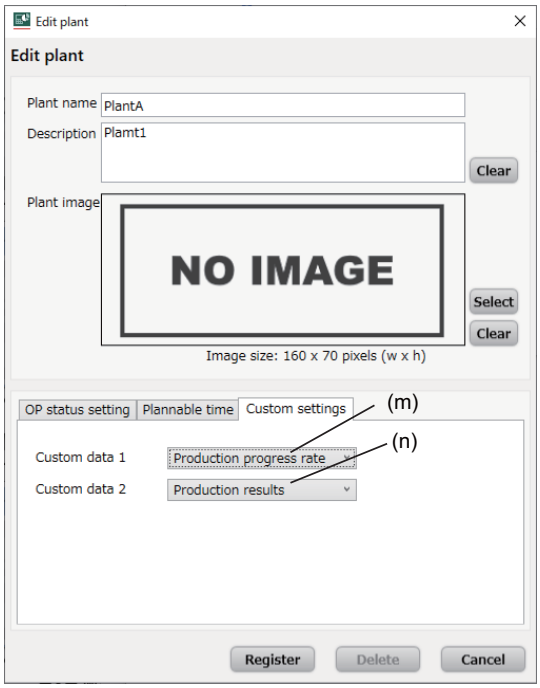
(1) Screen overview

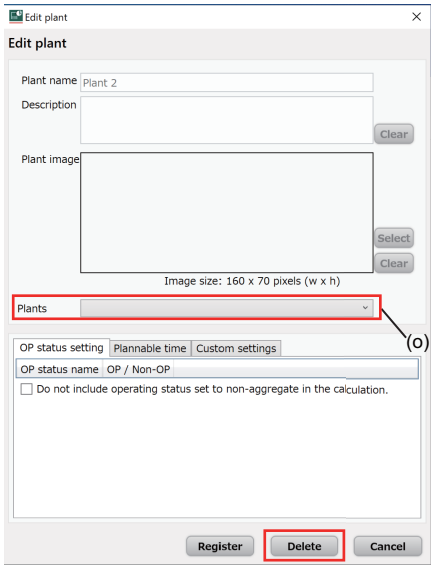
The Edit plant screen allows you to edit the settings of the plants registered from the Add plant menu.

To display the screens below, first select the plant tab of the plant for which you want to edit the settings, and then select the [Setting] - [Plant setting] menus in the Plant machines overview screen. While this screen is open, auto-update for the Plant machines overview screen is not performed.









In the Edit plant screen, you can do the following tasks.

Edit plant information	Set the plant name, the short description, and the plant image of the base plant.
Delete plant information	Delete a plant other than the base plant added in the Add plant screen. The corresponding plant tab in the Plant machines overview screen is deleted.
Configure settings for collecting machine data	To refer the setting information and machine operation data of a plant other than the base plant, configure database settings for the plant. Then set the plant name referred in the Plant machines overview screen and Operating status overview screen. (This setting is not required when editing the base plant information.) For information on how to set the database for a plant, refer to the following manual. NC Machine Tool Optimizer (Pro/Lite) Install Manual
Configure settings for displaying machine data	You can select and set which data to be displayed in the Plant machines overview screen as the current day's operation data of each machine.
Set production plan information	You can configure settings for referring an external file (CSV) for planned production. The CSV file with the most recent date in the selected folder is applied as the production plan. (If there is more than one file with the same most recent date, the one that is the first in the list of the file names in descending alphabetical sort order is selected) If the file is not a production plan CSV file, an error message appears.

(2) Setting item

The following table describes the settings in the Edit plant screen.

No.	Item	Setting necessity for each plant		Function outline	Remark
		Base	Other		
(a)	Plant name	○	○	- Select the text field and enter the plant name to register. - The plant name can be up to 32 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters) - Other plants can be edited by selecting "(o) Plants". - You cannot set a plant name that is used as that of the base plant or another plant.	The plant name is displayed in the plant view in the Plant machines overview screen and the machine tree view in the Operating status overview screen.
(b)	Plant description	○	○	- Select the text field and enter the description of the plant. - The plant name can be up to 64 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters) - Other plants can be edited by selecting "(o) Plants".	The plant description is displayed in the plant view in the Plant machines overview screen.
(c)	Clear	○	○	This button clears the entry in "(b) Plant description".	The information registered for the plant is not deleted.
(d)	Plant image	○	○	- The Select button launches the image file setting dialog. Specify the path to the image file to set the image. - When not set, no plant image is displayed.	The plant image is displayed in the plant view in the Plant machines overview screen.
(e)	Select	○	○	- When an image is set, the image is displayed in the "(d) Plant image" area. - Image files with the .bmp, .jpg, .png or .gif extension can be registered. - Other plants can be edited by selecting "(o) Plants".	The base image size is 160 (H) × 70 (V) pixels.
(f)	Clear	○	○	This button hides the preview of "(d) Plant image" and the plant image is not set.	
(g)	OP/Non-OP setting	○	○	Select either 'Operation', 'Non-operation', or 'Non-aggregate' for each operating state. After changing this setting, check the operating status settings for each machine. The value you set determines how the utilization is calculated for the plant. (*1) Operation: The state is counted as operation time. Non-operation: The state is not counted as operation time. Non-aggregate: The state is not factored in the utilization calculation.	- The default value for the states other than 'Running' is 'Non-operation'. - For details on the calculation of utilization, refer to "Operating status specification" (Chapter 4.1). - If the setting is changed from 'Operation' to 'Non-operation' or from 'Non-operation' to 'Non-aggregate', the change is automatically reflected in the operating status of the machines in the plant. If necessary, set the operating status for each machine again in the Operating status setting screen. - If it is expected for the 'In standby' 'Stopping' or 'In alarm' state to be long because of holiday or overnight operation, set the states other than 'Running' as 'Non-operation' or 'Non-aggregate', not as 'Operation'. Otherwise the utilization and availability will not be useful indicators.
(h)	Non-aggregate data exclusion setting	○	○	- If this check box is ticked, the states set as 'Non-aggregate' in the OP/Non-OP setting are not factored in the calculation of utilization or the ratios of the operating states. - This setting applies to all machines registered for the plant.	- This setting does not apply to aggregation in the Operating details screen.
(i)	Register	○	○	This button registers the plant information configured in the screen and closes the screen.	The machines in the base plant to be monitored must be registered separately. Refer to "Edit machine screen" (Chapter 4.1).
(j)	Delete	×	○	- Deletes the tabs of the plant other than the base plant. (Monitoring is canceled, but data is not deleted). The base plant cannot be deleted. - When a plant is deleted, the selected plant tab is deleted.	
(k)	Cancel	○	○	Discards the settings and closes this screen.	
(l)	Production plan setting	○	○	- Specify the folder from which the production plan CSV file is imported as a common setting for the plant. - Press the Import button to launch the browse for folder dialog. Select the folder and close the dialog. The path to the selected folder is automatically displayed in the text box. - The CSV file with the most recent date in the selected folder is applied as the production plan. (If there is more than one file with the same most recent date, the one that is the first in the list of the file names in descending alphabetical sort order is selected)	- To set a production plan individually for each machine, refer to "Edit machine screen" (Chapter 4.1). - For information on the setting and format of production plan CSV files, refer to "Production plan setting" (Chapter 4.2). - You cannot set a path that contains more than 247 characters. (A double-byte character is counted as one character. The drive letters (C:\, etc.) are included in the word count.)

No.	Item	Setting necessity for each plant		Function outline	Remark
		Base	Other		
(m)	Custom data 1	○	○	Select which data to be displayed as custom display data 1 and 2 in the Plant machines overview. You can choose from the list of the following data items. (*2) (Refer to "Display items" in "4.1 Plant machines overview screen")	- For the data to display in the screen, you must configure the data collection settings for the operation data required. The information on how to set collection can be found in the following manual. NC Machine Tool Optimizer (Pro/Lite) Install Manual
(n)	Custom data 2	○	○		- For information on the OP/Non-OP setting, refer to "Edit plant screen" (Chapter 4.1). - For information on how to set the production plan, refer to "Edit machine screen" (Chapter 4.1).
(o)	Plants (*3)	×	○	- Select the plant name of a plant other than the base plant to be referred. The "(a) Plant name", "(b) Plant description", "(d) Plant image", "(g) OP/Non-OP setting" of the selected plant are automatically set and can be edited. - You cannot select the same plant name for multiple plants to be added. This item can be set only when editing a plant other than the base plant. This item is not displayed when editing the base plant.	You need to set a database for each plant separately. Refer to the following for details. NC Machine Tool Optimizer (Pro/Lite) Install Manual

(*1) Depending on the value set in the Edit plant screen, the values that can be set in the Operating status setting screen for the state are limited.

(○: Can be set ×: Cannot be set)

Value set in the Edit plant screen	Whether value can be set in Operating status setting screen		
	Operation	Non-operation	Non-aggregate
Operation	○	○	○
Non-operation	×	○	○
Non-aggregate	×	×	○

(*2)

	Data item	Data required	Data name For machines with multiple part systems, the data for only one part system can be displayed.
(1)	Work-in-progress rate	Production results The production plan (target quantity, period) must be set separately.	PartCount_1
(2)	Production results	Production results	PartCount_1
(3)	Running program	Running program	PrgMain_1
(4)	Daily total operation time	'Running' state	Any
(5)	Daily total power on time	Operating status The states that are set as 'Operation' in the OP/Non-OP setting in the Edit plant screen must be collected. (e.g. Running, In standby)	Any

(*3) When you revise the settings in (o) Plants and register (press (i)), if the sum of the machines including those registered for the plants exceeds the maximum number that can be added across all plants, an error message appears. (Lite version: 10, Pro version: 210)

Operating status overview screen

The Operating status overview screen displays the operational status of the machines monitored (e.g. utilization, change in status over time) based on the data collected from the machines. What is to be monitored can be set for each machine or for each machine group.

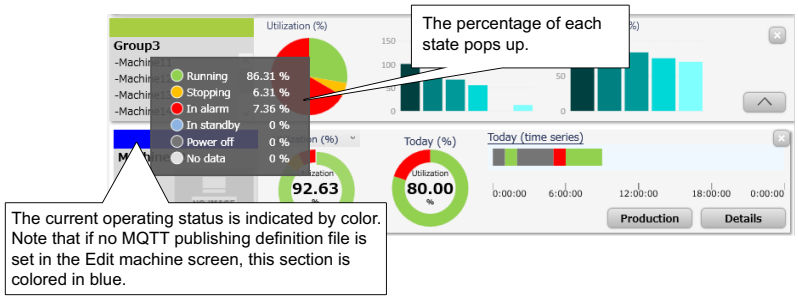
Display items

Position		Contents	Remark
(1)	Menu area	- The menus and icons for operation (add, delete and edit machine groups and machines in the base plant) for the "(2) Machine tree view" are displayed. (a) Menu (Setting) (b) Menu (Help) (c) Menu icons (Add machine ( )/Delete ( ), Add group ( ) /Delete ( ), Update ( )) The machine groups and machines you added appear in the Machine tree view. - When the Update icon is pressed, information about plants, machines and groups are updated, but aggregated results such as utilization are not updated with the latest data. Press the Aggregate button (f-2) separately to perform aggregation for the period.	- Menu operations are not available for other plants that have not been selected as a plant to be referred. (Refer to "Edit plant screen") - For details on each operation procedure, refer to "Menu operations" (described later in this chapter.)
(2)	Machine tree view	- The list (the names and monitoring statuses) of the groups and machines that you can select to monitor are displayed in the tree view. The machines in a group appear in a hierarchical view. - Double-click a group or machine to display its operation summary (utilization, the current day's utilization, change in operating status over time) in the "(5) Group view" or "(6) Machine view". Multiple groups and machines can be displayed. - If a plant other than the base plant is being referenced according to the Add plant setting, the machine groups or machines registered for the plant are displayed. The order of the hierarchical levels in the tree is Plant name - (Group name) - Machine name. - It is not possible to select multiple lines of groups and machines in the Machine tree view. ■ Explanation (a-1) Tree view: Expanded ( ) / Collapsed ( ) - These icons are displayed at the top of the tree and at the left of machine group lines. - Click this icon to expand/collapse the subordinate groups or machines. (a-2) Machine monitoring status: Displayed ( ) / Not displayed ( ) - These icons indicate the monitoring status of the groups and machines. (Displayed in "(5) Group view" or in "(6) Machine view") - If at least one machine in a group is being monitored, the monitoring status of the group is Monitored. (b) Plant name - Displays the name of the registered plant. Up to 7 plants can be registered. (c) Machine group name ( ) - Displays the registered name of the group. Up to 4 groups can be registered. (d) Machine name ( ) Displays the registered name of the machine. The maximum number of machines that can be registered (across all plants) Pro: 210 Lite: 10	- For information on how to set groups and machines, refer to the following. "Edit machine screen" (Chapter 4.1) "Edit group screen" (Chapter 4.1)

Position		Contents	Remark
(3)	Aggregate operation area	Specify the period over which actual operation data (utilization chart and pareto chart) is aggregated to be displayed in the "(4) Plant operation information view", the "(5) Group view", and the "(6) Machine view". ■ Explanation of buttons (e) Period specification field - You can choose from among the following options: Past week, Past month, Custom range. - You can set the start and end dates only when you select Custom range. - When the period is specified, the number of days in the aggregation period appears in the "Period" label. - The limit for Custom range is 30 days. A long period may cause aggregation and screen display to take a long time to complete. (f-1) Aggregation category switcher - You can switch the data to be aggregated when (f-2) is pressed. "Utilization" or "Availability" can be selected. - The following charts are updated when either Utilization or Availability is selected. When "Utilization" is selected: (j), (k), (l), (o), (q), (u), (v), (w) When "Availability" is selected: (j), (k), (l), (o), (p), (q), (u), (v), (w) - The other charts are not aggregated or updated. - Charts (k) and (u) depend on the chart display settings. Utilization and availability cannot be aggregated at the same time. (f-2) Aggregate button - Data is aggregated according to the category selected in (f-1). - When you press the Aggregate button after changing the aggregation period in (e), the actual operation charts for all machines, the monitored group and the monitored machines are updated. - If you set a date later than the current date as the period end date, this button is disabled. (g) Achievement output button - This button displays the Achievement output screen. Refer to "Achievement output screen" (Chapter 4.1). (h) List of Plant's machines button - Press this button to switch the display to the Plant machines overview screen.	- For the specification of the operating status, refer to "Operating status specification" (Chapter 4.1). - For the specification of aggregation for charts including utilization, refer to "Operation chart display specification" (Chapter 4.1). - When this screen opens for the first time, the items other than the "(v) Current day's utilization", and the "(w) Current day's operating status in time series" in the "(6) Machine view" are not displayed until the "(f-2) Aggregate button" is pressed.
(4)	Plant operation information view	■ Explanation of plant display (i) Select plant - Select the plant name to display the operation information. - The user-specified image file (top_machine_image.png) in the "Images" folder in the folder where the application is installed is displayed. If the size of the registered image is small, the image is aligned to the bottom right of the image area. ■ Explanation of displayed charts (j) Status report - Displays the percentages of the operating states aggregated for the specified period in a pie chart for all machines displayed in the tree view. (k-1) Utilization by machine (Availability by machine) - Displays the machine utilizations or availabilities (up to 5 machines) in ascending or descending order. (k-2) Ranking chart switcher - You can toggle the ranking chart (utilization by machine and availability by machine) to be displayed. (Default: utilization by machine) (l) Utilization by group - Displays the utilizations of groups in a column chart. (Displays the group utilizations of the top-ranked groups over the specified period in a column chart) (m) Machine/group legend - Explains the color coding for the machines and groups. (n) Sort - You can toggle between ascending and descending order for the utilization and availability rankings ((k-1), (l)). (Default: Descending)	- When the exclusion setting for the states set as 'Non-aggregate' is enabled, the charts (j), (k) (Utilization), and (l) display the utilization and the percentages of the operating states excluding Non-aggregate time. For details on the setting, refer to "Edit plant screen" (Chapter 4.1).

Position		Contents	Remark
(5)	Group view	- You can view the charts (operation results, machine utilization in the group) representing the operation data of the group in the base plant or another plant selected in the Machine tree view (being monitored) aggregated for the period specified in the "(3) Aggregate operation area". (o) Result chart and (p) Line balancing are displayed only when "Availability" is selected for (f-1) Aggregation category switcher. - The operating states are aggregated by the following categories: "Running", "In standby", "In alarm", "Stopping", "Power off", and "No data". - Up to 5 groups can be displayed at the same time. Note that if the number of machines already displayed in the "(6) Machine view" plus the machines in the group you select exceeds 15, the group cannot be displayed. ■ Explanation of displayed charts (o) Result chart - The operating status of all machines in the group is aggregated for the specified period and visualized as a pie chart representing the percentages of the operating states. (Displays the total utilization of all machines in the group over the specified period in a chart view) (p) Line balancing - The cycle time (availability time) of each machine in the group accumulated over the specified period is presented in a comparison chart. (q) Utilization in the group - Displays the utilizations of machines in a column chart. (Displays the total utilization of all machines in the group over the specified period in a chart view) ■ Explanation of buttons (r) Hide group button ( ) - You can hide a group and its monitored machines in the Group view and Machine view. (s) Show ( ) / Hide ( ) machines in group button - Press this button to show or hide the "(6) Machine view" for the machines in the group.	- For the specification of the operating status, refer to "Operating status specification" (Chapter 4.1). - For the specification of aggregation for charts including utilization, refer to "Operation chart display specification" (Chapter 4.1). - For information on how to set the group information (name) display, refer to "Edit group screen" (Chapter 4.1). - When the exclusion setting for the states set as 'Non-aggregate' is enabled, the charts (o) and (q) display the utilization and the percentages of the operating states excluding Non-aggregate time. For details on the setting, refer to "Edit plant screen" (Chapter 4.1).
(6)	Machine view	- You can view the charts (operation results, the current day's utilization, the current day's operating time series) representing the operation data of the machine in the base plant or another plant selected in the Machine tree view (being monitored) aggregated for the period specified in the "(3) Aggregate operation area". The operating states set as "Non-aggregate" are not factored into the calculation of the current day's utilization. - The operating states are aggregated by the following categories: "Running", "In standby", "In alarm", "Stopping", "Power off", and "No data". - Up to 15 machines can be displayed at the same time. If the number of machines exceeds 15, the machines selected in the "(2) Machine tree view" cannot be displayed. ■ Explanation of displayed charts (t) Machine image - Displays the user-specified image registered in the Edit machine screen. (u-1) Utilization (Availability) - The operating status of the monitored machine is aggregated for the specified period and visualized as a pie chart representing the percentages of the operating states. You can toggle the indicator in the hole of the donut chart between utilization and availability. (u-2) Result chart indicator switcher - You can toggle between charts (utilization by machine and availability by machine). (Default: Utilization by machine) (v) The current day's utilization - Displays the current day's utilization of the monitored machine. (w) The current day's operating status time series - Displays the current day's operating status in time series. ■ Explanation of buttons (x) Production results screen button - This button displays the Production results screen. (y) Operating details screen button - This button displays the Operation details screen.	- If the size of the registered image is small, the image is aligned to the bottom right. - For the settings of the machine information (name and image) to display, refer to "Edit machine screen" (Chapter 4.1). - When the exclusion setting for the states set as "Non-aggregate" is enabled, the charts (u) and (v) display the utilization and the percentages of the operating states excluding Non-aggregate time. For details on the setting, refer to "Edit plant screen" (Chapter 4.1).

When you hover the mouse pointer over the utilization chart in the Group view or Machine view, the percentages of the operating states pop up.



Precautions

The states that are set as "Non-aggregate" are displayed in the popup even if the exclusion setting is enabled. However, their percentages are shown as 0%.

Menu operations

The following describes the menu items in the Operating status overview screen.

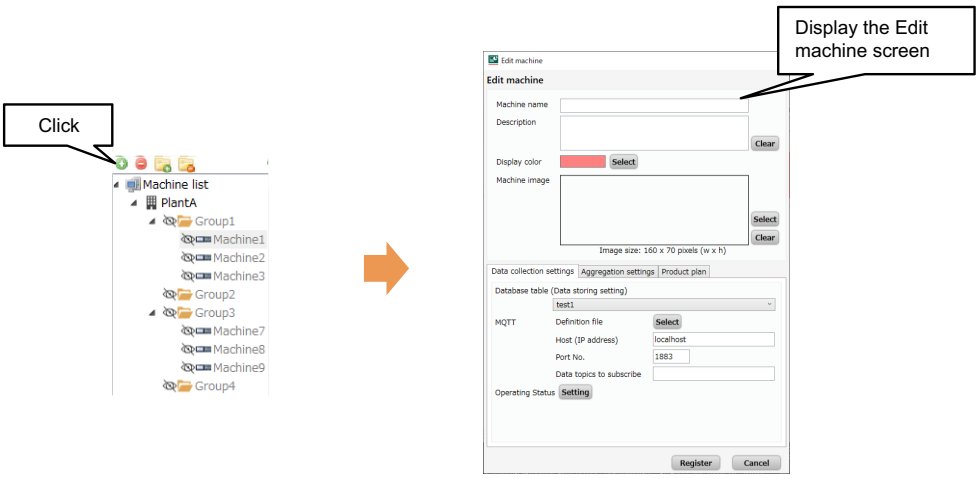
When selecting another plant that has not been selected as a plant to be referred, the menu is grayed out and cannot be edited. Refer to "Edit plant screen" for details.

Display items		Function outline	Remark
Menu	Setting	- Group setting menu Press this menu to display the Edit group screen.	- For details on the Edit group screen, refer to "Edit group screen" (Chapter 4.1).
	Help	- Switch language (English / Japanese) - Software version menu Press this menu to display the software version of NC Machine Tool Optimizer.	- For details on the Software version screen, refer to "Software version" (Chapter 4.1).
Menu Icon	Add machine ( )	- Press this icon to display the Edit machine screen. - When a machine is added in the Edit machine screen, the machine is inserted at the bottom of the tree view.	- For information on how to add machines, refer to "■ Add machine" in "Operation procedures" (Chapter 4.1).
	Delete machine ( )	- Removes the machine selected in the tree view from the tree. The removed machine is not to be monitored. (Deleting a machine is only possible when the machine is selected first.) - Even when the machine is hidden, its operation data is not deleted.	- For information on how to delete a machine, refer to "■ Delete machine" in "Operation procedures" (Chapter 4.1). - The machine cannot be deleted while the Operating details screen, the Daily details chart or the Production results screen is open.
	Add group ( )	- Press this icon to display the Add group screen. - When a machine group is added in the Add group screen, the group is inserted at the bottom of the groups in the tree view.	- For information on how to add machine groups, refer to "■ Add group" in "Operation procedures" (Chapter 4.1). - After creating a group, add machines to be monitored to the group.
	Delete group ( )	- Removes the group selected in the tree view from the tree. The removed group is not to be monitored. (Deleting a group is only possible when the group is selected first.) - Even when the group is hidden, its machines' operation data is not deleted.	- For information on how to delete a group, refer to "■ Delete group" in "Operation procedures" (Chapter 4.1).
	Refresh ( )	- Refreshes the tree view.	

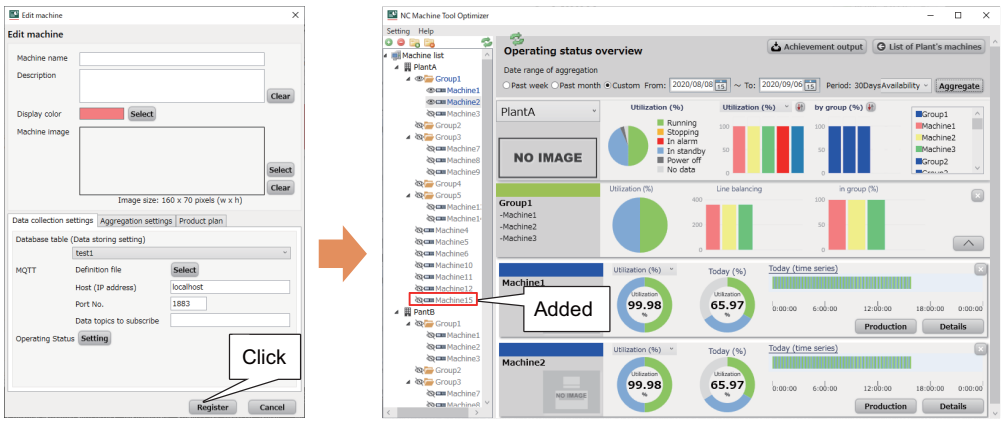
Operation procedures

■ Add machine

(1) Press the Add machine icon to display the Edit machine screen.



(2) After setting the necessary information in the Edit machine screen, press the [Register] button. For details on the settings, refer to "Edit machine screen" (Chapter 4.1).
When the machine is registered successfully, the Edit machine screen is closed, and the registered machine appears in the Machine tree view.

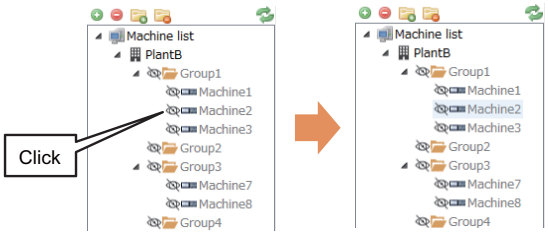


Precautions

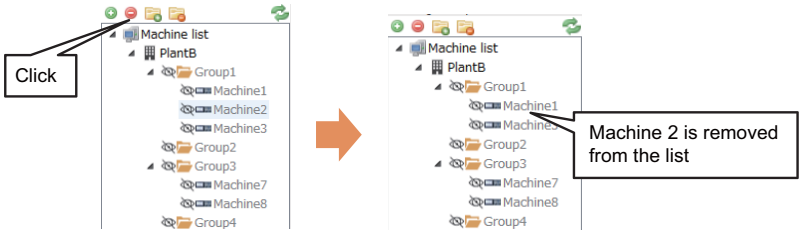
- If the Add machine icon is pressed when the maximum number of machines in the group has already been reached, an error message appears.
- When adding a machine, an error message is displayed when the number of machines exceeds the maximum number of machines that can be added to a plant. (Lite version: 10, Pro version: 30)
- If the maximum number of machines that can be added across all plants is exceeded when a machine is added, an error message appears. (Lite version: 10, Pro version: 210)

■ Delete machine

(1) Select the machine you want to delete by clicking on it.



(2) Press the Delete machine icon.
When the machine is deleted successfully, it is removed from the Machine tree view.

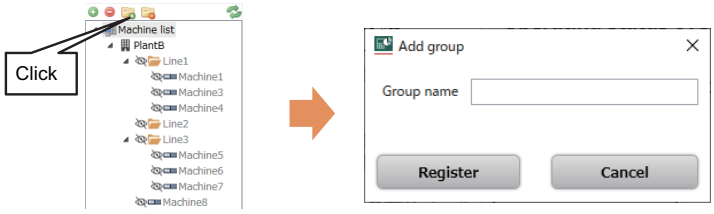


Precautions

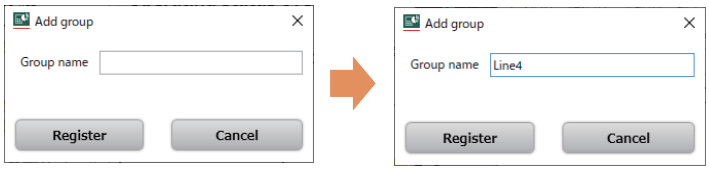
- If you select the machine that is being displayed on the Operation details screen, the Daily details chart or the Production results screen and attempt to delete it, an error message appears.
- If the Delete machine icon is pressed when no machine is selected, an error message appears.
- If the Delete machine icon is pressed when a group is selected, an error message appears.

■ Add group

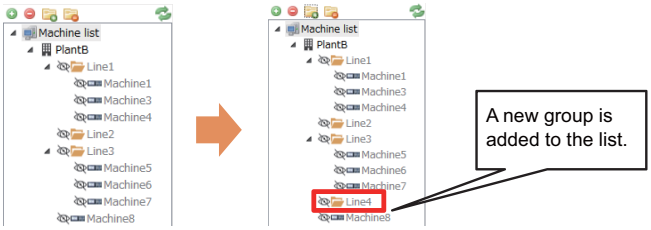
(1) Press the Add group icon to display the Add group screen.



(2) Set the group name in the Add group screen and press the [OK] button. For details on the Add group screen, refer to "Add group screen" (Chapter 4.1).



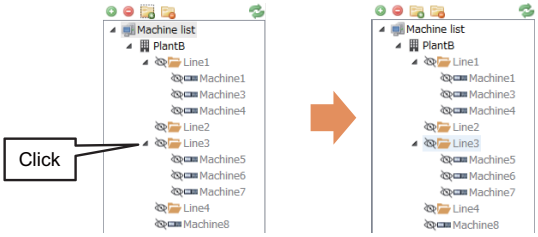
When the group is registered successfully, the Add group screen is closed, and the added group appears at the bottom of the Machine tree view.



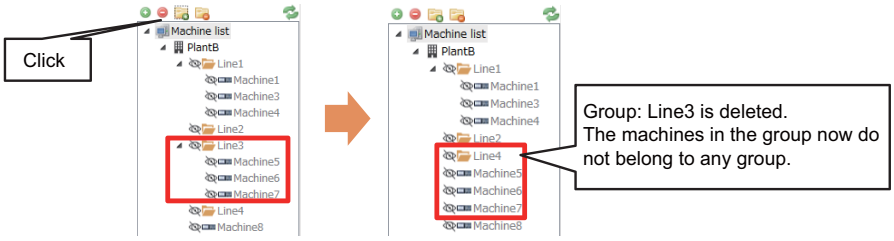
If the Add group icon is pressed when the maximum number of groups in the machine list has already been reached, an error message appears.

■ Delete group

(1) Select the group you want to delete by clicking on it.



(2) Press the Delete group icon.
When the group is deleted successfully, the selected machine group is removed from the Machine tree view.

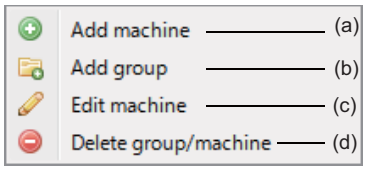


If the Delete group icon is pressed when no group is selected, an error message appears.

If the Delete group icon is pressed when a machine is selected, an error message appears.

Right-click operation

The screen shown below appears when you select a row in the Machine tree view in the Operating status overview screen and right-click to open the menu.



No.	Display items		Function outline	Remark
(a)	Menu Icon	Add machine ( )	- Select this menu to display the Edit machine screen. - When a machine is added in the Edit machine screen, the machine is inserted at the bottom of the tree view.	- The way to add a machine is the same as the Add machine icon. - Refer to "■ Add machine" in "Menu operations" (Chapter 4.1).
(b)		Add group ( )	- Select this menu to display the Add group screen. - When a group is added in the Add group screen, the group is inserted at the bottom of the groups in the tree view.	- The way to add a group is the same as the Add group icon. - Refer to "■ Add group" in "Menu operations" (Chapter 4.1).
(c)		Edit machine ( )	- Select this menu to display the Edit machine screen. - You can change the settings of the selected machine in the Edit machine screen. (Editing is only possible when the machine is selected first.)	- For details on the Edit machine screen, refer to "Edit machine screen" (Chapter 4.1). - You cannot edit a machine group from this menu.
(d)		Delete group/ machine ( )	- Select this menu to remove the machine group or the machine selected in the tree view from the tree. The removed machine group or the machine is not to be monitored. (Deleting a machine group or a machine is only possible when the machine group or the machine is selected first.) - Even when the machine group or machine is hidden, its operation data is not deleted.	- For information on how to delete a machine, refer to "■ Delete machine" in "Menu operations" (Chapter 4.1). - For information on how to delete a group, refer to "■ Delete group" in "Menu operations" (Chapter 4.1). - If a group is selected, the menu is grayed out, and the machine or group cannot be deleted. - The machine cannot be deleted while the Operating details screen, the Daily details chart or the Production results screen is open.

Precautions

- If an attempt is made to add a machine when the maximum number of machines in the group has already been reached, an error message appears.
- If an attempt is made to add a group when the maximum number of groups in the machine list has already been reached, an error message appears.
- If the Edit machine screen is opened when an item other than a machine is selected, an error message appears.
- If an attempt is made to delete a group or machine when no group or machine is selected, an error message appears.
- If you press the "Delete group/machine" menu when a group is selected, a confirmation message appears.
- If you press the "Delete group/machine" menu when a machine is selected, a confirmation message appears.
- When adding a machine, an error message is displayed when the number of machines exceeds the maximum number of machines that can be added to a plant. (Lite version: 10, Pro version: 30)
- If the maximum number of machines that can be added across all plants is exceeded when a machine is added, an error message appears. (Lite version: 10, Pro version: 210)
- If you select the machine that is being displayed on the Operation details screen, the Daily details chart or the Production results screen and attempt to delete it, an error message appears.

Edit machine screen

The Edit machine screen allows you to add a machine to be monitored in the plant and change its settings.

Add machine	Add and register a machine to be monitored. A created machine belongs to the plant.
Edit machine information	Set the machine name, description, and machine image.
Collection settings	The machine being edited is linked with the database table and the MQTT communications settings are configured because the machine operation data is collected through data logging by NC Machine Tool Connector and MQTT data publishing. Configuring the operating status settings is also required. For information on how to configure the settings, refer to "Operating status setting screen" (Chapter 4.1) described later in this chapter.
Aggregation settings	When aggregating in the Operating status overview and Production results screens, it is possible to set the machine being edited to be excluded from the aggregation calculation.
Production plan setting	To analyze the variance between the planned and actual production output in the Production results screen, set the product plan in the Edit machine screen. For details on the Production results screen, refer to "Production results screen" (Chapter 4.2).

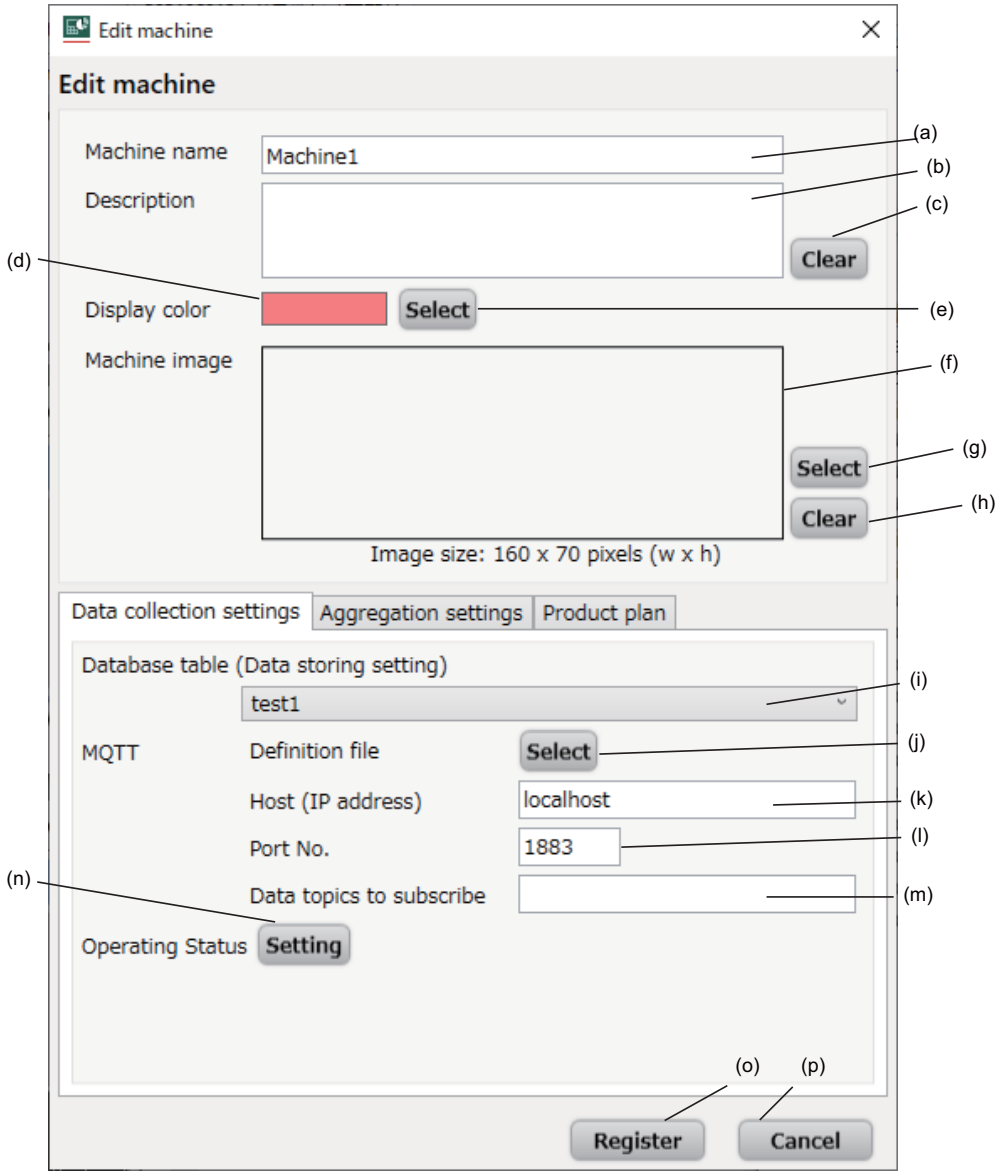
The following operations display the Edit machine screen.

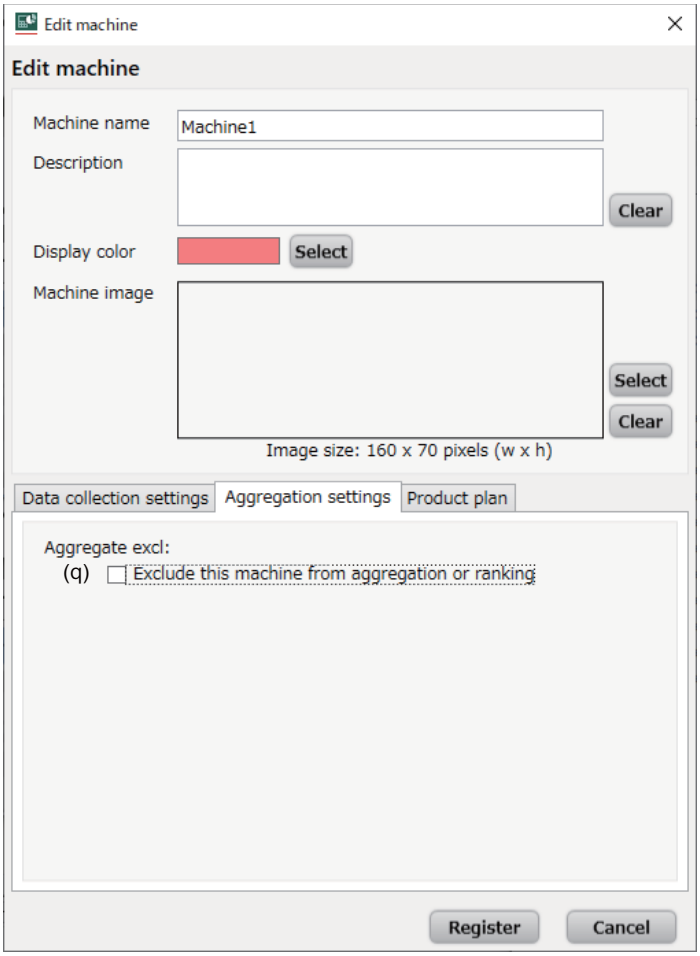
- Press the Add machine menu icon in the Operating status overview screen.
- Right-click in the Machine tree view and select the Add machine or Edit machine menu.

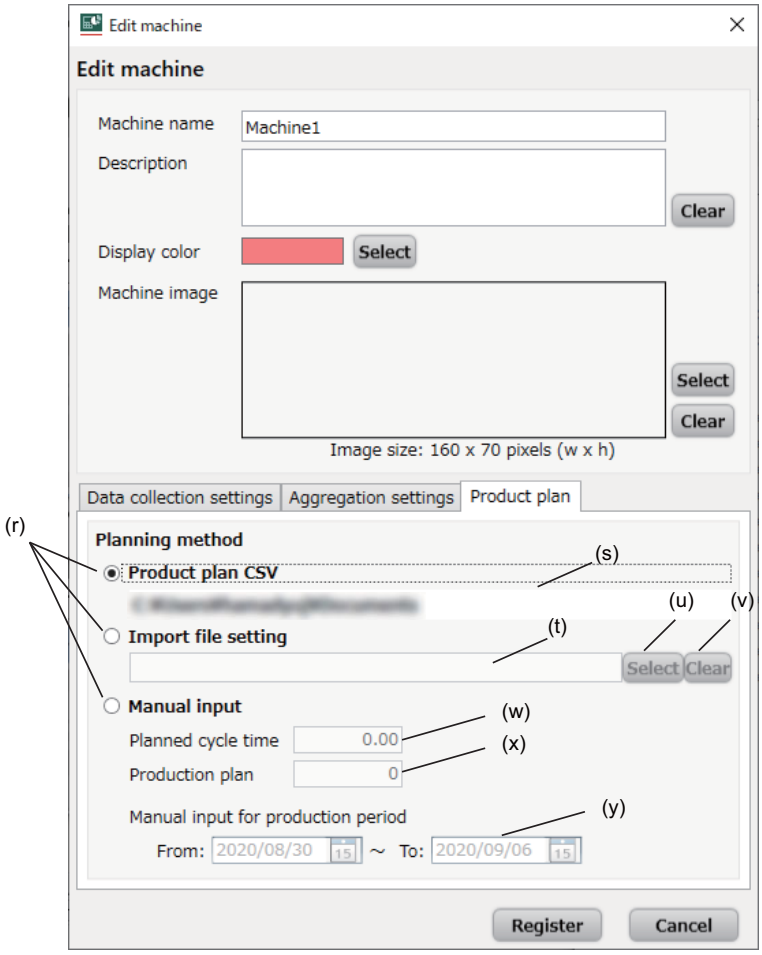
For information on how to perform each operation, refer to "Menu operations" or "Right-click operation" in "Operating status overview screen" (Chapter 4.1).

Precautions

- If the maximum number of machines that can be added across all plants is exceeded when a machine is added, an error message appears. (Lite version: 10, Pro version: 210)




Edit machine
Edit machine
Machine name
Machine1
Description
Clear
Display color
Select
Machine image
Select
Clear
Image size: 160 x 70 pixels (w x h)
Data collection settings
Aggregation settings
Product plan
Aggregate excl:
(q)
Exclude this machine from aggregation or ranking
Register
Cancel


Edit machine
Edit machine
Machine name
Machine1
Description
Clear
Display color
Select
Machine image
Select
Clear
Image size: 160 x 70 pixels (w x h)
Data collection settings
Aggregation settings
Product plan
(r)
Planning method
Product plan CSV
(s)
(u)
(v)
Import file setting
(t)
Select
Clear
Manual input
(w)
Planned cycle time
0.00
(x)
Production plan
0
Manual input for production period
(y)
From:
2020/08/30
~
To:
2020/09/06
Register
Cancel

Setting items

Position	Setting items	Function outline	Remark
(a)	Machine name	- Select the text field and enter the name of the machine to add. - The machine name can be up to 16 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters) - Commas and double quotation marks cannot be used in machine names.	- This information appears in the machine operation data area (left of the machine image) in the Operating status overview screen, the plant machines overview in the Plant machines overview screen, etc. - The machine name must match the machine name in the production plan. When using a production plan, refer to "Production plan setting" (Chapter 4.2).
(b)	Machine description	- Select the text field and enter the description of the machine to add. - The description can be up to 64 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters)	- This information appears in the header area in the Operation details screen, etc.
(c)	Clear	The Clear button clears the contents of the description field.	- The description registered as machine information is not deleted. To delete the registered description, after pressing the Clear button, press the "(o) Register" button.
(d)	Display color	Click a color to change the display color for the machine. The color you selected is displayed.	- This information appears in the utilization by machine of the Plant operation information view in the Operating status overview screen and in the machine utilization in the group of the Group view in the Operating status overview screen.
(e)	Select	Change the display color for the machine.	
(f)	Machine image	- The Select button launches the image file setting dialog. Specify the path to the image file to set as the machine image. - When not set, no machine image is displayed.	- The machine image appears in the machine operation data area in the Operating status overview screen and the plant machines overview in the Plant machines overview screen.
(g)	Select	- When the machine image is set with the Select button, the preview of the machine image is displayed in "(f) Machine image". - Image files with the following extension can be registered. bmp, jpg, png, gif	- The base image size is 160 (width) × 70 (height) pixels.
(h)	Clear	This button deselects the set image and hides the preview.	- The image registered as machine information is not deleted. To delete the registered image, after pressing the Clear button, press the "(o) Register" button.
(i)	Database table (Data storing setting)	- Select the name of the database table for collecting machine operation data. - This must be the same as the table name configured in the Data logging settings of NC Machine Tool Connector.	- For details on how to set data logging, refer to the following manual. NC Machine Tool Optimizer (Pro/Lite) Install Manual
(j)	Definition file	- Select the MQTT publishing data definition file for collecting machine operation data. - The file used in this setting is the publishing data definition file that was output in the Data publishing settings of NC Machine Tool Connector. - If this item is not set, the machine operating status indicator color in the Machine view in the Operating status overview screen is displayed in blue.	- For details on the data publishing settings, refer to the following manual. NC Machine Tool Optimizer (Pro/Lite) Install Manual - Be sure to set the database table before you configure this setting. If the database table is changed, you must again configure the setting for the machine.
(k)	Host Name (IP address)	- Select the text field and enter the host name of the MQTT to be connected to that collects machine operation data. - This must be the same as the host name or IP address specified in the Data publishing settings of NC Machine Tool Connector.	
(l)	Port number	- Select the text field and enter the port number of the MQTT that collects machine operation data. - This must be the same as the port number specified in the Data publishing settings of NC Machine Tool Connector.	
(m)	Data topics to subscribe	- Select the text field and enter the topic of the data to subscribe to for the MQTT that collects machine operation data. - This must be the same as the topic name of the data to be published specified in the Data publishing settings of NC Machine Tool Connector.	
(n)	Operating status setting	This button displays the Operating status setting screen.	For details, refer to "Operating status setting screen" (Chapter 4.1). Be sure to set the database table before you configure this setting. If the database table is changed, the settings are cleared and you must reconfigure the setting.

Position	Setting items		Function outline	Remark
(o)	Register		This button registers the settings in the screen as the machine's information and closes the screen.	
(p)	Cancel		Discards the settings and closes this screen.	
(q)	Aggregation exclusion setting		When this check box is ticked (the setting is enabled), the machine being edited is excluded from the aggregation for each plant and group. (Default: Unticked)	The machine is not factored into the aggregation of the plant's actual utilization and utilization/ availability ranking, the group utilization and line balancing.
(r)	Planning method		Select how the production plan for each machine is set. According to the option you select, the corresponding production plan is applied for the machine . 1. Plant setting, 2. Machine setting, 3 Manual input (Default: Plant setting)	- If the selected plan is not set, the production plan set in the Edit plant screen is applied as the production plan for the machine. - If the production plan for the plant is not set, no production plan is set for the machine.
(s)	Folder setting	Plant production plan setting	- Displays the path to the folder specified as the location of the production plan CSV file in the Edit plant screen. Manual entry is not allowed. - The same path to the folder containing the CSV is also displayed in the Production results screen.	- For information on the production plan the CSV file in the specified folder that is applied, refer to "Edit plant screen" (Chapter 4.1). - You cannot set a folder or file that has a path length longer than the following limits. (A double-byte character is counted as one character. The drive letters (C:\, etc.) are included in the character count.) Specifying folder: Max 247 characters Specifying file: Max 259 characters - For information on the format of production plan CSV files, refer to "Production plan setting" (Chapter 4.2).
(t)	File setting	Machine production plan setting	- Displays the path to the CSV file reference specified as the machine-specific production plan in (u). - The same path to the folder containing the CSV is also displayed in the Production results screen.	
(u)		Select button	This button launches the file selection dialog. Select the file to reference and close the dialog. The path to the selected file automatically appears in (t).	Depending on the network configuration and communications status, the reference setting of the file path you want may not be possible.
(v)		Clear button	Unset the file path for the production plan CSV. Machine-specific production plan enters an undefined state (blank).	
(w)	Manual input setting	Planned cycle time	This setting makes it possible to determine whether the average cycle time in the Production results screen is good or bad. This is applied only when the contents of an external CSV file are not selected as the production plan. (Default value: Blank, Value range: 0 to 99.99)	This setting is common to all programs used for the machine. Set an appropriate cycle time.
(x)		Production plan (required)	- Set the planned number (other than 0) to be considered as completion (100%) in the Production results chart view in the Production results screen. - The allowed value range is 0 to 999,999. (Default: 0)	- If this setting is omitted when manual setting is enabled, the plan is invalid. - Even if you set this item in this screen, the charts in the Production results screen are not updated immediately. - For details on the Production results, refer to "Production results screen" (Chapter 4.2).
(y)		Product period	- Set the planned production period when displaying the production plan line in the Production results chart view in the Production results screen. - The planned production period can be up to 30 days. (Default: Blank)	

Precautions

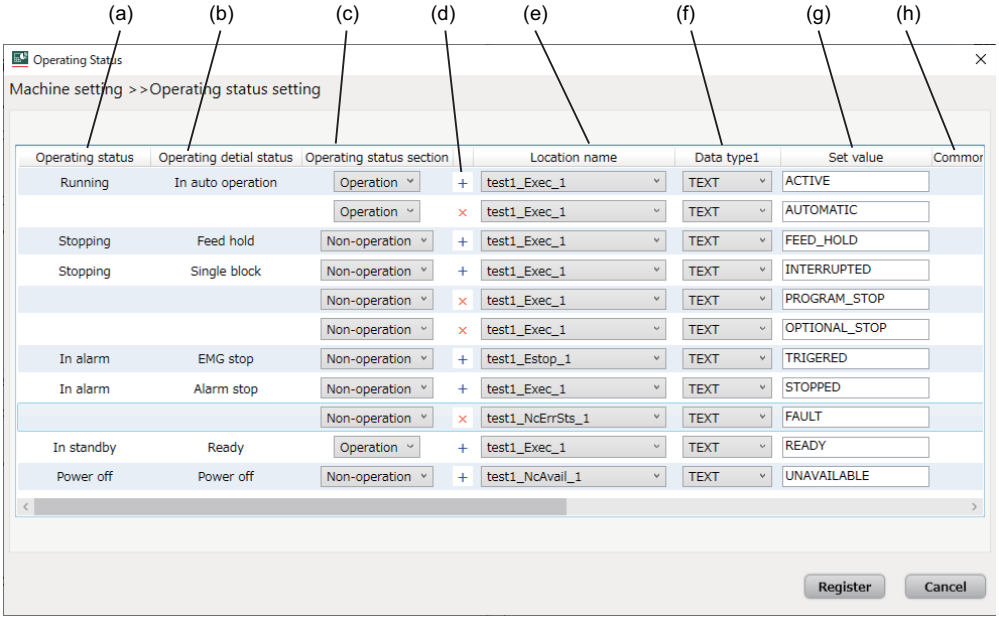
If the setting of the database table is changed after the operating status setting of the machine has been set, a message appears, and the operating status setting is cleared.
For details about the operating status settings, refer to "Operating status setting screen" (Chapter 4.1).

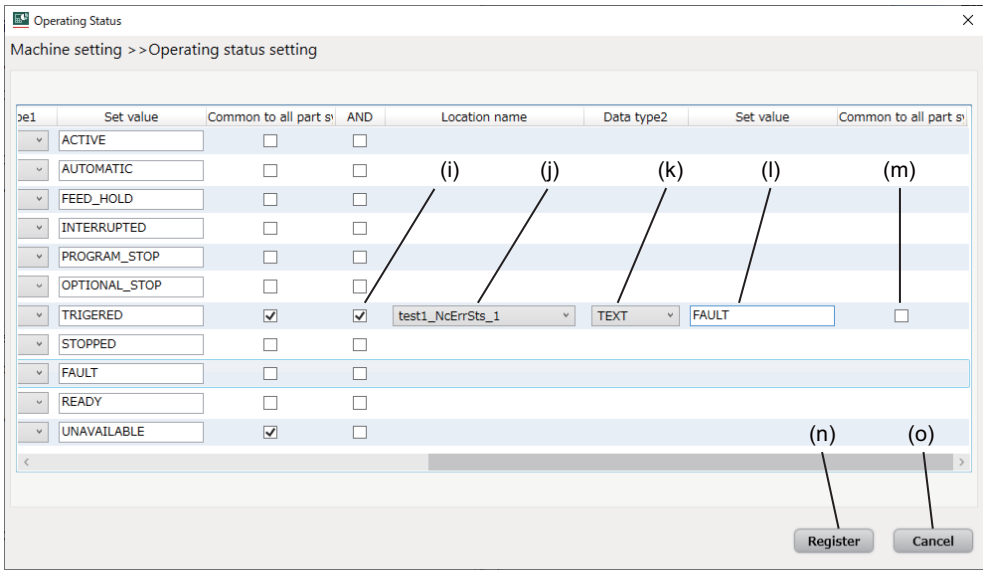
Operating status setting screen

The Operating status setting screen allows you to set the criteria for the operating states for each machine.

Edit status	You can edit the status classification, data collection name, data type and values used to determine the operating status.
Register status criteria	You can register the criteria that determines the status.
Cancel registered status criteria	You can cancel the registered criteria that determines the status. When the machine is deleted, the settings for the criteria that determines the status are automatically canceled.

The settings configured here are applied to the operating status displayed in the Operating status overview screen, the Operation details screen, the Daily details chart screen, and the Daily total screen.
The Operating status setting screen appears when you press the Operating status button in the Edit machine screen.





Setting items

Position	Setting items		Function outline	Remark
(a)	Items of status determination	Operating status	Displays the operating states that the utilization calculation is based on.	
(b)		Operating detail status	- Displays the operation detail states corresponding to the operating state. Criteria can be set for 7 states (In auto operation, Feed hold, Single block, EMG stop, Alarm, Ready (Stand-by), and Power off). - Up to three criteria can be set for the same operating state. When multiple criteria are set, the state is determined by the logical sum (OR) of the outcomes.	Even for a machine (e.g. machine tool) with multiple part systems, it is unnecessary to set criteria for each part system for the same operating state.
(c)		Operating status section	Specify which category the selected state is assigned to. (1) Operation, (2) Non-operation, (3) Non-aggregate Set "Operation" or "Non-operation" for the states other than those set as "Non-aggregate" in the Edit plant screen. The utilization is calculated based on those states. (*1)	- If no run time took place, utilization is 0%. - When the setting is changed from 'Operation' to 'Non-operation' or from 'Non-operation' to 'Non-aggregate' in the Edit plant screen, the change is automatically reflected in the operating status setting of the machines in the plant. Reconfigure the operating status setting of each machine in this screen as needed. - If it is expected for the 'In standby' 'Stopping' or 'In alarm' state to be long because of holiday or overnight operation, set the states other than 'Running' as 'Non-operation' or 'Non-aggregate', not as 'Operation'. Otherwise the utilization and availability will not be useful indicators.
(d)		Add criteria button (+)/ Delete criteria button (×)	- Click the Add criteria button (+) to add a new criteria row to the state corresponding to the row. Up to 3 rows of criteria can be added for each state. - Click the Delete criteria button (-) to delete the criteria row.	
(e)		Location name 1	You can select the name of the collected data used to determine the state. (Select from the names of collected data in the database table specified in the Edit machine screen.) For the location name, only the name of the collected data that is common to all part systems or that of the first part system can be specified.	The name of the collected data must follow the naming conventions of NC Machine Tool Optimizer. Refer to the following for details on the naming conventions. NC Machine Tool Optimizer (Pro/Lite) Install Manual
(f)		Data type 1	Select from the three types according to the data type of the location to be determined. (*2) If the combination of the data type and the data type of the location are those not specified, the state cannot be determined because of a data type mismatch.	
(g)		Set value 1	Set the condition value to enable the state. Depending on the data type selected in "(e) Location name 1", the condition value can be set in the specified range. (*2) If you set a value outside the specified range, the original value is restored when the focus is moved from the cell.	
(h)		Common to all part systems 1	Unticked: The state is determined for each part system treating the specified location name as data specific to the part system. Ticked: The state is determined treating the specified location name as data common to all part systems.	
(i)		AND	When this check box is ticked, the state is determined by the logical conjunction (AND) of the location names and their criteria specified in (d) to (g) and (i) to (l).	
(j)		Location name 2	What and how to specify is the same as (e) Location name 1.	
(k)		Data type 2	What and how to specify is the same as (f) Data type 1.	
(l)		Set value 2	What and how to specify is the same as (g) Set value 1.	
(m)		Common to all part systems 2	What and how to specify is the same as (h) Common to all part systems 1.	

Position	Setting items		Function outline	Remark
(n)	Operation button	Register	- Press this button to save the settings configured in this screen and close the screen. (Up to 3 rows per state are allowed. If you attempt to save 4 or more rows, an error message appears.) - Entries for (b), and (e) to (g) in each row are required. If any one of them is not configured, the settings of the row are invalid.	The information you edit in this screen is not applied until the Register button is pressed in the Edit machine screen.
(o)		Cancel	Discards the settings and closes this screen. (The settings last registered remain effective.)	

(*1) Depending on the value set in the Edit plant screen, the values that can be set in the Operating status setting screen for the same state are limited.

(○: Can be set ×: Cannot be set)

Value set in the Edit plant screen	Whether value can be set in Operating status setting screen		
	Operation	Non-operation	Non-aggregate
Operation	○	○	○
Non-operation	×	○	○
Non-aggregate	×	×	○

(*2) Data type and the valid range of the Location name are as follows.

Data type	Data type of location (data collection settings)	Valid range
TEXT	String	Up to 32 characters long
NUMERIC	Int16, Uint16, Int32, UInt32	Decimal integer -2147483648 to 2147483647
BOOLEAN	Boolean	True or False

Precautions

(1) Location names that cannot be set

Do not use the name of the running program, the operation mode, and the production results as the location name to determine the state.

For details on the naming conventions, refer to the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

(2) Behavior for an unconfigured state

If registration is attempted when the name of collected data or the value is not set, the setting change for the operating state in the corresponding row is invalid, and the default operating status setting applies.

For details on the default settings, refer to the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

(3) Priority order for status when multiple states are evaluated to be true

The operating status of the first part system is first determined according to the setting.

The status is determined according to the order of priority below.

If multiple operating states are true in one occurrence of operation data collection, the machine's operating status is determined in the following order of priority.

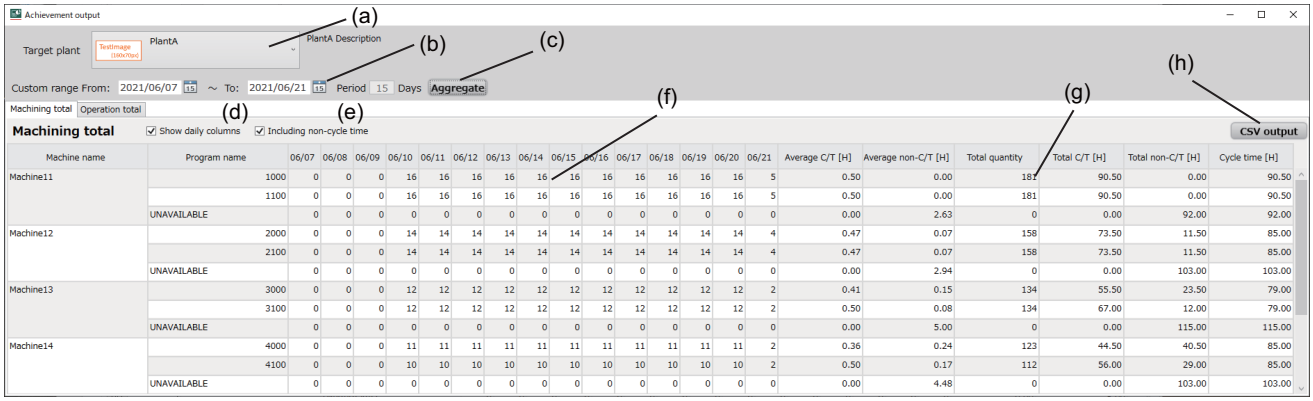
1 In alarm (EMG stop)
2 In alarm (Alarm stop)
3 Stopping (Feed hold)
4 Stopping (Single block)
5 In auto operation
6 In standby
7 Power off
8 No data

For a machine with multiple part systems, the operating status of each part system is evaluated, and then the machine's operating status is determined as described in "How operation data (today) is calculated" (Chapter 4.1).

Achievement output screen

Production results by plant

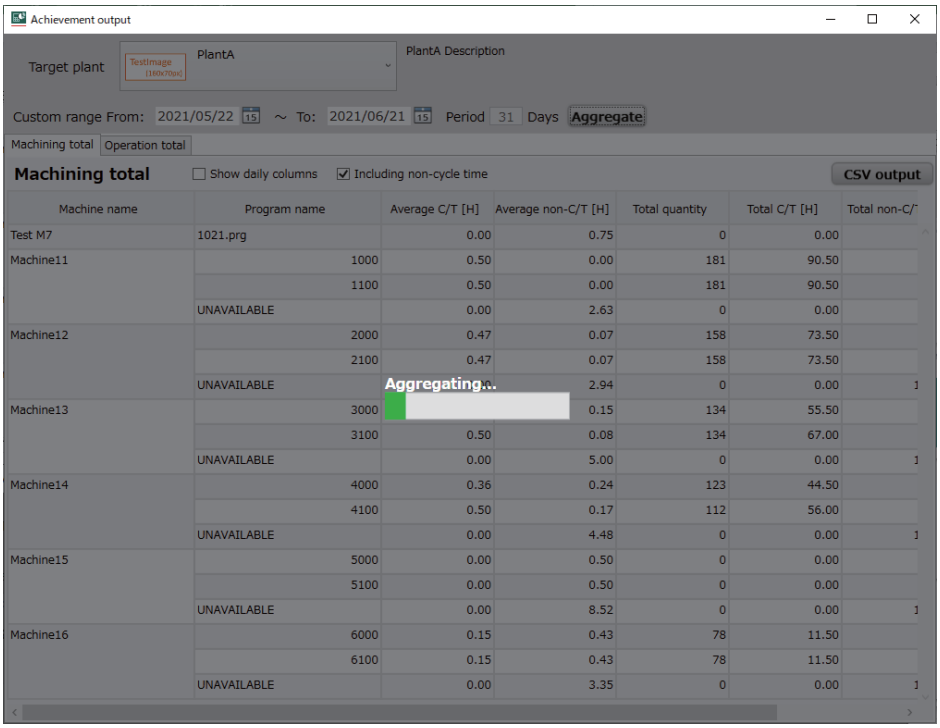
The Achievement output screen appears when you press the "Achievement output button" in the Operating status overview screen.
Select the Machining total tab, aggregate the production results for each plant, and export them to a CSV file.



The following describes how to use this screen. For details on the display items, refer to "Display items".

(1) Select the plant for which you want to aggregate the production results.
(2) Specify the aggregation period and press the Aggregate button. The production result for each program is displayed for each machine in the plant.
(3) Press the CSV output button and specify the output folder and the file name. What is displayed in the screen is exported to a CSV file.

When the Aggregate button is pressed, the entire screen is dimmed and the progress bar indicating the progress of the aggregation appears in the center of the screen.
When the screen is in this state, the operations in the screen are disabled until aggregation completes.



Display items

Position	Setting item		Description	Remark
(a)	Target plant		Select and display the plant for which the production results are output.	
(b)	Custom range		- When the period is specified, the number of days in the aggregation period appears in the "Period" label. - The limit for Custom range is 30 days. A long period may cause aggregation and screen display to take a long time to complete.	When this screen opens for the first time, production results are not displayed until aggregation is performed.
(c)	Aggregate button		- Press this button after setting the aggregation period (b) to display the production result for each program of the machines in the plant in the area showing the production results by plant. - If you set a date later than the current date as the period end date, this button is disabled.	- For the machines of which the completed quantity has not been collected, the data is not aggregated correctly.
(d)	Display toggle	Show daily columns	Select this option if you want to display the daily result. If you tick this check box, the daily completed quantities are shown for each machine and program. If you untick this check box, the daily completed quantities are hidden in the screen, but are exported to a CSV file as they are when shown.	
(e)		Including non-cycle time	Select whether the column item 'Cycle time' includes the 'Non-C/T' time. If you tick this check box, the 'Cycle time' is the search time including the times other than run time. The search time is the time period during which operation search is executed in the program to be aggregated (the program is selected) by the NC.	
(f)	Total quantities view		Displays the aggregated production results for each program and machine in the specified plant. (*1)	
(g)	Production statistics view		Displays various summarized values for each program based on the actual completed quantities. (*2)	- The run time is the time period during which the operating status is "Running".
(h)	CSV output button		Press this button and specify the output folder and the file name of the production results CSV file in a dialog box. The displayed actual production data is exported to a CSV file. (*3)	- Open the output CSV file with an editor that supports UTF-8 with BOM encoding such as Microsoft Excel.

(*1)

Column item	Contents
Machine name	Displays the names of the machine in the plant. Does not display the machines with no actual production for the period.
Program name	Displays the names of the programs with actual production for the period. Does not display the programs with completed quantities of 0 because they are excluded from the aggregation.
Daily completed quantity	Displays the daily completed quantity for each program.

(*2)

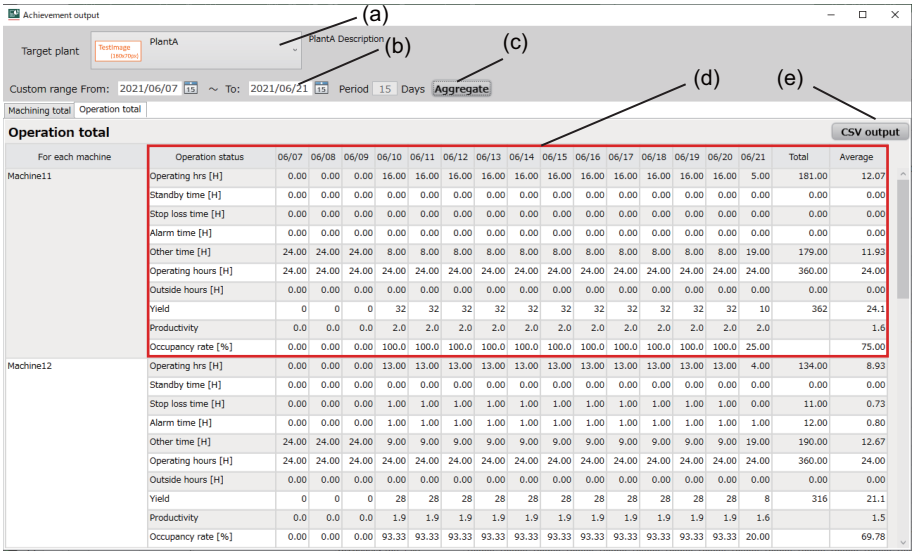
Column item	Contents
Average C/T [H]	Displays the cycle time required to complete per product. Total run time ÷ Total quantity
Average non-C/T [H]	Displays the non-cycle time per product. (Total search time - Total run time) ÷ Total quantity
Total quantity	Displays the total completed quantity over the aggregation period.
Total C/T [H]	Displays the total cycle time over the aggregation period. Average C/T × Total quantity
Total non-C/T [H]	Displays the total non-cycle time over the aggregation period. Total search time - Total run time
Cycle time [H]	Displays the total search time over the aggregation period.

(*3) CSV file format

Item	Specification
Extension	.csv
Delimiter	Comma (,)
Line delimiter	CRLF (0x0D, 0x0A)
Character code	UTF-8 (with BOM)
Number of records	Number of programs in the displayed results

Operation statistics on plant basis

The Achievement output screen appears when you press the "Achievement output button" in the Operating status screen. Select the Operation total tab, aggregate the operation results for each plant, and export them to a CSV file.



For each machine	Operation status	06/07	06/08	06/09	06/10	06/11	06/12	06/13	06/14	06/15	06/16	06/17	06/18	06/19	06/20	06/21	Total	Average
Machine11	Operating hrs [H]	0.00	0.00	0.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	5.00	181.00	12.07
	Standby time [H]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Stop loss time [H]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Alarm time [H]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Other time [H]	24.00	24.00	24.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	19.00	179.00	11.93
	Operating hours [H]	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	360.00	24.00
	Outside hours [H]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Yield	0	0	0	32	32	32	32	32	32	32	32	32	32	32	10	362	24.1
	Productivity	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		1.6
	Occupancy rate [%]	0.00	0.00	0.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	25.00		75.00
Machine12	Operating hrs [H]	0.00	0.00	0.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	4.00	134.00	8.93
	Standby time [H]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Stop loss time [H]	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	11.00	0.73
	Alarm time [H]	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.00	0.80
	Other time [H]	24.00	24.00	24.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	19.00	190.00	12.67
	Operating hours [H]	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	360.00	24.00
	Outside hours [H]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Yield	0	0	0	28	28	28	28	28	28	28	28	28	28	28	8	316	21.1
	Productivity	0.0	0.0	0.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.6		1.5
	Occupancy rate [%]	0.00	0.00	0.00	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	20.00		69.78

The following describes how to use this screen. For details on the display items, refer to "Display items".

(1) Select the plant for which you want to aggregate the production results.
(2) Specify the aggregation period and press the Aggregate button. The operation result for each program is displayed for each machine in the plant.
(3) Press the CSV output button and specify the output folder and the file name. What is displayed in the screen is exported to a CSV file.

When the Aggregate button is pressed, the entire screen is dimmed and the progress bar indicating the progress of the aggregation appears in the center of the screen in the same way as the Machining total tab.
When the screen is in this state, the operations in the screen are disabled until aggregation completes.

Display items

Position	Setting item	Description	Remark
(a)	Target plant	Select and display the plant for which the operation results are output.	
(b)	Custom range	- When the period is specified, the number of days in the aggregation period appears in the "Period" label. - The limit for Custom range is 30 days. A long period may cause aggregation and screen display to take a long time to complete.	When this screen opens for the first time, operation results are not displayed until aggregation is performed.
(c)	Aggregate button	- Press this button after setting the aggregation period (b) to display the operation result for each program of the machines in the plant in the operation statistics view area. - If you set a date later than the current date as the period end date, this button is disabled.	- For the machines of which the operating states have not been configured, the data is not aggregated correctly. For details, refer to "Operating status setting screen" (Chapter 4.1).
(d)	Operation statistics view	Displays various summarized values for each machine based on the actual operation. The average and total values over the period are displayed for each item. (*1)	- The displayed value for occupancy rate varies depending on the exclusion setting for the states set as 'Non-aggregate'. For details on the settings, refer to "Edit plant screen" (Chapter 4.1). - No average value is displayed for Productivity and Occupancy rate.
(e)	CSV output button	Press this button and specify the output folder and the file name of the operation results CSV file in a dialog box. The displayed actual operation results are exported to a CSV file. (*2)	- Open the output CSV file with an editor that supports UTF-8 with BOM encoding such as Microsoft Excel.

(*1)

Row item	Contents
Operating state time [H]	The total time of each state below in the planned production time is displayed. The times of the states other than (1) to (4) are aggregated as (5). (1) Running (2) In standby (3) Stopping (4) In alarm (5) Others
Operating hours [H]	The total amount of time per day that products can be manufactured at a plant. The value is fixed at 24 hours.
Outside hours [H]	The time not scheduled for production, which is not included in operation aggregation.
Yield [pieces]	The total count of the parts produced by each machine.
Productivity [H/Qty]	Planned operating time divided by Yield.
Occupancy rate [%]	Operation time ÷ Planned production time or Operation time ÷ Planned operating time (Planned production time - Non-aggregate time)

(*2) CSV file format

Item	Specification
Extension	.csv
Delimiter	Comma (,)
Line delimiter	CRLF (0x0D, 0x0A)
Character code	UTF-8 (with BOM)
Number of records	Number of programs in the displayed results

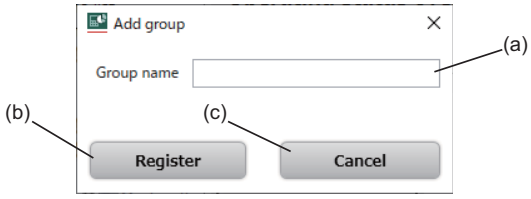
Add group screen

The Add group screen allows you to add a machine group in the plant to monitor.

Create group	Enter a group name and press the OK button to create a machine group to monitor. The created group belongs to the plant.

By creating a group, you can monitor the overall utilization of multiple machines in the group and their operating states.
Up to 5 groups (up to 6 machines per group) can be registered.

The following operations display the Add group screen.
- Press the Add group menu icon in the Operating status overview screen.
- Right-click in the Machine tree view and select the Add group menu.



Setting items

Position	Setting items		Function outline
(a)	Group information	Group name	- Select the text field and enter the name of the group to add. - The machine name can be up to 16 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters)
(b)	Operation button	Register	This button adds a new machine group with the name specified in (a), and closes the screen.
(c)		Cancel	Discards the settings and closes this screen.

Precautions

- Advanced group settings
  Configure advanced settings for an added machine group in the Edit group screen.

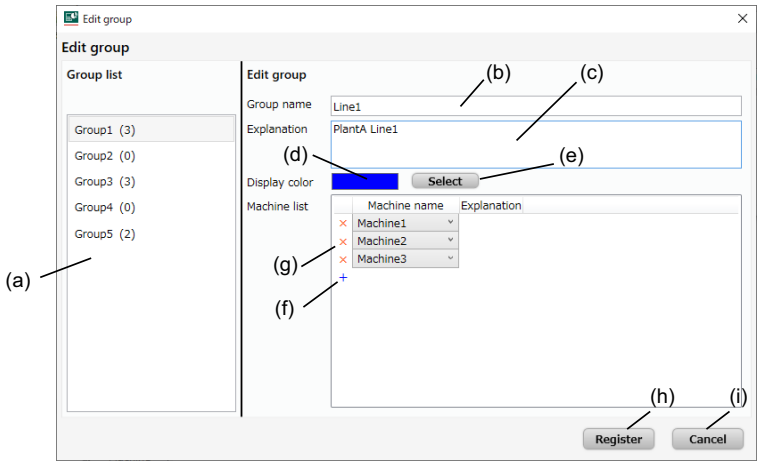
Edit group screen

The Edit group screen allows you to change the settings of a machine group in the plant.

Edit group	You can edit the name, description and display color of the machine group.
Enroll machines	Enroll machines in the group. Only machines in the plant being edited can be added to the group.
Cancel machine enrollment	You can cancel the enrollment of the machines in the group. The enrollment of machines is automatically canceled if the machine group is deleted.

The Edit group screen appears when you select the following in the Operating status overview screen.

- Menu [Setting] - [Edit group]



Setting items

Position	Setting items		Function outline	Remark
(a)	Group list	Group list	- Lists the registered machine groups in the plant. - When you select a machine group, its registered information appears in the Edit group area. - The number of machines enrolled is indicated in the parentheses following the group name.	
(b)	Edit group	Group name	- You can edit the group name selected in the Group list. - The machine name can be up to 16 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters)	- This information appears in the group operation information area in the Operating status overview screen.
(c)		Explanation	- You can edit the description of the machine group selected in the Group list. - The description can be up to 64 characters long. (Regardless of whether they are half-width [single-byte] or full-width [double-byte] characters)	
(d)		Display color	Click a color to change the display color for the group. The color you selected is displayed.	- This information appears in the utilization by group in the Plant operation information view in the Operating status overview screen.
(e)		Select	You can change the display color for the group.	
(f)		Enroll machine (+)	- This icon displays the list box in the row, from which you can select a preregistered machine (name). The machines enrolled in the plant being edited are displayed in the list box. - When a machine is selected, its name and description appears, and " + " changes to " × " (Remove machine).	- Be sure to add the machines to monitor in the Edit machine screen before enrolling machines in the group. - When all added machines have been enrolled in other groups, the icon is grayed out and cannot be pressed.
(g)		Remove machine (×)	This icon cancels the enrollment of the machine in the selected row from the group being edited. (The row is deleted.)	
(h)	Operation button	Register	This button commits the settings in the screen as the group information and closes the screen.	- The information you edit in this screen is not applied until the Register button is pressed.
(i)		Cancel	Discards the settings and closes this screen.	

Operating status specification

The following describes the specifications for the display of the utilization, availability, operating status, and operation detail status in the Operating status overview screen and the Operation details screen.
For details on the definitions of the states and how to configure the settings for collecting data, refer to the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

Note that the 'Display order' in the table refers to the display order in a pie chart in clockwise order.

(1) Operating status

The data is used for the utilization charts (period total, today) and the operating status time series in the Operating status overview screen. When you configure the data collection settings, you need to be aware of how each status definition impacts the utilization.

Operating status		Definition of machine status	NC signal (*1)			Default display color	Remark
Display order	Display name		OP	STL	SPL		
1	Running	In automatic operation	ON	ON	OFF	Green	The NC is operating in the automatic operation mode with cycle time being accumulated.
2	Stopping	In automatic operation stop	ON	OFF	OFF	Yellow	The NC is operating in the automatic operation mode without cycle time being accumulated.
		In automatic operation pause			ON		
3	In alarm	In alarm stop (Automatic operation disabled)	OFF	OFF	OFF	Red	An alarm is occurring on the NC Warnings are not included.
			ON	ON			
4	In standby	Operation wait (In manual operation, In setup)	OFF	OFF	OFF	Light blue	The NC is operating in the manual operation mode or the manual mode is selected (manual interruption during automatic operation is excluded)
5	Power off	Power off	OFF	OFF	OFF	Gray	Operation data cannot be collected from the NC

(2) Operating detail status

The data is used for the operation detail status chart and the operation detail status time series in the Operation details screen.

Operating detail status		Definition of machine status	NC signal (*1)			NC status (*2)					Default display color	Remark
Display order	Display name		OP	STL	SPL	RDY	AUT	BST	HLD	EMG		
1	In automatic operation	In automatic operation	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	Green	The NC is operating in the automatic operation mode with cycle time being accumulated.
2	Feed hold	In automatic operation pause	ON	OFF	ON	OFF	OFF	OFF	ON	OFF	Yellow	The NC is operating in the automatic operation mode without cycle time being accumulated.
	Single block	In automatic operation stop	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF		
3	Emergency stop	In emergency stop	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	Red	The NC is in the emergency stop state
4	Alarm	In alarm stop (Automatic operation disabled)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		An alarm is occurring on the NC. Warnings and emergency stops are not included.
5	Ready (Stand-by)	In automatic operation wait (In manual mode)	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	Light blue	The manual mode is selected. (Manual interruption during automatic operation is excluded.)
6	Power off	Power off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Gray	Operation data cannot be collected from the NC

(*1) For details on the NC signal, refer to the following manual.

M800/M80/E80/C80 Series PLC Interface Manual

(*2) For details on the NC status, refer to the following manual.

M800/M80/E80 Series Instruction Manual

(3) NC operation mode

The data is used for the operation detail (series).

NC operation mode		Tool tip display name	Status definition (selected)	Default display color	Remark
Display order	Mode				
1	Memory mode	MEMORY	Automatic operation mode	Green	Manual interruption, manual arbitrary reverse run, simultaneous operation of manual and automatic modes are included.
2	MDI mode	MDI	MDI operation mode	Purple	MDI interruption is included.
3	Manual mode	MANUAL	Manual operation mode	Yellow	Manual interruption, simultaneous operation of JOG and handle modes, and tool handle feed are not included.

Operation chart display specification

The following describes what is aggregated for each operation chart that can be displayed in the Operating status overview screen.

<table>
<tr><th colspan="2" rowspan="3"></th><th colspan="4">Custom range</th><th colspan="2">Today</th></tr>
<tr><th colspan="2">Pie/donut chart</th><th colspan="2">Ranking</th><th rowspan="2">Utilization</th><th rowspan="2">Operating status time series</th></tr>
<tr><th>Utilization</th><th>Availability</th><th>Utilization</th><th>Availability</th></tr>
<tr><td>Plant machines overview screen</td><td>Plant machines overview</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Machines in each plant</td><td>-</td></tr>
<tr><td rowspan="4">Operating status overview screen</td><td rowspan="2">Plant operation information view</td><td rowspan="2">Selected plant (*)</td><td>-</td><td>All groups in the selected plant (*)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>-</td><td colspan="2">All machines in the selected plant (*)</td><td>-</td><td>-</td></tr>
<tr><td>Group view</td><td>Monitored group (*)</td><td>-</td><td>All machines in the monitored group (*)</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Machine view</td><td colspan="2">Monitored machine</td><td>-</td><td>-</td><td colspan="2">Monitored machine</td></tr>
</table>

(*) The machines for which aggregation exclusion setting is enabled in the Aggregation settings tab in the Edit machine screen are not included in the aggregation.

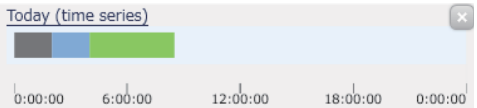
How operation data (today) is calculated

The operating states are the operating status signals that indicate the machine's operational status. They are collected from the NC via NC Machine Tool Connector.
The machine utilization is calculated as the ratio of the total time of the states set as 'Operation' in the Edit plant screen to the total time of all operating states. The current day's utilization and percentages of the aggregated operating states of the machine up to the time of monitoring are calculated based on the collected operating status data and presented in pie/donut charts.

(1) Operating status time series

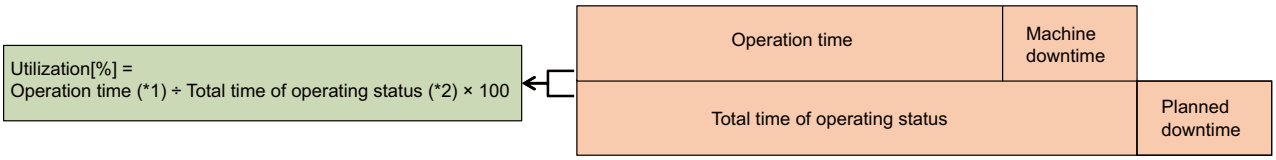
As described in "Operating status specification", since the operating status may vary by machine, the data collection settings must be configured according to the machine specification. Operating status time series shows how the operation status changed over time. For the definition of the operating status, refer to "(1) Operating status" in "Operating status specification" (Chapter 4.1).

(Example) Time series chart of the current day's operating status



(2) Utilization of monitored machine

The utilization and the percentage of each state are calculated as follows based on the status classification set in the Edit plant screen and Operating status setting screen.
(The current day's data is aggregated for the times in the following calculation)



- Percentage of operating state = Time of operating state ÷ Total time of all operating states (*2) × 100

The operating states set as "Non-aggregate" in the OP/Non-OP setting in the Edit plant screen are not factored into the calculation above.
For details on the OP/Non-OP setting, refer to "Edit plant screen" (Chapter 4.1).

(*1) Total time of the operating states set as '"Operation" in the OP/Non-OP setting in the Edit plant screen.

-> When 'Running' and 'In standby' states are set as "Operation", the operation time is the total time of 'Running' and 'In standby' states.

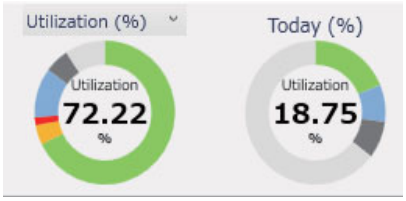
(*2) Total time of the operating states set as "Operation" or "Non-operation" in the OP/Non-OP setting in the Edit plant screen.
Total time of operating status = Σ Time of 'Operation' state + Σ Time of 'Non-operation' state

The operating status of a machine with multiple part systems is determined by the order of priority for the operating statuses of the part systems. This means that if an alarm occurs in one part system at a point in time, the status of the machines is 'In alarm'.

■ How the operating status of a machine with multiple part systems is determined
The operating status time series is determined according to the order of priority below.

1 In alarm
2 Stopping
3 Running
4 In standby
5 Power off
6 No data

(Example) Example of the display of the current day's utilization



(3) Utilization of machine group

The operating status of a machine group is determined by the order of priority for the operating statuses of all machines in the group. This means that if one machine is in stop state, the status of the machine group is 'Stopping'.
The operating status time series is determined according to the operating status of a machine group. The operating status of a machine group follows the order of priority below.

1 In alarm
2 Stopping
3 Running
4 In standby
5 Power off
6 No data

The utilization of a machine group is calculated as follows.

- Utilization of machine group [%] = Operating time of machine group (*1) ÷ Total time of the operating status of machine group (*2) × 100
- Percentage of operating state [%] =
Σ Time of operating state of machine group ÷ Σ Time of 'Operation' state of machine group × 100

(*1) Total operation time of a group following the status determination described above.
(*2) Total time of the operating states of a group following the status determination described above.

The operating states set as "Non-aggregate" in the OP/Non-OP setting in the Edit plant screen are not factored into the status determination and calculation described above. For details on the OP/Non-OP setting, refer to "Edit plant screen" (Chapter 4.1).

(4) Utilization of plant

The current day's utilization of the plant is the average of the utilizations of the machines in the plant of the current day.
The operating status settings follow the OP/Non-OP setting in the Edit plant screen.

How operation data (specific period) is calculated

The calculation of the utilization and the percentages of the operating states for a specific period are essentially the same as those for the current day, but with an extended aggregation period.

(1) Percentages of operating states of machines in selected plant
The percentage of each operating state of all machines is calculated as follows.

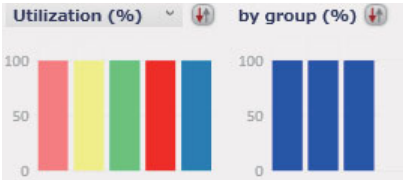
- Percentage of each operating state [%] =
  Σ Time of each operating state of all machines ÷ Σ Time of 'Operation' state of all machines × 100
  (excluding the states set as 'Non-aggregate')

(2) Percentages of operating states of each group and machine
The calculation of the percentages of the operating states of a machine group or a machine for a specific period is the same as the calculation of operation data (today). Only the aggregation period is extended.

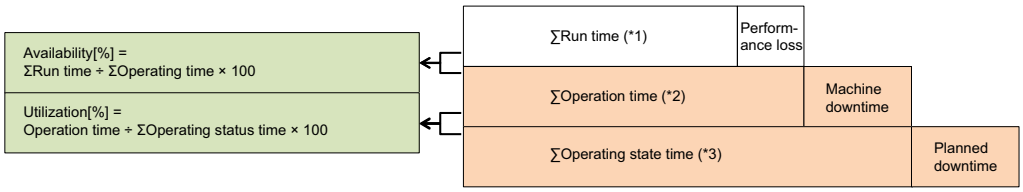
(3) Utilization (ranking)
The machine utilizations are ranked in ascending or descending order for all machines in the plant, for all groups, and for the machines in the group, and presented in charts. For details on the calculation of machine utilization, refer to "(2) Utilization of monitored machine" in "How operation data (today) is calculated" (Chapter 4.1). For details on the calculation of availability, refer to "(3) Availability of each machine" in "How operation data (today) is calculated" (Chapter 4.1).

- Ranking of the machines in the plant
  Displays the utilizations or availabilities rankings of the machines in the selected plant
- Ranking of all groups
  Displays the group utilization rankings of the monitored groups
- Ranking of machines in the group
  Displays the utilization rankings of the machines in the monitored group

(Example) Example of the display of the utilization ranking



(4) Availability of each machine
The machine availability is calculated as the ratio of the run time of the operating states with actual production to the total time of the states (operating time) set as 'Operation' in the Operating status setting screen.
Note that NC Machine Tool Optimizer treats the run time of the operating states with actual production as cycle time (availability time, CT).



(*1) Total operating status run time
(*2) Total time of the states set as "Operation" in the Operation status setting screen.
(*3) Total time of the states set as "Operation" and "Non-operation" in the Operating status setting screen.

4.2 Operating Status Analysis

The Operation details screen appears when you press the Details button of each monitored machine in the base plant in the Machine view of the Operating status overview screen.

Operating details screen

The Operating details screen displays summarized data in a variety of charts, including operation detail status history and the occurrences of alarm stops causing interruption to automatic operation. You can use these charts to analyze the trends of the operational status details each machine.

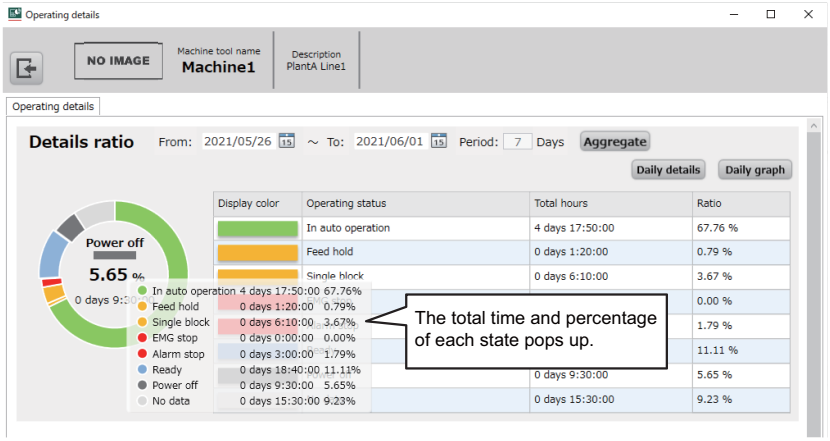
The following describes the basics of using this screen. For details on the display items, refer to "Display items".

- Specify the aggregation period in the "(2) Aggregate operation area" and press the Aggregate button.
- In the "(3) Aggregation view", check the total time and the percentage of each operation detail state over the period, and identify which state is problematic.
- In the "(4) Daily history view", verify when and how the identified state occurred while referring to the change in the utilization to determine which date you should check the details for.
  To view the time of day when the state occurred, press the Daily details button to open the Daily total screen.
- Press the Daily graph button to open the Daily details chart screen, and verify how that day's operation detail status changed over time for each program.
- In the chart screen, display the detailed data of the operating status as needed and determine why the identified state continued for a prolonged period.

Display items

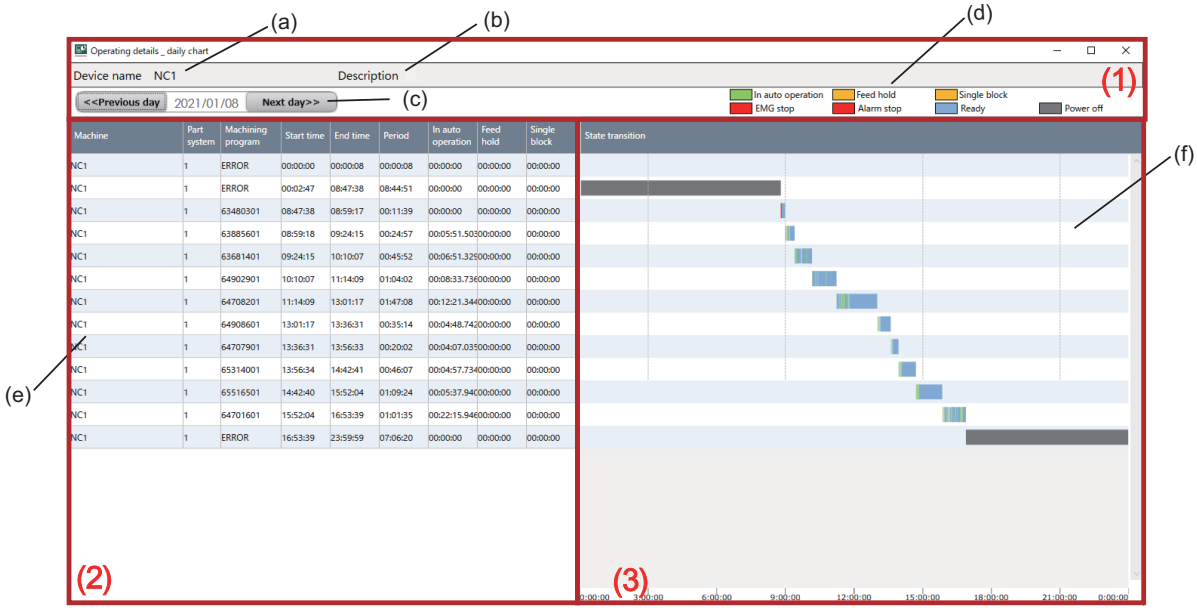
Position		Item	Description	Remark
(1) Header	(a)	Machine name	Displays the name of the machine selected in the Operating status overview screen.	- For information on how to register machine information, refer to "Edit machine screen" (Chapter 4.1).
	(b)	Machine information	Displays the description of the selected machine.	
(2) Aggregate operation area	(c)	Custom range	- When the period is specified, the number of days in the aggregation period appears in the "Period" label. - The limit for Custom range is 30 days. A long period may cause aggregation and screen display to take a long time to complete.	- How to specify the period and how to aggregate data are the same as in the Operating status overview screen. Refer to (3) of "Display items" in the "Operating status overview screen" (Chapter 4.1). - When this screen opens for the first time, nothing is displayed in the "(3) Aggregation view", "(4) Daily history view", and "(5) Daily chart" until the "(d) Aggregate button" is pressed.
	(d)	Aggregate button	- When you press the Aggregate button after changing the aggregation period in (c), the donut chart (h), the summary table (g), the daily stacked chart (i), the daily total chart (k), and the production details time series chart (m) are updated. - If you set a date later than the current date as the period end date in (c), this button is disabled.	
	(e)	Daily details	Displays the Daily total screen for the specified period.	- For details, refer to "Daily total screen" (Chapter 4.2).
	(f)	Daily graph	Displays the Daily details chart for the specified period.	- For details, refer to "Daily details chart screen" (Chapter 4.2).
(3) Aggregation view	(g)	Summary table	Displays the summary table for each of the operation detail states that occurred over the specified period when the Aggregate button is pressed.	
	(h)	Donut chart	Displays the percentages of the operation detail states that occurred over the specified period in a donut chart when the Aggregate button is pressed. In the hole of the donut chart, the name and the percentage of the operating state that has the highest percentage are displayed.	
(4) Daily history view	(i)	Daily stacked chart	Displays the change of the operation detail status for each day in a stacked column chart and the machine utilization in a line chart. The date range displayed in the screen is one week (7 days). You can use the Display period scroll bar (l) to scroll the display within the specified period linked with the Daily total chart (k).	
	(j)	Chart legend	Displays the chart legend for the donut chart (h) and the daily stacked chart (i).	
	(k)	Daily total chart	Displays the percentages of the operation detail states aggregated for each day in the period defined in (c) in a chart. Also displays the daily chart (line chart) of the utilization.	- The display size is automatically adjusted according to the number of days in the period.
	(l)	Display period scroll bar	Drag this scroll bar to change the date range that the Daily stacked chart (i) displays within the specified period.	
(5) Daily chart	(m)	Production details time series chart	Displays the changes of machining data over the specified period in a time series chart for each part system. The following items can be displayed. - Operating status - NC operation mode (MEMORY/MDI/MANUAL) - Machining program name	For MTConnect, the NC operation modes are displayed as the following strings. Everything else is displayed as the collected value from the machine. MEMORY: In automatic operation MDI: In MDI operation MANUAL: In manual operation
	(n)	Display period switcher	Switches the date displayed in the Production details time series chart (m) by one day. When you select a date from the calendar, (m) displays the data for the selected date.	- A date outside the aggregation period cannot be specified.

When you hover the mouse pointer over the donut chart in the Aggregation view, the total time and percentages of the operation detail states pop up.



Daily details chart screen

The Operation details (daily chart) screen displays the total times and the history of the operation detail states for each machining program operation over the period specified in the Operating details screen.

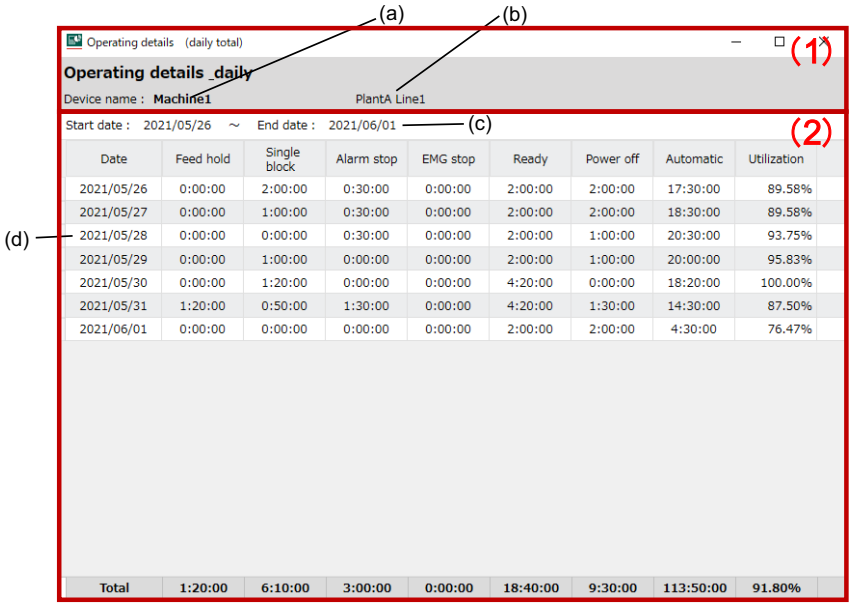


Display items

Position		Display items	Description	Remark
(1) Header	(a)	Machine name	Displays the name of the machine selected in the Operating status overview screen.	- For information on how to register machine information, refer to "Edit machine screen" (Chapter 4.1).
	(b)	Machine information	Displays the description of the selected machine.	
	(c)	Date specification	The Previous day and Next day buttons switches the contents in (2) and (3).	
	(d)	Chart legend	Explains the color coding for the items in the Gantt chart.	
(2) Summary table	(e)	Daily details summary table	Lists the total times of the operation detail states that occurred in the specified day for each program.	- Total times of the operation detail states matches the total time displayed in (f) Gantt chart. - Up to 3 part systems can be displayed. - If program names cannot be collected, the fallback setting value set with NC Machine Tool Connector appears. Refer to the following manual for the setting method. NC Machine Tool Connector User's Manual - Up to 1000 rows can be displayed for each day specified.
(3) Chart area	(f)	Daily details Gantt chart	- Displays the changes of the operation detail status over time in a chart. - The period covered by the entire display is one day.	

Daily total screen

The Daily total screen displays the total times of the operation detail states of each program in the order of program operation over the period specified in the Operating details screen.



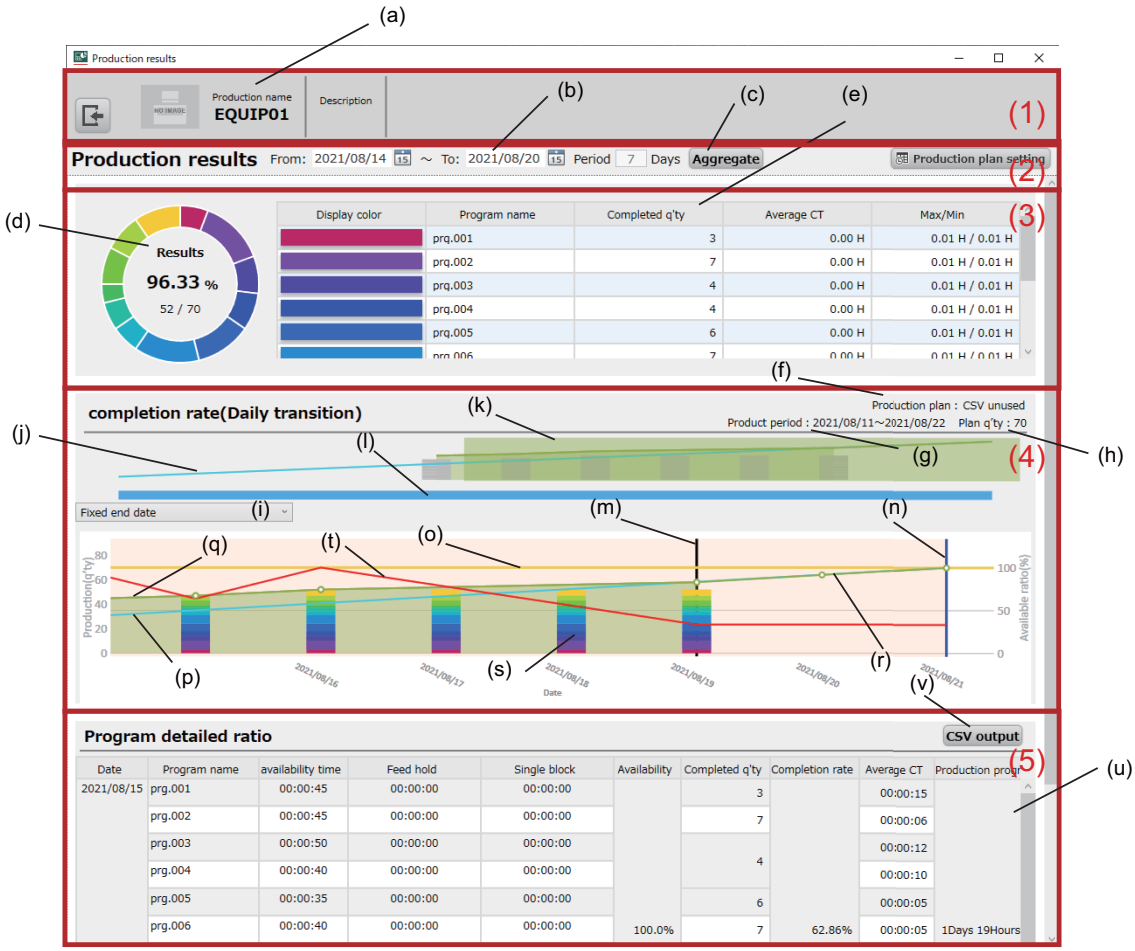
Date	Feed hold	Single block	Alarm stop	EMG stop	Ready	Power off	Automatic	Utilization
2021/05/26	0:00:00	2:00:00	0:30:00	0:00:00	2:00:00	2:00:00	17:30:00	89.58%
2021/05/27	0:00:00	1:00:00	0:30:00	0:00:00	2:00:00	2:00:00	18:30:00	89.58%
2021/05/28	0:00:00	0:00:00	0:30:00	0:00:00	2:00:00	1:00:00	20:30:00	93.75%
2021/05/29	0:00:00	1:00:00	0:00:00	0:00:00	2:00:00	1:00:00	20:00:00	95.83%
2021/05/30	0:00:00	1:20:00	0:00:00	0:00:00	4:20:00	0:00:00	18:20:00	100.00%
2021/05/31	1:20:00	0:50:00	1:30:00	0:00:00	4:20:00	1:30:00	14:30:00	87.50%
2021/06/01	0:00:00	0:00:00	0:00:00	0:00:00	2:00:00	2:00:00	4:30:00	76.47%
Total	1:20:00	6:10:00	3:00:00	0:00:00	18:40:00	9:30:00	113:50:00	91.80%

Display items

Position		Display items	Description	Remark
(1) Header	(a)	Machine name	Displays the name of the machine selected in the Operating status overview screen.	- For information on how to register machine information, refer to "Edit machine screen" (Chapter 4.1).
	(b)	Machine information	Displays the description of the selected machine.	
	(c)	Display period	Displays the period set in the Operating details screen.	
(2) Data	(d)	Aggregated results overview	Displays the aggregated results of the operation detail states (Feed hold, Single block stop, Alarm stop, EMG stop, Ready (Stand-by), Power off, In automatic operation) and of the utilizations over the period shown in (c).	

Production results screen

The Production results screen displays the variance between planned and actual work for the machine, such as the number of parts produced and the production progress, which helps you to track the trends of productivity for each machine.



In this screen, you can view and operate the following items. For details on the display items, refer to "Display items" described below.

- You can view the summary of the actual production (the number of parts produced, the average (max/min) cycle time) over the specified period for each program. Note that the actual production is not displayed for a program for which the number of parts produced over the specified period is 0.
- If you set the production plan in the Edit machine screen or import an external CSV file in advance, you can track the variance between planned and actual values over the specified period and forecast when the planned number of parts will be produced based on the production results.
- You can view the details of production results over the aggregation period for each date and each program.
  -You can identify which program is lowering productivity from the number of parts produced and the average cycle time for each program.
  - If the percentage of completion is increasing at a low rate compared to availability, checking the operation history and the occurrences of the events causing stops on the day using the Daily details chart in the Operating details screen helps you identify problems in production.
  - You can export the aggregation results in the Production results screen to a CSV file.

Display items

What is displayed in the screen depends on how the production plan is set. For details, refer to "Aggregate operation".

Position		Setting items	Description	Remark
(1) Header	(a)	Machine information	- Displays the machine information (machine name, machine image, machine description) set in the Operating status overview screen. - The information must be predefined in the Edit machine screen.	For information on how to register machine information, refer to "Edit machine screen" (Chapter 4.1).
(2) Aggregate operation area	(b)	Custom range	- When the aggregation period (Start date and End date) is specified, the number of days in the period is displayed in the "Period" area. - The limit for Custom range is 30 days. A long period may cause aggregation and screen display to take a long time to complete.	- You cannot specify an aggregation period that starts on the current date or a date after the current date.
	(c)	Aggregate button	Press this button after setting the aggregation period to update the display of the Donut chart (d), the Summary table (e), the Production results charts (l) to (t), and the Daily details summary table (u).	
(3) Aggregation view	(d)	Donut chart	- Displays the ratio of the numbers of parts produced for the machining programs over the specified period in a donut chart. In the hole of the donut chart, the availability is displayed. - If no production plan (g) and (h) is set, or only production results (q) and (s) are displayed ((n) to (p) and (r) are hidden), the formula to calculate the percentage of completion is displayed in the following format. (The number of digits is fixed) Formula: ---- / ----	- When you hover the mouse pointer over the chart, the program names, the total times of automatic operation, the availabilities, and the percentages of numbers of parts produced for the programs are displayed. - Only the operating programs of the first part system are included in the aggregation. MDI programs are not included in the aggregation.
	(e)	Summary table	Displays the production results over the specified period.	

Position		Setting items	Description	Remark
(4) Production results chart view	(f)	CSV folder/file path display	- Displays the folder (or file) path for the production plan CSV specified in the Edit machine or Edit plant screen. - When the Aggregate button is pressed, aggregation is processed using the production plan corresponding to the displayed items. If the production plan CSV file has an incorrect format, a message indicating that the file cannot be imported appears.	- For details about production plan setting, refer to "Edit plant screen" (Chapter 4.1) and "Edit machine screen" (Chapter 4.1). - For information on the format of production plan CSV files, refer to "Production plan setting" (Chapter 4.2). - After the production plan is set, the display of the aggregated results in the Production results screen are not updated until the Aggregate button is pressed.
	(g)	Product period	- Displays the planned production period based on the production plan set in the Edit plant screen or the Edit machine screen. (When no production plan is set, this field is blank) - The Production plan end date line (n) is displayed in the Production results chart. - If the production plan CSV file has an incorrect format, the period is not displayed.	
	(h)	Planned q'ty	- Displays the planned total number of parts for the planned production period based on the set production plan. (When no production plan is set, this field is blank)	
	(i)	Forecast switcher	- Switches the basis of calculation for the Forecast line (r) or the actual availability line (t) for the current date and later dates. The calculation can be based on either the plan end date (*1) or the actual availability (*2), depending on whether [Fixed end date] or [Fixed availability] is selected. (*1) Fixed end date: Displays the production forecast that is calculated so that the completion rate is 100% on the planned end date. (*2) Fixed availability: Displays the production forecast that is based on the actual availabilities during the period for the current date and later dates.	
	(j)	Daily graph	Displays the daily cumulative chart representing the production over the entire aggregation period. Line: Number of parts produced (green), Planned number of parts (light blue) Stacked: Number of parts produced (by program)	
	(k)	Display period scroll bar	Drag this scroll bar to change the date range the Production results chart displays within the specified period.	■ Display period Start: Aggregation start date End: Plan end date
	(l)	Plan period bar	Indicates the planned production period relative to the Daily graph (j). If the planned production period is not within the aggregation period, it is not displayed.	
	(m)	Current date line	Indicates the current date in the planned production period with a solid line (black).	- The line is not displayed unless the production plan (f) to (h) are set for each machine in advance. - If either situation (a) or (b) below is the case, lines other than those representing actual production (q) and (s) are not displayed. Revise the production plan. (a) A date later than the current date is set as the start date of the planned production period (g) (b) A date earlier than the start date of the aggregation period is set as the end date of the planned production period.
	(n)	Production plan end line	Indicates the end date of the planned production period with a solid line (blue).	
	(o)	Production plan target line	Indicates the planned total number of parts (h) with a solid line (yellow).	
	(p)	Planned progress line	Indicates the number of parts required to be produced between the production plan start date and the end date to complete 100% of the planned total number of parts (h) with a solid line (light blue).	
	(q)	Actual production line	Indicates the daily completion rate over the aggregation period with a solid line (green).	
	(r)	Forecast line	- The dashed green line indicates the number of parts required to be produced from the current date to complete 100% of the planned total number of parts if the number of parts produced as of the current date is less than the planned number. - Depending on the setting of the Forecast switcher (i), what is displayed as the forecast for the number of parts on and after the current date varies. (Whether calculation is based on the plan end date or the actual availability) - If the number of parts produced is 0 or the machine availability is 0% during the aggregation period, the Forecast line is not displayed, and the following message appears. "Since machining results during the period is 0 hours, the production forecast cannot be displayed."	- If the contents of the set production plan are incorrect, the Forecast line is not displayed correctly. - If the number of parts produced is equal to or greater than the planned number as of the current date, the Forecast line is not displayed.
	(s)	Daily count stack chart	Displays the cumulative number of parts produced for each day between the aggregation period start date and the current date.	- This chart is not displayed if the data on the number of parts produced has not been collected.
	(t)	Availability line	- Indicates the change in availability up to the planned end date. - Depending on the setting of the Forecast switcher (i), what is displayed as the forecast for the availability on and after the current date varies. (Whether calculation is based on the plan end date or the actual availability)	

Position		Setting items	Description	Remark
(5) Production result details view	(u)	Daily details summary table	Displays the aggregated daily change in the production results for each program over the specified period. Items (i) to (ix) below are displayed. (i) Date (Ii) Program name (iii) Availability time (sum of cycle time [CT]) [hh:mm:ss] (iv) Non-availability state time 1 to 3 [hh:mm:ss] (v) Availability [%] (vi) Completed quantity (vii) Completion rate [%] (Cumulative count of parts produced ÷ Number of parts planned × 100) (viii) Average CT (ix) Production progress [DD:HH] (minutes are rounded to the nearest hour) - For Non-availability state time, up to 3 columns of the states that are set as 'Operation' in the Operating status setting are displayed. (The display priority is as described in "How operation data (today) is calculated" (3)) - The average cycle time is shown with a red background if it exceeds the planned cycle time in the production plan.	- The completion rate is the ratio (%) of the total number of parts produced over the aggregation period to the number of parts planned. The completion rate does not match the current day's percentage of completion in the Plant machines overview screen. - The number of parts planned is the total value for the planned production period. If the manually set production plan in the Edit machine screen is applied, the number of parts planned is calculated as the average number of parts per day. - If the number of parts produced over the aggregation period is 0 for a program, the average cycle time for that program is 0.
	(v)	Production results CSV output button	Press this button and specify the output folder and the file name in the resulting dialog. The Daily details summary table (u) in the screen is exported to a CSV file as displayed. (*1)	- Refer to "(2) Results CSV file format" for details. - Open the output CSV file with an editor that supports UTF-8 with BOM encoding such as Microsoft Excel.

(*1) CSV file format

Item	Specification
Extension	.csv
Delimiter	Comma (,)
Line delimiter	CRLF (0x0D, 0x0A)
Character code	UTF-8 (with BOM)
Number of records	Number of programs in the displayed results

Precautions

If the completed quantity exceeds the maximum value that can be aggregated, the production results (summary table, daily graph, daily count stack chart, daily details summary table) are not displayed, and an error message appears.

Production plan setting

(1) How to set a production plan

From the Production plan setting button in the upper right corner of the screen, you can revise the production plan settings.

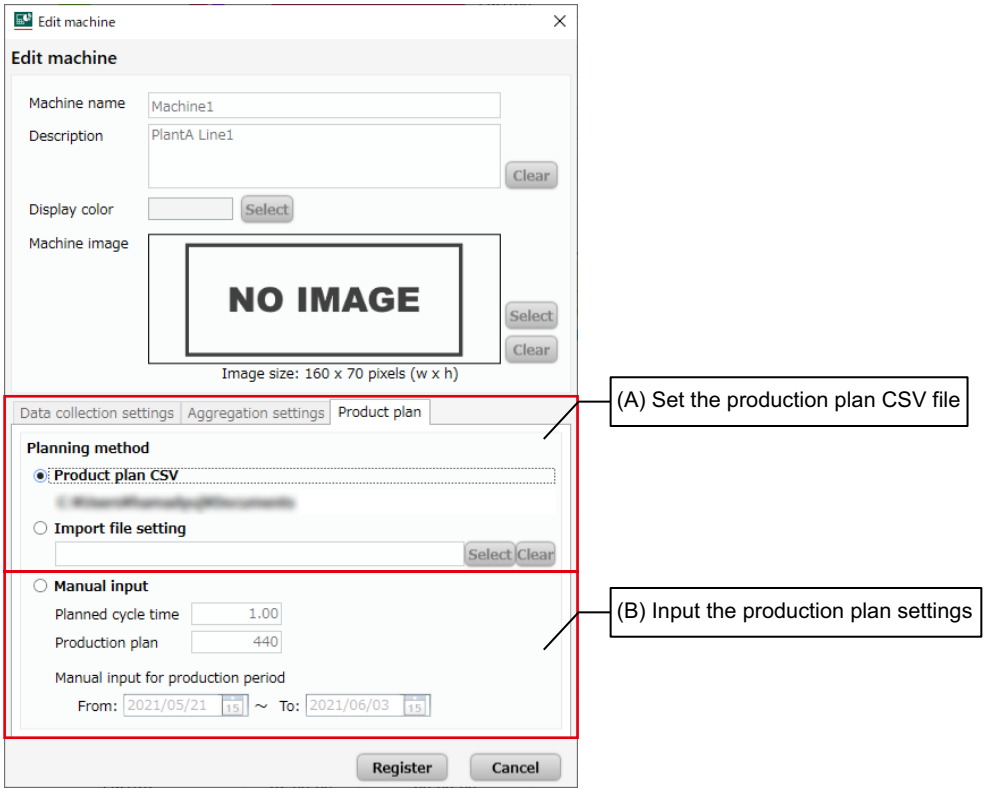
When you press the "Production plan setting" button, the Edit machine screen appears. (In this case, only the Product plan tab can be configured)

After either (A) setting the production plan CSV file or (B) manually entering the production plan settings, press the Register button.

After the production plan is registered, you can aggregate data in the Production results screen with the revised production plan.

The following describes the settings in the Edit machine screen.

For the description of the settings, refer to "Setting items".



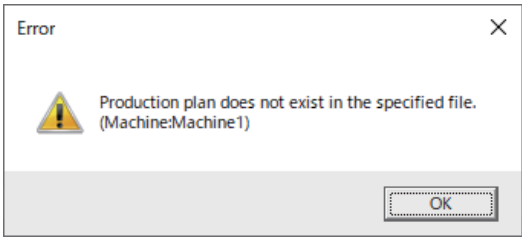
(A) Set the production plan CSV file

Select either of the following options and set the item described below.
You cannot use the "(B) Input the production plan settings" with a production plan CSV file.

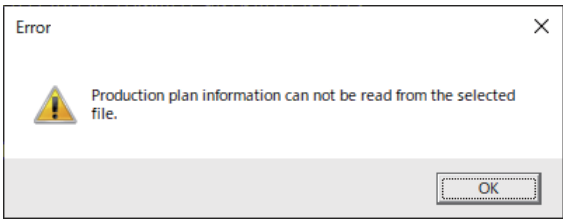
- Plant production plan (when "Production plan CSV" is selected)
The folder path selected in the "Production plan setting" in the Edit plant screen is displayed.
The production plan CSV file in the selected folder is applied as the product plan.
(For details on the setting, refer to "(I) Production plan setting" in "Edit plant screen" (Chapter 4.1).)

- Machine production plan (when "Import file setting" is selected)
Press the Select button to designate a production plan CSV file for the machine.

While it is possible to set a production plan CSV file containing no production plan for the machine being edited, the following error appears. (The error is not displayed when the Production plan setting is configured in the Edit plant screen.)



If the selected file is not a production plan CSV, you cannot set the file and the following error appears.



(B) Input the production plan settings

Manually enter the planned cycle time, the number of parts planned, and the planned production period in this screen.
You cannot use the "(A) Set the production plan CSV file" with manually input settings.
(This is per-machine setting. It is not possible to set a plan for each program)

- Manual input for production period
Manually set the planned production period used in aggregation.

- Start date
- End date

(2) Production plan CSV file format

The following describes the format specification of the CSV file used in production plan setting.

■ CSV Format

	Item	Specification	Remark
1	Extension	.csv	If the file has an invalid extension, a read error occurs.
2	Delimiter	Comma (,)	
3	Line delimiter	CRLF (0x0D, 0x0A)	If CR (0x0D) or LF (0x0A) alone exists in the file, it is deleted when the file is read.
4	Character code	Shift_JIS	If the character code is not Shift_JIS, a read error occurs.
5	Number of records	100000 (rows)	If the number of records in one file exceeds 100000, the excess records are not read.
6	Record size	71 characters (119 bytes) or less (per record)	If the size of one record exceeds the maximum limit, a read error occurs. For details of the number of characters, refer to "CSV stored data information".

■ CSV stored data information

	Column name	Data type	Length	Remark
1	Machine name	String	32	The machine names in the CSV file must match the machine names registered in this application. (*1)
2	Program name	String	16	The program names in the CSV file must match the machining programs name on the NC.
3	Date	Date	10	The date for which production is planned. Format: yyyy/mm/dd
4	Planned number	Number	4.0	The number of parts planned (0 to 9999) (*2)
5	Planned cycle time	Number	2.2	Enter a decimal number with two decimal places (0.00 to 99.99) Example: When the planned cycle time is 40 minutes 0.67: (40 min/60 min ≈ 0.67 hours)

(*1) Commas, double quotation marks and other special characters are not allowed. An error occurs when the file is imported. Set the machine name with half-width [single-byte] alphanumerical characters or full-width [double-byte] Japanese characters (SJIS compatible characters).

(*2) The maximum total number of plans in a file is 999,999. If a file contains more plans than allowed, an error occurs when the file is imported.

[Example of error]

Machine name: Machine, A

Program name: "Prg01"

(3) Example of production plan CSV file

planCSV.csv

```
Machine 1, O1001, 2020/04/01, 1, 3.33
Machine 1, O2000, 2020/04/01, 1, 1.33
Machine 1, O3000, 2020/04/01, 1, 2.17
Machine 1, O4000, 2020/04/02, 1, 2.17
Machine 1, O5000, 2020/04/02, 2, 1.33
Machine 1, O3000, 2020/04/03, 1, 2.17
Machine 1, O6000, 2020/04/03, 2, 0.5
Machine 1, O5000, 2020/04/03, 1, 1.33
Machine 1, O4000, 2020/04/04, 1, 2.17
Machine 1, O5000, 2020/04/04, 3, 1.33
Machine 1, O4000, 2020/04/05, 1, 2.17
Machine 1, O5000, 2020/04/05, 3, 1.33
Machine 2, O1000, 2020/04/01, 1, 1
Machine 2, O2000, 2020/04/01, 3, 1
Machine 2, O3000, 2020/04/01, 2, 2.17
Machine 2, O4000, 2020/04/02, 2, 0.5
Machine 2, O5000, 2020/04/02, 4, 1.33
Machine 2, O6000, 2020/04/02, 1, 7.5
Machine 2, O5000, 2020/04/03, 4, 1.33
Machine 2, O2000, 2020/04/03, 2, 1.33
Machine 2, O4000, 2020/04/04, 1, 0.5
Machine 2, O5000, 2020/04/04, 3, 1.33
Machine 2, O4000, 2020/04/05, 1, 0.5
Machine 2, O5000, 2020/04/05, 3, 1.33
Machine 3, O1000, 2020/04/01, 5, 1.33
Machine 3, O2000, 2020/04/02, 1, 1
Machine 3, O3000, 2020/04/02, 6, 0.67
Machine 3, O4000, 2020/04/03, 5, 0.58
Machine 3, O5000, 2020/04/03, 4, 0.5
```

Results CSV file format

The following describes the format of the CSV file to which the aggregated results in the Production results screen are exported.

The aggregated results in the Production results screen as displayed are exported as the output data.

Column name	Unit	Length	Format	Remark
Date	Date	32	yyyy/mm/dd	A date in the aggregation period
Program name	String	16	Arbitrary character string	UTF-8 (with BOM)
Availability time	Time	8	HH:MM:SS	The run time.
Non-availability state time 1	Time	8	HH:MM:SS	- The time during which the status is any state set as 'Operation' in the Operating status screen other than 'Running'. - If the setting is missing, the data is blank.
Non-availability state time 2	Time	8	HH:MM:SS	
Non-availability state time 3	Time	8	HH:MM:SS	
Availability	Real number	2.2	-	% is not appended to the number
Completed quantity	Integer	20	-	-
Completion rate	Real number	2.2	-	% is not appended to the number
Average cycle time	Time	8	HH:MM:SS	If no production plan CSV file is set, the average cycle time for each machine is output.
Production progress	String	-	xx Days yy Hours	xx = the number of days yy = the number of hours

Aggregate operation

The following describes how aggregate operation differs depending on the applied production plan.
The aggregate operation of production results assumes that the data to be aggregated covers the planned production period up to the current date within the aggregation period.
For information on how to set production plan for each machine, refer to "Edit machine screen" (Chapter 4.1).

Display items	Production results screen Display items	When production plan CSV file is applied	When production plan is manually set
Availability (actual)	For the calculation formula, refer to "How operation data (specific period) is calculated" (Chapter 4.1).		
	(d)	Aggregates the actual values over the period by machine.	Same as when a production plan CSV file is applied (left)
	(l), (r), (u) - (5)	Aggregates the actual values by day by machine.	
Completed quantity	(e) - (3)	Aggregates the actual values over the period by program.	Same as when a production plan CSV file is applied (left)
	(l)	Aggregates the actual values by day by machine.	
	(s), (u) - (6)	Aggregates the actual values by day by program.	
Number of works planned	(i)	The sum of the planned numbers by day by program	The specified planned number
	(r)	(As of the current date) Number of remaining parts planned = Number of parts planned - Number of parts produced	Same as when a production plan CSV file is applied (left)
Average cycle time	(e) - (4)	By program Σ Availability time ÷ Number of parts produced (over the period)	Same as when a production plan CSV file is applied (left)
	(u) - (8)	By day by program Σ Availability time ÷ Number of parts produced	
Forecast (estimated number of remaining days required to complete the planned quantity, required availability)	(r) (t)	- The average cycle time is the average value of the availability times by program. - The production forecast for each day is the average value of the number of remaining parts planned until the completion date. (1) Based on the actual availability (*1) Estimated number of remaining days required to complete the planned quantity = Σ (Average cycle time × Number of remaining parts planned) ÷ (Average operating time per day × Actual availability) (2) Based on the plan end date (*2) Required availability = Σ (Average cycle time × Number of remaining parts planned) ÷(Average operating time per day × Number of remaining days)	- The average cycle time is the average value of the availability times by program. - The production forecast for each day is the average value of the number of remaining parts planned until the completion date. (1) Based on the actual availability (*1) Estimated number of remaining days required to complete the planned quantity = Average cycle time × Number of remaining parts planned ÷ (Average operating time per day × Actual availability) (2) Based on the plan end date (*2) Required availability = Average cycle time × Number of remaining parts planned ÷ (Average operating time per day × Number of remaining days)

(*1) The completion rate is 100% as of the current date + the estimated number of remaining days required to complete the planned quantity. The displayed availability is the actual value up to the current date.
(*2) The availability required for the completion rate to be 100% on the plan end date is displayed in a graphical format.

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5 RESTRICTIONS

The following describes the restrictions in NC Machine Tool Optimizer.
The information on how to set data collection can be found in the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

(1) Due to the system configuration, the operations including consistent data collection in each cycle, communication performance and screen output depend on the specifications of the related software and communication environment. The collection interval must be set considering the data to be collected, the connected machines, and the communication environment.

(2) The data collection settings on NC Machine Tool Connector must be configured according to the machines to be connected. Even when the settings are correctly configured, the behavior may not be in accordance with the specification of NC Machine Tool Optimizer, depending on what data the machine can output.

(3) Do not restart MQTT broker (Mosquitto) while NC Machine Tool Optimizer is running.

(4) Do not edit the data in the database regardless of whether NC Machine Tool Optimizer is running or not. If incorrect record timestamps or data inconsistency arises, NC Machine Tool Optimizer may not work correctly.

(5) Since each calculated value is rounded to the second decimal place when the aggregated results are displayed, the total of all percentages may not equal 100%, or the total hours of the operating status in one day may not equal 24 hours.

(6) For the screens that can be resized, resizing may make the contents hard to see because automatic adjustment is not performed.

(7) For a machine with multiple part systems, if the status setting is configured in the Operating status setting screen, the same setting is applied to all part systems.

(8) When a remote plant is monitored, the display may temporarily become incorrect because of a communications failure of the network and delayed communication data or for other reasons.

(9) When a remote plant is monitored, the time on the PC in the plants other than the base plant must match that of the base plant. Otherwise, the display for the plants other than the base plant may not work properly.

(10) If the count of parts produced is reset on the machine, the data of the completed quantity collected for the period following the reset may contain a slight error, depending on the data collection interval of NC Machine Tool Connector.

(11) If the operating states are not set in the OP status setting tab in the Edit plant screen or in the Operating status setting screen, the operating states cannot be monitored or aggregated correctly.

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6 APPENDIX

6.1 Appendix 1: Open Source Software

This software consists of multiple software components. Each of them is copyrighted by this consortium and/or third parties.

Software information

This product contains the following open source software.

(1) LiveCharts
(2) Prism
(3) .NET Core Libraries (CoreFX)
(4) M2Mqtt
(5) Npgsql
(6) Unity Container
(7) CommonServiceLocator
(8) ToggleSwitch

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6.2 Appendix 2: Supported Version

NC Machine Tool Optimizer	NC Machine Tool Connector
Version A5 (1.1.5.0)	Version A1 (1.1.2.0) or newer
Version A6 (1.1.6.0)	
Version A7 (1.1.7.0)	

Precautions for version upgrade

When upgrading NC Machine Tool Optimizer, to use the information before the upgrade without any changes, the measures in the following table are required.
For details on the measures, refer to the following manual.

NC Machine Tool Optimizer (Pro/Lite) Install Manual

Target version	Measure
Version A5 or earlier to A6	Database connection needs to be set again.
Version A6 or earlier to A7	Data in the database needs to be migrated.

REVISIONS

Revision date	Manual No.	Revision details
Aug. 2021	IB(NA)1501672-A	First edition created.
Jan. 2022	IB(NA)1501672-B	Added the supporting models (M8V, C80). Revised the description on the system configuration. Added the supporting language (Korean, Siplified Chinese, Traditional Chinese). Added the description on the machies supporting OPC UA. Revised the number of machines connected (custom API, MTConnect) Corrected errors.
Dec.2022	IB(NA)1501672-C	Revised the description on the system configuration. Revised the number of connectable machines for the Pro version. Revised the Edit plant screen. Revised the menu operations in the Operating status overview screen. Revised the description on the Edit machine screen, the Achievement output screen, the Production results screen, and the Edit group screen. Added precautions for version update. Corrected errors.
Apr. 2024	IB(NA)1501672-D	Revised the description on the PostgreSQL version. Revised the description on the Operating status overview screen and the Production results screen. Revised the supported version and the precautions for version upgrade. Corrected errors.

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MODEL	NC Machine Tool Optimizer (Pro/Lite)
MODEL CODE	100-797
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