Panasonic

Motion Controller GM1 Controller EtherCAT **User's Manual**

Operation

WUME-GM1ETCOP-03

(MEMO)

Introduction

Thank you for purchasing a Panasonic product. Before you use the product, please carefully read through the user's manual, and understand it in detail to use the product properly.

Types of Manual

• There are different types of manuals for the GM1 series, as listed below. Refer to the appropriate manual according to your need.

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These manuals can be downloaded from our website: https://industrial.panasonic.com/ac/e/
motor/motion-controller/mc/gm1/index.jsp
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Manuals for GM1 series

Manual name	Manual code	Description
GM1 Controller EtherCAT User's Manual (Setup Edition)	WUME- GM1ETCSU	Explains wiring between the GM1 and its peripheral devices, installation method, and operation check method.
GM1 Controller EtherCAT User's Manual (Operation Edition)	WUME- GM1ETCOP	Explains how to use GM Programmer and PANATERM Lite for GM, set up each function, create projects, and perform other operations.
GM1 Series Reference Manual (Hardware Edition)	WUME-GM1H	Explains the functions and performance of each GM1 unit.
GM1 Series Reference Manual (Instruction Edition)	WUME-GM1PGR	Explains the specifications of each instruction that can be used with the GM1 Series.
GM1 Series Reference Manual (Analog I/O Unit)	WUME-GM1AIO	Explains the functions and performance of each GM1 Analog Expansion Unit.
GM1 Series Reference Manual (Pulse Output Unit)	WUME-GM1PG	Explains the functions and performance of each GM1 Pulse Output unit.

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Compliance with IEC 61131

International standard IEC 61131 is the international common standards in which the International Electrotechnical Commission (IEC) defines programming languages for PLC. IEC defines the following five programming languages:

- Ladder Diagram (LD)
- Structured Text (ST)

- Sequential Function chart (SFC)
- Function Block Diagram (FBD)
- Instruction List (IL)

Glossary

GM Programmer

A configuration tool for the GM1 controller. Using GM Programmer makes it possible to set positioning data and various positioning parameters, and perform various monitoring. As this tool is equipped with tool operation mode that starts a motor independently without using user programs, it is convenient especially to verify operations at the time of initial startup.

PANATERM Lite for GM

A setup support tool for the MINAS series servo amplifiers manufactured by Panasonic Corporation. When GM Programmer is installed, "PANATERM Lite for GM" is also installed at the same time. By using this tool, parameter setup within servo amplifiers, control status monitoring, setup support, machine analysis, and other operations can be executed on the PC screen.

P-point control

Refers to control passing through a "Pass Point". In this manual, this control is referred to as "P-point control" for the sake of convenience.

This method is used when target multi-stage velocities are specified in a sequence of motions.

C-point control

Refers to control passing through a "Continuance Point". In this manual, this control is referred to as "C-point control" for the sake of convenience. This method is used to execute consecutive E-point controls by one-time startup.

E-point control

Refers to movement up to an "End Point". In this manual, this control is referred to as "E-point control" for the sake of convenience. This method is used for single-speed acceleration / deceleration control. It is also called "trapezoidal control".

Automatic operation

An operation that is automatically performed. It means position control.

Manual operation

An operation that is performed at initial startup or during adjustment. Home return, JOG operation, and pulser operation are manual operations.

Position control

A generic term for E-point control, P-point control, and C-point control. For each control, control for single axes and interpolation control for multiple axes can be performed. Interpolation control can be selected from 2-axis linear interpolation, 2-axis circular interpolation, and 3-axis linear interpolation.

Home return

The reference position for positioning is called a home position and an operation to travel to a home position is called home return. Each axis is moved to the preset home position and the coordinates of the home position are defined as absolute position zero. The motor rotation is

reversed automatically when the limit input (+) or the limit input (-) is input and the home position or near home position is searched to return to the home position automatically.

JOG operation

Refers to an operation in which the motor is rotated only while operation commands are being input. This is used to forcibly rotate the motor using inputs from external switches during startup or adjustment, for example. This can also be applied to unlimited feed.

Limit input (+), limit input (-)

A limit switch input that is used to limit the motor movement. Limit input (+) is the limit point on the side where the elapsed value increases and limit input (-) is the limit point on the side where the elapsed value decreases.

Dwell time

For E-point control, the time from the completion of a position command until the operation done contact turns ON can be specified as a dwell time. For C-point control, similarly, the time from deceleration stop until execution of the next positioning table can be specified as a dwell time.

Soft limit

Limits in software can be set for the absolute coordinates managed by the GM1 controller. When the range of soft limits is exceeded, an error occurs, causing the system to decelerate and stop. Deceleration time can be set individually.

Torque control

The output torque of the servo amplifier can be limited arbitrarily.

Servo ON / Servo OFF

The operation that changes the servo free state to a servo lock state is called "servo ON", and the operation that changes the servo lock state to a servo free state is called "servo OFF".

Linear interpolation

Interpolation control that controls straight lines as loci for the operations of 2-axis motors with grouped X-axis and Y-axis or 3-axis motors with grouped X-axis, Y-axis, and Z-axis. There are two setting methods, which are a composite speed specification and long axis speed specification.

Circular interpolation

Interpolation control that controls arcs as loci for the operation of 2-axis motors with grouped Xaxis and Y-axis. There are two setting methods, which are a center point specification and pass point specification.

Edge detection

One of the methods for detecting the request signals allocated to this unit. It executes each requested process by detecting a trigger that is the rising edge when the request signal turns ON.

Therefore, the next request cannot be accepted until the current request signal turns OFF.

(MEMO)

Table of Contents

1	Before Using This Product1-1
	1.1 Safety Precautions1-2
	1.2 Handling Precautions1-3
	1.3 Software License Agreement1-4
2	Operation Flow2-1
	2.1 System Configuration Diagram2-2
	2.2 Work Flowchart2-4
3	Overview of the GM Programmer3-1
	3.1 System Requirements
	3.2 Installation and Uninstallation
	3.2.1 Installing GM Programmer
	3.2.2 Uninstalling GM Programmer
	3.3 Basic Operations.3-83.3.1 How to start.3-8
	3.3.2 How to quit
	3.4 Component Names
	3.4.1 Menu Bar
	3.4.2 Toolbar
	3.4.4 Main Pane
	3.4.5 Status Bar
	3.5 Window Operations
	3.5.1 Moving the Pane Location3-253.5.2 Showing / Hiding Panes3-27
	3.5.3 Switching the Tab of the Main Pane
	3.5.4 Full-screen Display
	3.6 Switching the Object Window
	3.6.1 Operating the Object Window
	3.7 Other Functions
	3.7.1 Option Setting Function 3-32 3.7.2 Display Language Setting Function 3-33
	3.7.3 Online Help Function
	3.7.4 Version Display Function
4	Project Operations4-1
	4.1 Creating a New Project4-2
	4.2 Saving a Project4-5
	4.3 Opening a Project4-6
	4.4 Closing a Project4-7
	4.5 Device Tree Configuration4-8

	4.6 Project Configuration	4-11
	4.7 Adding an Object	4-12
	4.7.1 Adding Objects	4-13
	4.7.2 Adding Devices	4-17
	4.8 Setting up A Project	
	4.9 Exporting and Importing Objects	
	4.9.1 Exporting Objects	
	4.9.2 Importing Objects 4.10 Creating a Backup when a Project Is Saved	
	4.10 Creating a backup when a Project is Saved	
	4.12 Printing a Project	
	4.13 Printing an Object within a Project	
	4.14 Comparing Projects 4.14.1 Project Comparison Method	
	4.14.1 Project comparison Method	
5	Project Creation	5-1
	5.1 Project Creation Flow	5-2
	5.2 Setting up the GM1 Controller	5-3
	5.3 Setting up Motion Control	5-5
	5.3.1 Basic Setting for GM1 Controller	
	5.3.2 Adding and Setting up Servo Amplifiers 5.3.3 Adding and Setting up Free Encoder and Virtual Drive	
	5.4 Setting up Unit Control	
	5.4.1 Setting up General-purpose I/O, PWM Output, and High-speed	
	Counter for GM1 Controller	
	5.4.2 Adding Expansion Units	5-16
	5.5 Setting up the Communication Function	
	5.5.1 Adding a Protocol to Be Used for the LAN Port	
	5.5.2 Adding a Protocol to Be Used for the COM Port	5-23
6	Program Creation	6-1
	6.1 Flow of Program Creation	6-2
	6.2 Program Creation Window	6-3
	6.2.1 Main Pane	6-3
	6.2.2 Declaration Editor	
	6.2.3 Auto Declaration	
	6.2.4 Toolbox 6.2.5 Setting up the Program Input Window	
	6.2.6 Window Operations for the Program Input Window	
	6.3 Creating a Program Object (POU Object)	6-14
	6.4 Types of Programming Language	6-15
	6.5 Variables	6-18
	6.5.1 Standard Data Types	6-18
	6.5.2 STRING type	
	6.5.3 WSTRING type	6-19

6.5.4 Array	
6.5.5 Subrange Types	
6.5.6 Structure, Enumeration, Alias, and Union Data Types	
6.5.7 Constants	
6.5.8 Object for Global Variable Declaration	6-25
6.5.9 Global Variables	. 6-25
6.5.10 Persistent Variables	. 6-27
6.5.11 Short Form Function	
6.6 Function and Function Block	
6.6.1 Function	
6.6.2 Function Block	
	0-30
7 Entering Programs in Each Programming Language	
7.1 Programming in Ladder Diagram (LD)	.7-3
7.1.1 Inserting Contacts, Coils, and Function Blocks	. 7-3
7.1.2 Inserting Contacts in Parallel	. 7-8
7.1.3 Inserting a Network (Circuit)	. 7-9
7.1.4 Inserting a Branch	
7.1.5 Input of Title and Comment (LD)	
7.1.6 Commenting out a Network (Circuit)	
7.2 Programming in Structured Text (ST)	
7.2.1 ST Program Syntax	
7.2.2 Commenting out Code in ST Program	
7.3 Programming in Sequential Function Chart (SFC)	.7-19
7.3.1 Inserting Elements from Menu	. 7-19
7.3.2 Inserting Elements from Toolbox	
7.3.3 Inserting Elements from Toolbar	
7.3.4 Setting up the SFC Editor	
7.3.5 Setting SFC Program Execution Conditions	
7.4 Programming in Function Block Diagram (FBD)	
7.4.1 Entering Function Blocks	
7.4.2 Inserting and Commenting out a Network (Circuit)	
7.4.3 Input of Title and Comment (FBD)	
7.4.4 Settings in FBD Program	. 7-32
7.5 Programming in Instruction List (IL)	.7-34
7.5.1 Entering Instructions and Operands	. 7-34
7.5.2 Settings in IL Program	. 7-36
7.6 Programming in Continuous Function Chart (CFC)	
7.6.1 Inserting and Connecting Elements	
7.6.2 Connection Mark	
7.7 Program Creation Support Functions	
7.7.1 Bookmark	
7.7.2 Call Tree View	
7.7.3 Cross reference List View	
7.7.4 Function Block Guidance	
7.7.5 Input Assistant Function	
7.7.6 Argument / Variable Input Support (Component List)	. 7-51
7.7.7 Global Renaming (Refactoring)	. 7-52
7.7.8 Displaying Programs in Multiple Languages (Project Localization)	. 7-55
7.8 Build	
	.1-09

	7.8.1 Build 7.8.2 Rebuild	7-59
	7.8.3 Code Generation	
	7.8.4 Clean	
	7.8.5 Clean All	7-61
	7.9 Tasks	
	7.9.1 Adding Programs	
	7.9.2 Adding a UserTask	
	7.9.3 Task Configuration Window	/-/0
8	Connecting the GM1 Controller and PC	8-1
	8.1 Flow of Operation Check	8-2
	8.2 Connecting the GM1 Controller and PC	8-3
	8.2.1 Selecting a Connection Port for GM Programmer	
	8.2.2 Connecting the GM1 Controller and PC with a Cable	
	8.2.3 Operation when Power is ON	8-3
	8.3 Operation Mode Switching	8-5
	8.4 Communication Setting	8-6
	8.4.1 Adding USB Ports	
	8.4.2 Setting the LAN Port	8-8
	8.5 Connecting to the GM1 Controller	
	8.6 Setting Time	8-12
	8.7 Other Settings	8-14
	8.7.1 Changing the Device Name	
	8.7.2 Sending Echo Services	8-15
	8.7.3 Device Preference Management	
	8.7.4 Confirmed Online Mode	
	8.8 Login / Logout	
	8.8.1 Login	
	8.8.2 Logout	
	8.8.4 Online Change	
	8.8.5 Code Analysis (Static Analysis Light)	
	8.9 Source Upload	
	8.10 Commissioning	
	8.10.1 Online Config Mode	
	8.10.2 Conducting Commissioning for Servo Amplifiers	
9	Debug	9-1
	9.1 Running and Stopping the GM1 Controller	9-2
	9.1.1 Running and Stopping the GM1 Controller	
	9.1.2 Single Cycle	9-3
	9.2 Breakpoint	
	9.2.1 Setting a Breakpoint	9-5
	9.2.2 Setting an Execution Point	9-6
	9.2.3 Call Stack View	9-8
	9.3 Debug Operations	
	9.3.1 Writing Values and Forcibly Changing Values	9-10

	9.3.2 Watch	
	9.3.3 Flow Control	
	9.3.4 Operation Mode	9-14
	9.4 Monitoring Function	9-15
	9.5 Reset	9-18
	9.5.1 Reset Warm, Reset Cold, and Reset Origin	
	9.5.2 Executing Device Reset from GM Programmer	
	9.5.3 Executing Device Reset from GM1 Controller	
	9.6 Checking the Status of GM1 Controller	9-22
	9.6.1 Checking Logs	
	9.6.2 Checking the Status	
	9.6.3 Checking the System Data History	9-24
	9.6.4 Task Monitoring	9-25
	9.7 Device Trace Function	9-26
	9.8 Checking the Performance of GM1 Controller	9-33
	9.8.1 Checking Missing EtherCAT Packets	9-33
	9.8.2 Performance Check Based on Device Trace	
	9.9 Error Notification Function	9-36
	9.9.1 Overview of Errors	9-36
	9.9.2 Checking and Clearing Errors Using GM Programmer	
	9.9.3 Obtaining Error Information Using User Programs	
	9.9.4 Error Recovery Processing	
	9.9.5 Error Code List	
10	Useful Functions of GM Programmer	10-1
	10.1 Simulation Function	
	10.2 Security Function	
	10.3 Security Function: User Management	10-4
	10.3.1 Project User Management	
	10.3.2 Creating a New User and Group	
	10.3.3 Setting Operation Privileges	
	10.3.4 Performing Operation with Privileges Set 10.3.5 Device User Management	
	-	
	10.4 Security Function: Encryption 10.4.1 Encrypting Project Files	
	10.4.2 Encrypting the Communication Path: Encrypting Communic	
	Using the Certificate Possessed by the GM1 Controller	
	10.4.3 Encrypting the Communication Path: Encrypting Communic	
	Using a Created Certificate	
	10.5 Security Function: Write-protection	
	10.5.1 Opening Files in Read-only Mode	
	10.5.2 Setting the "Released" Flag	10-24
	10.6 User Library Function	
	10.6.1 Creating a Library and Adding to the Library Repository	
	10.6.2 Using Created Libraries	10-31
	10.7 POU for implicit checks	
	10.7 POU for implicit checks 10.7.1 Setting up POU for implicit checks	
		10-34

	10.8.1 Setting up an Interface Object	. 10-36
	10.8.2 Implementing in New Function Block	
	10.8.3 Implementing in Existing Function Block	. 10-40
	10.8.4 Extending the Interface	. 10-43
	10.9 External File Functions	.10-46
	10.9.1 Setting up an External File Object	
	10.10 Servo Amplifier / Motor Operation Function (PANATERM Lite for	
	GM)	.10-48
	10.10.1 Starting PANATERM Lite for GM	. 10-48
11	Motion Control	.11-1
	11.1 EtherCAT Master Setting	
	11.1.1 EtherCAT Master SoftMotion	
	11.2 EtherCAT Slave Settings	
	11.2.1 EtherCAT Slave Settings	
	11.3 EtherCAT Axis Settings	.11-12
	11.3.1 Overview of EtherCAT Axis Settings	
	11.3.2 Basic Settings for EtherCAT Axes	
	11.3.3 EtherCAT Axis Extended Setting	. 11-16
	11.4 Basic Preparations for Operation	.11-23
	11.4.1 Overview of Basic Preparations for Operation	
	11.4.2 Servo ON or OFF	. 11-23
	11.4.3 Home Return	. 11-24
	11.4.4 JOG Operation	. 11-36
	11.5 Single-axis Operation	.11-38
	11.5.1 Overview of Single-axis Operation	
	11.5.2 Position Control	
	11.5.3 Switching the Control Mode	. 11-45
	11.5.4 Velocity Control	
	11.5.5 Torque Control	. 11-48
	11.5.6 Stop	. 11-50
	11.6 Synchronous Operation	.11-52
	11.6.1 Synchronous Cam Operation	. 11-52
	11.6.2 Synchronous Gear operation	. 11-58
	11.7 Multi-axis Operation	11-61
	11.7.1 Overview of Interpolation Control	
	11.7.2 Linear Interpolation and Circular Interpolation	
	11.7.3 How to Use Interpolation Control	
	11.7.4 Registering a CNC Table	
	11.7.5 Overview of G-code	. 11-75
	11.7.6 G-code Editor and Coding Rules	
	11.7.7 Movements Executed by Each G-code and Setting Methods	
	11.7.8 SMC_CNC_REF and SMC_OUTQUEUE	. 11-90
	11.7.9 Interpolation Operation Programming: How to Create a Program	44.04
	for Executing Operation	. 11-91
	11.7.10 Interpolation Operation Programming: Explanation of Function Block (FB)	11.0/
	11.7.11 Interpolation Operation Programming: Specifying the Starting	. 11-94
	Coordinates	. 11-97

	 11.7.12 Interpolation Operation Programming: P-point Control and C-point Control. 11.7.13 Interpolation Operation Programming: Settings in CNC Table for C-point Control. 11.7.14 Interpolation Operation Programming: Settings in POU for P-point Control and C-point Control. 11.7.15 Interpolation Operation Programming: Joining and Repeating CNC Tables. 11.7.16 Interpolation Operation Programming: Changing Parameter Settings (Converting to Variables in CNC Table). 11.8 Motion Function Errors. 11.8.1 Overview of Motion Function Errors. 	11-103 11-104 11-105 11-108 .11-110
	11.8.2 Error Check Method 11.8.3 Clearing Errors	11-111 11-112
12	Unit Control	.12-1
	12.1 Overview of Unit Control	.12-2
	12.2 IO Parameters for Unit Control	.12-3
	12.3 I/O Mapping for Unit Control	
	12.4 General-purpose I/O	
	12.4.1 Overview of General-purpose I/O Function	12-5
	12.4.2 Setting Parameters with GM Programmer	
	12.4.3 Setting Items of IO_Configuration Parameters	12-6
	12.4.4 I/O Mapping for General-purpose I/O	12-7
	 12.5 PWM Output 12.5.1 Overview of PWM Output 12.5.2 Setting Output Ports with GM Programmer 12.5.3 I/O Mapping for PWM Output 12.5.4 Data Update Timing (Output Frequency) 12.5.5 Data Update Timing (Duty Ratio)	12-9 12-9 12-10 12-11 12-12
	 12.6 High-speed Counter Function 12.6.1 Overview of High-speed Counter Function	12-18 12-19
	12.6.4 I/O Mapping for High-speed Counter Output 12.6.5 Operation Ready Request 12.6.6 Count Function	12-25 12-28 12-31
	12.6.7 Comparison Function	
	12.6.8 External Output Function	
	12.6.9 Capture Function 12.6.10 Unit Error	
	12.7 Settings of I/O Unit	
	12.7.1 Parameter Settings	
	12.7.2 I/O Mapping for I/O Unit	
13	Communication Function	.13-1
	13.1 Overview of Communication Function	
	13.1.1 Adding Network Communication Devices 13.1.2 Adding Serial Communication Devices	

	13.2 General-purpose Communication	
	13.2.2 General-purpose Communication (Serial)	
	13.3 MODBUS	13-24
	13.3.1 What is Modbus TCP?	
	13.3.2 Modbus-TCP Master Communication	
	13.3.4 Modbus-RTU Master Communication	
	13.3.5 Modbus-RTU Slave Communication	
	13.4 EtherNet/IP	
	13.4.1 What is EtherNet/IP?	
	13.4.2 Cyclic Communication Function	
	13.4.3 EtherNet/IP Scanner Function	
	13.4.4 Setting up the EtherNet/IP Scanner Function	13-42
	13.4.5 EtherNet/IP Scanner Operation	
	13.4.6 EtherNet/IP Adapter Function	
	13.4.7 Setting up the EtherNet/IP Adapter Function	
	13.4.8 EtherNet/IP Adapter Operation	13-55
14	Other Controller Functions	14-1
	14.1 SD Card Access	14-2
	14.1.1 Overview of SD Card Access Function	14-2
	14.1.2 File Manipulations Using the CAA File Library	14-2
	14.2 Time Function	
	14.2.1 Overview of Time Function	
	14.2.2 Settings Based on GM Programmer	
	14.2.3 Settings Based on Function Blocks	
	14.3 Trace Function	
	14.3.1 Setting up Trace	
	14.3.2 Executing Trace	
	14.4 Recipe Manager Functions	
	14.4.1 Setting the Recipe Manager	
	14.4.2 Setting the Recipe Definition	
	14.4.3 Recipe Operation Using the GM Programmer	14-19
15	Overview of PANATERM Lite for GM	15-1
	15.1 System Requirements	15-3
	15.1.1 Operating Environment of PANATERM Lite for GM	
	15.2 Installation and Uninstallation	
	15.2.1 Installing PANATERM Lite for GM	
	15.2.2 Uninstalling PANATERM Lite for GM	15-4
	15.3 Basic Operations	15-5
	15.3.1 How to Start	
	15.3.2 How to Exit	
	15.4 Component Names	
	15.4.1 Menu Bar	
	15.4.2 Toolbar	
	15.4.3 Navigation Pane	
	15.4.4 Main Pane	15-11

15.4.5 Status Field	15-12
15.5 Window Operations15.5.1 Moving the Pane Location15.5.2 Switching the Tab of the Main Pane	15-13
 15.6 Selecting the Device to Connect 15.6.1 Configuring Servo Amplifier Communication Settings 15.6.2 Setting up the Servo Amplifier Connected to the GM1 Controlle 15.6.3 Editing Settings without Connecting to the GM1 Controller 	15-16 r 15-18 15-23
 15.7 Parameter Window	15-25 15-27 15-29 15-30 15-31
15.8 Object Window15.8.1 Configuration of Object Window15.8.2 Setting Objects	15-33
15.9 MINAS Parameters for the GM1 Controller	15-38
15.10 Monitor Window15.10.1 Configuration of Monitor Window15.10.2 Checking the Monitor Window	15-39
15.11 Alarm Window 15.11.1 Configuration of Alarm Window 15.11.2 Checking Alarms	15-43
 15.12 Other Functions	15-47 15-47
 15.13 Troubleshooting for Servo Amplifiers and Motors	15-49 15-49 15-50 15-50 15-50 15-51 15-51 15-51
Appendix Warranty / Cautions for Proper Use	Арр-1
Warranty Warranty Period Warranty Scope	App-2
Cautions for Proper Use	

(MEMO)

1 Before Using This Product

1.1	Safety Precautions	1-2
1.2	Handling Precautions	1-3
1.3	Software License Agreement	1-4

1.1 Safety Precautions

This section explains important rules that must be observed to prevent personal injury and property damage.

• Injuries and damages that may occur as a result of incorrect use are classified into the following levels and safety precautions are explained according to the level.

WARNING	Indicates that there is a risk of death or serious injury
	Indicates that there is a risk of minor injury or property damage

\otimes	Indicates an action that is prohibited
	Indicates an action that must be taken

	WARNING
0	• Take safety measures outside this product to ensure the safety of the entire system even if this product fails or an error occurs due to external factors.
\oslash	 Do not use this product in atmospheres that contain flammable gases. Doing so may result in explosion.
\bigcirc	 Do not throw this product into the fire. Doing so may cause the batteries or other electronic parts to explode.

	A CAUTION
0	 To prevent abnormal heat generation or smoke generation, use this product with some leeway from the guaranteed characteristics and performance values of the product.
\oslash	 Do not disassemble or modify this product. Doing so may result in abnormal heat generation or smoke generation.
\oslash	 Do not touch any terminals while the power is on. Doing so may result in electrical shock.
0	Configure emergency stop and interlock circuits outside this product.
0	 Connect wires and connectors properly. Failure to do so may result in abnormal heat generation or smoke generation.
\oslash	 Do not perform work (such as connection or removal) with the power turned on. Doing so may result in electrical shock.
0	• If this product is used in any way that is not specified by Panasonic, its protection function may be impaired.
0	This product has been developed and manufactured for industrial use only.

1.2 Handling Precautions

In this manual, the following symbols are used to indicate safety information that must be observed.

Stop	Indicates an action that is prohibited or a matter that requires caution.
	Indicates an action that must be taken.
f Info.	Indicates supplemental information.
Note	Indicates details about the subject in question or information useful to remember.
1 ₂ Procedure	Indicates operation procedures.

1.3 Software License Agreement

Software License Agreement

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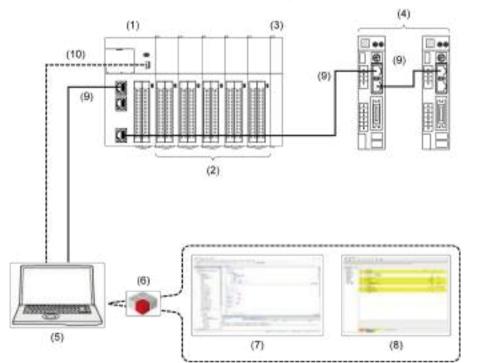
[Contact e-mail address: oss-cd-request@gg.jp.panasonic.com]

2 Operation Flow

2.1	System Configuration Diagram	2-2
2.2	Work Flowchart	2-4

2.1 System Configuration Diagram

The figure below shows the configuration of the GM1 series motion controller (controller and expansion units), servo amplifiers, and PC. GM Programmer and PANATERM Lite for GM communicate with the GM1 Controller via Gateway.



No.	Name
(1)	GM1 Controller
(2)	Expansion unit
(3)	End unit
(4)	Servo amplifier
(5)	PC (on which GM Programmer and PANATERM Lite for GM are installed)
(6)	Gateway, CodeMeter
(7)	GM Programmer
(8)	PANATERM Lite for GM
(9)	Ethernet cable ^(Note 1)
(10)	USB cable ^(Note 1)

(Note 1) Use either Ethernet cables or USB cables.

1 Info.

- To operate the system, you must install GM Programmer and PANATERM Lite for GM on the PC.
- When GM Programmer is installed, MINAS setup support software "PANATERM Lite for GM", Gateway (the application that connects GM Programmer and the GM1 Controller), and CodeMeter are installed at the same time.

2.2 Work Flowchart

The following table explains the workflow from installation of the GM1 controller through to its operation.

Step	Descrip	tion	Reference	
1	Install G	M Programmer and PANATERM Lite for GM.	"GM1 Controller EtherCAT User's	
2	Make pr	Make preparations for the servo amplifiers.		
	2-1	Connect the servo amplifiers and the PC.	Manual (Setup Edition)"	
	2-2	Install the USB driver on the PC.		
	2-3	Configure initial settings for the servo amplifiers.	_	
	2-4	Disconnect the servo amplifiers from the PC.		
3	Connec	t the GM1 controller and EtherCAT slaves.		
4	Connec	Connect the GM1 controller and the GM Programmer.		
	4-1	4-1 Connect the GM1 controller and the PC with a cable.		
	4-2	Create a new project.	1	
	4-3	Make communication settings.	_	
	4-4	Add and set up EtherCAT slaves.	_	
	4-5	Make basic settings of the EtherCAT axis	_	
	4-6	Connect the GM1 controller, PC, and EtherCAT slaves and perform an operation check.	_	
	4-7	Log in to the GM1 controller.		
	4-8	Log out from the GM1 controller.		
5	Connec	Connect the GM1 controller and PANATERM Lite for GM.		
	5-1	Set up the servo amplifier connected to the GM1 controller.		
	5-2	Write parameters to the servo amplifier.		
	5-3	Write objects to the servo amplifier.		
6	Prepare	Prepare for operation.		
	6-1	Check if safety circuit design is implemented.		
	6-2	Check wiring for each device.		
	6-3	Perform an operation check.		
7	Using th control,	e GM Programmer, make settings for GM1 parameters, motion unit control, and communication function.		
	7-1	Make settings for the GM1 controller.	"P.5-3"	
	7-2	Make settings for the motion control.	"P.5-5"	
	7-3	Make settings for the unit control.	"P.5-14"	
	7-4	Make settings for the communication function	"P.5-20"	
8	Create p	programs with GM Programmer.	"P.6-1"	
	8-1	Create objects (POU objects) for a program.	"P.6-14"	
	8-2	Select a programming language (LD, ST, SFC, FBD, IL, or CFC program) and enter a program.	"P.6-15"	

Step	Descri	ption	Reference
	8-3	Set variables.	"P.6-18"
9	Set up the GM1 controller in GM Programmer.		
	9-1	Make time setting.	"P.8-12"
	9-2	Log in to the GM1 controller.	"P.8-20"
	9-3	Log out from the GM1 controller.	"P.8-21"
	9-4	Upload the source.	"P.8-27"
10	Configu	ire security settings with GM Programmer.	"P.10-3"
	10-1	Configure user management settings.	"P.10-4"
	10-2	Configure encryption and signature settings.	"P.10-16"
	10-3	Configure write-protection settings.	"P.10-24"

(MEMO)

3 Overview of the GM Programmer

3.1 System Requirements3.1.1 Usage Environment of the GM Programmer	
3.2 Installation and Uninstallation3.2.1 Installing GM Programmer3.2.2 Uninstalling GM Programmer	3-3
3.3 Basic Operations.3.3.1 How to start.3.3.2 How to quit.	3-8
 3.4 Component Names 3.4.1 Menu Bar 3.4.2 Toolbar 3.4.3 Navigator Pane 3.4.4 Main Pane 3.4.5 Status Bar 	3-10 3-17 3-21 3-22
 3.5 Window Operations	3-25 3-27 3-28
3.6 Switching the Object Window3.6.1 Operating the Object Window	
 3.7 Other Functions 3.7.1 Option Setting Function 3.7.2 Display Language Setting Function 3.7.3 Online Help Function 3.7.4 Version Display Function 	3-32 3-33 3-34

3.1 System Requirements

3.1.1 Usage Environment of the GM Programmer

Programming software

Product name	Version	Applicable language
GM Programmer	Ver.1.1	Japanese / English / Chinese

(Note 1) When GM Programmer is installed, MINAS setup support software "PANATERM Lite for GM" is installed at the same time.

Software operating environment

Item	Description
OS	Microsoft(R) Windows(R) 10: 32 bit / 64 bit
PC	 PC with the following installed: Microsoft.NET Framework 4.6.1 or higher Microsoft Visual C++ 2010 SP1 Redistributable Package (x86) Microsoft Visual C++ 2010 SP1 Redistributable Package (x64) Microsoft Visual C++ 2013 Redistributable Package (x86) Microsoft Visual C++ 2013 Redistributable Package (x64) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x86) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x64)
HDD	At least 4 GB of free space
Memory	At least 8 GB
Communication port	LAN port (for Ethernet connection) USB 2.0 port (for USB connection)

3.2 Installation and Uninstallation

3.2.1 Installing GM Programmer

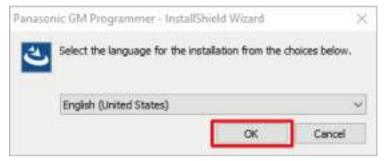
Before installing the GM Programmer on a PC, log on to the PC as an account with Administrator privileges.

If other applications are running, be sure to close all the applications before installing GM Programmer.

¹² Procedure

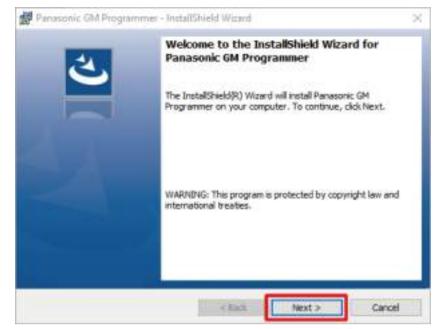
1. Double-click "setup.exe".

The following window will be displayed. Click [OK].



 The following window will be displayed. Click [Install]. The display content differs according to the PC environment that you use. (This window may not be displayed at all, depending on the situation.)

atus R	lequirement			
nding G	M_USB_Driver_Win	n10_x64		



3. The following window will be displayed. Click [Next].

 The following window will be displayed. Select [I accept the terms in the license agreement] and click [Next].

👹 Panasonic GM Programmer - InstallShield Wizard	×
License Agreement	1
Please read the following license agreement carefully.	S
	•
Software License Agreement	
Panasonic Corporation ("PANASONIC") grants to you this Software on condition that you accept this Agree read this Software License Agreement (this "Agree before using this Software. Only in case that y Agreement, you may start your use of this Software. Your unsealing the package of this Software, or you installing or launching this Software or the like shall be	ement. You must ement") carefully you accept this our downloading.
I accept the terms in the license agreement	Print
() I do not accept the terms in the license agreement	Open Source Licenses
< Back Next	> Cancel

5. The following window will be displayed. If you change the installation destination folder, click [Change] and specify a desired installation destination. If you do not change the installation destination folder, click [Next].

Panasor	ic GM Programmer - InstallShie	ld Wizard		8
12.22	on Folder			2
Click Ne:	it to install to this folder, or click Ch	ange to install t	to a different folder	
Pr	Install Panasonic GM Programmer	toc		
0	C:\Program Files (x86)\Panasonic	Corporation (G	M Programmer \	Change
nstaltihield	-		Next >	Cancel
		< Back	MEXC >	Carlos

6. The window below will be displayed. Click [Install] to start the installation.

👹 Panasonic GM Programmer - InstallShield Wizard	×
Ready to Install the Program	1
The wizard is ready to begin installation.	S
Click Install to begin the installation.	
If you want to review or change any of your installation settings, click Bar exit the wizard.	di. Click Cancel to
EAST OF PRANTS.	
Installibeid	
< Back Install	Cancel

7. The following window will be displayed while the installation is in progress.

3.2 Installation and Uninstallation

	a Panasonic GM Programmer gran features you selected are being installed.
17	Please wait while the InstallShield Waard installs Panasonic GM Programmer. This may take several einutes. Status:
nutal Shield	

Following this installation, the three packages below will be installed. (The segments indicated by * differ according to the version of the software.)

- CODESYS SoftMotion*.*.*.*_P
- GMPLibrary (*.*.*)
- PANATERM-Lite for GM V*.*

These packages take a long time to install. Take care not to click [Cancel] while the installation is in progress.

8. When the installation of all the packages is completed, the following window will be displayed. Click [Finish].



This completes the installation procedure.

i Info.

• When the GM Programmer is installed, PANATERM Lite for GM, Gateway (CODESYS Gateway), and CodeMeter applications are installed at the same time.

3.2.2 Uninstalling GM Programmer

¹ 2 Procedure

 From the Start menu, select Windows System>Control Panel, and then click "Uninstall a program".

A list of installed programs will be displayed.

2. Double-click "Panasonic GM Programmer". The following window will be displayed. [Yes]



 Click the [Yes] button. The GM Programmer will be uninstalled.



- When the GM Programmer is uninstalled, PANATERM Lite for GM and Gateway are also uninstalled at the same time.
- CodeMeter will not be uninstalled at this time. Uninstall it separately.

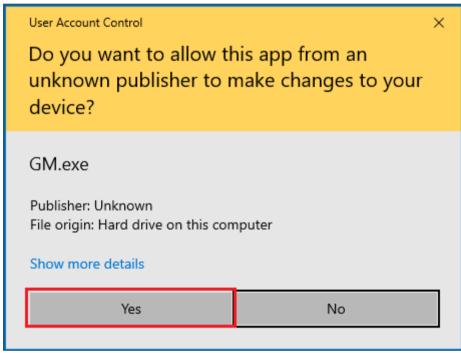
3.3 Basic Operations

This section explains how to start and quit GM Programmer.

3.3.1 How to start



 Click the [Start] button and select Panasonic Corpration>GM Programmer. The "User Account Control" dialog box will be displayed. Click [Yes].



GM Programmer will be started.



3.3.2 How to quit

• Before closing GM Programmer, be sure to save any project files that you are editing and must save.



!

Procedure

1. From the menu bar, select File>Exit.

If changes have not been saved, the following window will be displayed. If exiting without saving, select [No].

If changes need to be saved, select [Yes] to perform the save process.

GM Programmer			
0	The current project has been ch the changes?	anged. Do you	want to save
	jes	[19	Cancel

2. Click the [Yes] button.

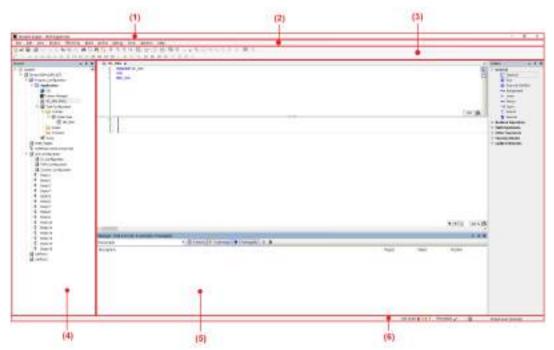
GM Programmer will be closed.



• You can also close GM Programmer by clicking the [x] button on the title bar.

3.4 Component Names

This section presents the name and display content of each component of GM Programmer.



No.	Name	Description
(1)	Title bar	The title bar displays the project file name, [minimize] button, [maximize] button, and [close] button.
(2)	Menu bar	The menu bar displays the menu commands for each purpose in list format.
(3)	Toolbar	The toolbar displays each command as an icon.
(4)	Navigator pane	The navigator pane displays the objects (such as devices, applications, and programs) added to the project in a tree structure.
(5)	Main pane	The main pane displays a program, function settings, messages, and other data. The window can be switched by selecting a desired tab.
(6)	Status field	The status bar displays the build status, logged-in users, and other information.

3.4.1 Menu Bar

The menu bar displays the following menus:

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>P</u> roject	FBD/LD/IL	<u>B</u> uild	<u>O</u> nline	<u>D</u> ebug	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp
--------------	--------------	--------------	-----------------	-----------	---------------	----------------	---------------	---------------	----------------	--------------

File

Item	Function
New Project	Creates a new project.
Open Project	Opens a project that is stored.

Item	Function
Close Project	Close the project that is currently viewed.
Save Project	Saves the project that is currently viewed, in overwrite mode.
Save Project As	Saves the project that is currently viewed, as a different file name.
Source Upload	Loads the project source code as a project archive.
Print	Prints the active editor screen.
Print Preview	Displays the active editor screen in print preview mode.
Page Setup	Opens the Page Setup dialog box to configure a print layout.
Recent Projects	Displays the recently used projects.
Exit	Closes GM Programmer.

Edit

Item	Function		
	Reverses the results of a previous editing action.		
Undo			
Redo	Allows the user to re	do the last editing action after Undo.	
Cut	Cuts data.		
Сору	Copies data.		
Paste	Pastes data.		
Delete	Deletes data.		
Select All	Selects all text.		
	Used to find and rep	lace a string.	
	ltem	Function	
	Find	Opens the "Find" dialog box.	
	Replace	Opens the "Replace" dialog box.	
	Find in Project	Opens the "Find" dialog box to find the target within the entire project.	
	Replace in Project	Opens the "Replace" dialog box to replace the target within the entire project.	
Find Replace	Find Next	Finds the next match from the selected cursor position within the project.	
	Find Next (Selected)	Finds the next match from the selected cursor position within the editor.	
	Find Previous	Finds the previous match from the selected cursor position within the project.	
	Find Previous (Selected)	Finds the previous match from the selected cursor position within the editor.	
	Toggle Field for Incremental Search	Searches for the character string within the POU editor each time a single character is entered.	
Browse	Used to browse the positions where the declaration part of a defined variable is referenced or used.		

Item	Function	
	Item	Function
	Go To Definition	Allows the cursor to move to the position where the variable or function specified by the cursor is defined within the editor.
	Browse Cross References	Allows the positions where the variable specified by the cursor is used to be displayed in the "Cross reference List" view.
	Browse Call Tree	Allows the callee and caller of the variable specified by the cursor to be displayed in the "Call Tree" view.
	Go To Reference	Displays the declaration position of the variable to which the pointer variable specified by the cursor refers.
	Go To Instance	Displays the instance of the function block specified by the cursor in the new editor.
Insert File as Text	Inserts the contents	of the specified text file in the cursor position.
	Executes functions r	elated to the text editor.
	Item	Function
	Overwrite Mode	Switches the text input mode from insert mode to overwrite mode.
	View Whitespace	Displays the control characters of spaces and tabs.
	View Indentation Guides	Inserts a broken line between indents when an indent is inserted in the program code.
	Go To Line	Displays a line number dialog box and moves the cursor to the specified line.
	Make Uppercase	Converts the selected character string in the text editor to uppercase letters.
Advanced	Make Lowercase	Converts the selected character string in the text editor to lowercase letters.
	Go to Matching Bracket	Moves the cursor to the corresponding bracket when the cursor is positioned in a bracket in the code.
	Select to Matching Bracket	Selects the entire code in brackets when the cursor is positioned in either of the brackets in the code.
	Expand All Folds	Unfolds the indented code segment.
	Collapse All Folds	Folds the indented code segment.
	Comment out selected lines	Comments out the selected line.
	Uncomment selected lines	Uncomments the selected line.
	Enable inline monitoring	Sets whether to enable or disable the function that displays the value of each variable on the code during online mode.

Item	Function			
		move to bookmarked locations. positions where the declaration part of a defined d or used.		
	Item	Function		
	Toggle Bookmark	Saves the position selected in the active editor as a bookmark.		
Bookmarks	Next Bookmark (active editor)	Moves to the previous bookmark in the active editor.		
	Previous Bookmark (active editor)	Moves to the next bookmark in the active editor.		
	Clear All Bookmarks (active editor)	Removes all bookmarks in the active editor.		
Input Assistant	types, or other data	elect variables, function blocks, operators, that can be inserted in the cursor position from t them in the cursor position.		
Function Block Guidance	Invokes the Function Block Guidance.			
Auto Declare	Opens the Auto Declare dialog box to support variable declaration.			
Next Message	Selects the next message in the message view.			
Previous Message	Selects the previous message in the message view.			
Go To Source Position	Moves to the position of the source code applicable to the message selected in the message view.			
Refactoring	Displays the positions where the changed variable name is used and allows changes to be made collectively.			

View

Item	Function		
Devices	Displays the device	view.	
POUs	Displays the POU vi	ew.	
Messages	Displays the messag	ge window.	
Element properties	Displays element pro	operties.	
ToolBox	Displays the toolbox		
	Displays the watch v	vindow.	
Watch	ltem	Function	
vvatch	Watch 1 to Watch 4	Displays a list of user-defined variables for the purpose of value monitoring.	
	Watch all Forces	Displays a list of value-forced variables.	
Cross Reference List	Displays the cross reference list window.		
Call Tree	Displays the call tree window.		
Bookmarks	Displays the bookmark window.		

3.4 Component Names

Item	Function
Breakpoints	Displays the breakpoint window.
Call Stack	Displays the call stack window.
Start Page	Displays the start page.
Full Screen	Displays the window in full-screen mode.
Properties	Displays the properties dialog box.

Project

Item	Function			
Add Object	Adds an object.			
Add Folder	Adds a folder.			
Edit Object	Allows the user to e	dit an object.		
Online Config Mode	Removes the application allows connection to	ations downloaded to the GM1 controller and the GM1 controller.		
Project Information	Allows the user to se information.	et project author information or check project file		
Project Settings	Allows the user to co	onfigure project-related settings.		
		anslate and register comments, titles, and other ogram to display the translated content in the		
	Item	Function		
Localization	Create Localization Template	Creates and saves a localization template.		
	Manage Localizations	Imports a localization template that has been created.		
	Toggle Localization	Switches the language in the project.		
Document	Allows the user to print the entire project.			
Compare	Compares the displayed project with the stored project.			
Commit accepted changes	Commits the difference between the objects compared by selecting Project>Compare from the menu bar.			
Export	Outputs an object from the displayed project as an XML file.			
Import	Imports an object into the displayed project.			
	menu commands an	rmissions for operations (such as executing id adding, editing, and deleting objects) to be oup in which users are registered.		
User Management	Item	Function		
	User Logon	Logs in to the displayed project.		
	User Logoff	Logs off from the displayed project.		
	Permissions	Logs off from the displayed project.		

Build

Item	Function
Build	Verifies the syntax of objects.
Rebuild	Verifies the syntax of all objects again.
Generate code	Generates application codes.
Clean	Deletes application build information.
Clean all	Deletes all application build information in the same way as "Clean".

Online

Item	Function				
Add USB Port	Adds a USB port as	Adds a USB port as a communication interface.			
Login	Downloads the applications generated by code generation to the GM1 controller at the time of login.				
Logout	Logs out from the de	evice to which the user logged in.			
Download	Downloads a progra	m while the user is logged in.			
Online Change	Allows the user to ch GM1 controller durin	nange applications without having to stop the g operation.			
Status	Allows the user to ch the GM1 controller.	neck any errors that are currently occurring in			
System Data History	Allows the user to ch controller.	neck any errors that occurred in the GM1			
Reset Warm	Initializes variables o variables.	other than the RETAIN and PERSISTENT			
Reset Cold	Initializes variables of	other than the PERSISTENT variable.			
Reset Origin	Initializes all variables. Removes active applications from the GM1 controller.				
Simulation	Allows the user to perform a login operation without connecting to the GM1 controller and check behaviors in the same way as if the user logged in.				
	Allows the user to configure user management, project encryption, and other settings.				
	Item	Function			
Security	Logoff Current Device User	Logs off the users who are logged in to the device.			
	Add Device User	Adds users who can log in to the device.			
	Change Password Device User	Changes the passwords of users who are logged in to the device.			
	Remove Device User	Removes users who can log in to the device.			
Operation Mode	Allows the user to prevent some debug operations from being executed.				

Item	Function	
	Item	Function
	Debug	Allows all debug operations to be executed.
	Locked	Prohibits some operations such as adding new breakpoints or forcing variable values.
	Operational	Prohibits any changes other than writing variables.

Debug

Item	Function	
Start	Starts the application.	
Stop	Stops the application.	
Single Cycle	Executes the application in every single cycle.	
New Breakpoint	Creates a new breakpoint.	
Edit Breakpoint	Allows the user to edit breakpoints.	
Toggle Breakpoint	Allows the user to set or delete breakpoints.	
Disable Breakpoint	Disables invalid breakpoints.	
Enable Breakpoint	Enables valid breakpoints.	
Step Over	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the next line.	
Step Into	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the first line of the called block.	
Step Out	When the program is executed within the called block, the execution continues until control returns to the calling block. When the program is executed outside the called block, the execution continues until control returns to the beginning of the program.	
Run to Cursor	Executes the program up to the line specified by the cursor.	
Set next Statement	Regards the line specified by the cursor as the next statement to be executed and skips processes over to that line.	
Show next Statement	Jumps the cursor to the program line to be executed as the next step.	
Write Values	Sets a value (to be changed later) only once. This value can then be changed by the program.	
Force Values	Sets a value to be changed in every cycle and maintains the value.	
Unforce Values	Cancels forced value change	
Toggle Flow Control Mode	Performs monitoring by using different colors in positions where the program is executed and in positions where the program is not executed.	
Display Mode	Allows the user to select binary, decimal, or hexadecimal as the display format of the variable value to be displayed.	

Tools

Item	Function
PANATERM Lite for GM	Allows the user to select a device to which PANATERM Lite for GM is to connect.
Library Repository	Allows the user to install a created library in the library repository in order to use the functions or function blocks in the library.
Options	Allows the user to set up each function of GM Programmer.

Window

Item	Function
Next Editor	Displays the next window.
Previous Editor	Displays the previous window.
Close All Editors	Closed all windows.
Reset Window Layout	Resets the layout of the window to its initial state.
New Horizontal Tab Group	Moves the selected window downward.
New Vertical Tab Group	Moves the selected window to the right.
Float	Sets the selected window in a floating state.
Dock	Sets the selected window in a docking state.
Auto Hide	Minimizes the window.
Next Pane	Switches the pane between the declaration section (first pane) and the implementation section (second pane).
Previous Pane	Switches the pane between the declaration section (first pane) and the implementation section (second pane).
Window	Displays a list of open windows.

Help

Item	Function
Manual	Displays the CODESYS manual.
About	Displays version information.

3.4.2 Toolbar

The toolbar displays the following icons:

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Name	lcon	Function
New Project		Creates a new project.

Name	Icon	Function
Open Project		Opens a project that is stored.
Save Project		Saves the project that is currently viewed, in overwrite mode.
Print		Prints the active editor screen.
Undo	*)	Reverses the results of a previous editing action.
Redo	~	Allows the user to redo the last editing action after Undo.
Cut	×	Cuts data.
Сору	Ra I	Copies data.
Paste	6	Pastes data.
Delete	×	Deletes data.
Find	dth	Searches for a particular character string that appears in the active editor.
Find Replace	C.E	Searches for a particular character string that appears in the active editor and replaces it with another character string.
Find in Project	1	Searches for a specified character string within the current project.
Replace in Project	1	Searches for a specified character string within the current project and replaces it with another character string.
Toggle Bookmark	Ħ	Saves the position selected in the active editor as a bookmark.
Previous Bookmark (active editor)	**	Moves to the previous bookmark in the active editor.
Next Bookmark (active editor)	*	Moves to the next bookmark in the active editor.
Clear All Bookmarks (active editor)	×	Removes all bookmarks in the active editor.
Function Block Guidance	100	Displays the Function Block Guidance.

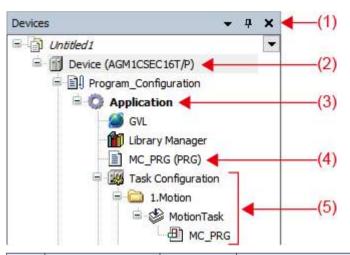
Name	Icon	Function
Properties	中	Displays the properties.
Add Object	-	Adds an object.
Edit Object	D,	Opens an object.
Build	Ħ	Compiles an object in the application.
Login	05	Downloads the applications generated by code generation to the GM1 controller at the time of login.
Logout	C)	Logs out from the device to which the user logged in.
Start	- b-	Starts the application.
Stop	=	Stops the application.
Online Config Mode	*	Removes the applications downloaded to the GM1 controller and allows connection to the GM1 controller.
Step Over	ÇШ	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the next line.
Step Into	(a)	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the first line of the called block.
Step Out	e.ill	When the program is executed within the called block, the execution continues until control returns to the calling block. When the program is executed outside the called block, the execution continues until control returns to the beginning of the program.
Run to Cursor	*3	Executes the program up to the line specified by the cursor.
Set next Statement	20	Regards the line specified by the cursor as the next statement to be executed and skips processes over to that line.
Show next Statement	ф	Jumps the cursor to the program line to be executed as the next step.
Toggle Localization	题	Switches the language to the one enabled in [Default Localization] in the window displayed by selecting [Project

Name	Icon	Function
		Localization] and then [Manage Localizations] from the [Project] menu.
Commit accepted changes	24	Commits the difference between the objects compared by selecting the [Project] > [Compare] from the menu bar.
Insert Network	622	Inserts an empty network.
Toggle network comment state	6-17	Changes the comment status of the selected network.
Insert Assignment	~1WR	Inserts a new assignment in the specified position.
Insert Coil	43	Inserts a coil in the specified position.
Insert Set Coil	-	Inserts a set coil in the specified position.
Insert Reset Coil	-00-	Inserts a reset coil in the specified position.
Insert Contact	4.6	Inserts a normally open contact in the specified position.
Insert Negated Contact	-8/0-	Inserts a normally closed contact in the specified position.
Insert Contact (right)	ñ	Inserts a normally open contact on the right side of the specified position.
Insert Contact Parallel (below)	$i_{\rm H}$ ${\rm B}^2$	Inserts a normally open contact below and in parallel with the contact at the specified position.
Insert Negated Contact Parallel (below)	$\iota_{\mathbb{R} \setminus \mathbb{S}^2}$	Inserts a normally closed contact below and in parallel with the contact at the specified position.
Insert Contact Parallel (above)	$_{1}0\ B_{1}$	Inserts a normally open contact above and in parallel with the contact at the specified position.
Insert Box	•	Opens the Input Assistant to insert a box in the specified position.
Insert Empty Box	•	Inserts an empty box in the specified position.
Insert Box with EN/ENO	•	Opens the Input Assistant to insert a box with EN/ENO in the specified position.
Insert Empty Box with EN/ENO	•	Inserts a box with EN/ENO in the specified position.

Name	Icon	Function
Insert Jump	->	Inserts a jump in the specified position.
Insert label		Inserts a label in the selected network.
Insert Return	-	Inserts a return value in the specified position.
Insert Input	-	Adds an input to the specified box.
Negation		Adds a negation to the selected element.
Edge Detection	19	Adds an edge detection (rising edge detection) to the selected element.
Set/Reset	-81	Converts the selected coil to a set coil or reset coil.
Set output connection	ŀ	Converts box output to forwarding box output.
Insert Branch	T	Inserts a branch on the right side of the selected contact.
Insert Branch below	-AF	Inserts a new branch below the selected branch.
Insert Branch above	-St	Inserts a new branch above the selected branch.
Set Branch Start/End Point	45	Sets the selected line as the branch starting point.

3.4.3 Navigator Pane

The navigator pane displays the following tree:



No.	Name	lcon	Function
(1)	Window Position	•	 New Horizontal Tag Group Moves the selected window to the right. New Vertical Tag Group Moves the selected window downward. Float Sets the selected window in a floating state. Dock Sets the selected window in a docking state. Auto Hide Minimizes and hides the navigator pane.
	Auto Hide	4	Always shows the navigator pane.
		P	Minimizes and hides the navigator pane.
	Close	×	Closes the navigator pane.
(2)	Device object		Sets up device objects.
(3)	Application object		Sets up application objects.
(4)	Program object (POU o	bject)	Sets up program objects (POU objects).
(5)	Task object		Sets up task objects.

3.4.4 Main Pane

The main pane displays the following sub-panes:

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e Persegen Te Persegen Description		TOursellin_1	onnergio <mark>(O Tonessignio) 3</mark> Object	t)+l4, (mmm.)A + # + Poster		
					Presenter 19 Feation	

No.	Name	Function			
(1)	Declaration section (first pane)	Allows the user to declare variables.			
(2)	Implement section (second pane)	Allows the user to enter a program.			
(3)	Message view	Displays any error or warning messages.			
(4)	ToolBox	Allows the user to place elements in the implementation section by selecting them and then dragging and dropping them in the implementation section.			

3.4.5 Status Bar

The status bar displays the following icons:					
Last build: 😮 0 🕐 0 🛛 Precompile 😋		Project user: (nobody)			
Name	Icon	Function			
Last Build	82	Displays the number of errors in the results of the build process.			
	<u>301</u>	Displays the number of warnings in the results of the build process.			
Precompile	_	Displays the results of the precompile process.			

3.4 Component Names

Name	lcon	Function
Application Information	ж	Compares the application information of the displayed project with the application information downloaded to the GM1 controller.
Project user	_	Displays the users who are logged in to the displayed project.

3.5 Window Operations

This section explains operations related to common windows for GM Programmer.

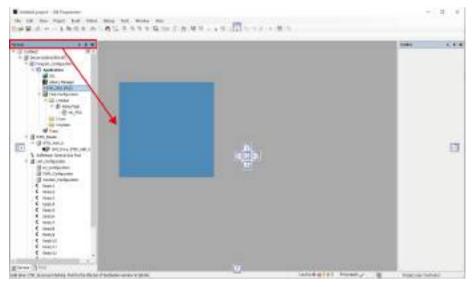
3.5.1 Moving the Pane Location

You can freely change the layout of each window for GM Programmer.

For example, use the following procedure to move the navigator pane from the left edge to the right edge of the window.



 Click the title bar of the navigator pane and then drag it to the main pane. The navigator pane will stay in a floating state and arrows indicating movable directions will be displayed.

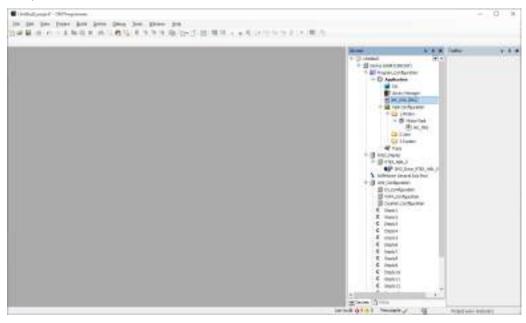


2. Drag the navigator pane in the direction in which you want to move it. The relocation destination will be displayed in light blue.

Note that the set of the		- 8.4
		of this arrow in insumed
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3. Release the left mouse button.

The navigator pane will be docked into the existing pane and the relocation will be completed.



f Info.

- You can return the changed layout of the window to its initial state.
- From the menu bar, select Window>Reset Window Layout.
- You can put a pane in a floating or docking state. To put a pane in a floating state, select **Window>Float** from the menu bar. To put a pane in a docking state, right-click the title bar in the window in a floating state and then select Dock from the context-sensitive menu that is displayed.

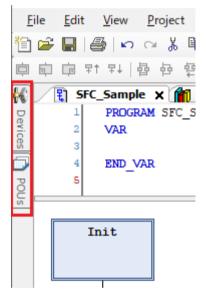
3.5.2 Showing / Hiding Panes

You can normally hide the navigator pane and some sub-panes in the main pane and show them only when you use them.

Showing / hiding the navigator pane

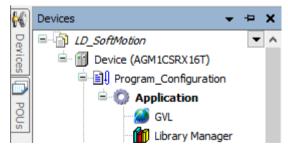
¹₂ Procedure

 Click on the title bar of the navigator pane. The navigator pane will be minimized and hidden.



2. Click the minimized pane.

The navigator pane will be displayed. Clicking in another pane automatically hides the navigator pane again.



3. Click in on the title bar of the navigator pane. The navigator pane will always be displayed.

1 Info.

• You can also hide the navigator pane from the menu bar. From the menu bar, select **Window>Auto Hide**. To always display the navigator pane again, select **Window>Auto Hide** again from the menu bar.

3.5.3 Switching the Tab of the Main Pane

You can switch the tab of the main pane.

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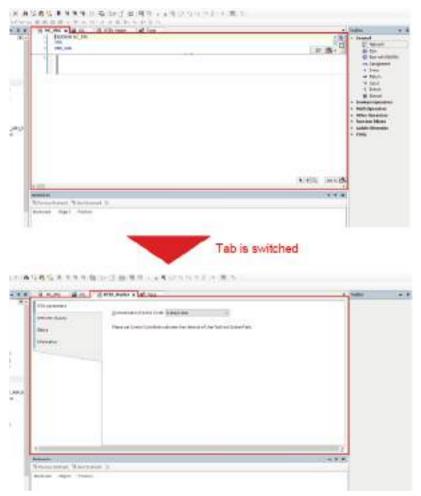


 Press the shortcut keys "Ctrl+Tab" simultaneously. The window for switching the tab of the main pane will be displayed.

Active Views	Active Editors	
Carton	A HC BBS	
10 Toolice	Dhart AT_Hatter_SaftHotor	1
	■ 04.	
	42 ⁴ 11348	

- 2. While holding down the "Ctrl" key, press the "Tab" key until the desired tab is selected.
- **3.** Release the "Ctrl" key.

The current tab will be switched to the selected tab.



3.5.4 Full-screen Display

You can display each window of GM Programmer in full-screen mode.

¹² Procedure

- From the menu bar, select View>Full Screen.
 Then GM Programmer window will be displayed in full-screen mode.
- From the menu bar, select View>Full Screen again.
 Then GM Programmer window will return from full-screen mode to normal display mode.



• You can also switch to full-screen mode by pressing shortcut keys "Ctrl+Shift+F12" simultaneously.

3.6 Switching the Object Window

Double-clicking an object added to the navigator pane displays its window in the main pane. You can open multiple objects in the main pane and switch to each of their windows using the tab.

3.6.1 Operating the Object Window

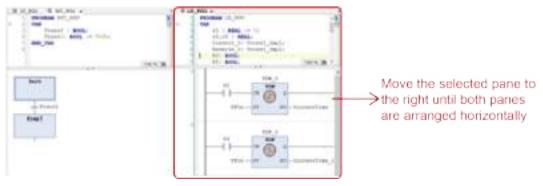
The following operations can be performed on the object window displayed in the main pane.

Operation	Menu	Shortcut keys
Displaying the next window	Window>Next Editor	<ctrl> + <f6></f6></ctrl>
Displaying the previous window	Window>Previous Editor	<ctrl> + <shift> + <f6></f6></shift></ctrl>
Closing all windows	Window>Close All Editors	None
Moving the selected window downward	Window>New Horizontal Tab Group	None
Moving the selected window to the right	Window>New Vertical Tab Group	None

<Moving the selected window downward (New Vertical Tab Group)>



<Moving the selected window to the right (New Horizontal Tab Group)>



3.7 Other Functions

3.7.1 Option Setting Function

GM Programmer allows the user to set up each function from the "Options" dialog box. The settings will be applied to all projects created with GM Programmer.

¹ ₂ Procedure

1. From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.

ptions	
CreCenter Dobugging Declaration Editor Device entror FBD, LD and IL editor FBD, LD and IL editor Load and Save FMonitoring FBD, Editor SFC editor SFC editor FS ShertCoding Text editor	General Wass Print Image: Chable AutoConnect When you drop elements somewhere on the canvas, unconnected pins that are touching each other are subornatically connected if this feature is activated. This can be helpful for quick editing, but be careful that you are not moking connections accidentally by moving elements around.) Prepare values in implementation part
1	DK Cancel

No.	Name	Function
(1)	Categories pane	Displays option categories.
(2)	Setting pane	Displays the settings of the selected category and allows the user to configure settings.

Option categories

Category name	Function	Reference page
CFC Editor	Allows the user to configure settings related to editing and printing CFC programs.	-

Category name	Function	Reference page
	Allows the user to configure settings related to editing,	"P.7-11"
FBD, LD and IL editor	commenting, and printing FBD, LD, and IL programs.	"P.7-32"
SFC editor	Allows the user to configure settings related to the sizes and fonts of SFC editor elements, the behavior at the time of action element insertion, the display of embedded objects in the navigator pane, the display of properties, stepwise execution time during online operation, and other items.	"P.7-23"
	Allows the user to configure settings related to the	"P.7-15"
SmartCoding	functions for supporting program creation, such as	"P.6-5"
	Input Assistant.	"P.7-51"
Text editor	Allows the user to configure settings related to program editing and inline monitoring.	"P.9-15"
Device editor	Allows the user to configure settings related to displays for the device editor.	-
Debugging	Allows the user to configure settings regarding whether to restore breakpoints after resetting.	-
Monitoring	Allows the user to configure settings related to displays for monitoring.	-
Refactoring	Allows the user to configure settings for the valid range of refactoring.	"P.7-52"
Load and save	Allows the user to configure settings regarding whether	"P.4-25"
Luau anu save	to enable backup and auto saving of project files.	"P.4-27"
International Settings	Allows the user to set a display language for GM Programmer and PANATERM Lite for GM, as well as a display language for the manual.	"P.3-33"
Declaration Editor	Allows the user to configure settings related to the display format (text format or table format) for the declaration section.	"P.6-3"

- Select a desired category from the Categories pane.
 The setting items for the selected category will be displayed in the setting pane.
- **3.** Change the setting items as appropriate and click the [OK] button. The setting items will be applied.

3.7.2 Display Language Setting Function

This function allows the user to change the display language setting for GM Programmer. The default setting is the same language as the one used in the operating system. If you want to use a different language from the one used in the operating system, change the display language setting. After you change the language setting, you must restart GM Programmer.

¹² Procedure

1. From the menu bar, select **Tools>Options**.

The "Options" dialog box will be displayed.

 Select "International Settings" from the Categories pane. The "International Settings" pane will be displayed.

Creditor	International Settings
Debugging Declaration Editor Device editor FBD, LD and IL editor FBD, LD and IL editor International Sectings International Sectings Monitoring Refactoring SFC editor SinertCoding Text editor	User Interface Language SpaceFic language: Pease note: Chasging the user interface language will not be effective until this application is restarted. Some components may not be available in the selected language and will then appear in their default culture (typically English). Help Language Same as user interface language Same as user interface language

- 3. Select User Interface Language>Specific language option and specify a desired language in the field.
- 4. Click [OK].

The "Options" dialog box will be closed. At this stage, the language has not been changed yet.

 Close GM Programmer and then start GM Programmer again. After GM Programmer is started, the selected language takes effect.



• The display language setting of GM Programmer is linked with that of PANATERM Lite for GM. Therefore, if the display language setting of PANATERM Lite for GM is changed, the display language setting of GM Programmer will also be changed automatically.

3.7.3 Online Help Function

This function allows the user to open the manual and check information such as operating methods.

¹² Procedure

1. Press the [F1] key.

Online help will be started and the page corresponding to the displayed window will be displayed.

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Contenta • # X	CODESYS Development System		d b 🗙
ili 🌸 CODESYS Development System	CODESYS Development Syste	m	2
	CODESYS Develop	ment System	
		35-Smart Software Solutions GmbH	
		This help corresponds to CODESYS V3.5 SP15	
	CODESYS	Last update: July 2019	
		www.codesys.com	
	₩ Uning CODESYS Help		
		-1	
¢ >	■ Features		
Contents 🚺 Index			
Ready			154

i Info.

• You can also start online help by selecting **Help>Manual** from the menu bar.

He	lp	
9	Manual	Ctrl+Shift+F1
	About	

3.7.4 Version Display Function

This function allows the user to check the version, license, and other information for GM Programmer.



1. From the menu bar, select **Help>About**.



2. Click a desired button at the bottom of the window.

Button	Description
Version Info	Displays information about the plug-ins that have been applied and the operating system of the PC that is used.
License Info	Displays license information for the software used by GM Programmer.

Clicking the [Version Info] button displays the "Version Info" dialog box.

UM Postratimer VI.1		
Component	Wester	A
Vection Colling	50158	
Action Object	0.0.15.8	
Alarre Configuration Editors	10101	
Alarm Gonfiguration Objects	38.15.40	
Application Object	10108	
A RIN Codegoneratur	28158	
A FINI 4 Codeparator	251540	
AutoDeclare	2816.00	
Elisary Archive	38188	
Book walks	0.615.8	
Broal-points	16161	
BronselOs e manda	281530	
Build Conwented	8.51.5.8	
Care Editor	1.8.3,8	
Care Suplementation Object	11.58	
CFC Editor	11/58	
CPC implementation Object	25155	
CMC Editor	1.0.3.0	
CHC function blocks	10.18	
Codepensator for sell-18 architecture	83358	
Operatine System:		
Ge Version / Microsoft We	down NT HEO.	18183.8
MET Uninity dif a later		

Clicking the [License Info] button displays the "License Information" dialog box.

La case Information	×
The product woorparates the following software: (1) the activates developed independently by or for Parabonic Corporation; (2) the activates overable that parts and learnand to Parabonic Corporation; (3) the software located under the BNU General Public Learna, Version 21 (USPL V28); (4) the activate located under the BNU General Public Learna, Version 21 (USPL V28); (4) the activates located under the BNU General Public Learna, Version 21 (USPL V28); (5) open source software of the family the activates located under the BNL V20, (GPL V20, GPL V21); (5) open source software of the family file software located under the GPL V20, (GPL V21); (5) open source software of the family file software located under the GPL V20, (GPL V21); (5) open source software of the family file software located under the GPL V20, (GPL V21); (5) open source software located under the software located under the GPL V20, (GPL V21); (5) open source software located under the software located under the GPL V20, (GPL V21); (5) open source software located under the software located under the GPL V20, (GPL V21); (5) open source software located under the software located under the GPL V20, (GPL V21); (5) open source software located under the software located under the GPL V20, (GPL V21); (5) open source software located under the software located under the GPL V20, (GPL V21); (5) open software located under the GPL V21; (5) open software located under the GPL V21; (5) open software located under the software located under the GPL V20, (GPL V21); (5) open software located under the software located under the GPL V20, (GPL V21); (5) open software located under the software located under the GPL V20, (GPL V21); (5) open software located under the GPL V21; (5) open software located under the GPL V	-
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The settinger categorized as (3) - (5) are distributed in the hope that it will be useful but WETHOLIT ANY WARRANTY, without even the implied earning of MERCHARTABELITY or PERCERT FOR A PARTICULAR PUPPOLE.	
At least three years from delivery of products. Penasonic will size to any third party relix contact us at the contact information provided balley, for a charge no more than our cost of physically performing source code distribution, o complete eachieve readable copy of the corresponding -source code converted under OPULOPL. Please code that we convert respond to any insultance integrating the costnor code.	
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4 Project Operations

4.1 Creating a New Project	.4-2
4.2 Saving a Project	.4-5
4.3 Opening a Project	.4-6
4.4 Closing a Project	.4-7
4.5 Device Tree Configuration	.4-8
4.6 Project Configuration	.4-11
4.7 Adding an Object	.4-12
4.7.1 Adding Objects	4-13
4.7.2 Adding Devices	4-17
4.8 Setting up A Project	.4-19
4.9 Exporting and Importing Objects	.4-21
4.9.1 Exporting Objects	
4.9.2 Importing Objects	
4.10 Creating a Backup when a Project Is Saved	.4-25
4.11 Automatically Saving Project Files	.4-27
4.12 Printing a Project	.4-29
4.13 Printing an Object within a Project	.4-31
4.14 Comparing Projects	.4-32
4.14.1 Project Comparison Method	
4.14.2 Merging Differences	

4.1 Creating a New Project

When creating a program using GM Programmer for the first time, create a new project. For the new project, set a device and a programming language to be used.

This section describes how to create a new project.

Given below is an example that explains the procedure to create a project for the GM1 Controller (product number: AGM1CSEC16T/P) in Structured Text (ST) format.

¹² Procedure

1. Start GM Programmer.

For details on how to start GM Programmer, refer to "3.3.1 How to start". When GM Programmer is started, the Start Page will be displayed.

- 11 T		
	Panasonic	
	Control GM Programmer	and a standard and a
	The second second	
-		

 Select "New Project" under "Basic Operations". The "New Project" dialog box will be displayed.

New Pro		Templates
: 🗀 Lib	oraries ojects	Standard project
A project c	ontaining one device, one a	application, and an empty implementation for MC_PRG
	la set te	
<u>N</u> ame	Untitled 1	

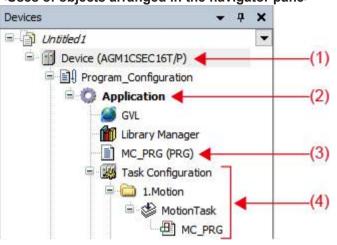
- **3.** Select **Projects**>**Standard project**, and specify a project file name in the "Name" field and a project storage location in the "Location" field.
- 4. Click the [OK] button.

The "Standard project" dialog box will be displayed.

Standard Pr	roject		×
		ndard project. a device and programming language.	
Device(D):	AGM1CSEC16T/P (Panasonic Corporation)	~
Version(<u>v)</u> :	1.1.1.0	~
Program	in(<u>P</u>):	Structured Text (ST)	~
		ОК	Cancel

5. Select "AGM1CSEC16T/P(Panasonic Corporation)" in the "Device" field and "Structured" in the "Program in" field, and click the [OK] button.

A new project will be created. Device and other objects including objects for ST programs are arranged in the navigator pane.



<Uses of objects arranged in the navigator pane>

No.	Name	Function
(1)	Device object	Sets up device objects.
(2)	Application object	Sets up application objects.
(3)	Program object (POU object)	Sets up program objects (POU objects).
(4)	Task object	Sets up task objects.

i Info.

• A new project can also be created from the menu bar by selecting File>New Project.

4.2 Saving a Project

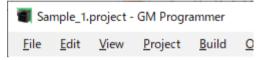
Save a project that is created. The project will be saved as a file with extension "".project"". Unsaved projects are indicated by "*" on the right side of their project file names on the title bar.

👅 Sar	mple_1.	projec *	- GM Prog	rammer
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>P</u> roject	FBD/LD/ <u>I</u> L

¹² Procedure

 From the menu bar, select File>Save Project, or press the shortcut keys "Ctrl+s". A project that has been created will be saved.

"**" displayed on the right side of the project file name will disappear.



1 Info.

- Before saving a project, you can change its project name. From the menu bar, select **File>Save Project As**.
- Project files can be saved automatically. For details, refer to "4.11 Automatically Saving Project Files".
- Before updating a file, you can save it as a backup file. For details, refer to "4.10 Creating a Backup when a Project Is Saved".

4.3 Opening a Project



1. From the menu bar, select File>Open Project. The "Open Project" dialog box will be displayed.

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-	langie, i	6	3030/11/08 15:22	Elle Gulder
	Sample_4		2039/10/09 15:52	File felder
Denticp	Sample, 3		2520/11/09 15:22	Title fielder
TeaPC Padwork				
	* (1000
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		LI One har read-one		

2. Select a project file and click the [Open] button. The selected project file will be opened.

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	* 2			29
	Nacima	Oversta Standa et		- 100
	Hei ofges	Property Name and		- Dealert
	0.000.00000	LI Open arrest-one		and a subset

4.4 Closing a Project



1. From the menu bar, select File>Close Project. The project that has been created will be closed.

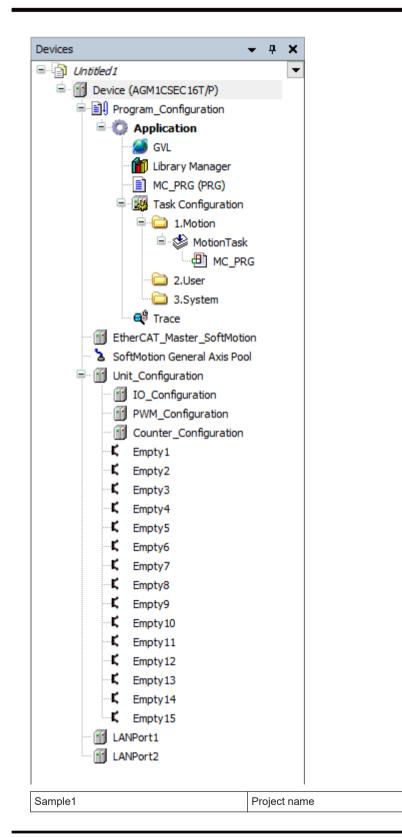


• If you select "Close Project" without saving a project file that has been updated, a confirmation dialog box will be displayed, asking whether to save the project. Click the [Yes] button to save the project.

UN Progr	ammer			2
0	The current proje the changes?	ect has been cha	nged. Do you	want to save

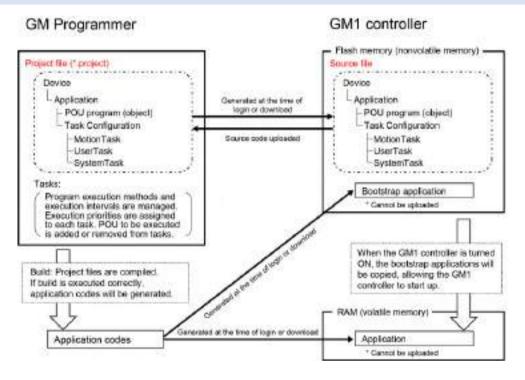
4.5 Device Tree Configuration

When a new project is created, it is started in the device tree configuration shown below.



Device	GM1 controller device
Program Configuration	Object that defines applications including source codes
Application	Application object
GVL	Global variable object
Library_Manager	List of all libraries linked to the project
MC_PRG(PRG)	Main program
Task Configuration	Configuration of tasks invoking application programs
1.Motion	User program tasks for motion control
MotionTask	
MC_PRG	
2.User	User program task for any control other than motion control
3.System	Task used by the system
Trace	Object that monitors variable data graphically
EtherCAT_Master_SoftMotio	Object that is the parent node of servo amplifiers for EtherCAT
SoftMotion General Axis Pool	Object that is an interface for inserting a free drive unit
Unit_Configuration	Object that is the parent node of I/O related devices
IO_Configuration	General-purpose I/O incorporated in GM1 controller
PWM_Configuration	PWM output incorporated in GM1 controller
Counter_Configuration	High-speed counter incorporated in GM1 controller
Empty1	Objects for adding I/O for expansion unit
Empty2	
Empty3	
Empty4	
Empty5	
Empty6	
Empty7	
Empty8	
Empty9	
Empty10	
Empty11	
Empty12	
Empty13	
Empty14	
Empty15	
LAN Port1	Objects that are the parent node of devices that use the Ether
LAN Port2	protocol

4.6 Project Configuration



4.7 Adding an Object

Check the following list for objects that can be added.

Addition source	Added object
Device	DeviceTrace
Application	CNC program
POU	CNC setting
	DUT
	POU
	Interface
	Cam table
	Global variable list
	Trace
	External file
	Persistent variable
	POU for implicit checks
POU	Action
	Transition
	Property
	Methods
Interface	Interface property
	Interface method
Global Variables	Property
Persistent variable	Property
MotionTask	Program call
"2.User" folder	User task

Check the following list for devices that can be added.

Addition source	Added device
Device	Modbus COM
EtherCAT_Master_SoftMotion	Various EtherCAT slaves can be selected.
SoftMotion General Axis Pool	SM_FreeEncoder SM_Drive_Virtual
Unit_Configuration or Empty1 to Empty15	AGM1X64D2 AGM1Y64T AGM1Y64P AGM1XY64D2T AGM1XY64D2P AGM1AD8 AGM1DA4 AGM1PG04T AGM1PG04L
LAN Port1	Modbus TCP Master ModbusTCP Slave Drive

Addition source	Added device
LAN Port2	Modbus TCP Master
	ModbusTCP Slave Drive
	EtherNet/IP Scanner
	EtherNet/IP Adapter
Modbus TCP Master	Modbus TCP Slave
EtherNet/IP Scanner	Remote adapter for each device can be selected
EtherNet/IP Adapter	EtherNet/IP Module
Modbus COM	Modbus Serial Device
	Modbus Master, COM Port
Modbus Master, COM Port	Modbus Slave COM Port

4.7.1 Adding Objects

Program creation objects (POU objects) and objects with various functions can be added to applications within a project.

For example, use the following procedure to add POU objects for ST programs.

¹² Procedure

1. Right-click the [Application] object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

Devices	- 0 ×				
Sample7 Sample7 Brvice (ADMSCSECS67,P) Fill Program_Configuration	560	12	Parte		Global Variable List
- O Application		-	Add Object	-2	Interface
GML .		10	Add Folder		Persistent Variables
		05	Login	8	POU. POU for implicit checks
			Delete application from device		2

The "Add POU" dialog box will be displayed.

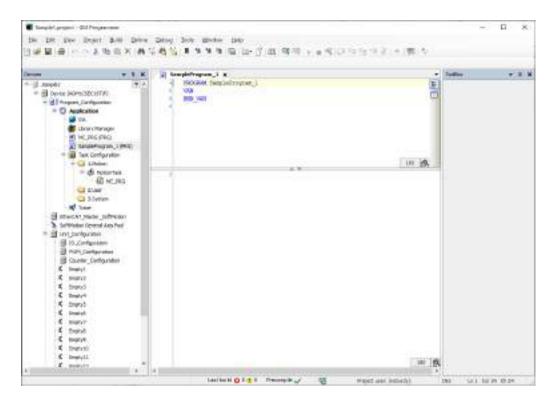
4.7 Adding an Object

Create a new	/ POU (Program Org	enizetice Unit)	
Name			
200			
Type			
Reogram			
O Function bloc	ck.		
Extends		1.	11
		-	
(ind)			
Access specific	er.		111
11.11.2 P. 1.1			В.,
Ladder Logic D	mentation language		1
Eunction	CARL CARL		
Estum type			1
Implementation Jan;	guage		
(mpressionistic production)	Chart (CPC)		v

2. Enter a program name in the "Name" field, select a programming language from the "Implementation Language" drop-down list, and click the [Add] button.

Name SampleProgram_1		_
Type		
Program		
O Function blo	eck .	
Extends		124
Implament	40 Ú.,	
- Faul	Abouter.	
Access specif	ier	
Matka d imple	mentation language	
Controleus Pu	incline Chart (CFC)	3
Eunction		
Estum type		in the second second

A [POU] object for the programming language selected in the "Implementation Language" drop-down list will be added to the navigator pane.

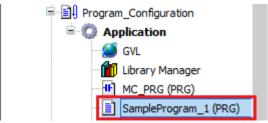


1 Info.

- You can also add objects by selecting the [Application] object in the navigator pane and then selecting **Project>Add Object** from the menu bar.
- To remove an object, select the object in the navigation pane and then press the "Delete" key or right-click the object and then select "Delete" from the context-sensitive menu that is displayed.
- You can add folders under the [Application] object in the navigation pane. By adding objects under each folder, you can create a hierarchical structure.

Right-click the [Application] object in the navigator pane and then select "Add Folder" from the context-sensitive menu that is displayed. The "Add Folder" dialog box will be displayed. Enter a folder name and click the [OK] button.

Example: When a [POU] object is added under an added folder (program for project A)



• You can also add an object for creating functions and function blocks. For details, refer to "6.6 Function and Function Block".

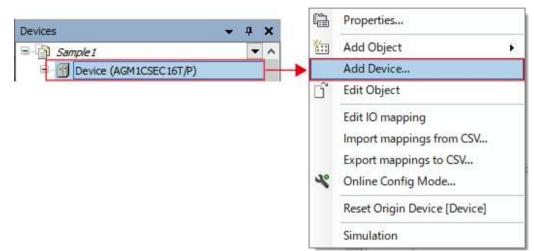
4.7.2 Adding Devices

You can add a device to the devices within the project.

For example, use the following procedure to add a Modbus COM device to Device (AGM1CSEC16T).

¹² Procedure

1. Right-click "Device (AGM1CSEC16T)" in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



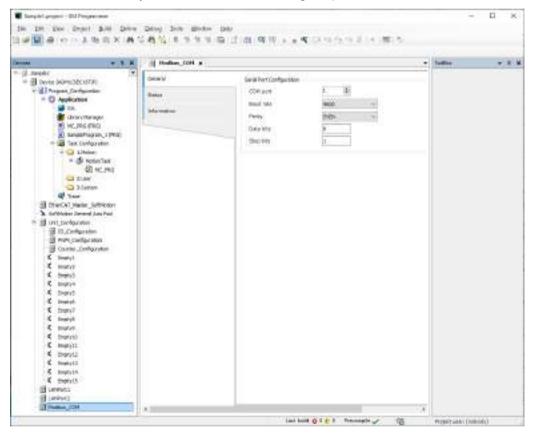
The "Add Device" dialog box will be displayed.

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Norre: In III Induses IIII Nodus Deal Part IIII Nadus (201	
Network 1	
	Add Deviter Ganeel

2. Select "Modbus COM" and click the [Add Device] button.

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I SHE Modeum	
- Mit Neders Sond Part	
Matura COM	
Network Mudbur_COM	
	Add Deviter Canel

The "Modbus COM" object will be added to the navigator pane.



4.8 Setting up A Project

Projects can be set up using the "Project Settings" dialog box. The settings will be applied to only the project that is set up.

¹² Procedure

1. From the menu bar, select **Project>Project Settings**. The "Project Settings" dialog box will be displayed.

** Comple options	Compile options
 Complex warnings Prope Setup Security SEC 	Complex Version 3.5.15.40 ~
SoftMotion Static Analysis Light Static Analysis Light Liters and Groups	Settings Setting Settings Settings Settings Settings S
	Complex Workings Meximum sumber of warmings 200
•	

No.	Name	Function
(1)	Categories pane	Displays project setting categories.
(2)	Setting pane	Displays the settings of the selected category and allows the user to configure settings.

Project setting categories

Category name	Function	Reference page
SFC	Allows the user to configure settings related to variables used in SFC and code generation.	"P.7-23"
SoftMotion	Displays the version of the SoftMotion package.	"P.5-11"
Sraric Analysis Light	Allows the user to configure settings regarding whether to enable code analysis during code generation.	-
Compiler warnings	Allows the user to configure settings regarding whether to enable warnings output during build.	"P.10-40"

Category name	Function	Reference page
Compile options	Allows the user to configure build-related settings such as whether to enable Unicode for the program objects (POU objects) and the number of compiler warnings to be output.	"P.9-6"
Security	Allows the user to configure settings related to project file encryption using passwords.	"P.10-16"
Page Setup	Allows the user to configure printing-related settings.	-
Users and groups	Allows the user to add, edit, and remove users and groups for project user management.	"P.10-4"

- Select a desired category from the category pane.
 The setting items for the selected category will be displayed in the setting pane.
- **3.** Change the setting items as appropriate and click the [OK] button. The setting items will be applied.

4.9 Exporting and Importing Objects

Objects in a project can be exported as XML files. The extension of exported files is ".export". Files that are being exported can be imported to GM Programmer.

4.9.1 Exporting Objects

¹² Procedure

1. From the menu bar, select **Project>Export**.

The "Export" dialog box will be displayed.

Export	×
Please select the objects which are to be exported: (Devices) POUs	
Sample I Sample I Second (AGM1CSEC1ST/P) Second (AGM1CSEC1) Second (AGM1CSEC1)	
□Qne file per subbree	
GM Programmer V1.1	~ ~ ~
	OK Cancel

f Info.

- To import an object into GM Programmer, select only one object below the [Application] object and export it.
- Select objects to be exported. Normally, there is no need to make changes.
- **3.** Click the [OK] button.

The "Export" dialog box will be displayed. If necessary, change the file name and save destination.

Epot						2
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Organiza - New Yolder					30.0	0
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CeaDrive	The Barris Pla	th providents.				
This PC						
2D ORgents						
E Servitop						
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👃 Deventualit.						
Metic						
E Pictares						
Widens						
🔟 Windevo (C)						
🔿 Network 🖉 🖉						
File game Service, Lasped						
Sere as type Export Mes Croppet						
A Hida fallon				Sere	Casis	-

4. Click the [Save] button. Export will be executed.

GM Prog	rammer	×
	Export completed successfully.	
	ОК	

4.9.2 Importing Objects

This section explains the procedure for importing objects exported to a project into GM Programmer.

For example, use the following procedure to import objects below the "Application" object.



 Select the [Application] object in the navigator pane and then select Project>Import from the menu bar.

The "Import" dialog box will be displayed.

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Organia + New Falder				in + 01 (
Sunnioudi e * Trette	Data modified	644	Sex	
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The Pictures #				
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This PC				
30 Objects				
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Bacumente				
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Widens				
L Windows (C)				
🚅 Natwork 👻				
Rie gane			Bepatt fibes (*	es porti
			Spen.	Cased

2. Select a file with extension ".export" and click the [Open] button.

The "Import" dialog box will be displayed.

Objects that can be imported will be displayed in the "Insertable items" area.

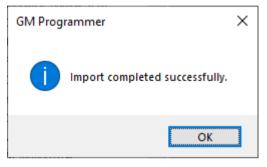
reatly selected target object: A ertable items:		
🐨 🐾 our		
P B ADO		
FunctionBlock_Sample		
MC_PRG		
PLC_PRG		
004_FR 51_POU		
D ST_Sample		
🕑 🔡 Task Configuration		

1 Info.

- To import an object into GM Programmer, select an export file where only one object below the [Application] object is selected.
- **3.** Clear the check boxes of the objects that do not need to be imported and click the [OK] button.

Import will be executed.

The objects that have been imported will be displayed below the [Application] object in the navigator pane.



4.10 Creating a Backup when a Project Is Saved

When saving a project, you can create a backup file of the project file to be updated. The extension of backup files is ".backup".



- **1.** From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.
- Select the "Load and Save" category. The "Load and Save" pane will be displayed.

Options		×
CPC Edior Delaugging Contex editor PED, 1D and 1L editor Refactoring Refactoring PC editor Text editor	Consider and Server Consider backwords gutanosically solve every Some before build Oneste project (provery information)	
	DK Detail	

3. Select the "Create backup files" check box and click the [OK] button.

Then, whenever a project is saved, the project file to be updated will be automatically saved as a backup file (with extension ".backup").

Options		×
CPC:bdox Celsuggrg Celsuggrg Celsusgrs Celsusgrs Celsusdan Editor PED, LD and IL editor Celsus editor Celsus editor Celsus editor Celsus editor Celsus Cels	Lound Lound Citive: Image: Constant packup flag Image: Citive project geowery information	
	DK Devid	

<Restoring backup files>

To restore a project file that has been backed up, manually change the extension of the file from ".backup" to ".project" and then open the project file in GM Programmer.

4.11 Automatically Saving Project Files

Project files can be saved automatically during editing. Even if data disappears when GM Programmer terminates abnormally, a file up to the point in time when it was saved automatically can be restored. The extension of backup files is ".autosave".

¹² Procedure

- 1. From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.
- Select the "Load and Save" category. The "Load and Save" pane will be displayed.

Options	×
CPC edkor	Load and Save
Delsugang Declaration Editor Declaration Editor Declaration Editor Declaration Declar	Create gacitud files
-	Aduanced Settings

 Select the "Automatically save evey" check box and click the [OK] button. The automatic save interval can be changed in minutes (default value: 10 minutes).

Options		×
CPC Editor Coloration Editor Coloration Editor FBD, LD and LL editor FBD, LD and LL editor Load and Save Refactoring SFC editor SFC editor Test editor	Load and Save	
	Automatically anter every 10 minutes Save before build Create project geowery information	
	Adgenced Sottings	
	Adgented Settings	Gancel

After auto save is set, project files will be automatically saved as files with extension ".autosave" at the specified interval during editing.

After a project file is closed due to abnormal termination of GM Programmer, when you open the project file again, you can select either the original project file with extension ".project" or the automatically saved project file with extension ".autosave". To open the automatically saved project file, click the [Open Auto Save File] button.

Auto Save Backup	Auto Save Backup				
The project which you attempt to open has not been closed correctly. However, there is an automatic backup.					
Project:	Untitled6.project				
Location	C:¥Users¥Documents				
Date of the original file	2020年11月13日 9:46:16				
Date of the auto save file	2020年11月19日 13:51:01				
Open <u>A</u> uto Save File	Open <u>O</u> riginal File Cancel				

4.12 Printing a Project

You can print the entire project.

1₂ Procedure

 From the menu bar, select Project>Document. The "Document Project" dialog box will be displayed.

2
Ý
Breview

2. Select the check boxes of the devices and objects for which documents are to be printed, and click the [OK] button.

The "Print" dialog box will be displayed. Select a printer to be used and click the [OK] button.

Documents will be printed.

1 Info.

- By clicking the [Preview] button in the "Document Project" dialog box, a print preview window is displayed, so that you can check what a hard copy would look like when printed.
- You can edit page orientation, margin, header, footer, table of contents, and title page details. From the menu bar, select **File>Page Setup**. The "Project Settings" dialog box will appear with the Page Setup pane displayed.

Select the tab of the item to be changed and change the settings.

Comple options Complex warnings Page Setup	Page Setu	. Header and Pooter Document	Trie Dame	
Security SFC SoftWaten Static Analysis Light Users and Groups	Orientation		ndscape	Beriew
	<u>Formet</u> Source	A4 210 x 297 mm 自動運行	Ŷ	
	<u>Q</u> uality	600 x 600 dpi	4	

4.13 Printing an Object within a Project

1₂ Procedure

1. With the object editor opened, from the menu bar, select File>Print. The "Print" dialog box will be displayed. Execute printing.

Print	×
Printer <u>N</u> ame: Status: Type: Where: Comment:	Properties
Print range ④ 신	Copies Number of <u>c</u> opies:
Pages from: to: Selection	123 123 Collate
	OK Cancel

4.14 Comparing Projects

You can compare the opened project file with another project file to display and merge the differences between them.

4.14.1 Project Comparison Method

Compare the opened project file with another project file.

¹² Procedure

1. From the menu bar, select **Project>Compare**.

The "Project Comparison" dialog box will be displayed.

Project Comparison	×
Compare the currently open project with	
Oreject on disk	14
· Prepart or e gourne territed distance	
Bast	
Pgrt	
Location	
Compana Options	
Generationally relevant writespaces, e.g. In	entring literals, are never ignored)
] Ignore Comments	
Groldens, eccess rights, exclusion from bu	ild, POLI bitmaps, etc.)
	OK Cancel

2. In the "Project on disk" field, specify a project file to be compared with and click the [OK] button.

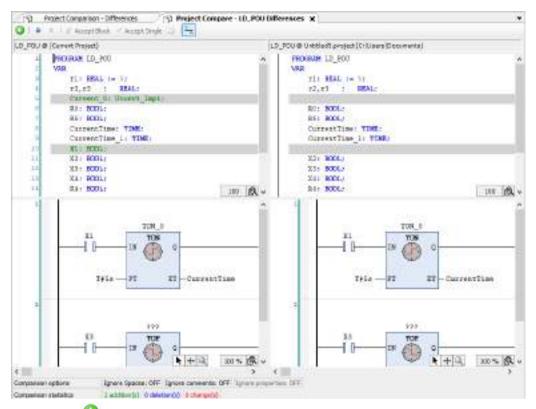
The comparison results will be displayed in the main pane.

The backgrounds of object lines with differences are displayed in gray. The text color of each object indicates the type of difference.

Carrent Project)	Untide	di project (C/Users/Doisments)	
Devis Program_Cooliguation P Application SAL		Denta Program_Configuration Application St.	î
H ID_POD	1002	4) 10,900	
Lbray Managar		Librery Manager	
H NC.IRS	7	•] HC 295	
+ (Task Configuration		Task Configuration	
Trace		BIT Trace	
ef Trace 1 -		and the second s	
+ S RTEX Metter		RTEC Nastar	
SoftMation General Also Past		3 SoftMotion General Axis Post	
+ I Unit_Coeliguation		Unit_Configuration	
LANPorti		LANPoti	
I LANPORT		III LANPost2	
			4
	ore connents: OFF Ignor	e propertes OFF	
sperison statutoto (1 soldbor)s) 1 dele bori	(i) Schwege(ii)		
(5)		(6)	

No.	Description
(1)	Removed object
(2)	Object with a difference in contents
(3)	Object with a difference in properties
(4)	Added object
(5)	Opened project
(6)	Specified project

Double-clicking an object line with a difference in contents displays the object comparison results.



Clicking the ${}^{igodold o}$ icon returns the display to the comparison view in the navigator pane.

Clicking the icon switches to the mode in which comparison results including removed object lines are displayed. The above window in which comparison results are displayed will be switched to the window shown below. If the differences displayed as variable bVar0 and empty lines that have been added differ from the specifications of variable bVar0, differences will be displayed as changes in variable bVar0.

<pre>FRECRAM LD_FOU WAR 1 cl: REAL := 1; c2,r3 : REAL; 2 Corvent_D: Doow1_Dep1; R0: EDCL; R5: EDCL; Currentlime: TIME; 2 Currentlime: TIME;</pre>	POU	Corrent Project)	LD	_POU & UntitledS.pro(ect(Cr\Users\Documents)	
R5: BODL; B5: BODL; CurrentTime: TIME; CurrentTime: TIME;	1 2 3 4 5 2	VAR r1: REAL := 1; r2.r3 : REAL; Current_D: Donwi_Empl:	Î	VAR r1: REAL := 5; r2,r3 : REAL;	
	7 8 7	R5: BOOL;		B5: BODL;	

4.14.2 Merging Differences

Differences displayed by comparing projects can be merged into the opened project.

When there are differences in the contents of objects, the differences can be merged by using the [Accept Block] button or [Accept Single] button.

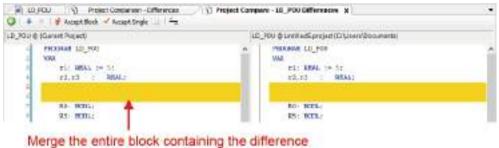
For example, use the following procedure to merge the differences in the contents of programs.

¹² Procedure

- Perform project comparison. Project comparison results will be displayed. For details on how to perform project comparison, refer to "4.14.1 Project Comparison Method".
- 2. Move the cursor to the difference location and click the [Accept Block] button or [Accept Single] button.

The difference will be merged into the opened project. The background of the merged section will be displayed in yellow. At this stage, the merged content has not been reflected in the project yet. To reflect the merged content, approval operation is required as below.

[Accept Block] button: Merges the entire block containing the difference at the cursor position



at the cursor position (delete two lines)

[Accept Single] button: Merges the difference at the cursor position

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L2, Fre & Scient Prints	12,50.@39860.com10.0.0e001ee0e01	
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811 WDC.	Bi. BIL	
10 10 100	81. 825.0	

Merge the difference at the cursor position (delete one line)

3. From the menu bar, select **Project>Commit accepted changes**.

The merged content will be approved and reflected in the opened project. Because the reflected content has not been saved yet, save the project as necessary.

i Info.

• To merge between objects whose properties are different, select an object with differences and click the icon. The "Accept" dialog box will be displayed. Select the "Properties" check box and click the [OK] button.

Accept	×
Which meta information do you want to	accept?
Acceptablegroups	Not acceptable groups (missing in either project)
Properties	
	OK Cancel

5 Project Creation

5.1 Project Creation Flow	5-2
5.2 Setting up the GM1 Controller	5-3
 5.3 Setting up Motion Control	5-5 5-6
 5.4 Setting up Unit Control 5.4.1 Setting up General-purpose I/O, PWM Output, and High-spe Counter for GM1 Controller	ed 5-14
5.5 Setting up the Communication Function5.5.1 Adding a Protocol to Be Used for the LAN Port5.5.2 Adding a Protocol to Be Used for the COM Port	5-20

5.1 Project Creation Flow

To create a program, you must first create a project.

This section explains operations for projects, operations for adding objects to projects, and other related operations.

First, this section explains the flow of project creation.

1. Setting up the GM1 controller

Set up parameters for the GM1 controller. Refer to "5.2 Setting up the GM1 Controller".



2. Setting up motion control

- Add device objects for servo amplifiers to a project and set them up.
- Add device objects for free encoders and virtual drives to a project and set them up.

Refer to "5.3 Setting up Motion Control".



3. Setting up unit control

- Set up general-purpose I/O, PWM output, and high-speed counter for the GM1 controller.
- Add device objects for expansion units to a project and set them up.

Refer to "5.4 Setting up Unit Control".



4. Setting up the communication function

• Add an object of the protocol to be used for the LAN port to a project and set it up.

• Add an object of the protocol to be used for the COM port to a project and set it up.

Refer to "5.5 Setting up the Communication Function".

5.2 Setting up the GM1 Controller

Set up parameters for the GM1 controller.

¹² Procedure

1. Double-click the [Device] object in the navigator pane.



The Communication Settings window for the device will be displayed.

Cameraniani san Sant Pentrerk. Galerany Y. Denez. *
Applications Log Users mit Theues Access Rights R. c. stref Task Displayment Task Displayment Information

2. Click the "PLC Parameters" tab.

The parameter settings sub-pane will be displayed.

Date and Take and Settings 	Communication Sattings	Persyneter	Bpe.	Veb.av	Default Reise	Unit	Description
Date and Take and Definitions 		A unit write occurred	Chumenation of \$175	Stap powretion	Sta perior		Please select the operation who
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Change the values of the parameters that you want to update.
 "A unit error occurred": Select whether to stop or continue operation when an error occurs.
 "LAN port1": Change the IP address of LAN port1.
 "LAN port2": Change the IP address of LAN port2.

5.3 Setting up Motion Control

5.3.1 Basic Setting for GM1 Controller

Set a control cycle for the GM1 Controller.

¹² Procedure

1. Double-click the MotionTask object in the navigator pane.



The "MotionTask" editor will open in the main pane.

2. Set a control cycle.

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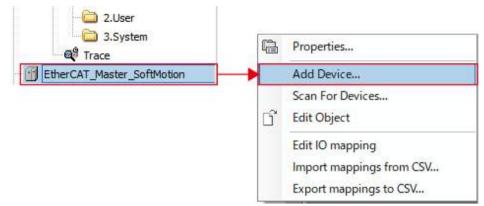
5.3.2 Adding and Setting up Servo Amplifiers

This section explains how to add device objects for servo amplifiers to a project and set them up.

The description below explains how to add device objects for A5B servo amplifiers to a project and how to set them up.

¹² Procedure

1. Right-click the EtherCAT_Master_SoftMotion object in the navigator pane and then select **Device addition** from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

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2. Select a device object for the servo amplifier.

The selected device object of the servo amplifier will be added.

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3. Click the [Add Device] button.

The selected device object of the servo amplifier will be added to the navigator pane.

	- 🗀 2.User
	3.System
	G ⁹ Trace
G	EtherCAT_Master_SoftMotion
	😑 🎬 MADHT1105BA1
	SM_Drive_ETC_Panasonic_MINAS_A5B

Click the [Cancel] button to close the "Select Device" dialog box.

4. Double-click the added object. The setting pane will be displayed in the main pane.

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1 Info.

- To remove a device object that has been added, select the device object in the navigation pane and press the <Delete> key.
- 5. Enable the "Enable expert setting" item.

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6. Set "Station alias".

Depending on the setting of Pr7.41 as the initial setup for the servo amplifier, the method for setting "Station alias" is different.

• When Pr.7.41 is set to 0

Select the configured station alias and input in the input field the set value of the rotary switch on the front panel of the servo amplifier and the set value of Pr7.40.

Example) Set value of the rotary switch on the front panel of the servo amplifier:8, set value of Pr7.40: 1

The higher 8 bits are 1 and lower 8 bits are 8. Therefore, input 264 in the input field.

wer 8 bits		
t value of the rotary switch		
Address	Additional	
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D DC Cyclic Unit Control: Assi	to Local pC	
i Watchdog Identification		
() Disabled		
Configured station alias (ADO	1012) Value	264 (2)
C Expluit device devification (A	0 8x0124) ADD (hex)	20.412 2
		10.0

• When Pr.7.41 is set to 1 Select "Disable".

The value displayed on the EtherCAT address is set as the station alias value.

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f Info.

• Select the configured station alias value and log in, and then you can also set a desired value.

Input a desired value in the input field and click the [Write to EEPROM] button.

(ii) Configured station alias (ADO 0x0012)	Value	2	-
Write to EEprom	Actual address	1	

Restart the power supply to the servo amplifier and then log in again, and the desired value input in the input field will be set as the station alias value.

Select the configured station alias value and log in for the first time, and the device name of the servo amplifier in the navigation pane will be grayed out due to a mismatch of the station alias value .



5.3.3 Adding and Setting up Free Encoder and Virtual Drive

This section explains how to add device objects for free encoders and virtual drives to a project and set them up.

For example, use the following procedure to add a device object for a virtual drive to a project and set it up.

¹ 2 Procedure

1. Right-click the [SoftMotion General Axis Pool] object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.

Trace EtherCAT_Master_SoftMotion	Properties
SoftMotion General Axis Pool	Add Device
Unit_Configuration	Edit Object
	Import mappings from CSV Export mappings to CSV

The "Device Management" dialog box will be displayed.

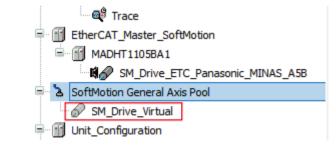
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2. Select a device object for the virtual drive.

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3. Click the [Add Device] button.

The selected device object of the virtual drive will be added to the navigator pane.



4. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to the virtual drive.

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• To remove a device object that has been added, select the device object in the navigation pane and press the "Delete" key.

f Info.

5.4 Setting up Unit Control

5.4.1 Setting up General-purpose I/O, PWM Output, and High-speed Counter for GM1 Controller

This section explains how to set up general-purpose I/O, PWM output, and high-speed counter for the GM1 Controller.

The object of each unit is shown below.



i Info.

- For details on general-purpose I/O, refer to "12.4 General-purpose I/O".
- For details on PMW output, refer to "12.5 PWM Output".
- For details on the high-speed counter function, refer to "12.6 High-speed Counter Function".

For example, use the following procedure to set up a high-speed counter.

12

Procedure

 In the navigator pane, double-click the [Counter_Configuration] object. The high-speed counter setting window will be displayed.

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2. Set up parameters for the high-speed counter.

Select the category of a channel to be set up in the "Category Selection" section and enter values in the "Parameter Settings" section.

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3. Select the "Counter I/O Mapping" tab and set the correspondence (mapping) between the channel and variable in the mapping setting pane.

Click the "Variable" column corresponding to the channel to be used by the program and enter a variable name.

Clicking the mark in the "Mapping" column allows you to change the type of mapping.

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• You can copy the parameter set in a channel. To do so, select a channel (CH0 or CH1) in the "Category Selection" column and click the [Copy] button. Next, select another channel and click the [Paste] button.

5.4.2 Adding Expansion Units

This section explains how to add device objects for expansion units to a project and set them up.

For example, use the following procedure to add a digital input unit (product number: AGM1X64D2) to Empty1.



1. Right-click the [Empty1] object in the navigator pane and then select "Unit Management" from the context-sensitive menu that is displayed.

PWM_configuration Counter_Configuration	陷 Properties
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15	Empty	Empty	2
24	Enpty	Slepty	
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The "Unit Management" dialog box will be displayed.

2. Double-click the first row in the "Device: Unit_Configuration" table. The "Select Device" dialog box will be displayed.

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3. Select a device object for the expansion unit to be added.

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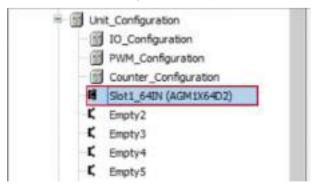
4. Click the [Select Device] button.

The selected device object of the expansion unit will be added.

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5. Click the [OK] button.

The selected device object of the expansion unit will be added to the navigator pane.



6. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to the expansion unit.

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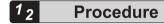
• To remove the device object of an expansion unit that has been added, select the expansion unit to be removed in the "Unit Management" dialog box and press the "Delete" key or click the [Delete] button.

5.5 Setting up the Communication Function

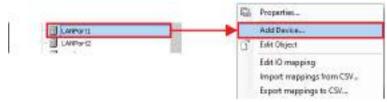
5.5.1 Adding a Protocol to Be Used for the LAN Port

This section explains how to add an object of the protocol to be used for the LAN port to a project and set it up.

For example, use the following procedure to add an object of Modbus TCP to LANPort1 and set it up.



1. Right-click the [LANPort1] object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

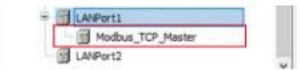
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2. Select device "Modbus TCP Master".

Add Device	
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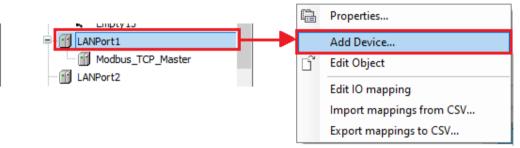
3. Click the [Add Device] button.

Object [Modbus_TCP_Master] will be added to the navigator pane.



Then, add object [ModbusTCP_Slave_Device] below object [Modbus_TCP_Master].

4. Right-click the [LANPort1] object and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

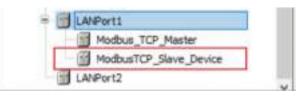
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5. Select device "Modbus TCP Slave Device".

Add Device	
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4	
eme: ModbusTCP_Slave_Device	

6. Click the [Add Device] button.

The [ModbusTCP_Slave_Device] object will be added.



7. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to Modbus TCP.

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• To remove a device that has been added, select the device in the navigator pane and press the "Delete" key.

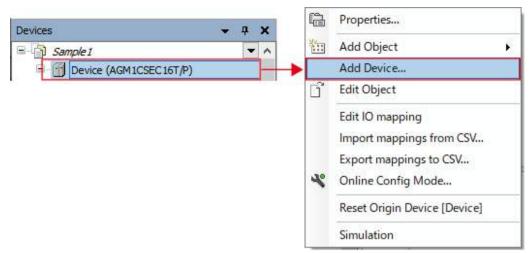
5.5.2 Adding a Protocol to Be Used for the COM Port

This section explains how to add an object of the protocol to be used for the COM port to a project and set it up.

For example, use the following procedure to add an object of Modbus RTU to the COM port and set it up.



1. Right-click the [Device] object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

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	Add Device Concet

2. Select device "Modbus COM".

Add Device	×
Device: Device	
Name	
E Mal Modbus	
i⊟ ₩₩\$ Modbus Serial Port	
Modbus COM	
Name: Modbus_COM	
	_
Add Device	Cancel

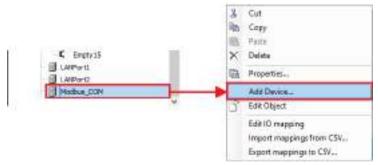
3. Click the [Add Device] button.

Object [Modbus_COM] will be added to the navigator pane.

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LANPort1	
LANPort2	
Modbus_COM	
	~

Then, add object [Modbus_COM_Master] below object [Modbus_COM].

4. Right-click the [Modbus_COM] object in the navigation pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

Add Device	
Vevice: Modbur_COM	
Name	
i 🗊 riekbuses	
😑 💶 Modbus	
 Modbus Serial Device 	
😤 🎫 Modbus Serial Master	
N See	
ame:	
	Add Device Gancel
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5. Select device "Modbus Master, COM Port".

Add Device	2
Device: Modbuz_COM	
Name I meldbuses I meldbuses I meldbus I modbus Senal Device I Modbus Senal Master Modbus Naster, COM Port	
lame: Modbus_Master_COM_Part	
	Add Device Gancel

 Click the [Add Device] button. The [Modbus_Master_COM_Port] object will be added.

C Empty15	
LANPort1	
LANPort2	
Modbus_COM	
Modbus_Master_COM_Port	1

 Double-click the added [Modbus_Master_COM_Port] object. The setting pane will be displayed in the main pane. Specify settings related to Modbus RTU.

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fodbærgeneriderid Parter (0 Fæding Fædinersseriderid Parter (0 Redseres Rese	Transiende werden in		MUDBUS		
Marana.					

(MEMO)

6 **Program Creation**

6.1 Flow of Program Creation	.6-2
 6.2 Program Creation Window	. 6-3 . 6-3 . 6-5 . 6-7 . 6-8
6.3 Creating a Program Object (POU Object)	.6-14
6.4 Types of Programming Language	.6-15
 6.5 Variables 6.5.1 Standard Data Types 6.5.2 STRING type 6.5.3 WSTRING type 6.5.4 Array 6.5.5 Subrange Types 6.5.6 Structure, Enumeration, Alias, and Union Data Types 6.5.7 Constants 6.5.8 Object for Global Variable Declaration 6.5.9 Global Variables 6.5.10 Persistent Variables 6.5.11 Short Form Function 	. 6-18 . 6-19 . 6-19 . 6-20 . 6-20 . 6-21 . 6-24 . 6-25 . 6-25 . 6-27
6.6 Function and Function Block.6.6.1 Function6.6.2 Function Block	. 6-32

6.1 Flow of Program Creation

1. Creating a POU object

Create an object (POU object) for the program.

- ➡
- Entering program data (refer to "7.1 Programming in Ladder Diagram (LD)" through to "6.5 Variables")

Open the POU object. Enter program data, declare variables, and perform other necessary work.

-

3. Executing build (refer to "7.8 Build")

- Execute build and check the program.
- If there are any errors, return to "Step 2" and correct the program.

4. Registering for a task (refer to "7.9 Tasks")

Register the POU objects (to be executed on the GM1 controller) for a task.



- GM Programmer provides support functions that can be used to create programs efficiently. For details on support functions, refer to "7.7 Program Creation Support Functions".
- Programs consisting of functions and function blocks can be created. For details on functions and function blocks, refer to "6.6 Function and Function Block".

6.2 Program Creation Window

This section explains the window for creating programs in GM Programmer.

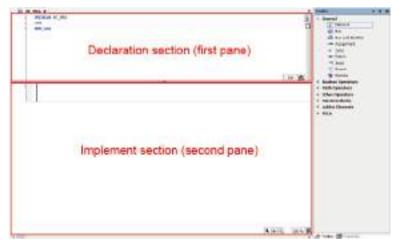
6.2.1 Main Pane

The upper section of the main pane is the declaration section where variables are declared.

The lower section of the main pane is the implementation section where program processes are coded. The declaration section and implementation section may be called the first and second panes, respectively.

The editing method in the implementation section differs according to the program. Refer to the section related to each program creation.

Example: Main pane for LD programs



1 Info.

- The selected pane can be switched between the declaration section (first pane) and the implementation section (second pane). To switch the selected pane, from the menu bar, select **Window>Next Pane** or "Previous Pane".
- You can also hide the declaration section (first pane) or the implementation section (second pane).

To hide the declaration section, from the menu bar, select **Window>Switch First Pane**. To hide the implementation section, from the menu bar, select **Window>Switch Second Pane**.

- When the cursor stays in a variable position in the implementation section, the cursor can be moved to the declaration position of the variable by selecting **Edit>Browse>Go To Definition**.
- You can also declare variables of user-defined types such as structure. User-defined types must be defined in DUT objects beforehand. For details, refer to "6.5.6 Structure, Enumeration, Alias, and Union Data Types".

6.2.2 Declaration Editor

The declaration editor is used to declare variables.

The display format of declarations is divided into table format and text format. The table format and text format can be switched using the switching button on the top right of the declaration editor.

Table format

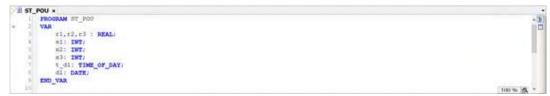
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6								1.0

- To add a new declaration, click the [22] icon ("Insert") to add a new row. Enter a variable name in the "Name" column. For other items, double-click each cell to set the cell in an input-enabled state, and enter values as necessary.
- To sort variables, use the [* *] icon ("Move up" or "Move down").
- To delete variables, use the [X] icon ("Delete").
- When adding a program name or program name comment, click the declaration header section.

The "E	dit Declaration	Header"	dialog	box will	be	displaye	əd.
--------	-----------------	---------	--------	----------	----	----------	-----

Declaration		
PROGRAM	WC_PRG	
Comment		
e.		

Text format



• As is the case with the text editor, enter variables to be declared.

- You can use single-line comments (prefixed with //) and multiple-line comments (enclosed with *).
- Pressing the "F2" key starts Input Assistant, which allows the user to enter variable types and other items by selecting them. For details on Input Assistant, refer to "7.7.5 Input Assistant Function".



- You can set the display format to be used, as below.
 - 1. From the menu bar, select **Tools>Options**.

The "Options" dialog box will be displayed.

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Device +dax Petro, LD weith, while Second Sec Device of Sec Dev	

2. In the Options dialog box, select the "Declaration Editor" category.

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Discourse Order elater Order elater Pato, 10 en/12 eller Pato, 10 eller	 □ Testan Kree □ Testan Kree □ Testan Kree □ Sharper traduit 	
		Di Dest

3. Select a desired display format.

6.2.3 Auto Declaration

If a variable that has not been declared in the declaration section is entered in the implementation section, the "Auto Declare" dialog box will be displayed.

If you change any necessary items and click the [OK] button, the variable will be declared in the declaration section.

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Example: When the variable name of a contact is entered as bVar0 in an LD program

Address

In the Address field, you can specify the address of input data or output data for the GM1 controller or expansion unit. In such a case, the variable assigned to the input data or output data corresponding to the entered address is declared.

Flag

If you select the CONSTANT, RETAIN, and PERSISTENT check boxes in the Flag section, you can set variable attributes.

CONSTANT

Declares the variable as a constant. Enter a default value.

RETAIN

Declares the variable as a retain variable. For retain variables, values are not reset even if warm reset is performed. For details on warm reset, refer to "9.5.1 Reset Warm, Reset Cold, and Reset Origin".

PERSISTENT

Declares the variable as a persistent variable. To declare a persistent variable, you must also select the RETAIN check box. For persistent variables, values are not reset even if cold reset or warm reset is performed.For details on cold reset or warm reset, refer to "9.5.1 Reset Warm, Reset Cold, and Reset Origin".

f Info.

You can also prevent the "Auto Declare" dialog box from being displayed when a variable that
has not been declared is entered in the implementation section. From the menu bar, select
Tools>Options>SmartCoding category and clear the "Delcare unknown variables
automatically (AutoDeclare)" check box.

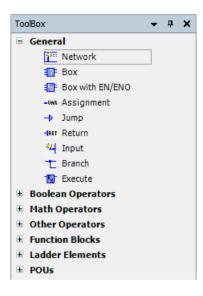
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• Using the Array Wizard, you can declare an array only by entering an index and base type. Click on the right side of the Type field and select "Array Wizard".

Туре	
INT ~	>
Address	Input Assistant
	Array Wizard

6.2.4 Toolbox

Programs can be created by dragging the programming elements displayed in the toolbox. For programs other than ST programs, programming elements are displayed in the toolbox. For details on how to create programs, refer to the section related to each program creation. Example: Toolbox for LD programs



6.2.5 Setting up the Program Input Window

You can change settings related to the text editor.

From the menu bar, select Tools>Options to open the "Options" dialog box.

In the "Options" dialog box, select the "Text editor" category and change the settings.

Theme

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(2) Reference :::::::::::::::::::::::::::::::::::		Terme Solling Technics Harge Hontong Teste Default () Person 2 () 2

Item name	Default value	Settings
Theme	Default	Sets a color scheme theme for the text editor
		Default / Dark

Edit

Options		- 2
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	and the second s	Aleas Marge Rootong al (2) Bobe (2) Ros (2) (2) (2) (2) (2) (3) (2) (2) (2) Ros (2) (2) (2) (4) (2) (2) (2) (2) (4) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2

Item name	Default value	Settings
Number of undos	100	Sets the maximum number of times [Edit]-[Undo] can be executed from the menu bar
		Setting range: 1 to 1000 (times)
		Specifies the method for defining the code structure
	None:	
		Does not collapse code
Folding	Indent	Indent:
		Combines all lines indented from the previous line as a unit
		Explicit:
		Explicitly marks a unit of code sections as a comment
		Sets a rule for wrapping entered text automatically
		None:
		Does not collapse code
		Soft:
Word wrap None	None	If the number of characters entered in a single line exceeds the value specified in "Wrap margin", a code continuation mark (:) will be added and a line break will be inserted automatically. If "0" is selected in the "Wrap margin" drop-down list, a line break will be inserted at the right edge of the editor window.
		Hard:
		If the number of characters entered in a single line exceeds the value specified in "Wrap margin", a line break will be inserted automatically. However, a code continuation mark (":") will not be added. If the number of initially entered word characters exceeds the value specified in "Wrap margin", a line break will not be inserted.
	0	Specifies the number of characters per line that triggers a line feed
Wrap margin	0	Setting range: 0 to 240
Tab width	4	Specifies the number of space characters equivalent to the code to be inserted when the Tab key is pressed
		Setting range: 1 to 16

6.2 Program Creation Window

Item name	Default value	Settings
Keep tabs	Selected	Specifies whether to insert space characters or a tab character when the Tab key is pressed
		Selected: Inserts a tab character when the Tab key is pressed
		Cleared: Inserts space characters when the Tab key is pressed
		Inserts tab spaces with the specified width when "Auto" or "Auto coding" is selected from the "Auto indent" drop-down list.
Indent width	4	However, if the "Keep tabs" check box is cleared, space characters will be inserted.
		Setting range: 1 to 16
		Specifies the behavior to be performed when auto indentation is performed
e i i i ai i		None:
		Does not insert indentation automatically
		Block:
	Smart with code	Inserts indentation with the same width as that of the previous line at the time of line feed
	completion	Auto:
		Inserts indentation automatically for lines following a line containing keywords (such as VAR) according to the setting of "Indent width"
		Smart with code completion:
		Inserts applicable keywords such as "END_IF" and "END_VAR" automatically, in addition to the behavior performed by "Auto"

Text Area

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	Typt (Fight and the second schedule) Ladio Contenty Co. Dr. Owned

Item name	Default value	Settings	
Highlight current line	Selected	Highlights the line selected by the cursor Selected / Cleared	
Matching brackets	Selected	Highlights the corresponding bracket when the cursor is positioned at a bracket within code Selected / Cleared	
End of line markers	Cleared	red Indicates the end of a line as a small dash mark (".") with the color specified for the theme	

Item name	Default value	Settings
		Selected / Cleared
		Displays a guide as the vertical line specified for the theme, in the column used as the base of wrapping.
Wrap guide	Cleared	If any value other than "0" is specified in "Wrap margin", a guide will be displayed.
		Selected / Cleared
Font	-	Displays a font dialog box for setting fonts.

Margin

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		adictorian	jla	

Item name	Default value	Settings
Line numbering	Selected	Displays line numbers in the variable declaration section and program implementation section
	Selected	Selected: Displays line numbers
		Cleared: Does not display line numbers
		Highlights the line selected by the cursor by changing the color of the line number.
Highlight current line		If the "Line numbering" check box is cleared, the current line will not be highlighted.
		Selected: Highlights the current line by changing the color of the line number
		Cleared: Does not change the color of the line number
Show bracket scope	Selected	Displays a scope in the space on the left side of the line number to indicate the beginning to the end of a keyword (such as "IF" to "END_IF")
		Selected: Displays a scope
		Cleared: Does not display a scope
	-	Assigns a mouse action to be performed when "+" or "-" in a space is clicked
Mouse Actions		None: Assigns no mouse action
		Select fold: Selects all lines within the area enclosed in brackets
		Toggle fold: Expands or folds the area enclosed in brackets

Item name	Default value	Settings
		Toggle fold fully: Expands or folds all nested areas when areas are nested
Font	-	Displays a "Font" dialog box for setting fonts

Monitoring

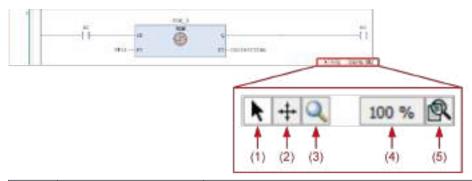
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Item name	Default value	Settings
Enable inline monitoring	Selected	Displays a monitoring field in the program implementation section in online mode Selected: Displays a monitoring field Cleared: Does not display a monitoring field
Number of displayed digits	3	Sets the number of digits after the decimal point that are displayed in the monitoring field Setting range: 1 to 20
String length	10	Sets the maximum length of string variables in the monitoring field Setting range: 1 to 80

6.2.6 Window Operations for the Program Input Window

You can perform window operations such as increasing the display size in the program input window.

The window operation icons are displayed in the bottom right corner of the window.



Number	Item	Description		
(1)	Normal mode	This mode allows the user to select a component by clicking it.		
(2)	Move mode	This mode allows the user to moves the window by clicking in the window and then dragging the mouse.		
(3)	Enlarged view tool	Clicking the icon opens the enlarged view tool window.		
(0)		The display at the cursor position is enlarged in the window.		
(4)	Current display size	This section indicates the current display size of the program input window		
		This icon is used to change the display size. Clicking the icon displays a menu. Select a desired size.		
		400%		
		200%		
		150%		
(5)	Change display size	✓ 100%		
(5)	Change display size	50%		
		25%		
		Selecting — displays the "Enlarge" dialog box where you can enter a magnification rate.		

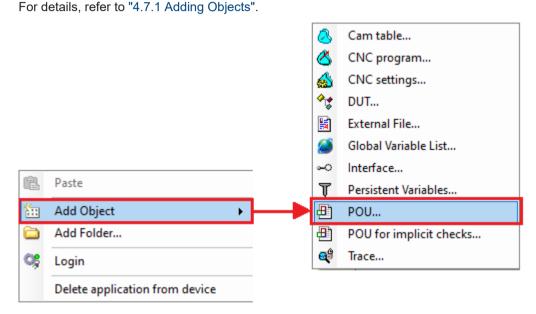
6.3 Creating a Program Object (POU Object)

Creating programs

Programs are created within POU objects. A single POU object allows the use of only one program. If you want to use different programs within a project, you must add POU objects.

Adding POU objects

To add POU objects, right-click the [Application] object in the navigator pane and then select **Add Object>POU** from the context-sensitive menu that is displayed.



6.4 Types of Programming Language

GM Programmer supports five programming languages that comply with IEC 61131-3, the international standard for PLC programming languages.

f Info.

• Continuous Function Chart (CFC) and Page-Oriented CFC are not included in the five programming languages compliant with IEC 61131-3. However, the third edition of IEC 61131-3 defines them as object-oriented programming languages.

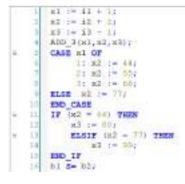
Ladder Diagram program (LD program)

Ladder Diagram is a graphical programming language used to create a program by arranging ladder logic elements such as contacts and coils on a network (circuit). It also allows the use of functions and function blocks with various functions.

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1	-	

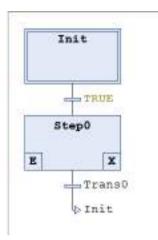
Structured Text program (ST program)

Structured Text is a programming language that creates expressions, conditional statements, and other program elements in text format. It is based on the Pascal programming language and suitable for numerical calculation, data processing, and processing such as conditional branch and repetitive processing.



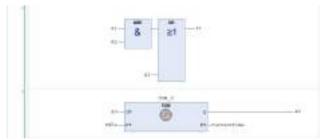
Sequential Function Chart program (SFC program)

Sequential Function Chart is a graphical programming language used to create a program by arranging steps, transitions, actions, and other elements sequentially from top to bottom. It is suitable for processing that describes state transitions.



Function Block Diagram program (FBD program)

Function Block Diagram is a graphical programming language used to create a program by arranging functions and function blocks on a network (circuit). Unlike Ladder Diagram programs, contacts, coils and other ladder logic elements cannot be arranged in Function Block Diagram programs.



In addition to the five programming languages compliant with IEC 61131-3, Continuous Function Chart (CFC) and Page-Oriented CFC can also be used.

Instruction List program (IL program)

Instruction List is a programming language that creates assembler-like instructions sequentially in text format. This language is suitable when you want to perform high-speed processing, restrict the memory usage, and perform other similar operations.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
2	JMPC	markl	
	mark1:		
	LD	bVar2	
	S	bVar3	

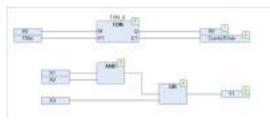
In addition to the five programming languages compliant with IEC 61131-3, Continuous Function Chart (CFC) and Page-Oriented CFC can also be used.

Continuous Function Chart (CFC) and Page-Oriented CFC programs

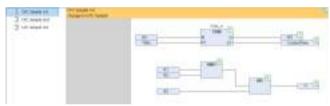
Continuous Function Chart (CFC) and Page-Oriented CFC are graphical programming languages used to create a program by arranging function blocks and other elements on the screen. Elements can be freely arranged on the screen and the order of execution can be specified.

CFC allows the user to create a program on a single screen, while Page-Oriented CFC allows the user to create a program while switching the screen called a page.

<CFC program>



<Page-Oriented CFC program>



6.5 Variables

Variables are declared in the main pane of POU objects for programs.

6.5.1 Standard Data Types

GM Programmer allows the following data types to be used as standard data types.

Туре	Туре	Range	Size (in bits)
Truth	BOOL	TRUE (1) and FALSE (0)	8
Integer	BYTE	0 to 255	8
Integer	WORD	0 to 65535	16
Integer	DWORD	0 to 4294967295	32
Integer	LWORD	0 to 2 ⁶⁴ -1	64
Integer	SINT	-128 to 127	8
Integer	USINT	0 to 255	8
Integer	INT	-32768 to 32767	16
Integer	UINT	0 to 65535	16
Integer	DINT	-2147483648 to 2147483647	32
Integer	UDINT	0 to 4294967295	32
Integer	LINT	-2 ⁶³ to 2 ⁶³ -1	64
Integer	ULINT	0 to 2 ⁶⁴ -1	64
Floating-point number	REAL	-3.402823e+38 to 3.402823e+38	32
Floating-point number	LREAL	-1.7976931348623158e+308 to 1.7976931348623158e+308	64
Character string	STRING		(Number of characters + 1) × 8
Character string	WSTRING		(Number of characters + 1) × 16
Time	TIME	0 to 4294967295	32
Time	LTIME	0 to 213503d23h34m33s709ms551us615ns	64
Time	TIME_OF_DAY(TOD)	0 (00:00:00:000) to 4294967295 (11:59:59 PM:999)	32
Date	DATE	0 (1970-01-01) to 4294967295 (2106-02-07)	32
Date and time	DATE_AND_TIME(DT)	0 (1970-01-01,00:00:00) to 4294967295 (2106-02-07,06:28:15)	32

i Info.

• You can also use user-defined data types such as structure, enumeration, alias, and union. For details, refer to "6.5.6 Structure, Enumeration, Alias, and Union Data Types".

6.5.2 STRING type

The STRING type data can be used by enclosing the data with single quotation marks. Usable characters are half-width English letters (a to z and A to Z), Arabic numerals (0 to 9), symbols, and space characters in the ASCII code.

Possible to set the memory size when declaring variables.

Declaration example of a 35-letter character string:

str : STRING(35):= 'This is a String';



• In principle, there are no restrictions on the length of a character string. However, when using character string functions described in Section 3.9 of Instruction Edition, only the length of 1 to 255 characters are processed.

Any characters exceeding 255 characters will be truncated from the right.

6.5.3 WSTRING type

The WSTRING type data can be used by enclosing the data with double quotation marks. Usable characters are Unicode characters.

Typical example: ASCII characters, hiragana characters, katakana characters, kanji characters, symbols, ancient characters, Korean characters, etc.

Some of them may not be used correctly.

Possible to set the memory size when declaring variables.

Declaration example of a 35-letter character string:

wstr : WSTRING(35):= "This is a WString";

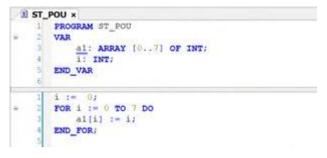
6.5.4 Array

GM Programmer allows the use of arrays.

Using arrays enables multiple data items to be used as a single variable.

This feature is useful when variables of the same type are handled collectively.

Example: When one-dimensional array a1 with eight INT type data items is declared and used in an ST program





- Whether indexes are within the declared range can be automatically checked when variables in an array are accessed. Use a POU for implicit checks that checks boundaries. For details, refer to "10.7 POU for implicit checks".
- Using the array wizard for auto declaration enables array variables to be declared only by entering index and base types. For details, refer to "6.2.3 Auto Declaration".

6.5.5 Subrange Types

GM Programmer allows the use of subrange types. Subrange types allow the user to specify the range of values for standard data types.

The following is a declaration example of subrange type variables in character string format. If an attempt is made to substitute an out-of-range value for a variable, an error will be displayed during build.

10	ST_	POU ×
12	1	PROGRAM ST_POU
-	2	VAR
	3	1 : INT (-255255) 7> INT type value within the range between -255 and 255
	4	ui : USINT (0100);> USINT type value within the range between 0 and 255
	3	END VAR
	- 6	
1.0	- 11	1 1001 T
	- 11	ui := 105; Out-of-range error
	1	

Subrange types can also be declared in table format.

ो झ	POU 8					PROGRAM	ST_POU
	Scope	Name	Address	Data type	Initialization	Comment	Attributes
- 1	Ø WAR			INT (-255255)	100 C 100 0 100 1		
- 1	Ø VAR	aut.		US2NT (0 100)			



 Whether values are within the declared range can be automatically checked when subrange type variables of the DINT, UDINT, LINT, or ULINT data type are accessed. Use a POU for implicit checks that checks ranges. For details, refer to "10.7 POU for implicit checks".

6.5.6 Structure, Enumeration, Alias, and Union Data Types

User-defined structure, enumeration, alias, and union data types can be declared using DUT objects.

When using these data types, add DUT objects to the project.



1. Right-click the [Application] object in the navigator pane and then select Add Object>DUT from the context-sensitive menu that is displayed.



The "Add DUT" dialog box will be displayed.

The name in the "Name" field will be used as the name when the data unit type is accessed by programs.

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2. Select a data type to be defined, enter the necessary information, and then click the [Add] button.

A DUT object for defining the selected data type will be added to the navigator pane.

Example: Adding a structure data type



3. Select an object to be added and enter definitions in the main pane. How to define and use each data type is described below.

Structure

The following is an example of declaring structures struct1 and struct2. struct2 is an extended structure of struct1.

To extend a structure before declaration, select the "Extends" check box in "Step 2" and enter an extension declaration.

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C Break	
Add Camel	
<pre> struct1 x TYPE struct1 : STROCT member1 : DN7; member2 : DN7; BDD_STROCT BDD_TYPE T </pre>	<pre> struct2 x i TYPE struct2 EXTENDS struct1 : STRUCT Sember3 : BCOL; sember4 : BCOL; END_STRUCT END_TYPE 3 </pre>

The variable declared as a variable for structure struct2 can access the members of struct1 and struct2.

Example: An ST program that accesses members of structure struct2



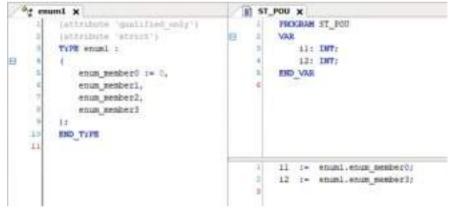


• The BIT data type can be used as members of a structure. TRUE (1) or FALSE (0) can be used as a value. The size of the BIT data type is one bit.

Enumeration

The following are a declaration that defines enumeration enum1 and an example of an ST program that accesses members of enum1.

"0" and "3" are substituted for variables iVar0 and iVar1, respectively.



Alias

An alias can be used to assign a user-defined name as the name of a data type. Declare a variable by using an alias defined in the declaration section.

The following are an alias declaration that defines alias "alias1" for LINT and an example of a declaration section that declares variable iVar0 of the alias1 data type.

Variable iVar0 declared as the alias1 data type is handled as a variable for the LINT data type.



Union

The following are a union declaration that defines union "union1" and an example of an ST program that accesses members of union1.

	x Inoin	ST_POU X
<pre># member2 : BOOL # member3 : BOOL # member3 : BOOL # BOOL # BOOL</pre>	member1 : NOOL; member2 : NOOL; member3 : NOOL; member3 : NOOL; member4 : NOOL; END_UNIOS	I PROGRAM ST_POU VAR B U : Unionir B bI : NOOL; E bZ r BOOL; B BO_VAR
		i bi := u.memberi: 2 bi := u.memberi:

6.5.7 Constants

GM Programmer allows the use of constants.

Constants are declared according to the following syntax.

VAR CONSTANT

Constant name:Type:=Default value;

END_VAR

Туре	Constant type	Description
BOOL	BOOL	TRUE (1), FALSE (0)
Integer	Types that can be used as numerical values	Binary, octal, decimal, and hexadecimal numbers For numbers other than decimal numbers, integer constants are entered after number base and #. Examples: 14, 2#0101, 8#27, 16#34AB
Decimals and exponents	REAL / LREAL	Decimals and exponents Examples: 1.4, 2.34e+008
Time	TIME	32-bit time constants compliant with IEC 61131-3 Syntax: t#, T#, time#, TIME# Examples: T#12ms, T#12h32m24s
Time	LTIME	64-bit time constants In addition to TIME constants, the following units can be used. Microsecond: m Nanosecond: ns Syntax: LTIME# Example: LTIME#123m456ns
Time	TIME_OF_DAY	Time Syntax: tod#, TOD#, time_of_day#, TIME_OF_DAY# Example: tod#12:24:20.123
Date	DATE	Date

Туре	Constant type	Description	
		Syntax: d#, D#, date#, DATE# Example: d#2018-01-01	
Date and time	DATE_AND_TIME	Date and time Syntax: dt#, DT#, date_and_time#, DATE_AND_TIME# Example: dt#2018-01-01-07:04:13	
Character	STRING	Enclosed with single quotation marks Example: 'Hello World'	
string	WSTRING	Enclosed with double quotation marks Example : "Hello World"	

6.5.8 Object for Global Variable Declaration

GM Programmer allows the use of global variables that can be used within the entire project.

Global variable list

This is an object for declaring global variables.

Variables declared in the global variable list can be accessed by using "object-name.global-variable-name" in the global variable list.

Example: When variables in global variable list "Object GVL" are accessed by an ST program

GVL X	ST_POU X
E I VAR GLOBAL 2 XI I INT: X2 I INT: 4 KND_VAR:	1 <u>11</u> := UVL.X1; 2 <u>12</u> := UVL.X2;

For details, refer to "6.5.9 Global Variables".

Persistent variable list

This is an object for declaring global variables that are persistent variables. From "Add Object", select "Persistent Variables".

For details, refer to "6.5.10 Persistent Variables".

6.5.9 Global Variables

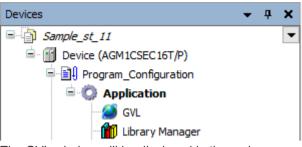
GM Programmer allows the use of global variables that can be used with all projects.

Global variables are declared within the global variable list (GVL) object.

This section explains how to declare global variables and access the declared variables.

¹² Procedure

1. Double-click the GVL object in the navigator pane.



The GVL window will be displayed in the main pane.

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2. Declare variables in the global variable list (GVL).

Example: Declaring global variable g_iVar0 of INT data type



The declared variable can be accessed from the program by using "name.variable name".

Example: Substituting value "5" for global variable g_iVar0



i Info.

 Variables declared before the build process can be imported and exported in XML format. Right-click the object in the global variable list and then select "Properties" from the contextsensitive menu that is displayed. The "Properties" dialog box will be displayed. Open the "Link To File" tab window, select either the check box for import or the check box for export, and enter the path to the file to be imported or exported in the File name field.

Properties - GVL [Device: Program_Configuration: Application]	<
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Export before compile	
<u>O</u> K <u>C</u> ancel Apply	

6.5.10 Persistent Variables

GM Programmer allows the use of global variables that are persistent variables which hold values without initializing them at the time of reset.

Persistent variables that can be used as global variables are declared within the persistent variable list object.

Only one persistent variable list object can be registered.



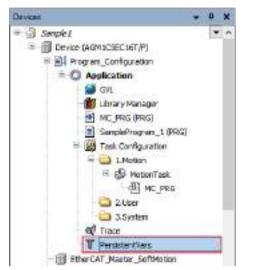
1. Right-click the [Application] object in the navigator pane and then select Add Object>Persistent Variable from the context-sensitive menu that is displayed.

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		o;	Login	-83	POUL.
			Delete application from device	9 1	POU for implicit chacks Trace

The "Add Persistent Variable" dialog box will be displayed.

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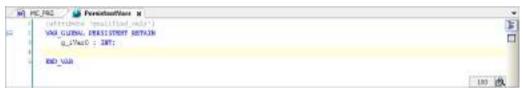
Enter a name for the persistent variable list and click the [Add] button.
 A "persistent variable list" object will be added to the navigator pane.



Example: Persistent variable list object with name "PersistentVars"

3. Declare variables in the persistent variable list.

Example: Declaring global variable g_iVar0 that is a persistent variable of INT type



The declared variable can be accessed from the program by using "name.variable name".

Example: Substituting value "6" for global variable g_iVar0 that is a persistent variable



i Info.

- Persistent variables used as local variables can be declared (as VAR PERSISTENT RETAIN) in the declaration section for each POU object.
- Instance paths of persistent variables declared in each POU object can be added to the persistent variable list.

With the persistent variable list declaration section selected, from the menu bar, select **Declare>Add All Instance Paths**.



6.5.11 Short Form Function

Using the short form function in the declaration section in character string format enables variables to be declared by entering fewer characters.

Example: Declaring Boolean variables bVar0 and bVar1 with the short form function



 Enter variables bVar0 and bVar1, and press the <Ctrl> key + <Enter> key simultaneously. "bVar0, bVar1:BOOL;" will be entered automatically.



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The table below shows examples of input using the short form function.

Strings entered following a semicolon (;) are treated as comments.

Input in short form	Result after the <ctrl> key + <enter> key are pressed simultaneously</enter></ctrl>		
bVar0	bVar0:BOOL;		
iVar0 iVar1 I 6	iVar0, iVar1: INT := 6;		

2

Input in short form	Result after the <ctrl> key + <enter> key are pressed simultaneously</enter></ctrl>		
strVar S 8	strVar: STRING(8)		
wVar w; wVar comment	wVar: WORD; // wVar comment		

6.6 Function and Function Block

Functions and function blocks can be invoked from programs. Functions and function blocks can be created with POU objects.

The differences between functions and function blocks are as below.

Function (FUN)

- Functions can be used without being declared in the declaration section.
- Only one output is generated. However, additional outputs can be defined.
- Output variable and internal variable values are not saved.
- Function block (FB)
- Function blocks can be used by declaring instances in the declaration section.
- Multiple outputs can be generated.
- Output variable and internal variable values are saved.
- Object-oriented definitions can be made by using EXTENDS (inheritance), IMPLEMENTS (interface implementation), or access qualifiers.

6.6.1 Function

A function generates one output in response to one or more inputs. Functions can be used without declaring variables.

For example, use the following procedure to create and invoke function "ADD_SUB", which uses three INT type arguments as inputs, calculates (first argument) + (second argument) - (third argument), and output the result.

¹₂ Procedure

1. Right-click the [Application] object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

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- 🥌 GM.	1	0	Add Folder.	-	Persistent Variables POU
		9	Login	8	POU for implicit checks
			Delete application from device	1285	

The "Add POU" dialog box will be displayed.

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2. Select the "Function" radio button, enter appropriate values in the Name and Return type fields, and select an appropriate programming language from the Implementation Language drop-down list.

In the Name field, specify a function name. In the Return type field, select a return value to be output when the function is executed. From the Implementation Language drop-down list, select a programming language that is used to code function processing.

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3. Click the [Add] button.

A POU object of the function will be added.

The POU object is displayed as "function-name (FUN)" in the navigator pane.



4. Enter function processing.

Open the POU object of the function and create a function. In "VAR_INPUT", declare input variables for the function. Substitute function output for the variable of the function name.



This completes the function creation procedure.

Next, the procedure for invoking the created function is explained below.

 Open the POU object from which the function is to be invoked, and invoke the function. The function can be invoked by using its name. To invoke the function, there is no need to declare variables.

Example: Invoking the function from LD program



Example: Invoking the function from ST program



f Info.

• Additional outputs can be defined for the function. Declare an additional output as variable "VAR_OUTPUT" in the declaration section of the POU object that defines the function.

Example: Definition of function "ADD_SUB" to which variable iOut that outputs the sum of three input variables is added

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Invoking function "ADD_SUB" from LD program



Invoking function "ADD_SUB" from ST program



6.6.2 Function Block

A function block generates one or more outputs in response to one or more inputs. To use function blocks, variables (instances) must be declared.

For example, use the following procedure to create function block "FB_ADD", which uses three INT type variables as inputs and outputs the sum of three arguments, and to invoke an instance.

¹ ² Procedure	
-------------------------------------	--

1. Right-click the [Application] object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

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Seeple 7					
G Device (AQ45CSEC567,P) Program_Configuration		18	10 parts	2	Global Variable List
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The "Add POU" dialog box will be displayed.

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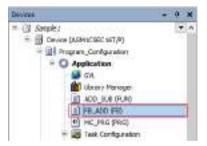
Select the "Function block" radio button, enter a name in the Name field, and select a
programming language from the Implementation Language drop-down list.
In the Name field, specify a function block name. In the Implementation Language dropdown list, select a programming language that is used to code function block processing.

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3. Click the [Add] button.

A POU object of the function block will be added.

The POU object is displayed as "function-block-name (FB)" in the navigator pane.



4. Enter function block processing.

Open the POU object of the function block and create a function block. In "VAR_INPUT", declare input variables to the function block. In "VAR_OUTPUT", declare output variables from the function block.

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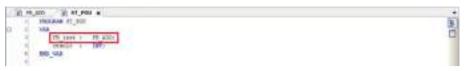
This completes the function block creation procedure.

Next, the procedure for invoking the created function block is explained below.

5. Open the POU object from which the function block is to be invoked, and declare an instance of the function block in the declaration section.

Declare an instance that is a copy of the function block.

Declare an instance name in the form of "instance-name: function-block-name".



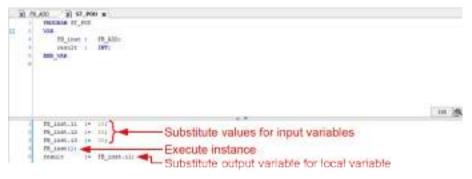
6. Invoke the instance of the function block.

Invoking the instance of the function block executes the processing defined with the function block. Input variables and output variables can be accessed by specifying "instance.variable-name".

Example: Invoking the instance from LD program



Example: Invoking the instance from ST program



7 Entering Programs in Each Programming Language

 7.1 Programming in Ladder Diagram (LD 7.1.1 Inserting Contacts, Coils, and Fun 7.1.2 Inserting Contacts in Parallel 7.1.3 Inserting a Network (Circuit) 7.1.4 Inserting a Branch	ction Blocks	3 8 9 10 11
7.2 Programming in Structured Text (ST)7.2.1 ST Program Syntax7.2.2 Commenting out Code in ST Prog	7-1	15
 7.3 Programming in Sequential Function 7.3.1 Inserting Elements from Menu 7.3.2 Inserting Elements from Toolbox 7.3.3 Inserting Elements from Toolbar 7.3.4 Setting up the SFC Editor		19 21 22 23
 7.4 Programming in Function Block Diagonality 7.4.1 Entering Function Blocks	7-2 Ietwork (Circuit)7-3 7-3	27 32 32
7.5 Programming in Instruction List (IL)7.5.1 Entering Instructions and Operand7.5.2 Settings in IL Program	ls7-3	34
7.6 Programming in Continuous Function7.6.1 Inserting and Connecting Element7.6.2 Connection Mark	s7-3	38
 7.7 Program Creation Support Functions 7.7.1 Bookmark 7.7.2 Call Tree View 7.7.3 Cross reference List View 7.7.4 Function Block Guidance 7.7.5 Input Assistant Function 7.7.6 Argument / Variable Input Support 7.7.7 Global Renaming (Refactoring) 7.7.8 Displaying Programs in Multiple Lage 	7-4 7-4 7-4 7-4 7-4 7-5 7-5 7-5 7-5 7-5 7-5	44 45 46 50 51 52
7.8 Build	7-5	59

7.8.1 Bu	uild	7-59
7.8.2 Re	ebuild	7-59
7.8.3 Co	ode Generation	7-59
7.8.4 Cle	ean	7-60
7.8.5 Cle	ean All	7-61
7.9 Tasks		7-63
7.9.1 Ad	dding Programs	7-63
7.9.2 Ad	dding a UserTask	7-68
7.9.3 Ta	sk Čonfiguration Window	7-70

7.1 Programming in Ladder Diagram (LD)

This section explains how to create programs (LD programs) in Ladder Diagram compliant with IEC 61131-3, the international standard for PLC programming languages.

To create LD programs, POU objects for LD programs are required. Set the object setup language to Ladder Diagram (LD).

7.1.1 Inserting Contacts, Coils, and Function Blocks

This section explains how to create an LD program that consists of the normally open contact, coil, and function block TON shown below.

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¹² Procedure

1. In Toolbox, select Ladder elements>Contact and drag the mouse until "Start here" is displayed in the main pane.

"Start here" will be displayed in the implementation section.



When you drag the mouse until the position of "Start here" is reached, the display of "Start here" turns green.



When you stop dragging the mouse at the position of "Start here", a normally open contact will be placed in the network (circuit).

	1 mm

i Info.

- You can also insert a normally open contact in the network (circuit) using the following procedure:
 - Right-click in the network (circuit) and select "Insert Contact" from the context-sensitive menu that is displayed.
 - Click the icon on the toolbar.
 - From the menu bar, select FBD/LD/IL>Insert Contact.
 - Press the <Ctrl> key + <k> key simultaneously.
- 2. Select "???" of the normally open contact and enter variable bVar0, and then press the <Enter> key.

The "Auto Declare" dialog box will be displayed.

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3. Click the [OK] button.

Variable bVar0 will be declared in the declaration section.



4. In Toolbox, select Ladder elements>Coil and drag the mouse until "Add output or jump here" is displayed in the main pane.

When you drag the mouse until the position of "Add output or jump here" is reached, the display of "Add output or jump here" turns green.



When you stop dragging the mouse at the position of Add output or jump here, a coil will be placed in the network (circuit).



5. Select "???" of the coil and enter variable bCoil0, and then press the <Enter> key. The "Auto Declare" dialog box will be displayed.

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6. Click the [OK] button.

Variable bCoil0 will be declared in the declaration section.



7. In Toolbox, select Function block>TON and drag the mouse until $\overline{*}$ is displayed in the main pane.

Function block TON will be displayed.

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TON will be placed in the implementation section.

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8. Select TON and enter a variable name, and then press the <Enter> key. The "Auto Declare" dialog box for TON will be displayed.

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9. Click the [OK] button.

The name of TON will be declared as variable TON_0.



 Enter "T#5s" for input PT ("IN PT") and "CurrentTime" for output ET ("O ET"), as shown below.

In the declaration section, declare "CurrentTime" as a TIME type variable.

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This completes insertion of a normally open contact, coil, and function block TON. The network (circuit) is now complete.

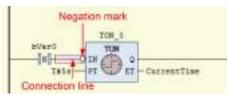
f Info.

- To remove an element that has been placed, select the element and press the <Delete> key. You can also remove an element by right-clicking the element and selecting "Delete" from the context-sensitive menu that is displayed.
- The normally open contact that is placed can be set as a normally open contact for detecting a rising edge (III). To do so, perform the following procedure with the normally open contact selected.
 - Right-click the normally open contact and select "Edge Detection" from the contextsensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Edge Detection.
 - Press the <Ctrl> key + <e> key simultaneously.
 - Click the <a>I icon on the toolbar.

If the above procedure is performed one more time, the normally open contact that is placed can be set as a normally open contact for detecting a falling edge (

- Input to the function block can be negated. To do so, perform the following procedure with the connection line to the input selected.
 - Right-click the function block and select "Negation" from the context-sensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Negation.
 - Press the <Ctrl> key + <n> key simultaneously.
 - Click the <a>Imster icon on the toolbar.

A negation mark will be displayed on the left side of the input ("IN").

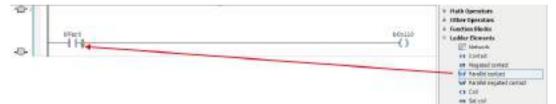


• The LD program can be converted and displayed as an FBD program. From the menu bar, select **FBD/LD/IL>View** and select a post-conversion programming language.

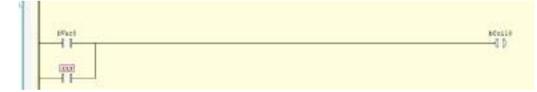
7.1.2 Inserting Contacts in Parallel

This section explains how to place a contact in parallel with a normally open contact.

In Toolbox, select **Ladder elements>Parallel contact** and drag the mouse until the position of v displayed on the right side of the normally open contact is reached.



The normally open contacts will be placed in parallel with the other one.

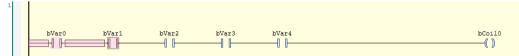


Placing a contact in parallel with multiple contacts

The following explains how to place a contact in parallel with multiple contacts.

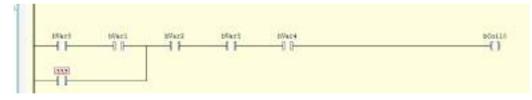


While holding down the <Ctrl> key, select relevant contacts and then right-click.



u	<u>.</u>
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e.	Paste
\times	Delete
	Browse
Ð	Insert Box
1	Insert Empty Box
1	Insert Empty Box with EN/ENO
-E ₂ -	Insert Execute Box
-0 D-	Insert Contact
-1 /1-	Insert Negated Contact
11	Insert Contact (right)
la al	Insert Contact Parallel (below)
40	Insert Negated Contact Parallel (below)
լն նլ	Insert Contact Parallel (above)
	Paste Contacts
7	Negation
P _M	Edge Detection
t	Insert Branch

Select "Insert Contact Parallel (below)" from the context-sensitive menu that is displayed. A contact will be placed in parallel with the selected contacts.



7.1.3 Inserting a Network (Circuit)

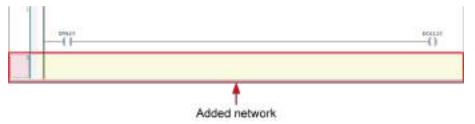
This section explains how to insert a new network (circuit).



1. In Toolbox, select **General>Network** and drag the mouse until select displayed in the network (circuit) in the main pane is reached.



A network (circuit) will be inserted underneath.



f Info.

- You can also insert a network (circuit) underneath using the following procedure:
 - Right-click in the network (circuit) and select "Insert Network (Below)" from the contextsensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Insert Network (below).
 - Press the <Ctrl> key + <t> key simultaneously.
- To add a network (circuit) above the existing network, in Toolbox, select **General>Network** and drag the mouse until the position of is reached.

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• To remove a network (circuit), select the network (circuit) and press the <Delete> key.

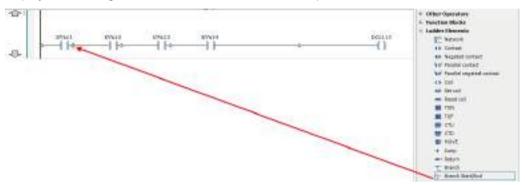
7.1.4 Inserting a Branch

This section explains how to add a branch by specifying the starting point and end point of the branch.

Example: Creating a branch in the following network (circuit) that extends from a point between contacts bVar1 and bVar2 to a point between contacts bVar3 and bVar4



 In Toolbox, select Ladder elements>Branch Start/End and drag the mouse until displayed on the right side of contact bVar1 in the main pane is reached.

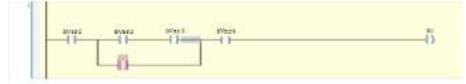


When you stop dragging the mouse, a red square mark indicating the starting point of a branch is displayed between contacts bVar1 and bVar2. Blue square marks indicate candidates for the end point of the branch.



2. Click the blue square mark between contacts bVar3 and bVar4.

A branch that extends from the point between contacts bVar1 and bVar2 to the point between contacts bVar3 and bVar4 will be inserted.



7.1.5 Input of Title and Comment (LD)

The Ladder Diagram programming language allows the user to enter the following four types of titles and comments.

Display examples of titles and comments are shown below.

PROGRAM POUL 1 VAR (1) // NU manod formelt X0: BOOL // Rd minical commit RO: BOOLI // for \$ spikel conset TON O: TON; //CurrentTibe //rymbell committee Currenttime: TIME 21 BID VAB 111 Q + Network title ┥ (2)(3) Netsuck connect rum 6 operand combant THE F symbol X0 operand compart X0 symbol compart - (4) H5 specatd commant 4 transer lideys 05 T000 0 30 30 TON Ŧŀ 131 þ 0 Convert Time syster: _____ Tilo -27 ET - Current Time

No.	Item	Description
(1)	Symbol comment	This is a comment on a declared variable. The same comment is displayed for the same variable. Enter a comment on a variable in the declaration section. The comment will be displayed in a cell with a black background.
(2)	Network title (circuit title)	A title can be assigned to each network (circuit). Click the top left of the network (circuit) and enter a title.
(3)	Network comment (circuit comment)	A comment can be assigned to each network (circuit). Click the top left of the network (circuit) and enter a comment.
(4)	Operand comment	This is a comment on a variable. Different comments can be assigned to the same variable. Click a position above each variable in the implementation section and enter a comment.

To display titles and comments, you must configure settings.

Open the Options window (by selecting **Tools**>**Options**), select the "FBD, LD, and IL editors" category and then the General tag, and select the items to be displayed in the Display section.

7.1 Programming in Ladder Diagram (LD)

CPC Editor	FBD, LD and IL editor	
Deixugging Deckaration Editor Device editor PhD, LD and LL editor Trannational Settings Used and Sare Nonitoring ShortCoding ShortCoding Text editor	Show network [ite Show network [ite Show network gorman Show box (par Show symbol comment Show symbol comment Show symbol galarses Show network separators	ehaver Placeholderfor sew operands Empty operands for function block pine posed size for operand fields: Pdit Opmand Series.

1 Info.

• Titles and comments can be displayed as those translated in a particular language beforehand. For details, refer to "7.7.8 Displaying Programs in Multiple Languages (Project Localization)".

7.1.6 Commenting out a Network (Circuit)

Networks (circuits) can be commented out. A network (circuit) that is commented out cannot be executed.



Procedure

1. Select a network (circuit) to be commented out.



2. Click the *initiation* (Toggle Network Comment State) on the toolbar.

The network (circuit) will be commented out. To cancel the comment-out state, perform the same operation again.



1 Info.

- You can also comment out the selected network (circuit) using the following procedure:
 - Right-click in the network (circuit) and select "Toggle network comment state" from the context-sensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Toggle network comment state.
 - Press the <Ctrl> key + <o> key simultaneously.

7.2 Programming in Structured Text (ST)

This section explains how to create programs (ST programs) in Structured Text compliant with IEC 61131-3, the international standard for PLC programming languages.

- To create ST programs, POU objects for ST programs are required. Set the object setup language to Structured Text (ST).
- An ST program is made up by combining expressions and instructions. Expressions and instructions can also be executed under certain conditions or within a loop. Each instruction must end with a semicolon (;).

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INCOME 200 VIA SIX-VAR		
	Declaration section	
	Implementation section	
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7.2.1 ST Program Syntax

For ST programs, the following syntax can be used.

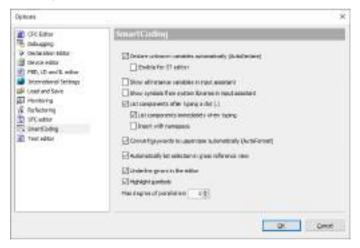
Item	Example
Assignment statement	The value of the right side is set on the left side. Example: iVar1 := 4;
Set assignment statement If the value of the right side is judged to be TRUE, TRUE will be set on the left side Once the value of the left side is judged to be TRUE, the left side will maintain TR even if the value of the right side is judged to be FALSE. Do not leave any spaces between "S" and "=". Example: bVar0S=bVar1:	
Reset assignment statement	If the value of the right side is judged to be TRUE, FALSE will be set on the left side. Once the value of the left side is judged to be FALSE, the left side will maintain FALSE even if the value of the right side is judged to be FALSE. Do not leave any spaces between "R" and "=".

Item	Example	
	Example:	
	bVar0R=bVar1;	
IF instruction	Conditions are judged and subordinate instructions are executed according to the judgment result. Example: IF (iVar0 = 4) THEN iVar1 : = 5; ELSIF (iVar0 = 7) THEN iVar1 : = 10; ELSE iVar1 : = 15;	
	END_IF;	
FOR instruction	Subordinate instructions are executed repeatedly the specified number of times. Example: FOR iVar0 : = 1 TO 10 BY 1 DO iVar1 : = iVar1 + 1; END_FOR;	
WHILE instruction Conditions are judged and subordinate instructions are executed repeatedly as long the conditions are satisfied. Example: WHILE (iVar0 <> 0) DO iVar1 : = iVar1 * 2; END_WHILE;		
CASE instruction	Conditions are judged and subordinate instructions are executed according to the judgment result. Example: CASE iVar0 OF 1 : iVar1 : = iVar1 / 2; 2 : iVar1 : = iVar1 / 4; ELSE iVar1 : = iVar1 / 8; END_CASE;	
REPEAT instruction REPEAT instruction REPEAT instruction REPEAT iVar0 := iVar0 + 1; UNTIL iVar0 = 100 END REPEAT;		
EXIT instruction	The EXIT instruction is used to terminate a loop within the FOR, WHILE, or REPEAT instruction.	
RETURN instruction	The RETURN instruction is used to terminate a program organization unit (POU). Instructions within POUs following the RETURN instruction will not be executed.	
JMP instruction The JMP instruction is used to unconditionally move control to the line indicated by JMP label. Example:		

Item	Example	
	iVar0 : = 0;	
	Label1 : iVar0 : = iVar0 + 1;	
	IF (iVar1 = 5) THEN	
	JMP Label1;	
	END_IF;	
CONTINUE instruction	The CONTINUE instruction is used to move control to the beginning of the loop within the FOR, WHILE, or REPEAT instruction.	

f Info.

• Entered keywords are converted to uppercase letters automatically (AutoFormat). To disable this function, clear the "Convert keywords to uppercase automatically (AutoFormat)" check box in the Options window.



7.2.2 Commenting out Code in ST Program

In ST programs, code can be commented out. Program code that is commented out cannot be executed.

Comment type	Description	
Single line	Program code from // to the end of the line is treated as a comment. Example: bVar1 := 2; // Single-line comment	
Multiple lines	Program code from (* to *) is treated as a comment. (* *) can also be inserted into another comment enclosed between (* and *). Example: (* Multiple-line comment 1 Multiple-line comment 2 *)	

Example: Single-line and multiple-line comments

```
1 X1 := 2; //Single line comment

2 (*

3 Multi-line comment 1

4 Multi-line comment 2

5 *)

6
```

7.3 Programming in Sequential Function Chart (SFC)

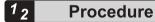
This section explains how to create programs (SFC programs) in Sequential Function Chart compliant with IEC 61131-3, the international standard for PLC programming languages.

- To create SFC programs, POU objects for SFC programs are required. Set the object setup language to Sequential Function Chart (SFC).
- The SFC program editor is divided into the declaration section and implementation section. Three elements are originally coded in the implementation section.

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a and the		
	Declaration section	
		1 III 18
111X -	-Step component	
e tan	- Transition component - Jump component	
	Implementation section	
		1 4 9 W S (8

7.3.1 Inserting Elements from Menu

For example, step elements and transition elements can be inserted from the menu, as below.



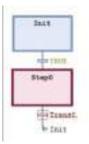
1. Select the TRUE transition element in the implementation section. The selected transition element will turn red.



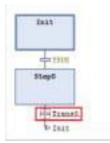
2. Click the right mouse button and select "Insert Step-transition After" from the contextsensitive menu that is displayed.

+ + +	Insert Step-transition	
₽↑	Insert Step-transition	
	Add Exit Action	
Ę.	Add Entry Action	
¢	Init Step	

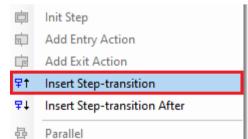
"Step0" step element and "Trans0" transition element will be inserted below the TRUE element.



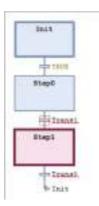
3. Select the "Trans0" element.



4. Click the right mouse button and select "Insert Step-transition" from the context-sensitive menu that is displayed.



"Step1" step element and "Trans1" transition element will be inserted above the "Trans0" transition element.



7.3.2 Inserting Elements from Toolbox

Each element can be inserted from Toolbox.

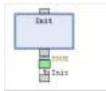
This section explains the procedure for inserting elements from Toolbox, using a step element as an example.

¹² Procedure

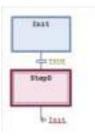
1. In Toolbox, select "Step" and then drag the step element to the position where you want to insert it.



When you drag the step element to the insertion position, the step element is transformed into .



2. Stop dragging the mouse. The step element will be inserted.



7.3.3 Inserting Elements from Toolbar

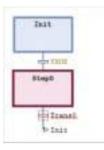
For example, step elements and transition elements can be inserted from the toolbar, as below.



1. Select the TRUE transition element in the implementation section. The selected transition element will turn red.

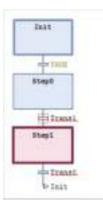
8	init	
-	101 20122	
	to Init	

Click the step-transition After") on the toolbar.
 "Step0" step element and "Trans0" transition element will be inserted below the TRUE element.



3. Select the "Trans0" transition element and click the ***** icon ("Insert Step-transition") on the toolbar.

"Step1" step element and "Trans1" transition element will be inserted above the "Trans0" transition element.



7.3.4 Setting up the SFC Editor

For SFC editor elements, you can change step specifications, fonts, and other settings. From the menu bar, select **Tools>Options** to open the "Options" dialog box. In the "Options" dialog box, select the "SFC editor" category and change the settings.

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Item name)	Default value	Function
	Step height	2	Sets the height of a step.
			Setting range: 1 to 100 matrix units ^(Note 1)
	Step width	6	Sets the width of a step.
			Setting range: 2 to 100 matrix units ^(Note 1)
Elements	Action width	6	Sets the width of an action.
			Setting range: 2 to 100 matrix units ^(Note 1)
	Qualifier width	3	Sets the width of a qualifier.
			Setting range: 2 to 100 matrix units ^(Note 1)
	Property width	6	Sets the width of a property.

Item name		Default value	Function
			Setting range: 2 to 100 matrix units ^(Note 1)
Font		-	Sets a font to be displayed on the SFC editor.
Step			Sets the operation to be performed when an action is added to a step.
			Copy reference: When a step is copied, a link to the step action is also copied. The step that is copied invokes the same action.
Actions and	Default insertion method	Always check	Copy implementation:
Transition s		niways chock	The step action of a step that is copied is embedded. A new action object is copied to a new step.
			Always ask:
			Which of the above operations is to be executed is checked each time an action is initially added to a step.
			This check box is used to specify whether to display the actions embedded in steps in the navigator pane when an action is added to a step by "Copy implementation".
	Show actions and transition objects in navigator pane	Selected	Selected:
Embedde d Objects			An action that is embedded in a step by "Copy implementation" is displayed in the Device view or POU view.
			Cleared:
			An action that is embedded in a step by "Copy implementation" is not displayed in the Device view or POU view.

(Note 1) "1 matrix unit" is equal to the font size specified in Font in **Options>Text editor>Text area** tab.

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Item name		Default value	Settings
Property Visibi	lity	Cleared	Specifies whether to display property values and names beside steps, etc.
			Selected: Displays property values and names
			Canceled: Does not display property values or names
Online	Display step time	Selected	Specifies whether to display step active time beside the step in online mode
			Selected: Displays active time
			Cleared: Does not display active time

7.3.5 Setting SFC Program Execution Conditions

Setting SFC program execution conditions

For SFC programs within a project, you can specify whether to generate code for variables used to check processing or for active transitions during build.

From the menu bar, select **Project>Project Settings**. In the Project Settings dialog box, select the "SFC" category.

The settings will be applied to all SFC objects.

Compleaptions	SFC				
Compler warnings Page Setup	Flags Build				
Security	Use	Variable	Declare	Description	
SoftMation		secinit		All steps and actions are reset. T	
		SFCRepet	2	All steps and actions are reset. T	
Static Analysis Light Lisers and Groups		StCDror		Gets 'TRUE', if a time check failed	
		S*CBrableLinit		Enable time check on steps	
		SFCErrorStep	2	Contains the name of the step th	
		SPCEmorPOL	2	Contains the name of the POU th	
		SECQuitError		Execution is stopped. SPCError is	
		SFCPeure	9	Execution is stopped. SPCError is	
		SPCTrane		Gets 'TRUE', if a transition switch	
		SPCCurrentStep		Contains the name of the active of	
		SECTIO		Switches the next transition on a V	
	¢			3	
	Acip	ly to Al			

The "Properties" dialog box for SFC objects can be enabled for only particular SFC objects. Right-click the POU object in the navigator pane and then select "Properties" from the contextsensitive menu that is displayed.

Devices	▼ ₽	×	3	ĸ	Cut	
Sample 1 Device (AGM1CSEC16T/P) Program_Configuration Application GVL Library Manager MC_PRG (PRG)	E	• ^			Copy Paste Delete Browse <u>R</u> efactoring	F
E POU (PRG)		1		1	Properties	
Task Configuration			6	ii A A	Add Object Add Folder Edit Object Hide Embedded Objects	•

In the "Properties" dialog box, select the "SFC Settings" tab and clear the "Use default" check box.

_	(Dever Proyers, Carlynator Applosted)	×	Properties - FDU (Device Program, Carring system Application) () Context (IPC Tell Rev sub) Robins Carring Minute Theory Sub)
3 Full serve Speciality Speciality	PCL PCL (Denser Ringser, Selfgeretten Application) PAL Definal (PC-PCL/Date	_	Term Terministic Declary Oraciption 0700m 000
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Clearing the check box allows settings to be changed and the Properties dialog box to be enabled for only particular SFC objects.

7.4 Programming in Function Block Diagram (FBD)

This section explains how to create programs (FBD programs) in Function Block Diagram compliant with IEC 61131-3, the international standard for PLC programming languages.

- To create FBD programs, POU objects for FBD programs are required. Set the object setup language to Function Block Diagram (FBD).
- The editor for FBD programs is a window like the one shown below. It consists of the declaration section used to declare variables and the implementation section used to enter program data. Elements can be arranged in the implementation section by selecting them from Toolbox and then dragging and dropping them in the implementation section.

R PRO M		
NOS NOS		
	Declaration section	
		10 JA
	Implementation section	
	Implementation section	
	Implementation section	

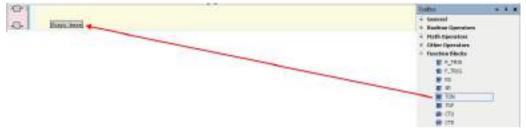
7.4.1 Entering Function Blocks

This section explains the procedure for entering function blocks, using an FBD program consisting of the following variables and function block TON as an example.

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VER TOS_0: TOS: Werds BEEL: Consection: TDEL BVair BOOL: ser_ver	
- 1	un 🙊
TOB : TOB : TO	



 In Toolbox, select Function block>TON and drag the mouse until the mouse pointer reaches the position where "Start here" is displayed in the implementation section.
 "Start here" will be displayed in the implementation section.



When you drag the mouse until the position of "Start here" is reached, the display of "Start here" turns green.



When you stop dragging the mouse at the position of "Start here", function block TON will be placed in the network (circuit).



 Select TON and enter variable TON_0, and then press the <Enter> key. The "Auto Declare" dialog box will be displayed.

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WAR	- TON_0	TON
gizjett	Detraination	8dárce
POLICADACHTWC	-	in.
ENER Doorstaan Deetaen	Cognett	- Waltin B
]Bestrateu		

3. Click the [OK] button.

Instance variable TON_0 for function block TON will be declared in the declaration section.

2) POL # PROVING 101 1 302 - 1300 1 300 1 300	
	- A

4. Select "???" beside IN of function block TON and enter variable bVar0, and then press the <Enter> key.

The "Auto Declare" dialog box will be displayed.

Auto Declare				×
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Ørjent ocustant servet	printation	-	Address	4
Data Sector Sect	Cogynet	Jae J		
			OK Cented	

5. Click the [OK] button.

Variable bVar0 will be declared in the declaration section.

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	 - 8
MSGC1- III - III - III - III	

 In function block TON, enter "T#5s" for input PT ("IN PT") and variable "CurrentTime" for output ET ("O ET").

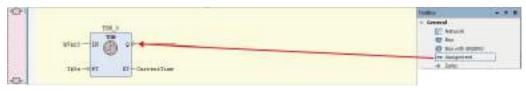
When "CurrentTime" is entered, the "Auto Declare" dialog box is displayed.

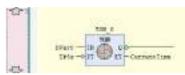
grope VAR	-	Sane CurrentTime		Type	
gojent.		Designation	_	Address	-18
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EMER Decretant Decretant Decretant		Cognett			

When making a declaration, check that the type is "Time".

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206,4	 (**) N

7. In Toolbox, select **General>Assignment** and drag the mouse until a diamond-shaped icon appears on the right side of output "Q" in function block TON.





When you stop dragging the mouse, "???" appears on the right side of output "Q".



8. Select "???" on the right side of output "Q" and enter variable bVar1, and then press the <Enter> key.

The "Auto Declare" dialog box will be displayed.

grope	Sana	Z/p4	
VAR	 blari	8001	
gizjett	Drive instant	Address	
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Ewer Constant Betadn Bergerent	Cognett		

Declare variable bVar1.

BY FOUR TOS_D: TOS: VOR TOS_D: TOS: VVerD: EDD: Conservine: TOS: EVerD: BOOL: TOS: EVerD: BOOL: TOS: EVERD: BOOL:		
1 1 1 100 1 100 100	EVA / S	(A

f Info.

• The FBD program can be converted and displayed as an LD program. From the menu bar, select **FBD/LD/IL>View** and select a post-conversion programming language.

7.4.2 Inserting and Commenting out a Network (Circuit)

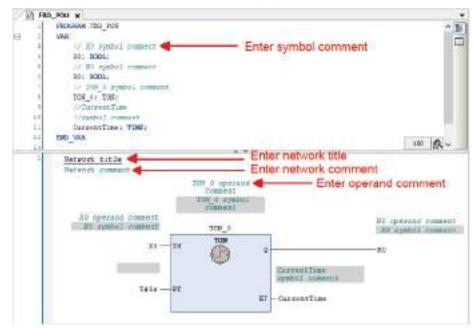
The procedure for inserting a new network (circuit) is the same as for LD programs. Refer to "7.1.3 Inserting a Network (Circuit)".

Networks (circuits) can be commented out. The procedure for commenting out a network (circuit) is the same as for LD programs.

Refer to "7.1.6 Commenting out a Network (Circuit)".

7.4.3 Input of Title and Comment (FBD)

In FBD programs, titles and comments can be entered in the same way as for LD programs. Refer to "7.1.5 Input of Title and Comment (LD)".



7.4.4 Settings in FBD Program

For FBD programs, the following settings can be configured.

Open the Options window (by selecting **Tools>Options**), select the "FBD, LD and IL editors" category and specify settings in the "FBD" tag window.

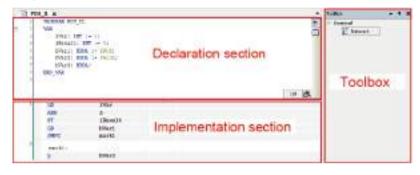
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Declaration Editor Device editor Device editor PRD, ED end IL editor Transform Sortinge Total and Sale Reflectioning SnetCoding SnetCoding Text editor	General TOO LD LL Prest View Nationaries with itre greates Connect boxes with going it line	Behaver Oefault network context After maartion select	Empty e Network -
		04	Decal

Туре	Item	Description
View	Networks with line breaks	Selects whether to arrange elements by inserting line breaks automatically so that the display fits in the lateral width of the main pane.
	Connect boxes with straight line	Selects whether to fix the shortest length of a line connecting boxes.
Behavior	Default network content	Selects whether to arrange elements and variables automatically or arrange nothing when a network (circuit) is inserted.
	After insertion select	Selects whether to select a circuit or element after a network (circuit) is inserted.

7.5 Programming in Instruction List (IL)

This section explains how to create programs (IL programs) in Instruction List compliant with IEC 61131-3, the international standard for PLC programming languages.

- IL programs are text-based programs that consist of instructions and operands.
- To create IL programs, POU objects for IL programs are required. Set the object setup language to Instruction List (IL).
- The editor for IL programs is a window like the one shown below. It consists of the declaration section used to declare variables and the implementation section used to enter program data.



- To use POU objects for IL programs, the "Enable IL" check box must be selected as below.
- From the menu bar, select **Tools>Options>FBD**, **LD** and **IL** editors> and select the "Enable IL" check box in the "IL" tab.

7.5.1 Entering Instructions and Operands

This section explains how to create an IL program that consists of the following instructions.

11	_POU ×		
1	PROGRAM I	r_bon	
11.12	VAR		
3	iVar:	INT := 5;	
	iResu	1t: INT := 0;	
1	5 bVar1	: BOOL := TRUE;	
. 8	5 bVar2	: BOOL := TRUE;	
57	7 bVar3	: BOOL;	
	END_VAR		
	1 LD	iVar	
		iVar 3	,
	1 LD		
	1 LD ADD	3	
	LD ADD ST LD JMPC	3 iResult	
	LD ADD ST LD JMPC	3 iResult bVar1	
	1 LD ADD ST LD JMPC	3 iResult bVar1	

¹² Procedure

 Select the cell in the first row and the first column, and enter instruction "LD". The LD instruction will be entered.

1	L	D
---	---	---

- Press the <Tab> key to move to another cell and enter operand "iVar". The operand will be entered and the "Auto Declare" dialog box will be displayed. In the "Auto Declare" dialog box, declare a variable.
- Press the <Ctrl> key + <Enter> key simultaneously. The cursor will move to the next row.



In the second and subsequent rows, enter instructions and operands in the same way as above.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	

In Toolbox, select General>Network and drag the mouse until
 displayed in the
 network (circuit) in the main pane is reached.

A new network (circuit) will	be inserted.
-----------------	---------------	--------------

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	

5. From the menu bar, select FBD/LD/IL>Insert label. "Label" will be inserted.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	
2	Label:		

6. Enter label name "mark1" and add instructions and operands to the network (circuit) that has been inserted.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	
2	mark1:		
	LD	bVar2	
	S	bVar3	

1 Info.

- To create IL programs, the "Enable IL" check box in the Options dialog box must be selected. Refer to "7.5.2 Settings in IL Program".
- To delete a row, select the row and press the <Ctrl > key + <Delete> key simultaneously.
- Networks (circuits) can be commented out. The procedure for commenting out a network (circuit) is the same as for LD programs.
 Defen to "Z 1.6 Commenting out a Network (Circuit)"
 - Refer to "7.1.6 Commenting out a Network (Circuit)".
- The IL program can be converted and displayed as an LD or FBD program. From the menu bar, select **FBD/LD/IL>View** and select a post-conversion programming language.

7.5.2 Settings in IL Program

For IL programs, the following settings can be configured.

Open the Options window (by selecting **Tools>Options**), select the "FBD, LD and IL editors" category and specify settings in the "IL" tab window.

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Туре	Item	Description
View	Enable IL	Enables the use of IL programming language.
		If this check box is cleared, IL will not be displayed in the list of programming languages for setting objects when a new project is created.

Туре	Item	Description				
Behavior	Default network content	Selects whether to arrange elements and variables automatically or arrange nothing when a network (circuit) is inserted.				
	After insertion select	Selects whether to select a circuit or element after a network (circuit) is inserted.				

7.6 Programming in Continuous Function Chart (CFC)

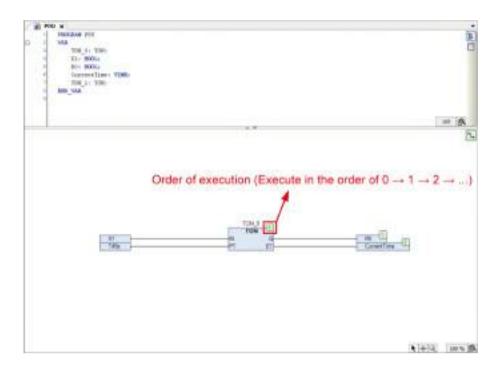
Continuous Function Chart is a graphical programming language that allows programs to be created by arranging elements within the CFC editor. Elements can be freely arranged within the editor and the order of execution is determined according to the list of elements inserted.

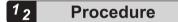
- CFC programs are classified into standard CFC programs and page-oriented CFC programs. Page-oriented CFC programs allow page-based switchover.
- To create CFC programs, POU objects for CFC programs are required. Use "Add Object" to add POU objects for CFC programs.

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Pool X Pool X		0
* (1) (2) (3)	Declaration section	
	Declaration section	
		10 10
	1.7	5
	Implementation section	
		1114 1115

7.6.1 Inserting and Connecting Elements

This section explains how to create a CFC program that consists of the variables and function block TON shown below.





1. In Toolbox, select CFC>Box and drag the box element and drop it in the implementation section.

The box element will be placed in the implementation section.



 Enter an instance name in "???". The box element will be transformed into function block TON and an instance name can be entered for function block TON.



 Select TON and enter variable TON_0, and then press the <Enter> key. The "Auto Declare" dialog box will be displayed.

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VAR	 TON_D	TON	- 2
Qizjett	[stimization	Addrese	
POULT Depication)		ie .	
EH4+ Goretant Jeptade Jepsestent	Cograet		

4. Click the [OK] button.

Variable TON_0 for function block TON will be declared in the declaration section.

Rec. H Hockwe per Sug Sug	n D
	A(=)

5. In Toolbox, select **CFC**>**Input** and drag the input element and drop it in the implementation section.

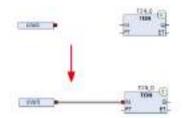
The input element will be placed in the implementation section.



 Enter variable bVar0 in input element "???" and press the "Enter" key. The "Auto Declare" dialog box will be displayed. Declare Boolean variable bVar0.

sool - is Sidraa
OK Canod

7. Select the pin on input element "variable bVar0" and drag it to "IN" on TON. Input element "variable bVar0" and "IN" on TON will be connected with a line.



8. In Toolbox, select **CFC**>**Input** and drag the input element and drop it in the implementation section.

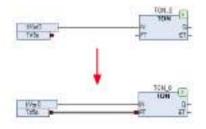
The input element will be placed in the implementation section.



9. Enter "T#5s" in "???" and press the "Enter" key.



10. Select the pin on input element "T#5s" and connect it to "PT" on TON. Input element "T#5S" and "PT" on TON will be connected with a line.



11. In Toolbox, select **CFC>Output** and drag the output element and drop it in the implementation section.

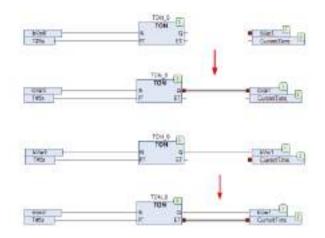
The output element will be placed in the implementation section.



12. Enter variable bVar1 and "CurrentTime" in output element "???" and press the "Enter" key. The "Auto Declare" dialog box will be displayed. Declare a Boolean variable for variable bVar1 and a Time variable for variable "CurrentTime".

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Secon Secon We Sout POLISPector Pass	Sarini Consertitions	IN G IT ET-	- <u>Lmc</u> u
Grops grops WR	Bartel Convertine Definitionen	IN G IT ET-	- <u>Lmc</u> u

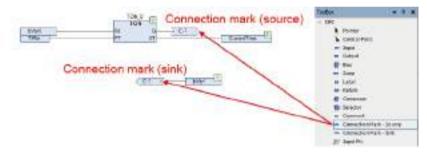
13. Connect output element "variable bVar1" and "Q" on TON and connect output element "CurrentTime" and "ET" on TON.



7.6.2 Connection Mark

Connection marks can be used to separate connection lines.

In Toolbox, select **CFC>Connection Mark - Source** and **CFC>Connection Mark - Sink**, arrange them in the implementation section, and enter the same name for them.





• You can also separate a connection line as a connection mark by selecting **CFC>Connection Mark** from Toolbox or clicking the = icon on the toolbar, with the connection line selected . Conversely, you can restore the connection mark to a connection line by selecting **CFC>Connection Mark** from Toolbox or clicking the = icon on the toolbar, with the connection mark selected.

7.7 Program Creation Support Functions

This section explains the program creation support functions used to create programs.

7.7.1 Bookmark

The bookmark function allows the cursor to move to bookmarked locations.

The bookmark function can be used in all programs other than SFC programs.

This section explains the procedures for setting bookmarks and moving the cursor between bookmarks, using an LD program as an example.



Procedure

1. Select the network (circuit) where you want to set a bookmark. From the menu bar, select Edit>Bookmarks>Toggle Bookmark, or click the <Ctrl> key + <F12> key simultaneously.

A bookmark () will be set in the selected network (circuit). Performing the above operation again clears (deletes) the set bookmark.



2. To move to the next bookmark, press the <F12> key. To move to the previous bookmark, press the <Shift> key + <F12> key simultaneously.

f Info.

- To clear (delete) all the set bookmarks, from the menu bar, select Edit>Bookmarks>Clear All Bookmarks.
- You can also perform bookmark operations by clicking appropriate icons on the toolbar.



No.	Item
(1)	Toggle Bookmark
(2)	Previous Bookmark
(3)	Next Bookmark
(4)	Clear All Bookmarks

7.7.2 Call Tree View

Opening the Call Tree view enables the user to search the callers and callees of blocks such as functions, function blocks, or POU.

¹² Procedure

- 1. From the menu bar, select View>Call Tree.
 - The Call Tree view will be displayed.

DallTree			- * H
Call Trea POL: name Symbol	1	A A A	
Symbol	Location		

2. Enter a block to be searched in the POU Name field and press the <Enter> key. The caller and callee of the block will be displayed in tree structure.

Double-clicking in any search result line displays the corresponding window in the main pane.

Example: Searching the caller and callee of FunctionBlock_Sample

Call Tree	→ ₽ X
POU name FunctionBlock_Sample	✓ ▶ 🔍 🗾 ♦
Symbol FunctionBlock_Sample is called by: ST_Sample FunctionBlock_Sample calls:	Location Line 1 (Ded) Line 22, Column 1 (Impl) Line 1 (Ded)



- Pressing the <F4> key moves the cursor to the next search result line. Pressing the <Shift> key + <F4> key simultaneously moves the cursor to the previous search result line.
- Position the cursor on a block in the implementation section. From the menu bar, select **Edit>Browse>Browse Call Tree**. The Call Tree view will be displayed with a search conducted for the block at the cursor position.

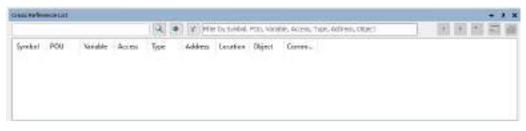
7.7.3 Cross reference List View

Opening the Cross reference List view allows the user to search the locations of variables and other elements used within the entire project.

¹² Procedure

1. From the menu bar, select View>Cross Reference List.

The Cross reference List view will be displayed.



 Enter a variable name (or another element name) to be searched in the search field and press the <Enter> key.

The locations of the variable (or element) used will be displayed in list form. Double-clicking in any search result line displays the corresponding section in the main pane.

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THE S			- I CALLER	Tueso na	skied, coo.	Yandole, Houers	10 180	time t	
Symbol	POU	Variable	Access	Туре	Address	Location	Obje	ict .	^
= Ward	F8_400	Narti	Dedaration	UNIT		Line 3 (Dec)	FB_4	00 Dev	oe: Pr
-iVar0	FB_400	Warth	Read	INT		Line 1, Column 10 (Impl)	FB_A	00 Dev	ice: Pr
War0	MC_PRIG	(verb		DNT		Line 1, Column 8 (Impl)	MC_P	RG Dei	ice: Pr
FB_inst.Nar0	ST_POU	/var0	wite	DMT		Line 1, Column 9 (Impl)	ST_P	ou pev	icei Pr
= War0	MC_PRG	illarti .	Dedaration	DNT		Line 3 (Decl)	MC_P	RG (Der	ice: Pr
•	110.000	11.1				1.1.1.1.1.1.1.	1.00	10.77	3

Example: When variable iVar0 is entered



- Pressing the <F4> key moves the cursor to the next search result line. Pressing the <Shift> key + <F4> key simultaneously moves the cursor to the previous search result line.
- For searches, you can use an asterisk (*) that represents any character string or a question mark (?) that represents a single character.
- Position the cursor on a variable in the implementation section. From the menu bar, select **Edit>Browse>Browse Cross Reference**. The Cross-reference view will be displayed with a search conducted for the variable at the cursor position.

7.7.4 Function Block Guidance

The Function Block Guidance allows the user to enter motion function blocks into a program. The Function Block Guidance can be used in LD programs, ST programs, FBD programs, and CFC programs.

The following procedure is explained, using an example in which "Power" is searched and function block "MC_Power" is inserted into an LD program.

¹² Procedure

1. Double-click the [MC_PRG(PRG)] object in the navigator pane.



The "MC PRG" window will be displayed.

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	(1)+(4) (100 × 10

2. Select the network in the implementation section and, from the menu bar, select Edit>Function Block Guidance.

The "Function	n Black Cuidence" die	lag hay will be displaye	d	

The "Function Block Guidance" dialog box will be displayed.

historiko kalmi		
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1 Settlemannen		
 9.8 Arc and 		
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 Autory Analysis 		

 Enter a character string in the Search field.
 Function blocks related to the entered character string will be displayed in the Function Block List table.

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land	Theo paint
 Instrument 	112121
Selarki	
inc. House Status (M)	the property of the
	Andread () of

4. Select a function block that you want to insert into the program.A description of the selected instruction will be displayed in the Document tab pane.

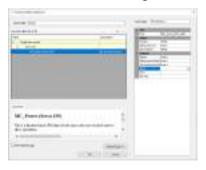
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Names Balting (1)			
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Contraction (Contraction)			
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5. Click the [Operand] button.

The instance and operand input fields will be displayed.

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enter (haiim f)	+ - * # #P
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 Benefit Cline Second 	Conception of the second secon
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	Acar .
	Acar .
	Acar .
MC_Power (Servo ON) This technical block (75) the set to set to	
MC_Power (Servo ON) This is eduction block (755 that yes the sale is	

6. Enter an instance name in the Name field and values in each operand field. If the operand for which a value has been entered is a variable that has not been declared, the "Auto Declare" dialog box will be displayed, so that the variable can be declared.



7. Click the [OK] button.

If an instance name has not been declared, the "Auto Declare" dialog box will be displayed, so that an instance can be declared.

The function block will be inserted into the program.

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i Info.

- To insert a function block into a CFC program, insert a box first and, with the box selected, start the Function Block Guidance.
- If the "With EN / ENO" check box is selected, a function block with EN input and ENO output will be inserted. When the value of EN input is TRUE, the function block is executed. Similarly, when the value of EN input is FALSE, the function block is not executed. The same value as EN input is output to ENO output.
- The Function Block Guidance can also be started using the following operations:
 - Click the "Function Block Guidance" icon on the toolbar.
 - Press the <Alt> key + <F2> key simultaneously.
 - Select the network in the implementation section, and then right-click and select "Function Block Guidance" from the context-sensitive menu that is displayed.

7.7.5 Input Assistant Function

By using the Input Assistant Function, variables, function blocks, operators, types, and other elements that can be inserted in the cursor position can be selected from categories.

¹² Procedure

 Move the cursor to the position where you want to insert a desired element and press the <F2> key.

The "Input Assistant" dialog box will be displayed.

Select a desired element from the "Categories" tab pane or the "Text Search" tab pane.

- Name	Type	Address	Origin
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+ O FLE	100-22-2		CHARLE J.S. 25.11 (C
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+ 1) Panasonic_GH_System	Library		Panjalanic OH, Syste
+ Ω 5H1_Beak	2.brury		SNS_flamit_ 4.6.2.03
* () 941_CNC	Library		910_DWC, 46.18(3
# 1) SH3_Error	(Jbrar)r		1942_BTH, 4.6.1.01
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2. Click the [OK] button.

The selected element will be inserted.



• You can also open the "Input Assistant" dialog box by selecting **Edit>Input Assistant** from the menu bar.

7.7.6 Argument / Variable Input Support (Component List)

This section explains the functions (component list) that support input of arguments and other data for function blocks during program creation.

The following three input support functions are available.

Displaying candidates for arguments that can be entered

Entering a dot (.) after a name such as a function block name or structure name displays a list of candidates for arguments that can be entered.

To enable this function, in the Options window, select **SmartCoding>List components after typing a dot(.)**.

Example: Displaying a list of members of structure variable stVar after structure variable stVar and a dot are entered



Displaying candidates for variables or other components starting with the entered character string

Entering any character string and then pressing the <Ctrl> key + <Space> key simultaneously displays a list of elements that can be inserted.

Example: Entering "TI" and pressing the <Ctrl> key + <Space> key simultaneously selects and displays the positions of variables or other components starting with "TI"



Displaying a description of function block or function

Entering a function block name (or some other name) followed by a left parenthesis displays a description of the function block in a pop-up window.

To open the closed pop-up window again, press the <Ctrl> key + <Shift> key + <Space> key simultaneously.



7.7.7 Global Renaming (Refactoring)

When a POU object name in the navigator pane or a variable name in the declaration section is changed, the sections where the changed name is used are displayed, so that the name can be changed collectively (this function is called "refactoring").

This section explains the procedure for changing the variable name of input variable " iVar2" in function block "FB_ADD" and using the refactoring function to change the variable name in the sections where the variable is called.

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* Te tag (d. ft.) attest 301	

¹² Procedure

1. Change the name of variable "iVar2" in the declaration section of the function block to "iVar3".

The "Automatic Refactoring" dialog box will be displayed.

Automatic Refactoring: Rename	×
You did rename the variable iVar2 to iVar3. Do you w references within the project?	ant to automatically adapt all
Configure Refactoring Yes	<u>N</u> o <u>C</u> ancel

2. Click [Yes].

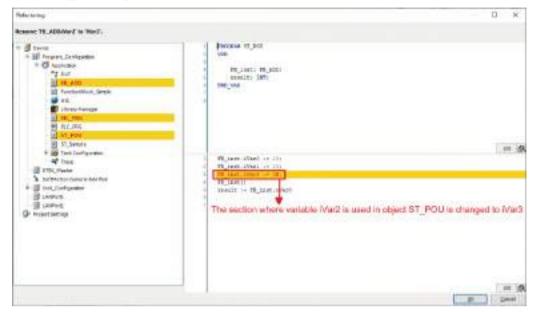
The "Refactoring" dialog box will be displayed.

Each section where the changed variable is used is displayed in red and the background of the section is displayed in yellow.

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Research 18_400/We/2 in We/2 -		
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By clicking an object in the navigator pane, you can check the change details of the object. At this stage, the changes have not been reflected yet.

When ST_POU object is selected:



Click the [OK] button.
 All changes will be reflected.

f Info.

• When the sections where the changed variable is used are displayed by the refactoring function, you can individually select whether to reflect the change. Right-click in the sections where the changed variable is used and select whether to reflect the change, from the context-sensitive menu that is displayed.

"Reject this change": Does not reflect the change in the selected section

"Accept this object": Reflects the change in the object

"Reject this object": Does not reflect the change in the object

<pre>FB_inst.iVar0 := 10; FB_inst.iVar1 := 20;</pre>		
<pre>FB_inst.iVar3 := 30; FB_inst() result := FB_inst.oVar0</pre>	Reject this change Accept this object Reject this object	
		100

In the Options window, you can specify the situations where the refactoring function is enabled.
 Open the Options window (by selecting **Tools>Options**), select the "Refactoring" category, and specify the situations where the refactoring function is enabled.

Options	*
Color Latter Color Advances Color C	Interference Suggest reflections for the following querolines: Adds declare: Interviewing reschines; on all intergreg the occupations; Interviewing reschines; Inte

7.7.8 Displaying Programs in Multiple Languages (Project Localization)

The project localization function allows the user to translate and register comments, titles, and other information in the program to display the translated content in the program window.

Procedure

 From the menu bar, select Project Project Localization>Create Localization Template. The "Create Localization Template" dialog box will be displayed. **2.** Select information to be translated.

To translate comments and titles in a program, select the "Comments" check box. To add location information to a template, select "First Appearance" or "All" in the Location information drop-down list.

Create Localization Template	Х
Include the Following Information	
Names	
Identifiers	
Strings	
Comments	
Position information	
First Appereance V	
Create Cancel	

3. Click the [Create] button.

The "Save As" dialog box will be displayed.

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Service type: POI transition template 1*pel)						
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in the restau				-		-

- Enter a file name and click the Save button.
 A POT translation template file (".pot") will be created.
- **5.** For localization, use an editor such as PoEditor to enter translations. Create a localization file (".po").

6

- From the menu bar, select Project >Project Localization>Manage Localizations. The "Manage Localizations" dialog box will be displayed.
- 7. Click the [Add] button.

The "Open Localization File" dialog box will be displayed. Select a localization file (".po") that has been created.

The added localization file will be displayed in the "Available Localizations" area.

Manage Localizations	×
Available Localizations	
Files	Add
ld_sample-en-US.po <original version=""></original>	Remove
Default localization	
Switch Localization	OK Cancel

8. Click the [OK] button.

The "Manage Localizations" dialog box will be closed.

This completes the localization file creation procedure.

Next, the procedure for switching the display is explained below.

 From the menu bar, select Project>Project Localization>Switch Localization. Symbol comments and title comments will be displayed according to the translations in the added localization file.

To return the display to its original state, select "Switch Localization" again.

7.7 Program Creation Support Functions

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1/260	Scope	Name	Address	Data type	Indialization	and the second se	Attributes	
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		RI	T. S.	Tr	anslated	title comme	nt	
	1.00010		CH 0					

1 Info.

• You can also switch the localization file by clicking 🗯 on the toolbar.

7.8 Build

When a created program is subject to a build process, objects in the application are compiled. If code generation is executed after the build process is executed, an application to be downloaded to the GM1 controller will be generated.

7.8.1 Build

The syntax of all objects is verified when the build process is executed for the first time.

The syntax of only differences is verified when the build process is executed a second time and thereafter. No application code will be generated.

7.8.2 Rebuild

Verifies the syntax of all objects again.

As is the case with build, no application code will be generated.

¹₂ Procedure

1. From the menu bar, select **Build>Rebuild**.

The syntax of all objects will be verified. If an error or warning occurs, an error or warning message will be displayed in the message view.

Check the message displayed in the message view and correct the program as necessary. After correcting the program, execute rebuild again.

7.8.3 Code Generation

The GM1 controller generates codes (application codes) to be executed when the application starts.

Displays the remaining program capacity and variable capacity during code generation.



1. From the menu bar, select **Build>Code Generation**.

Tests will be executed to check memory allocations, data types, and library availability and code size (in bytes), data size (in bytes), allocated memory contents, and most frequently used address (in bytes) will be displayed in the Messages view.

Example: Messages view displayed when code generation is completed correctly

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Never and torten here the Never and tortake Never and tortake Never and tortake Never and tortake Never and tortake	And Annu Million Lyton 137777. Sharen, Yanned, and anistene ATMAR WARF WILLION 137777. Sharen, Yanned, and anistene ATMAR WARF WILLION 137777. Sharen, Yanned and Anisan Share. Share Warf Warf Warf 20200 1 (Sine, Spitzer and Anisan Share), anged to strategies a million frame, Spitzer and Anisan Share. Share warf warf warf and "matterial Share" and Anisan Share. Share warf warf warf and the strate strategies and anisan Share. Share warf warf warf and "matterial Share" and Anisan Share. Share warf warf warf and "matterial Share" and Anisan Share. Share warf warf warf and the strategies and the str	namer solar interference for marr solar displan (2 %) hannin gazi (1 kelar 2 %) marr solar (1 kelar (2 %)			

Memory area 0	Program capacity	For the maximum capacity, refer to the GM1 Series Reference Manual (Hardware).
Memory area 1	Variable capacity (non-hold)	For the maximum capacity, refer to the GM1 Series Reference Manual (Hardware).
Memory area 2	Input variable	Automatic assignment during code generation
Memory area 3	Output variable	Automatic assignment during code generation
Memory area 4	Internal memory	Automatic assignment during code generation
Memory area 5	Variable capacity (hold)	For the maximum capacity, refer to the GM1 Series Reference Manual (Hardware).

i Info.

• After application codes are generated, if some codes are changed and code generation is executed again, differential compilation will reallocate memory to only newly added and changed blocks and variables. If memory fragmentation occurs as a result of memory reallocation, the amount of memory that can be actually used will be reduced. To eliminate memory fragmentation, you must perform the procedure described in "7.8.4 Clean".

7.8.4 Clean

Deletes application build information.

¹² Procedure

From the menu bar, select Build>Clean.
 If "Clean" is executed, the following confirmation message will be displayed.

GM Prog	jrammer >	<
?	Attention: After this action login is no longer possible without download! Do you wish to continue?	
	<u>Y</u> es <u>N</u> o	

Clicking the [Yes] button executes "Clean".



- If "Clean" is executed, online change can no longer be performed. Therefore, to log in to the GM1 controller again, you must download the applications.
- If you copy a program object (POU object), execute "Clean" for the copied POU object.



• Even if "Clean" is executed, the variables registered in the global persistent variable list will not be initialized. Other variables and persistent variables will be initialized.

7.8.5 Clean All

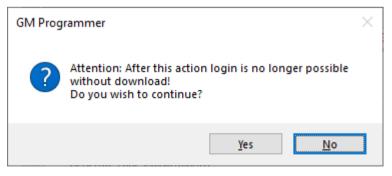
Deletes all application build information in the same way as "Clean".



Procedure

1. From the menu bar, select **Build>Clean All**.

If "Clean All" is executed, the following confirmation message will be displayed.



 Clicking the [Yes] button executes "Clean All". If variables have been registered in the persistent variable list, the following confirmation message will be displayed.

GM Prog	rammer	\times
?	The project contains persistent variables lists with internal data (e.g: placeholders for deleted or changed variables). Do you want to delete the internal data? The persistent variables may have to get initialized after the next download.	
	Yes <u>N</u> o	

3. If you delete internal data, click the [Yes] button. If you do not delete it, click the [No] button.



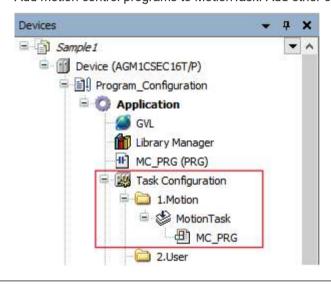
• If you have made changes such as "Add new variables to the top of persistent variable list", note that actual variable values could become different values because the memory areas for retaining variables have become misaligned.

7.9 Tasks

The GM1 series motion controller executes the following three tasks.

Task	Description
MotionTask	This is a user program task to perform motion control. It is given the highest priority. Only one MotionTask is allowed for each project.
UserTask	This is a user program task to perform control other than motion control. The user can set the level of priority. Up to 50 tasks can be registered in a single project.
SystemTask	This is a task that is used by the system and cannot be added by user programs. It is processed while other tasks are inactive.

To execute a user program, the program (POU object) must be added to tasks. Add motion control programs to MotionTask. Add other control programs to UserTask.



7.9.1 Adding Programs

POU objects of programs can be added to tasks. For example, use the following procedure to add program "LD_POU" to task "MotionTask".

¹² Procedure

 Double-click the "MotionTask" object in the navigator pane. The "MotionTask" task configuration window will be displayed in the main pane.

Task type:	Noturitait	
Priority (3.3):	P	+
Type		
Cyclic 🕑	> (interval()) Imp	
Watubdag		
Enable		
Time(T):	4	7
Sensitivity(5):		4
Pous	a) ★ Remove Call(B) 🛃 Onange Call(D) ♦ Move Up(D) ♦ Move Down(D) ♥ Open PO(UQ) Connent	
Add Cally POU		
- Add Cally		_
Add Cally POU		

2. In the "MotionTask" window, click the [Add Call] button.

Add Call (A) X Remove Call (3) 😪 Charg	# Call(S) R Mean lang) & Mean Down(D) *** Open POU(S)	
POU	Comment	
E MG		

The "Input Assistant" dialog box will be displayed.

put Assistant				
Text Search Categories				
Program	Application	Type Applitudor Accontant	Origin	
Spuctured view		- Danet i	yiti argamenta	Duart with Development broke

3. Select the POU object (LD_POU) of the program to be added to the task and click the [OK] button.

Program	- Name	Туре	Origin	1
	T LD_POU	ALXION		
⊴ Structured view			11.12.11.12.14.14.1	
ogeneration		Streety	edi wygomienta	Daart orb garagaaa poro
PROGRAM LD_POU				

The POU object of the program will be added to the task.

	Type (E) Cyclic Interval(()) Ima Watchdog □ Erable Terre(T): Sensitivety(S): POUs POUs POU POU POU Convent No. FRG	Task type:	MoturiTesk		
<pre>@ Cvolic viteval() in viteval() Watchdog Bitable Tmre(): Sensitivity(S): ************************************</pre>	(⊕ Cyclic interval()) Interval() Waithdog □ Enable Trive(): Sensitivety(S): POUs POUs POU POU POU Compent No.: PRG	Priority (33):	2		4
Watchdog Datable Trine(T): Sensitivety(S): POUs Add Col(<u>A</u>) >C Remove Col(<u>B</u>) =f Onange Col(<u>C</u>) + Move Up(<u>U</u>) + Move Down(<u>C</u>) + (Open POL(<u>C</u>)) POU Convent MC_PRG	Waithdog Datable Time(1): Sensitivety(2): POUs POUs POU POU Comment Nc_prig	Туре			
□ Erable Time(1): 1 Sensitivity(2): 1 POUS	□ Enable Time(T): 1 Semattivety(S): 1 POUs	(E) Cyclic	Diterval(D)	bra 🗸	
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Senativety(5): \$	Senativety(5): \$	Erable			
POUS	POUS	Time(T):			4
POUS	POUS	1	2		
ID_PRG	ID_PRG	POUS			
ID_RG	LO JRG	POUS			
		POUS Add Cally POU POU POU POU POU			
		POUS Add Cally POU MC_FRG			
		POUS Add Cally POU POU PC_FRG			
		POUS			
		POUS			

Selecting a cell in the "Comment" column allows you to edit the comment. The task will also be added to the navigator pane.

Devices	•	 д	×
Sample 1		-	^
😑 🚮 Device (AGM1CSEC16T/P)			
Program_Configuration			
🖻 🧔 Application			
GVL			
- 🎁 Library Manager			
LD_PRG (PRG)			
📮 🎆 Task Configuration			
🖃 🧰 1.Motion			
🖻 🗳 MotionTask			
MC_PRG			
LD_PRG			
- 🖾 2.User			1

......



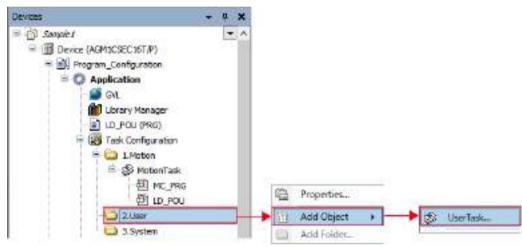
• You can also add a POU object to a task by dragging the POU object in the navigator pane and dropping it onto the task object.

7.9.2 Adding a UserTask

UserTask can be added to a project.



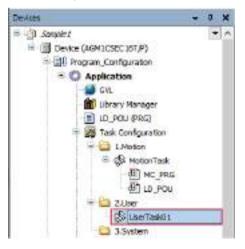
1. Right-click "2.User" in the navigator pane and then select Add Object>UserTask from the context-sensitive menu that is displayed.



The "Add UserTask" dialog box will be displayed.

Add UserTask			<u> </u>
Create new war task of	ject.		
Name(<u>h</u>):			
Los Tantol			
		_	
	Add		Cancel

2. Enter a task name in the Name field and click the [Add] button. The task object will be added.



3. Add a POU object to the UserTask.

The added POU object will be executed as a UserTask.

Double-clicking the object of the added UserTask displays a task configuration window where task settings can be configured.

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7.9.3 Task Configuration Window

The task configuration window allows the user to configure settings related to task execution, such as execution priorities, execution methods, execution intervals, and watchdog timer. For the procedure for displaying the task configuration window, refer to "7.9.1 Adding Programs".

Example: Task configuration window for task "MotionTask"

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ua Øradician Pou Pou			
ui Ø AddCall POU PC_PNU			
ui Ø AddCall POU PC_PNU			
ui Ørdad Call POU PC_PNU			

Item	Description
Task type	This field displays the type of the task. It displays MotionTask, UserTask, or SystemTask.
Priority	This field displays the priority of the task. The smaller the value, the higher the priority. For UserTask, the priority can be set between 7 and 15 inclusive.
Туре	 This field specifies the processing method for the task. For UserTask, one of the following two types can be selected. Cyclic: Processes the task at intervals. Specify a task interval in the "Period" field. Event: Starts task processing as soon as a rising edge of the global variable specified in the "Event" field is detected
Watchdog	 If the "Enable" check box is selected, when the program execution time exceeds the preset time, the task will enter an error state and comes to a halt. The stop conditions are divided into the following two cases: Case where the program execution time exceeds the number of times specified in "Sensitivity" or the time specified in "Time" Case where the program execution time exceeds "Sensitivity"×"Time" during a single cycle (Example: If "Sensitivity" is set to "3" and "Time" is set to "t#20ms", when the execution time exceeds 60 ms during a single cycle, the task will stop.) If the watchdog timer causes the task to stop, the event will be recorded in the "Log" tab of the device editor.

Item	Description			
	Summing Street	Internet Converte Convert		
	instantion LNL	Servity Insuitant Insuitant Insuitant Ap-(Appendix Ap-(Appendix Ap-(Appendix Appendix Appendi		

8 Connecting the GM1 Controller and PC

8.1 Flow of Operation Check	8-2
 8.2 Connecting the GM1 Controller and PC 8.2.1 Selecting a Connection Port for GM Programmer 8.2.2 Connecting the GM1 Controller and PC with a Cable 8.2.3 Operation when Power is ON 	8-3 8-3
8.3 Operation Mode Switching	8-5
8.4 Communication Setting8.4.1 Adding USB Ports8.4.2 Setting the LAN Port	8-6
8.5 Connecting to the GM1 Controller	8-10
8.6 Setting Time	8-12
 8.7 Other Settings	8-14 8-15 8-17
 8.8 Login / Logout	8-20 8-21 8-21 8-23
8.9 Source Upload	8-27
8.10 Commissioning8.10.1 Online Config Mode8.10.2 Conducting Commissioning for Servo Amplifiers	8-29

8.1 Flow of Operation Check

This chapter explains how to connect the PC where GM Programmer is installed and the GM1 controller and operate the GM1 controller from the PC.

First, this section explains the flow of operation check for a program that is created.

1. Build

Execute build to check a program that is created. If an error occurs, correct the program and execute build again. If code generation is executed after build is completed normally, an application will be generated.

Operation: From the menu bar, select **Build>Build**. From the menu bar, select **Build>Generate Code**.



Connecting to the GM1 controller

Connect the PC where GM Programmer is installed to the GM1 controller.

Operation: Double-click the Device object in the navigator pane to display the "Communication Settings" window, and then select the "Network Scan" tab and select the GM1 controller to which you want to connect.



3. Login

Log in to the GM1 controller. When you log in to the GM1 controller, applications are downloaded to the GM1 controller.

Operation: From the menu bar, select Online>Login.



4. Debug

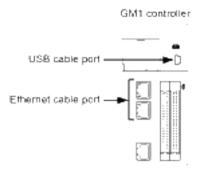
Execute the application and perform debugging. If there are any problems with behaviors, log out of the GM1 controller, correct the problem, and execute build again.

Operation: From the menu bar, select "Debug" and then each debug menu item.

8.2 Connecting the GM1 Controller and PC

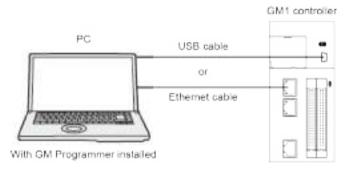
8.2.1 Selecting a Connection Port for GM Programmer

Select either LAN port connection or USB port connection.



8.2.2 Connecting the GM1 Controller and PC with a Cable

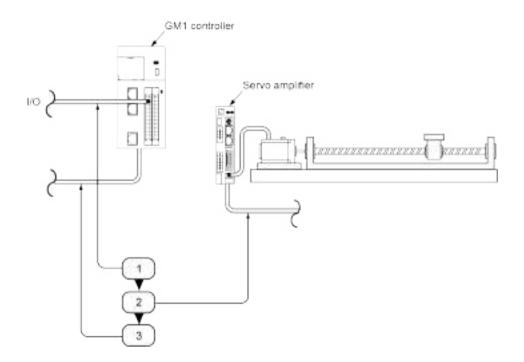
Use an Ethernet cable or USB cable to connect the GM1 controller and a PC on which the GM Programmer is installed.



8.2.3 Operation when Power is ON

When turning ON the power supply to the system incorporating the GM1 controller, consider the nature and statuses of any external devices connected to the system, and take sufficient care so that turning ON the power supply will not initiate unexpected movements.

- 1. Turn ON the power supplies to the I/O devices connected to the GM1 controller.
- 2. Turn ON the power supply to the servo amplifier.
- **3.** Turn ON the power supply to the GM1 controller.



8.3 Operation Mode Switching

Switching to the RUN mode

There are the following two methods.

- Press the operation button (▶) on the GM Programmer while the STOP LED is lit.
- Set the RUN/STOP switch on the GM1 Controller to RUN.

i Info.

• The switch cannot be set to the RUN mode if an error that does not allow to continue operation has occurred or if an exceptional situation has occurred.

Switching to the STOP mode

There are the following two methods.

- Press the stop button (=) on the GM Programmer while the RUN LED is lit.
- Set the RUN/STOP switch on the GM1 Controller to STOP.

8.4 Communication Setting

8.4.1 Adding USB Ports

This function allows the user to set a USB port as the communication interface between a tool such as GM Programmer or PANATERM Lite for GM and the GM1 Controller.

¹² Procedure

- 1. Connect the GM1 Controller and PC with a USB cable.
- 2. From the menu bar, select Online>Add USB Port.



The "Add USB Port" dialog box will be displayed.

USB Port	
Device	Panasonic GM USB-COM
Porti	Сомз

3. Click the [OK] button.

A dialog box to restart the Gateway will be displayed.



4. Click the [OK] button.

The "Select Device" dialog box will be displayed.

4.12	10
Device Name: Galeway-1	Scan Network
Oriver: TCP/IP BP-Address locaftest Port 1217	<u> </u>
	Gateway-1 Oviveri TCP/JP EP-Address locafiest Porti

 Select a GM1 Controller to which you want to connect and click the [OK] button. When the connection is completed, a dialog box will be displayed to notify successful connection.

GM Programmer	×
USB port added successfully.	
ОК	

6. Click the [OK] button.

A USB port will be added as the communication interface between the PC and GM1 Controller.

8.4.2 Setting the LAN Port

The following table shows the default network settings.

When connecting GM Programmer and the GM1 controller via a LAN port, match the network settings of the PC with those of the GM1 controller.

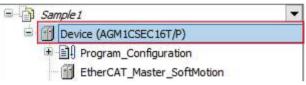
	LAN port 1	LAN port 2
IP address	192.168.1.5	192.168.2.5
Subnet mask	255.255.255.0	255.255.255.0
Default gateway	192.168.1.1	0.0.0.0

Set the IP addresses of LAN port 1 and LAN port 2 so that their network (subnet) addresses are different.

Network settings can be changed using the [PLC parameters] tab of the "Device" object in the navigator pane, as described below.

1₂ Procedure

1. Double-click the [Device] object in the navigator pane.



The Device setting window will be displayed.

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2. Click the "PLC parameters" tab in the Device setting window.

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# P Jakers STRC 381,081,18 192,301,1.8 Specify for is address for 100 per L1 log # BakerSteek STRDC 301,001,100 Str0.00,1 Specify for is address for 100 per L1 is are and Singer # D Jakers STRDC 301,001,100 Str0.00,1 Specify for is address for 100 per L1 # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for is address for 100 per L1 # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for isolating stronger # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for isolating stronger # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for isolating stronger # D Jakers STRDC Str0.00,1 Specify for isolating stronger Specify for isolating stronger # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for isolating stronger # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for isolating stronger # D Jakers STRDC Str0.00,1 Str0.00,1 Specify for isolating stronger # D Jakers	Date with Fire and Settings	· Pretoxicition				NationAugusta
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log United States State		# 7 Address	steac.	382.388,1.9	100.000.0.0	Spendry Herip soldiers: for LB1 port1.
Image Image <td< td=""><td></td><td># tubecreak</td><td>378.90</td><td>'ms ms.ms.d</td><td>200 258 259.0</td><td>specify the advectment for LH1 and 1</td></td<>		# tubecreak	378.90	'ms ms.ms.d	200 258 259.0	specify the advectment for LH1 and 1
Aussi Algebra Aussi		# Jackait Gebrivey	578/96	182,001.1.0	11,18.38	. Specify the default patentary for UNIC parts.
Annesifigting I have that INTERD 2015 2015 2015 2015 2015 2015 2015 2015	Dates and Droops	- #1,44 pert2				LAN per Climbrah witting:
N.2.Bert N.2.Bert N.2.Bert Not Deployment Salts		# 2 ^a Julijana	ITRAG	190.0812.0	102.988.3.8	Specify the p. address for Life per G.
Ru: Beel Ru: Destructory Reck Conference Rama	Accessification	and share and share and share and share and	178290	2010.2010.2010.0	288.298.286.0	
R. L. Parametery 1 Task Conference Status		P Sefault tolevas	378.041	0.6.8.0	0.6.8.6	specify the default patences for LMM parts.
Tank Conference Serve	4.13940	-				
âns	R.L.Parametery					
	Taxà Deployeere					
Menoperat	datus -					
	(discounts)					

3. Set the IP address, subnet mask, and default gateway for each LAN port.

Parameter	Type	Value	Default Raise 18	st.	Description
A sinit error attarned	Shareerston of BYTE	Ship operation	Fate constant		Rease select the operation when a unit enter occurred.
iii Netverk setting.			ntitue operation		Network setting
 9 L8Kports 		-			i dN port i network cettings
# IP Address	STRING	1997.168.L.f	192, 168, 1.5		Specify the ip address for LAN port1.
Subnet Mask	STRING	255.255.255.8	255.255.255.//		lipeof) the subnet reasi for LAM ports.
@ Default Geteney	STRING	'191.368.L.J	'192, 365, 1, 1'		Specify the default gateway for LAN port I.
# #1,ANport?					LAN port2 wetwork settings
Ø F Address	STRING	192.368.2.5	192, 168, 1.5		Specify the practices for LAN port2.
Subnet Mask	\$78(946	265.255.255.9	255.255.256.0		ipeofy the subnet risesk for LAN port2.
DefailtGaterwy	STRING	0.1.0.5	3.0.2.0		Specify the default patenay for LAN port2.

4. Download the project to the GM1 controller.

i Info.

• If you change the network settings for the LAN port that connects the GM1 controller and GM Programmer with a LAN cable, the connection will be temporarily disrupted.

8.5 Connecting to the GM1 Controller

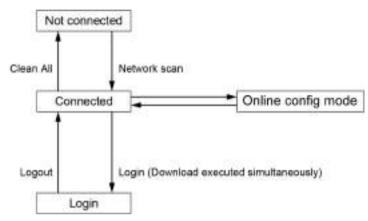
Connect the PC where the GM Programmer is installed to the GM1 Controller.

The connection status of the PC includes "Connected", "Connection as a device user", "Login", and "Online config mode".

Depending on the connection status, operations that can be executed are different.

If the Controller is provided with a device user registration, connection must be made as the device user.

Without device user registration



List of available GM1 Controller operations

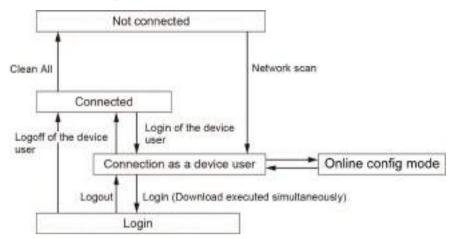
Function	Not connected	Connected	Login	Online config mode
Setting / acquiring Controller information	×	0	_O (Note 1)	×
Application management	×	×(Note 2)	0	×
Reset	×	×(Note 3)	0	× ^(Note 4)
Security	×	×	0	0
Debug	×	×	0	×
Commissioning	×	×	×	0

(Note 1) Not possible to operate the PLC Shell.

(Note 2) Possible to upload the source.

(Note 3) Possible to reset the device (PLC initialization) or to delete device application from the device.

(Note 4) Possible to reset the device (PLC initialization).



With device user registration

List of available GM1 Controller operations

Function	Not connected	Connected	\as a device user	Login	Online config mode
Setting / acquiring Controller information	×	×	0	_O (Note 1)	×
Application management	×	×	×(Note 2)	0	×
Reset	×	×	×(Note 3)	0	×(Note 4)
Security	×	×	_O (Note 5)	0	0
Debug	×	×	×	0	×
Commissioning	×	×	×	×	0

(Note 1) Not possible to operate the PLC Shell.

(Note 2) Possible to upload the source.

- (Note 3) Possible to reset the device (PLC initialization) or to delete device application from the device.
- (Note 4) Possible to reset the device (PLC initialization).
- (Note 5) Addition of the device user, changing the password for the device user, or deletion of the device user cannot be made if the user of the Device Editor is not synchronized with "Synchronization" of the group tab.

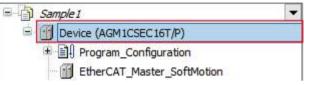
8.6 Setting Time

After executing the Network Scan function, set time for the GM1 controller. You can enter date and time directly or by getting date and time from the PC.



Procedure

1. Double-click the [Device] object in the navigator pane.



The Communication Settings window for the device will be displayed.

COMPANY AND A CONTRACT OF THE CONTRACT.	Scantletwork Gatavey + Device +	
Sets and Time and Gablings	-	
opication		- CARACTER STATE
	- Annual -	
wet and Groups	Set	
econa Righta	D. Add view	Device Name ASMICERNET
LCSHI	Purt	Ulevice Address
LE POINTIERES	1917	0347,4054
Task Deployment		Tangat 23.1 1849-900 L
Ratur		Tangan Telata 1932
Namation		Terust Vestion Panasini Calporation
10. U.S.		Target Vession 1.804

 Click the "Date and Time and Settings" tab. The Date and Time Settings window will be displayed. The "Device Date and Time" section displays the current date and time of the GM1 controller.

Communication Settings	Device Date/Time	Dute/Time	
Date and time and seconds	ows minimum [minimum]	tokebbi Sdd/mm/www1	11/1.10836
ASSIGNORS	with croiv	946494949494	
Long	Tive: 13:13:44 [biyandua]	Time(5)) [Distantuse]	tărălă 🔯
Union and Groups	Time Zanco UTC+01:00	Time Zanelgie	(UTC) Cowstholes Universal Time -
Access Rights			
ALC Shell			📋 Get dala/time fram PC (g)
R.C. Paramaters			12pdame313

Change the date, time, and time zone in the "Date and Time" section or select the "Get date / time from PC" check box, and click the [Update] button.
 A confirmation message will be displayed.

GM Prog	rammer	\times
?	Do you want to update device date and time?	
	<u>Y</u> es <u>N</u> o	

4. Click the [Yes] button.

The date and time of the GM1 controller will be updated.

8.7 Other Settings

For the connected device, configure settings described in "Change Device Name", "Sending Echo services", "Device preference management", and "Confirmed Online Mode".

8.7.1 Changing the Device Name

This section explains how to change the name of the device connected via "Network Scan".

¹² Procedure

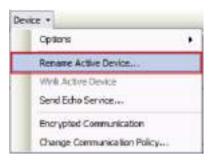
1. Double-click the "Device" object in the navigator pane.

Sample 1	-
Device (AGM1CSEC16T/P)	
■ ∰ Program_Configuration	
EtherCAT_Master_SoftMotio	n 🗧

The setting pane will be displayed in the main pane.

COmmunication Settings	Scan Historyk Gataway + Devico +	
Data and Time and Gattings		
kopication		- Contraction
Log		
unit and Groupe	Ga	- ERMANN (CREW)
Access Rights	D. A d d sere	Device Neme AGMECORVEST
n.cshell	POTE	Device Address
LE PORINIEDERS	1217	0347,4054
Task Deployment		Target 81: 1549-0001
Ratur		Target Types 9372
Manatori		Target Vendorr Penesion Corporation
10 A.		TargetVectum. 1.804

 Select "Rename Active Device" from the "Device" menu. The "Change Device Name" dialog box will be displayed.

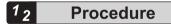


3. Enter a new device name and click the [OK] button. The device name will be changed.

Change Devic	e Name	×
Device name	2	
Current	AGM1CSEC16T/P	
New	Device	~
		<u>O</u> K <u>C</u> ancel

8.7.2 Sending Echo Services

This section explains how to send Echo services to the device connected via "Network Scan". Echo services can be used to conduct a network test.



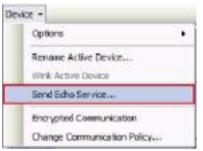
1. Double-click the "Device" object in the navigator pane.

-	Sample 1	-
4	Device (AGM1CSEC16T/P)	
	E Program_Configuration	
	EtherCAT_Master_SoftMotion	

The setting pane will be displayed in the main pane.

COMPRESSION SHOULD BE	Scan Network Gatavey + Devico +	
Date and Time and Geblings		
kolotion		Contraction of the local division of the loc
Log	Jacquered.	
unwe and liceage	Gitamay	- ERIACIS (CERN -
Access Rights	p.add-serv localited	Device Name AGM2CORVSST
R.CSHell	50D 1017	0 evec 400 est 0247.404
N.E. Porsetelle	2010 C ()	Target 83.
Task Deployment		1649-0001
Status		Tangan Tapas H302
blamation		Target Verdern Panasinik Calporation
		Tanget Vendam 1.804

2. Select "Send Echo Service" from the "Device" menu.



The results of five transmissions with no data size followed by five transmissions with data size will be displayed.



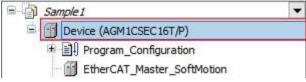
8.7.3 Device Preference Management

Devices connected via "Network Scan" can be managed by registering them as favorite devices.

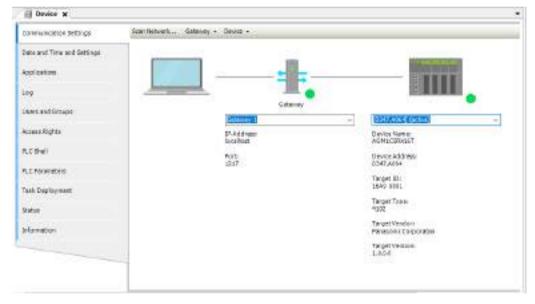
Devices registered as favorite devices will be displayed in the device selection list in the Communication Settings window.

¹² Procedure

1. Double-click the "Device" object in the navigator pane.



The setting pane will be displayed in the main pane.



2. From the "Device" menu, select "Options" and then "Add Current Device to Favorites". The connected device will be registered as a favorite device.

Options	*	Add Current Device to Favorites
Rename Active Device		Manage Favorite Devices
Welk Active Device		Filter Network Scans by Target ID
Send Edha Service		Confirmed Online Mode
Encrypted Communication	4	Store Communication Settings in Project
Change Communication Policy	1	

i Info.

• Devices registered as favorite devices can be viewed in the "Manage Favorite Devices" dialog box.

The "Manage Favorite Devices" dialog box can be displayed by selecting "Options" and then "Manage Favorite Devices" from the "Device" menu.



8.7.4 Confirmed Online Mode

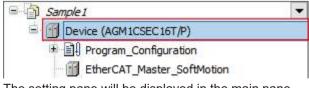
A confirmation message can be displayed when an attempt is made to implement the following actions.

- Login
- Operation
- Stop
- Single Cycle
- Force Values
- Write Values
- Unforce Values

1₂ Pro

Procedure

1. Double-click the "Device" object in the navigator pane.



The setting pane will be displayed in the main pane.

COMPRESSION SHOULD BE	Scan Heltverk Gataway + Devico +	
Date and Time and Settings		
oplation		CONTRACT OF STREET, ST
log		
in we and Groupe	Gatamay	-
kons Rights	P-Address localited	Device Name ASMECERNET
LCSHell	PUT	Device Address
LE Porientes	217	0347,4054 Target 83.
ash Deployment		1640 8081
and an		Target Target 9302
Manatori		Teropol Vendern Panasonini Corporation
		Target Vestilia. 1.804

2. From the "Device" menu, select "Options" and then "Confirmed Online Mode".

Options		Add Carrent Device to Favorites
Rename Active Device		Manage Pavorite Devices
Wink Active Device	-	Filter Network Scans by Target ID
Send Edho Service		Confirmed Online Mode
Encrypted Communication	4	Store Communication Settings in Project
Change Communication Policy	F	

When an attempt is made to log in with "Confirmed Online Mode" selected, the following message is displayed.

GM Prog	rammer			×
?	Are you sure you w with address '0005	nt to login to th ?	e node 'AG	M1CSEC16T/P
			Yes	No

8.8 Login / Logout

GM Programmer allows the user to log in to the GM1 controller.

!

• During login, the application and source code generated by code generation are downloaded to the GM1 controller.

- The combination of the application and source code downloaded to the GM1 controller differs according to the operations shown in the table below.
- o: Downloaded
- ×: Not downloaded

Operation	Boot application	Source code
Login	0	0
Initial download	0	0
Downloading after changing the program	0	0
"Update boot project" check box: Selected		
Downloading after changing the program	×	×
"Update boot project" check box: Cleared		
Downloading after changing the project	0	0
Online change "Update boot project" check box: Selected	0	0
Online change "Update boot project" check box: Cleared	×	×
Generating a boot application	0	0

After logging in to the GM1 controller, you can perform debug operations such as starting or stopping the GM1 controller.

8.8.1 Login

GM Programmer allows the user to log in to the GM1 Controller. When "Login" is executed, applications are downloaded to the GM1 Controller.

¹² Procedure

1. From the menu bar, select **Online>Login**, or press the <Alt> key and the <F8> key simultaneously.

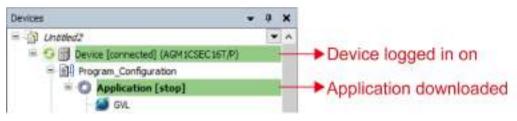
A confirmation message will be displayed, asking whether to download the applications to the GM1 controller (device).



2. Click [Yes].

The applications will be downloaded to the GM1 Controller at the same time as you log in to the GM1 Controller (device).

"connected" will be displayed at the [Device] object in the navigator pane and the status of the downloaded applications will be displayed.

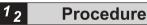


fi Info.

- You can also log in by clicking 🤔 on the toolbar.
- If you log in again after the applications have been downloaded, the confirmation message will not be displayed.

8.8.2 Logout

This function allows the user to log out from the device to which the user logged in.



 From the menu bar, select Online>Logout, or press the <Ctrl > + <F8> key simultaneously. You will be logged out.

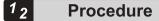


• You can also log out by clicking 🧖 on the toolbar.

8.8.3 Download

After changing programs and logging in without executing online change, you can download applications while being logged in.

The boot application is also updated during download.



1. When executing "login", select "Login without any change" and click the [OK] button.



Applications will not be downloaded to the GM1 controller.

2. From the menu bar, select Online>Download.

A confirmation message will be displayed, asking whether to download the source code to the GM1 controller.

GM Prog	raminer.	8
?	Do you really want to perform the operation 'Download'?	
	Yes No	

3. Click [Yes].

If the project has not yet been saved, a confirmation message will be displayed, asking whether to save the project.

 If you do not save the project, the source code will not be downloaded. In this case, click the [Yes] button.

GM Prog	rammer	\times		
?	Downloading the source requires the project to be saved first.			
Click 'Yes' to save the project and continue with the source download or click 'No' to skip the source download.				
	Yes <u>N</u> o			



• To delete the downloaded source code from the GM1 controller, execute "Reset Device". For details on reset, refer to "9.5.1 Reset Warm, Reset Cold, and Reset Origin".

8.8.4 Online Change

Online change allows the user to change applications without having to stop the GM1 controller during operation. Executing online change downloads only different applications to the GM1 controller.

If the applications generated by build during login differ from the applications within the GM1 controller, the following dialog box will be displayed.

0	Application changed at too less deventeed. What die ves ware to do?	
~	Dofers (@ Login with palms change,	
	Citizen with drawload.	
	C Login vithest ary diarga.	
	🖂 Ug date bootgrogent	
	Carrie	0000000000

Login with online change

Executes login by downloading only different applications without stopping the GM1 controller

Login with download

Executes login by downloading applications generated by build with the GM1 controller stopped

Login without any change

Executes login without downloading the applications generated by build

i Info.

- Do not clear the "Update bootproject" check box. If you clear the check box, the applications will not be saved when the GM1 controller is turned OFF.
- When changing the initial value of a variable with online change, be sure to add "attribute 'init_on_onlchange'" declaration to the attribute of the target variable.

If the declaration is not added, the initial value changed with online change will not be applied.

) HC	PRG X						
	×				PROG	RAM NC_PRG	
<u>.</u>	Scope	Name	Address	Data type	Initial Value	Comment	Attributes
-1	Ø VAR	data		TR	5		attrute 'rit_on_oricharge'

8.8.5 Code Analysis (Static Analysis Light)

Code analysis (Static Analysis Light) can be conducted on programs that are created. Code analysis can check for the following errors.

Error number	Description
SA0033	Unused variables
SA0028	Overlapping memory areas

Error number	Description
SA0006	Write access from several tasks
SA0004	Multiple write accesses on output
SA0027	Multiple uses of identifiers
SA0167	Report of temporary function block instance

1₂ Procedure

1. From the menu bar, select **Project>Project Settings**. The Project Settings dialog box will be displayed.

Compile optione	SEC				
Compiler warnings Page Setup	Page puld				
Security	Use: Variable	Declare	Oescription		
SPC .	SFCIAI		All steps and actions are reset. T		
SoftMation	S*CReset		All steps and actions are reset. T		
Static Analysis Light	SFCEr or	Ø	Gets 'TRUE', if a time check feeld		
😫 Users and Groups			Enable time check on steps		
	SFCBrorStep		Contains the name of the step th		
	SPCBrorPOU		Contains the name of the POU th		
	SFCQuitError	2	Execution is stopped. SPCEmoria		
	SFCPause		Execution is stopped. SPCError is		
	S*CTrans		Gets 'TRUE', if a transition switch		
	SFCCurrentStep	Ø	Contains the name of the active i		
	SPCTIp		Switches the next transition on a re-		
	¢		,		
	Apply to All				

2. In the "Project Settings" dialog box, select the "Static Analysis Light" category.

1

3. Select the check boxes of the items to be checked.

(1) Compile optione	Static Analysis Light		
😃 Complex warrings 🎒 Page Setup 👸 Security	Additional Compile Checks		
🛐 SFC 🖉 SoftWation	Unused veriables	0	
Static Analysis Light	Overlapping memory answe	B	
Users and Groups	Write access from several tasks		
CALCULAR STR	Nultiple write access on output Nultiple uses of identifiero		
	Asport temporary FunctionBlock instances		

4. Click the [OK] button.



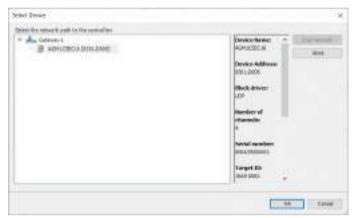
• If the items to be checked are set beforehand, code analysis will be performed automatically during login.

8.9 Source Upload

Upload the source code from the GM1 controller to the PC and retrieve it, as below.



 From the menu bar, select File>Source Upload. The "Select Device" dialog box will be displayed.



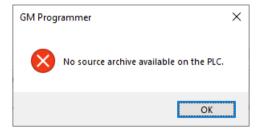
2. Select the GM1 controller from which the source code is to be retrieved and click the [OK] button.

The "Extract Project Archive" dialog box will be displayed.



i Info.

• If the source code does not exist in the selected GM1 controller, the following error message will be displayed.



3. Specify the upload destination folder and click the [Extract] button.

A confirmation dialog box will be displayed, asking whether to open the uploaded source code as a project file. Click the [Yes] button to open the uploaded source code as a project file.

GM Programmer		×
	want to open the project which has been extrac project archive?	ted
	<u>Y</u> es <u>N</u>	0

4. In the folder specified as the upload destination, "Archive.prj" and "<project name>.project" will be created.

Name	Date modified	Type
🗋 Archive.prj	2020/11/11 13:43	PIU File
Sample1.project	2020/11/11 13:43	GM Programmer

8.10 Commissioning

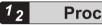
Commissioning can be conducted using GM Programmer.

To conduct commissioning, the GM1 controller must be connected in online config mode.

8.10.1 Online Config Mode

When the online config mode is selected, the servo amplifiers are set to be connected to the GM1 Controller.

When using the online config mode, perform the setting as described in "8.4 Communication Setting" in advance.



- **Procedure**
- 1. From the menu bar, select **Project>Online Config Mode**.

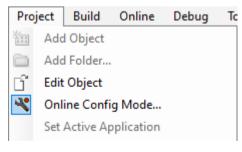
A confirmation message will be displayed, asking whether to remove all applications.

GM Prog	rammer	\times
?	Application configuration mode! All applications on PLC will be erased! Do you want to continue?	
	<u>Y</u> es <u>N</u> o	

2. Click [Yes].

All applications will be removed from the GM1 controller, and the GM1 controller and servo amplifiers will be connected in online config mode.

While online config mode is in progress, "Online Config Mode" in the menu bar remains selected.

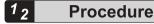


- f Info.
- To cancel the online config mode, select Project>Online Config Mode from the menu bar again.

8.10.2 Conducting Commissioning for Servo Amplifiers

While in online config mode, you can conduct commissioning for servo amplifiers. There is no need to create a program for commissioning.

The following is an example of commissioning using the A5B-series servo amplifiers.

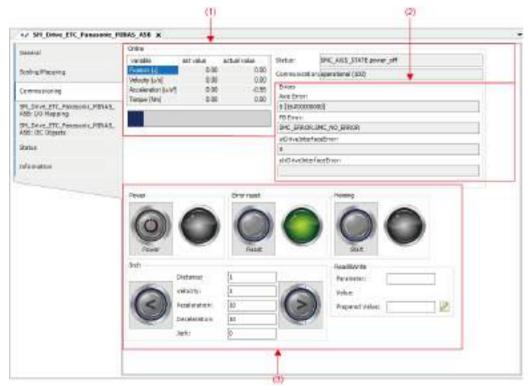


- 1. Double-click the servo amplifier object in the navigator pane.
 - G
 EtherCAT_Master_SoftMotion
 G
 MADHT11058A1
 G
 MADHT11058A1
 G
 Market SM_Drive_ETC_Panasonic_MINAS_ASB

The "EtherCAT Axis Setting" dialog box will be displayed.

2. Click the "Commissioning" tab.

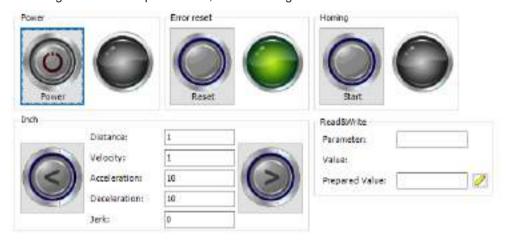
The Commissioning pane will be displayed.



No.	Group	Description
(1)	Status Displays the running status of the servo amplifiers during commissioning.	
(2)	Error	Displays errors that occurred during commissioning. Allows the user to clear errors.

No.	Group	Description	
(3)	Operation	Allows the user to set commissioning parameters.	
(3)		Allows the user to execute commissioning.	

 Click an appropriate button in the Operation group to start commissioning. Clicking an icon starts the corresponding commissioning. To change home return parameters, use the "Program" tab.



- 4. For the servo amplifier status during commissioning, check the "Status" and "Error" groups.
 - **4-1** To clear errors that are displayed, click the [Reset] button in the "Operation" group. Clicking the [Reset] button clears all errors.
- From the menu bar, select Project>Online Config Mode.
 Online config mode will be canceled and commissioning will be terminated.

This completes commissioning for servo amplifiers.

f Info.

- Even if communication with the servo amplifier is disrupted during "Inching" or "Home Return" operation, the servo amplifier will continue commissioning operation.
- If online config mode is canceled, commissioning will be terminated. To cancel the online config mode, select **Project>Online Config Mode** from the menu bar again.

(MEMO)

9 Debug

9.1 Running and Stopping the GM1 Controller9.1.1 Running and Stopping the GM1 Controller9.1.2 Single Cycle	. 9-2
 9.2 Breakpoint. 9.2.1 Setting a Breakpoint. 9.2.2 Setting an Execution Point. 9.2.3 Call Stack View 	. 9-5 . 9-6
 9.3 Debug Operations	. 9-10 . 9-11 . 9-12
9.4 Monitoring Function	.9-15
 9.5 Reset. 9.5.1 Reset Warm, Reset Cold, and Reset Origin 9.5.2 Executing Device Reset from GM Programmer 9.5.3 Executing Device Reset from GM1 Controller 	. 9-19 . 9-19
 9.6 Checking the Status of GM1 Controller	. 9-22 . 9-23 . 9-24
9.7 Device Trace Function	.9-26
9.8 Checking the Performance of GM1 Controller9.8.1 Checking Missing EtherCAT Packets9.8.2 Performance Check Based on Device Trace	. 9-33
 9.9 Error Notification Function	. 9-36 . 9-36 . 9-37 . 9-40
9.9.5 Error Code List	. 9-42

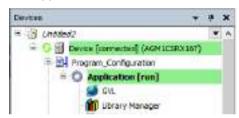
9.1 Running and Stopping the GM1 Controller

This section explains how to run and stop the GM1 controller and how to run a single cycle operation that is executed in units of a cycle.

9.1.1 Running and Stopping the GM1 Controller



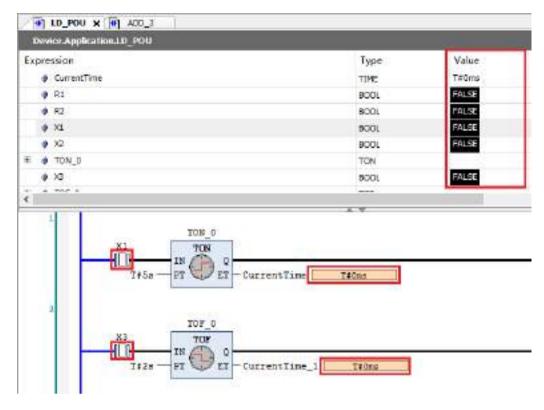
 After logging in, from the menu bar, select **Debug>Start** or press the <F5> key. The applications downloaded to the GM1 controller will start running.



2. From the menu bar, select **Debug**>**Stop**, or press the <Shift> key + <F8> key simultaneously.

The applications will be stopped.

During debug operation, you can check the current value of each variable in the declaration section and implementation section.

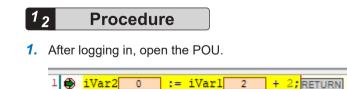




- You can start the GM1 controller by clicking ▶ on the toolbar and also stop it by clicking ■.
- You can select binary, decimal, or hexadecimal as the display format of the variable values to be displayed. From the menu bar, select **Debug>Display Mode** and select a display format from those shown.
- If you select confirmed online mode, a confirmation message will be displayed before you start or stop the GM1 controller. For confirmed online mode, refer to "8.7.4 Confirmed Online Mode".

9.1.2 Single Cycle

You can execute the application in simulation mode in a single cycle to check whether a created program is executed as intended.



2. From the menu bar, select Debug>Single Cycle or press <Ctrl+F5>.

The opened POU will enter a state in which it has been executed in a single cycle.

1 💮 iVar2 4 := iVar1 2 + 2; RETURN

100 100

107 10 4

9.2 Breakpoint

By setting a breakpoint in a particular position in a program, you can forcibly stop executing the program and check the variable values.

All programming languages support breakpoints.

9.2.1 Setting a Breakpoint

¹₂ Procedure

 Select a position where you want to set a breakpoint. From the menu bar, select Debug>Toggle Breakpoint or press the <F9> key. The breakpoint will be enabled.

Example: Setting a breakpoint in line 12 in an ST program

11 0	TE_Last. 17ar	10101
11	Th_tast_theri i	FOR 2
11 0	73 Last. 17az2 s	10-001
	TH CHARTER	1000

If operation is started, the operation will be stopped when the position of the set breakpoint is reached.

	PB_L381-17880 10	1-101
17 6	In the Lower Lines	10000
	15_tast.tRez2	18351
124.0	75 List	

In the stopped state, the following debug operations can be executed.

From the menu bar, select "Debug" and then one of the following menu items.

Menu item	Shortcut key	Icon on the toolbar
Step Over	<f10></f10>	Ç≣
Step Into	<f8></f8>	⊊ <u>≡</u>
Step Out	<shift> + <f10></f10></shift>	Ċ <u>I</u>
Run to Cursor	None	==
Set next Statement	None	\$
Show next Statement	None	\$

To cancel set breakpoints, from the menu bar, select **Debug>Toggle Breakpoint** or click the <F9> key again.

i Info.

You can specify conditions under which operation is stopped when a breakpoint is reached.
 From the menu bar, select **Debug>New Breakpoint**. The "New Breakpoint" dialog box will be displayed. Select the "Condition" tab and specify conditions under which operation is stopped when a breakpoint is reached.

New Breakpoint		
Condition Location Execution Point Settings		
Taska		
Only break if the breakpoint is hit in one of the follo	owing tasks	
Motion7ask		
C1 osminator		
		_
Hit Count		
Brook alwaya	~	
- CT TT TT TT TT TT		
Conditor		
SECTORE MODIA		-
Canditan		-
Canditan		

• The Breakpoint view allows the user to check a list of set breakpoints. You can check breakpoint positions, break conditions, and the hit count was reached. You can also add, delete, enable, and disable breakpoints.

To display the Breakpoint view, from the menu bar, select **View>Breakpoint**.

5 sports				1000		* 9 K	
Application: Application (Denner Drogram_Configuration)				•155mm×右市山田(金橋			
POU	Location	Instance Fafty	Tasks	Condition	Hit Coast Condition	Current Hit Court	Watched Value
D LD POU	Hetwork 1 (Operand TOH_C Dept)	(key)	dinty	Drank almays	Drauk Alisanya	1	
D LD POU	Network 3 / Operand 'TOP'_0' (Inpl)	(ary)	(imp)	Drask almana	Dreak almays	1	
L 00A 0	Network 1 (Operand 've" (Depa)	(arg)	dans?	Deput alcane	Grask always	1	

9.2.2 Setting an Execution Point

If an execution point is set, when the position of the execution point is reached, processing that is specified beforehand can be executed and the execution result can be output to the log of the GM1 controller. The application does not stop at the position where an execution point is set.



1. Select a position where you want to set an execution point. From the menu bar, select **Debug>New Breakpoint**.

The "New Breakpoint" dialog box will be displayed.

ireskpoint	Propertie	1	2
Condition	Location	Execution Point Settings	
Locate	n		
POU		POU [Device: Program_Configuration: Application]	
Positie		Line 1, Column 1 (Jopa)	-
Instanc			
Instan	ces selecte	d1 0	
			-
_ Ensbie	breakpoint	Immediately OK	Cantal

2. Click the "Execution Point Settings" tab.

The Execution Point Settings window will be displayed.

New Breakpoint			×
Condition Location	Execution Point Settings		
Execute the follo	int (Descution does not stop wing code	: at breakp bint)	
Print a message	in the device log		
You can include t by enclosing the	he value of variables in the r if name with {}	nessage	
_	intimediately	OK	

3. Select the "Execution point" check box and enter the code to be executed at the execution point and the message to be output to the log.

In the "Execute the following code" area, enter executable code in structure text format. In the "Print a message in the device log" field, enter the message to be output to the log.

Example: Multiplying the value of "x3" by 5 and outputting the value to the log

Execute the	following code x5 := x3 + 5;			-
			100	肉
The second se	sage in the device log		1.00	-
s3 is set to	the second s			_
	lude the value of variables in the ig their same with $\langle \rangle$	e message		

4. Click the [OK] button.

The execution point will be set. When the execution point is enabled, execution point.



• To output a message to the log when an execution point is reached, from the menu bar, select **Project Settings**. In the "Project Settings" dialog box, select the "Compile options" category. Change the setting in **Setting>Enable logging in breakpoints** to "Enabled".

9.2.3 Call Stack View

In the Call Stack view, you can check a stop position when operation is stopped due to a breakpoint or for some other reason. If the position is called from another block, the position of the block can also be checked.



 From the menu bar, select View>Call Stack. The Call Stack view will be displayed.

all Stade		- 0 ×
Applications	Task:	
POU Location	i Instance Path	

2. Set a breakpoint and stop the application.

The stop position and the POU calling the POU at the stop position will be displayed.

Example: When operation stops at line 1 of function "ADD_3" and "ST_POU" calls "ADD_3"

Call Itself			+ + x
Application: Donise Application: Tests: INSTRONTAGE			
POV	Location.	Instance Path	
A s20_1 (Device: Program, Configuration: Application)	Line 1, Column 1 (Impl)	4	- Stop position
ST_POU Device: https://configuration: 4pplication)	Line 30, Odiarin I. Ompil	4	 Block calling the process at the stop position

9.3 Debug Operations

This section explains how to perform debug operations such as writing values and watch.

9.3.1 Writing Values and Forcibly Changing Values

Variable values for the GM1 controller can be changed. There are two methods for changing values: Writing values and forcibly changing values.

Writing values: Sets a value (to be changed later) only once. This value can then be changed by the program.

Force Values: Sets a value to be changed in every cycle and maintains the value.

For example, use the following procedure to change the value of Boolean variable "x1" from FALSE to TRUE by writing the value.



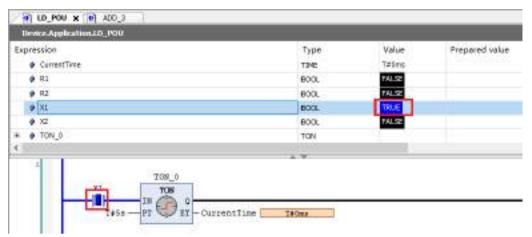
 In the implementation section, double-click the element whose value is to be changed. A new value will be preset.

You can also preset a value by clicking a cell in the "Preset value" column of the declaration section.

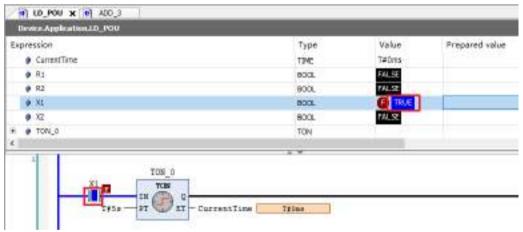
Expression	Type	Value	Prepared value
CurrentTire	T3M2	T#teo	
#1	900.	FALSE	
R2	800.	FALSE	and the second se
XL	900.	FALSE	THUE
ø x2	800L	FALSE	
* • TON_0	TON		
C TOM_0 X3 STREES TOM_0 T	- CorrentTime Tflue		

 From the menu bar, select Debug>Write Values, or press the <Ctrl> key + <F7> key simultaneously.

The preset value will be written.



From the menu bar, select **Debug>Force Values**, or press the <F7> key. The variabsle value will be forcibly changed. P appears in front of a variable whose value has been forcibly changed, and then the value will not be updated by the program.



From the menu bar, select **Debug>Unforce Values**, or press the <Alt> key + <F7> key simultaneously. Forced value change will be canceled.

9.3.2 Watch

By registering variables in the watch view, you can perform variable value management such as checking or changing variable values.

You can use up to four watch views (Watch 1 to Watch 4).

For example, use the following procedure to register variable "x1" in watch view "Watch 1".

¹² Procedure

 From the menu bar, select View>Watch>Watch 1. Watch view "Watch 1" will be displayed.

Application	Type	- 81	Execution point

2. Drag the variable "x1" element in the implementation section and drop it in the watch view. Variable "x1" will be registered in the watch view.

You can also register the variable in the watch view by dragging it from the declaration section and dropping it in the watch view.



This completes the procedure for registering the variable in the watch view. You can check variable values in the Value column.

f Info.

• Variables whose values have been forcibly changed are automatically registered in the "Watch all Forces" view.

From the menu bar, select View>Watch>Watch all Forces.

• If an execution point has been set, the timing of display in the watch view can be set to the point in time when the execution point is reached. In the "Execution point" column, select the execution point that has been set. For details on how to set execution points, refer to "9.2.2 Setting an Execution Point".

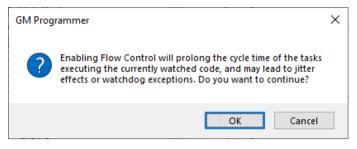
9.3.3 Flow Control

Flow control enables monitoring to be performed by using different colors in positions where the program is executed and in positions where the program is not executed.

Flow control can be used in LD programs, ST programs, and FBD programs.



 After logging in, from the menu bar, select Debug>Toggle Flow Control Mode. The flow control notification dialog box will be displayed.



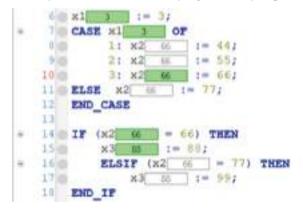
2. Click the [OK] button.

The display will be switched to flow control display.

The positions where the program was executed are displayed in green and the positions where the program was not executed are displayed in white.

Example: Flow control display for LD programs

Example: Flow control display for ST programs





• By using confirmed online mode, you can have a confirmation message dialog box displayed before you execute flow control. For confirmed online mode, refer to "8.7.4 Confirmed Online Mode".

9.3.4 Operation Mode

Using the operation mode function makes it possible to prevent some debug operations from being executed. This can prevent incorrect operation of the GM1 controller when it is operated accidentally.

The current operation mode is displayed as an icon on the status bar.

Debug (🖻)

This mode has no restriction.

Locked (🔒)

Start / stop, new breakpoint setting, and forcing values cannot be executed.

Single cycle operation, writing variables, and unforcing values can be executed.

Operational (1)

Only writing variables can be executed. Start / stop, new breakpoint setting, forced variable change, single cycle, and canceling forced variable change cannot be executed. To use this mode, the following conditions must be satisfied.

- Application is running
- There is no active breakpoint
- There is no variable whose value has been forcibly changed
- The application created in GM Programmer matches the boot application in the GM1 controller

1₂ Procedure

 After logging in, from the menu bar, select Online>Operation Mode>Locked. The operation mode will be changed from Debug mode to Locked mode.

Last build: 😋 0 😗 0 🛛 Precom	pile 🧹 🛛 🔒	RUN	Program loaded	Program unchanged
------------------------------	------------	-----	----------------	-------------------

9.4 Monitoring Function

The monitoring function allows the user to check the variables in the program and the current values of the device parameters in real time while being logged in the GM1 controller.

Monitoring variables in the declaration editor

The variables declared in the declaration editor can be monitored.

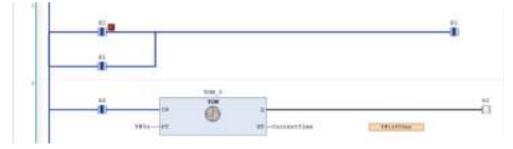
appears in front of forcibly changed values. For details on forced value change, refer to "9.3.1 Writing Values and Forcibly Changing Values".

pression	Type	Value	Prepared value
@ Carverffire	THE	TAITU	
@ R1	8001.	TRUE	
# G	6DOL	FALSE	
# 11	enol.	C TRUE	
0.12	800.	FAIRE	TRUE

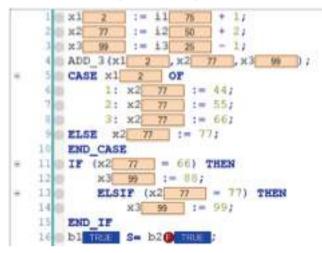
Monitoring variables in the implementation section of the program

- Variables can be monitored in the implementation section of the program (inline monitoring).
- The current value is displayed on the right side of each variable, such as
- Contacts, coils, and connection lines are displayed in blue when the current value is TRUE.

<Inline monitoring for LD programs>



<Inline monitoring for ST programs>



1 Info.

 Inline monitoring can be disabled. Open the Options window (by selecting Tools>Options), select the "Text editor" category and then "Monitoring" tab, and clear the "Enable inline monitoring" check box.

Options	- *
CPC Entre CPC E	There Soting Techinas Marga Postoring Crowle of a restoring Barrier of a restoring
	The control on table . The control on table
	Dt Ome

Monitoring variables in the watch view

By registering variables in the watch view, you can monitor the variables.

You can use up to four watch views, as well as a dedicated view where variables whose values are forcibly changed are automatically registered.

For details on how to register variables in the watch view, refer to "9.3.2 Watch".

Watth L						* * *
Expression	Application	Type	Malue	Prepared value	Rescution point	Address
# LO_POUNT	Device Application	BOOK.	O TRUE		Cydic Marstanig	
@ L0_P00.00	Device Application	8000	TRUE		Cirdic Monitoring	
# LB_POLC#	Device Japlicator	THE	Telim		Cadic Monitoring	
			L			
			Current va	lues		

9.5 Reset

Reset operation resets the active applications and initializes the variables and settings.

Reset is divided into the following four types and variables and settings that are initialized differ according to the reset type.

Reset Warm

Initializes variables other than the RETAIN and PERSISTENT variables.

Reset Cold

Initializes variables other than the PERSISTENT variable.

Reset Origin

Initializes all variables. Active applications are deleted from the GM1 controller.

Device Reset

Initializes all variables and device user management information. Applications and source code are deleted from the GM1 controller.

- The following table shows the items that are initialized by reset or other tool operation or controller operation.
- O: Retained
- ×: Initialized

Update: Updated

Operation		Variable s other than "RETAIN / PERSIS TENT"	RETAIN variable (RETAIN)	PERSIS TENT Variable s (PERSIS TENT)	(Boot) Applicati on	User manage ment	Source file	IP address	RTC time zone
Tool operation	Stop	0	0	0	0	0	0	0	0
operation	Reset warm	×	0	0	0	0	0	0	0
	Reset Cold	×	×	0	0	0	0	0	0
	Downloa d	×	×	0	Update	0	Update	Update	0
	Online change	0	0	0	Update	0	Update	0	0
	Power cycling	×	×	×	×	0	0	0	0
	Reset Origin	×	×	×	×	×	×	0	0
Controlle r	Resetting "Device"	×	0	0	0	0	0	0	0
operation	Resetting "Device" by means of hard switching	×	×	×	×	×	×	0	0

9.5.1 Reset Warm, Reset Cold, and Reset Origin

Execute Warm Reset, Cold Reset, and Reset Origin by selecting them from "Online" on the menu bar. This section explains the execution procedure, using Warm Reset as an example.

¹² Procedure

1. From the menu bar, select Online>Reset Warm.

Example: "Reset Warm" execution procedure

GM Programmer	×
Po you really want to perform the operation 'Reset Warm'?	
<u>Y</u> es <u>N</u> o	

 Click the [Yes] button. Reset warm will be executed.

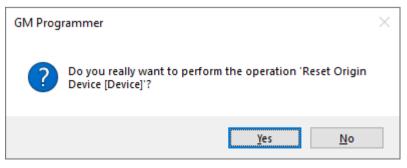
9.5.2 Executing Device Reset from GM Programmer

Device reset can be executed from the GM1 controller as well as from GM Programmer. To execute device reset from GM Programmer, right-click in the navigator pane and execute device reset from the context-sensitive menu that is displayed.



1. Right-click the [Device] object in the navigator pane and then select "Reset Origin" from the context-sensitive menu that is displayed.

A confirmation message will be displayed, asking whether to execute device reset.



2. Click the [Yes] button.

Device reset will be executed. When device reset is executed, you are logged out.



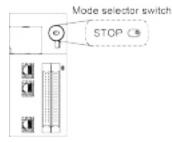
• If you right-click the [Application] object in the navigator pane and select "Delete application from device", the selected application will be removed.

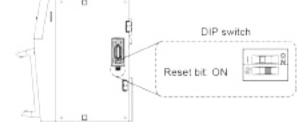
9.5.3 Executing Device Reset from GM1 Controller

Device reset can be executed from the GM1 controller.

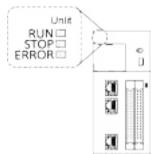


1. Check that the power is OFF, set the mode selector switch to STOP, and set the reset bit of the DIP switch to ON.

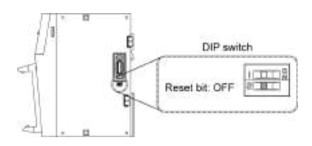




- Turn the power ON. Device reset will be executed.
- 3. When the "RUN", "STOP", and "ERROR" LEDs go out, device reset is completed.



After device reset is completed, turn the power OFF and set the reset bit of the DIP switch to OFF.



9.6 Checking the Status of GM1 Controller

9.6.1 Checking Logs

You can check logs of GM1 controller startup, shutdown, application download, and other events.



Procedure

 Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "8.5 Connecting to the GM1 Controller".
 Double click the [Dovice] chiest in the paying ter pape.

Double-click the [Device] object in the navigator pane.

] Sample 1	-
5	Device (AGM1CSEC16T/P)	
	🖻 🗐 Program_Configuration	
	EtherCAT_Master_SoftMotion	

The Device setting window will be displayed.

COMPANY OF COMPANY OF COMPANY	Scantiletverk Gatalysy + Device +	
Sets and Time and Gattings		
oplation	· · · · ·	- Contraction of the local division of the l
49		
wet and Groupe	Gatarra	- BENETIC OTHER -
koma Righta	p7.8 d d verer loca Ricet	Device Name: AGM2CRX61T
LCShell	POTE	0 evice #00/e66 0047.4654
LEPOWEERS	1217	Tanget 83:
ash Deployment		1640-000L
latur		Tangat Type a H302
Namation		Target Vesiderr Panasonix Carporation
Me the		Target Vession 1.808

 Click the [Log] tab. The log window will be displayed.

() investige				
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And and Taxa and Include	Catter Mind Chapter			
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-6.				
here in the set of the				
COLUMN .				
SCRE				
Chevrolet				
al bairpet				
ninen.				

3. Click the 🎂 icon.

The log will be displayed.

Common Control (Control)	Torra was	0 tents a record	0 million () Million () Annual ()	No. 20051000	
Canada Trea and Delivery	Data	1000 [] (PT2004			_
Contractor of the	Several	Ten Inna	Decemptor	i imporet.	
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		11.11.002 16.0149.208	retwinimentax coeffica coth-catel-catelina atraviar contenus a contenue ret	possed Distriction	
lang .		111120518-010-0128	repuering to a provide constant - program	Datedy	
Add add from the		11.11.000.00.00.00.008	Carlogener port ald, base adman shalld	EmpHaircrian	
		11.11.000.10.0017/402	CONTRACT Careed wine	184	
teres light		ALCORPT AND ADD DOWN	(3, R7, 400H2	ficience, DP, Junter	
		11.11.010-18.017.94	Appointer (Applicated Annual to start wheel wells	Drei Alli	
1224		11.11.202.01.01.01.00	count_rake	for assets (if it plustee	
		11.11.809 18.810.019	COURT, TARD	Reasons (24 Junior	
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		1111-009/01/01/01/01	Service international and a service in the service of the service	transis	
Sed-Deployment		11.11.000 (0.00.00.00.00.00	Sarting turker's address of \$1000.	Criphickel Coplinater	
		11.11.000 IA.0537.040	Tariang mater 2 widows to 2010	Dephader	
Nev .		ILILION DETERMON	terrinent of apeloaten (watertoni kalled	Direction .	
and the		11.11.05/0 (0.0119/008	reservative/ to/organe.co/ websets (septemn)		
and the second sec		as ya hop abdo thatw	instantine for Constant Busy	trainja - alaptota i	



• The displayed log can be exported (by clicking a) or imported (by clicking a) as an XML file.

9.6.2 Checking the Status

You can check only one error item that has the highest severity level among all errors currently occurring in the GM1 controller.

¹² Procedure

- Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "8.5 Connecting to the GM1 Controller".
- From the menu bar, select Online>Status.
 The "Status" dialog box will be displayed. You can check only one error item that has the highest severity level among all errors currently occurring in the GM1 controller.

INSTREET STREET SHITTER CA	Dire	1018 (Etheral)	Dan DankE	(Dona <u>(T</u>)
True lineter				Greater
The galf make number to buy street				3,222
prov Hand (SZ)				_
Draw Maria (1927) Nacional - Canadia Caratterio (1927)	000000			

Click the "Close" button.

The "Status" dialog box will be closed.



Error types

The following table shows the types and recovery methods of errors that are displayed. Clicking the [Error Clear] button deletes the target status item.

Error type	Recovery method
System error (power cycle)	Turn the GM1 controller OFF and then ON.
System error (Reinitialize)	Reinitialize the system. (Applications will be downloaded without executing a reset and the mode will be set to RUN.)
System error (Stop operation)	Click the [Error Clear] button.
System error (Continue operation)	Click the [Error Clear] button.
Incorporation / expansion error	Reinitialize the system.
Unit error	Click the [Error Clear] button or reinitialize the system.

Refer to "9.9.2 Checking and Clearing Errors Using GM Programmer".

9.6.3 Checking the System Data History

You can check histories of errors that have occurred up until now.

¹² Procedure

- **1.** Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "8.5 Connecting to the GM1 Controller".
- From the menu bar, select Online>System Data History. The "System Data History" dialog box will be displayed. You can check errors that have

occurred up until now.

Clicking the [Update] button collects system data histories again.

Clicking the [Export] button outputs the system data histories displayed in the dialog box to a ".csv" file.

Clicking the [Clear History] button deletes the system data histories that are displayed.

Ladeta (g) CR ar Hi	and the late	(itroad
Tine Stalp	- Grontaine	
unitaria unitaria	CONTRACTOR .	
11/15/2018 12:00:12	catesty era	
101862818117157	CODESYS error	
12/10/2020 12:17:27	CODERS env	
1) 18/2020 18:11/127	KTHI feelungk consumation break	
11/18/28 28 06:40:58	CODE/15 erm	
11/16/06/28 06:36:35	CODESYS error	
th and examples the	CODENTS AND	
12/12/2010 12:40:49	NTEX AMPreside number setting only	
1/12/2028 09 50-00	RTD APP nade number and rig error	
11)12/0808-04-43-33	RTED and nace number setting whor	
i lan berini da jer, inc	Company of the later	
Briton No. + 0306		

3. Click the "×" button.

The "System Data History" dialog box will be closed.

f Info.

For details, refer to "9.9.2 Checking and Clearing Errors Using GM Programmer".

9.6.4 Task Monitoring

You can check the task status, the number of cycles, cycle time, and jitter while being logged in the GM1 controller.

Double-click the "Task Configuration" object in the navigator pane and select the "Monitor" tab.

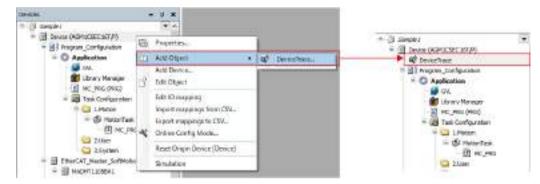
9.7 Device Trace Function

The Device Trace function of GM Programmer can monitor the CPU load factor of the GM1 controller.

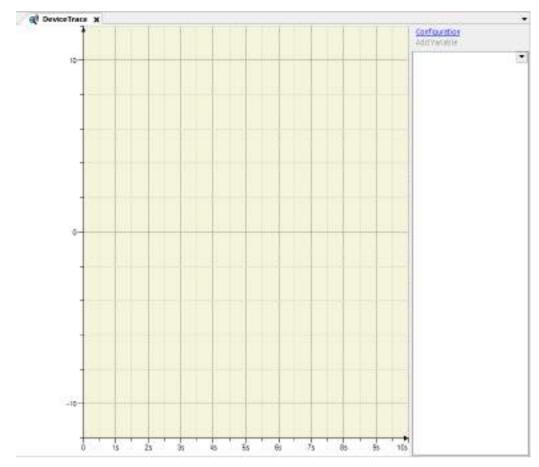
This function allows you to check whether the entire task falls within the appropriate CPU time range.

¹² Procedure

1. Right-click "Device" and select Add Object>DeviceTrace....



- 2. You will be logged in to the device.
- Double-click the "DeviceTrace" object that has been added. The "DeviceTrace" window will be displayed.

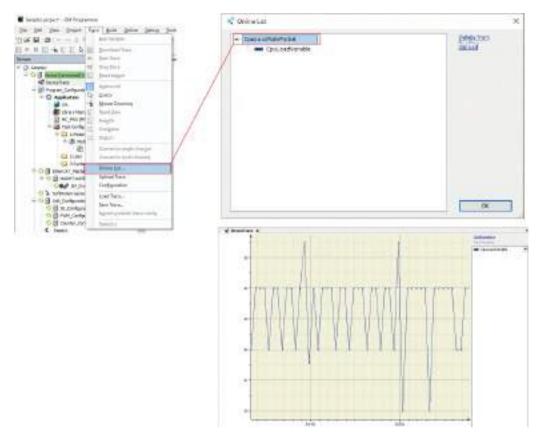


- 4. From the menu bar, select Trace>Online List....
- 5. The "Online List" window will be displayed. With "CpuLoadRatePacket" selected, click "Upload".

Plotting the CPU load factor will start.

Note: As the Online List window is still open, click the [OK] button to close the window.

9.7 Device Trace Function



6. To change the graph display settings, click "Configuration" in the top right corner of the "DeviceTrace" window to open the "Trace Configuration" window.

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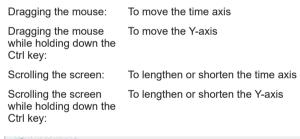
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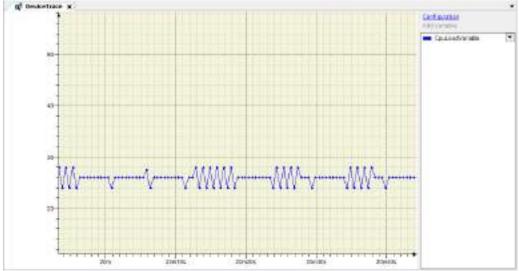
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7. The following operations can be performed on the graph.

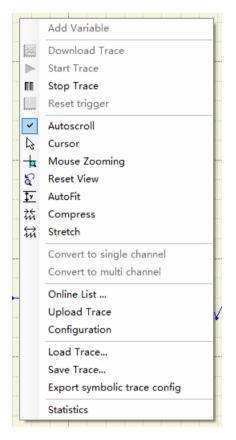




8. The following right-click menu items can be selected.

Save Trace: Allows you to save the data plotted on the graph as a file

Load Trace: Allows you to load the trace file saved by selecting "Save Trace" onto the graph screen





• Use the GM1 controller so that the average CPU load factor is no more than 90%. If 90% is exceeded, stable operation may not be achieved.

9.8 Checking the Performance of GM1 Controller

The GM1 Series motion controller is a system in which multiple tasks run.

To ensure that the GM1 controller operates as a system normally, CPU resources must be allocated to each task properly as described below.

- If CPU resources are insufficient: MotionTask and cyclic tasks cannot be operated at the specified intervals. Refer to "9.7 Device Trace Function" and keep the CPU load factor at 80% or less as a guideline.
- If the CPU load factor exceeds 80%:

Review the program in either one of the following ways.

- Extend the interval of MotionTask and cyclic tasks.
- For the program that does not require high speed processing, reassign to the tasks with long intervals.

Also, if the CPU load factor is high, a missing EtherCAT packet may occur. The following section explains how to check a missing EtherCAT packet.

9.8.1 Checking Missing EtherCAT Packets

The GM1 controller allows POU to be executed by allocating the POU to a task. To execute POU normally, the processing time ("cycle time") of the task must be smaller than the specified interval (*1) of the task.

*1: For "MotionTask", the specified interval is equivalent to the cycle time (control cycle) of "EtherCAT_Master_SoftMotion".

Task processing time

Task processing time can be viewed via the navigator pane and **Task Configuration>Monitor**. In the following example, cycle times of "MotionTask" can be viewed.

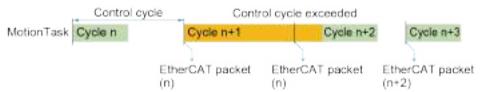
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Because cyclic communications are performed over the EtherCAT network, if the cycle time exceeds the task interval, the EtherCAT packet will not be updated in the next cycle, causing the commanded position to remain the same as the previous value. (Missing EtherCAT packet)

Example of a Missing EtherCAT Packet

In the following example, a missing EtherCAT packet occurs because the cycle time of cycle n +1 exceeds the cycle time (control cycle).



The occurrence of missing EtherCAT packet can be checked in the following ways.

1. Checking in POU

Using the "IoDrVEtherCAT.GetStatistics.udiLostFrameCount" method, the occurrence situtation of the missing EtherCAT packet can be checked on the program.

For details on "IoDrVEtherCAT.GetStatistics.udiLostFrameCount", refer to the *GM1 Series Reference Manual (Instruction Edition)*.

2. Checking with GM Programmer settings

Using the task watchdog timer function makes it possible to check whether the cycle time has exceeded the target value. In the example shown in the figure above, if time=1ms and sensitivity=1 are set, a watchdog timer error will occur in cycle n+1, causing the program to stop.

9.8.2 Performance Check Based on Device Trace

The GM1 controller allows multiple tasks to run. However, use the GM1 controller so that the CPU load factor (processing load of all tasks) is no more than 80%. The CPU load factor can be checked using the "Device Trace" function.



 Right-click the [Device] object in the navigator pane and then select Add Object>DeviceTrace from the context-sensitive object that is displayed.

Ē.	Properties			
***	Add Object	۶.	@ ₿	DeviceTrace
	Add Device			
đ	Edit Object			
	Edit IO mapping			
	Import mappings from CSV			
	Export mappings to CSV			
*	Online Config Mode			
	Reset Origin Device [Device]			
	Simulation			

The "Add DeviceTrace" dialog box will be displayed.

Add DeweeTroce	4
alasitatisped	r all traces i anning on the device.
Name of the Trace	
ECONOMIC	

The selected "DeviceTrace" object will be added to the navigator pane.



1 Info.

• If the CPU load factor constantly exceeds 95%, the GM1 controller will judge the system to be out of control, causing the system to terminate with an error.

9.9 Error Notification Function

9.9.1 Overview of Errors

The GM1 controller has a self-diagnostic function which identifies errors and stops operation if necessary.

Indications concerning self-diagnosis are as follows.

LEDs related to self-diagnostic errors

	LED displa	ay			Description	Operation	
	RUN	STOP	ERROR	ALARM	Description	status	
Normal	•	0	0	0	Normal operation	Operating	
	0	•	0	0	STOP mode	Stopped	
Error	•	0	▲	0	When a self-diagnostic error occurs (Operation continues.)	Operating	
	0	•	A	0	When a self-diagnostic error occurs (Operation stops.)	Stopped	
	0	•	-	•	System error	Stopped	

•: Lit, ▲: Flashing, ○: Unlit, -: Indefinite (Lit or unlit)

PLC parameter setting

Operation mode at the time of error can be set to continue operation or stop operation in the PLC parameter setting.

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9.9.2 Checking and Clearing Errors Using GM Programmer

Error information can be checked in the status window of GM Programmer. In case of an operation continue error, the error can be resolved by Error Clear.

f Info.

• Since the error resolution method varies depending on the error, refer to "9.9.5 Error Code List".

		Cisan	ing errors	
atus	_		+	
PLC Date Time: 11/11/2020 18:04:29	סדט⊡	RTEX Reset(<u>R</u>)	Error Clear(E)	Close(<u>C</u>)
Error Name				Operation
RTEX APP node number setting error				atap.
Error No. ; 1021				
Explain: 16493003 00000004 0000E000 629	20200			
	-	rror display		
		for display		

9.9.3 Obtaining Error Information Using User Programs

The following function block can be used to obtain error information for the GM1 controller.

SYS_SysGetSystemError

This function block is used to obtain error information for the GM1 controller from external devices such as display units.

¹ 2 Procedure

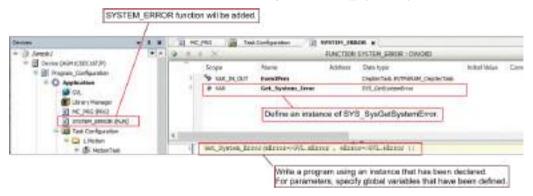
1. Define the variables to be used in the SYS_SysGetSystemError function block, as global variables.

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							as pa	rameters	of SYS_Sy	sGetSysten	nEmor.	2

2. Select "Task Configuration" and then the "System Events" tab, and register the function to be executed when a particular event occurs.

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= 🗐 Unit_Configuration 🗐 10_Configuration			En	ter the function	n name (arbitra	Cantal

3. In the function that has been added, write a program for SYS_SysGetSystemError.



4. Map the defined global variables to the I/O map of the ModbusTCP Slave Device to allow external devices to get error information for the GM1 controller.

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5. If an error occurs, the error code will be set in the variable, so that external devices can get error information for the GM1 controller.

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	3		8ir7 848	%QX88.7 %QX89.0	BOG8. 5008.	FALSE
	2		8H5 8H33	44(pidd 3 44(pidd 2	800L 800L	FALSE
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	ii ⁶ ₽ Application eDime		0.tps/tp[2]	NQM35	WORD	1678308

9.9.4 Error Recovery Processing

1 Info.

• For errors during simulation, check the log window or each function block. When an error occurs, normally, stop the operation.

When ERROR_LED flashes

A self-diagnostic error has occurred.

Solution

Check the condition according to the following procedure.

- 1. On the GM Programmer, select Online>Status and check the error content (error code).
- 2. Switch the mode to the PROG mode.
- 3. Cancel the situation in accordance with the error code.

When ALARM_LED lights up

Timeout of the system watchdog timer has been detected.

Solution

Check the condition according to the following procedure.

1. Turn the controller OFF and then ON. If the problem persists, consult your Panasonic representative.

Sample code

For a program that is used for error recovery processing, refer to the following.

<Sample program>

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9.9.5 Error Code List

Error No.	Operatio n	Name	Error description and action method	Recover y method
0x0001	Stop	System error (serious)	Notify us of the error information or system data history information displayed on the status window of GM Programmer.	Power cycle
0x0002	Stop	System error (CODESYS)	Notify us of the error information or system data history information displayed on the status window of GM Programmer.	Power cycle
0x0003	Continue	System error (minor)	Notify us of the error information or system data history information displayed on the status window of GM Programmer.	Power cycle
0x0106	Continue	Device date and time RTC error	Because the duration of the power failure exceeded the guaranteed period (14 days), the RTC time information was initialized. The device must be left ON for at least 10 minutes. Note: Time information is reset to April 1, 2019.	Clear the error
0x0110 to 0x113	Continue	PWM Cycle setting error	The cycle setting is out of range. Check whether the duty ratio is within the allowable range.	Re- downloa d
0x0120 to 0x123	Continue	PWM Duty ratio setting error	The duty ratio setting is out of range. Check whether the duty ratio is within the allowable range.	Re- downloa d
0x0130 to 0x131	Stop	Counter Overflow error	The counter value exceeds the upper limit. Perform reset or preset operation so that the counter value falls within the range between the upper and lower limits.	Re- downloa d
0x0140 to 0x141	Stop	Counter Underflow error	The counter value drops below the lower limit. Perform reset or preset operation so that the counter value falls within the range between the upper and lower limits.	Re- downloa d
0x0150 to 0x151	Continue	Counter Reset abnormal error	The count value becomes 0 under the reset conditions and goes out of the range between the upper and lower limits. Check the settings of the upper and lower limits of the counter. If 0 does not exist in the range between the upper and lower limits, make a preset request.	Re- downloa d
0x0160 to 0x161	Continue	Counter Preset abnormal error	The count value goes out of the range between the upper and lower limits under the preset conditions. Check whether the preset value falls within the range between the upper and lower limits.	Re- downloa d
0x0170 to 0x171	Continue	Counter Current value change abnormal error	The count value goes out of the range between the upper and lower limits when the current value is changed. After the current value is changed, check whether the new value falls within the range between the upper and lower limits.	Re- downloa d
0x0200	Continue	Expansion unit Communicatio n error	An expansion unit communication error has occurred. Check connections.	Clear the error
0x0201	Stop	Expansion unit	More than 15 expansion units are connected. Check connections.	Power cycle

Error Operatio No. n		Name	Error description and action method		ror description and action method Red y me	
		Number of connections exceeded				
0x0203	Stop	Expansion unit Startup error	An attempt to upgrade the expansion unit could have failed. Upgrade again.	Re- downloa d		
0x0205	Stop	Expansion unit Startup wait timeout error	Waiting for expansion unit startup has timed out. Check connections.	Re- downloa d		
0x020C	Stop	Expansion unit Connection number mismatch	The number of expansion units in the project does not match the number of expansion units mounted. Check connections.	Re- downloa d		
0x020D	Stop	Expansion unit Model code mismatch	The expansion unit model in the project does not match the expansion unit model mounted. Check connections.	Re- downloa d		
0x020E	Stop	Expansion unit Version mismatch	The version of the expansion unit registered in the project does not match the version of the expansion unit mounted.	Re- downloa d		
0x020F	Stop	Expansion unit Unit initialization error	Expansion unit initialization has failed. Check connections.	Re- downloa d		
0x0221 to 0x022F	Continue	Expansion unit I/O data error	An I/O data error has occurred in the expansion unit. Check the installation environment.	Clear the error		
0x0300	Continue	CODESYS error	A CODESYS error has occurred. Check the error details in the log window of GM Programmer.	Clear the error		

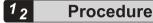
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10 Useful Functions of GM Programmer

10.1 Simulation Function	.10-2
10.2 Security Function	.10-3
 10.3 Security Function: User Management 10.3.1 Project User Management	10-4 10-4 10-8 10-10
 10.4 Security Function: Encryption	10-16 3 10-17
10.5 Security Function: Write-protection10.5.1 Opening Files in Read-only Mode10.5.2 Setting the "Released" Flag	10-24
10.6 User Library Function10.6.1 Creating a Library and Adding to the Library Repository10.6.2 Using Created Libraries	10-26
10.7 POU for implicit checks 10.7.1 Setting up POU for implicit checks	
 10.8 Interface	10-36 10-38 10-40
10.9 External File Functions 10.9.1 Setting up an External File Object	
 10.10 Servo Amplifier / Motor Operation Function (PANATERM Lite for GM) 10.10.1 Starting PANATERM Lite for GM 	.10-48 10-48

10.1 Simulation Function

Simulation mode allows the user to perform a login operation without connecting to the GM1 controller. It also allows the user to check behaviors in the same way as if the user logged in.



1. From the menu bar, select **Online>Simulation**.

Simulation mode will be invoked and "Simulation" will be displayed on the status bar.

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Cale and Tone and Salitage Applications		
Users and Groups Second Tigles FAC 2014	Gritower under ander an	
PLC Resonaters		
Sene Manufan		

2. From the menu bar, select **Online>Login**, or press the <Alt> key and the <F8> key simultaneously.

Login will occur in simulation mode. When login occurs in simulation mode, the device object is displayed in italic.

Devices	•	џ	×
Sample 1			•
□ ▲ 🚮 Device [connected] (AGM1CSEC16T/P)			
Program_Configuration			
🖹 🔘 Application			

Simulation will start.



- A is displayed in front of the object of a device that is operated in simulation mode.
- The cycle time in simulation mode may not operate according to the set cycle because of a difference in processing time depending on the operating environment.

10.2 Security Function

Stop

GM Programmer is equipped with a security function that can implement user management (project user management and device user management) and encrypt project files. This section explains security-related functions such as user management and project encryption, and the procedures for operating each security function.

- Each user ID and their corresponding password must be different character strings.
- Password strength must be sufficiently high. Do not use any passwords that can be easily guessed.
- Accounts must be managed properly and must not be shared unnecessarily.
- Use this controller in a secure network environment.
- Use encryption functions properly to protect information assets.
- Use the device user management function to perform authentication protection for the controller during operation.
- After logging in with the initial password, be sure to change the password.
 - Implement password management to prevent passwords from being forgotten. If the password is forgotten, device reset must be performed on the controller.
 - Implement password management to prevent passwords from being leaked to third parties.

Item	Description	Reference page
User management	Allows execution permissions for operations (such as executing menu commands and adding, editing, and deleting objects) to be assigned to each group in which users are registered.	"P.10-4"
	User management also enables logins to be permitted by assigning permission for login to the device to each user and entering passwords.	
Encryption / signature	Provides password-based encryption for project files and encrypts connections between the GM1 controller and the PC.	"P.10-16"
Write-protection	Provides write-protection for project files and prevents project files from being modified unintentionally by mistake.	"P.10-24"

10.3 Security Function: User Management

Project user management allows execution permissions for operations (such as executing menu commands and adding, editing, and deleting objects) to be assigned to each group in which users are registered. Logon must be performed by a user of a privileged group.

Device user management also enables logins to be permitted by assigning permission for login to the device to each user and entering passwords.

10.3.1 Project User Management

When a new project is created, Owner users, Owner group, and Everyone group are already registered.

Owner users belong to Owner group and can execute all operations.

All users including Owner users are automatically registered in Everyone group.

Group User		Remarks		
Owner	Owner	Users can execute all operations. For Owner users, the password field is left blank.		
Everyone Owner		All users are registered automatically.		

10.3.2 Creating a New User and Group

In the following example, a group (group name: GroupA) and a user belonging to the group (user name: Fred) are newly created and privileges are set so that users belonging to GroupA can access POU object "POU_1".

¹₂ Procedure

1. From the menu bar, select **Project>Project Settings**.

The "Project Settings" dialog box will be displayed.

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© tacity C(dec 5 Settleren 5 Static Instant (gh) € Instrumt Grount	Per Brails Port	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Description Al black and active were read: 7 all class and active were read: 7 all class and active were read: 7 distant active were read: 7 distant active were read. 7 distant active were read. Contains the nome of the state to Contains the nome of the state to Contains the nome of the state to Contains the nome of the state. Contains the nome of the active of Contains the new of the active of			
	Apply to All					

2. In the "Project Settings" dialog box, select the "Users and Groups" category.

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The "Users and Groups" setting pane will be displayed.

3. Click the [Add] button.

The "Add User" dialog box will be displayed.

Add User	>
Account proper tex	
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Euliname	1
Description	
Old paseword	
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Configuresswerd	1
Active 😥	
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Dvme:	
This user is also member of the "Gray and" gro	10.
the source restored a the evolution for	wp.

4. Enter information for a new user to be added. Enter information about a new user (Fred) to be added.

Add User		2
Account proper las		
Logon neme	Pred	
Eill rame	Fred	1
Description	Testuse	
@ld pasaword		
Essenard	*****	
Configuoasswerd	*****	
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Verberstes		
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This apar is also mereb	eral the Everyond' group.	Cenal

5. Click the [OK] button.

The "Logon" dialog box will be displayed. To add a new user, you must log in as an Owner user.

6. In the "User name" field, enter "Owner".

The default password for "Owner" is not set in the Password field. The "Password" field must be left blank.

Logon			?		
2	Bronder to perform this action, you must logan as a seer which is member of one of the following groups:				
	Denar				
	Please etter your	user rame and password			
	BolettLibrary	Protecti Unitified)	1		
	Upernave	Oviner			
	Passgord	<u></u>	1		
	(m)	OK Cancel	i		

7. Click the [OK] button.

Login by the Owner user will be completed and new user "Fred" will be added to the "Users" tab pane.

Avquect Settings					
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				(ox	One

The name ("Owner") of the user who logged on is displayed in the status field.

Last build: 😲 0 🕐 0 Precompile 🧹 🦓 Project user: Owner

- Select the "Groups" tab and click the [Add] button. The "Add Group" dialog box will be displayed.
- **9.** Enter information for a new group to be added.

Enter information about a new group (GroupA) to be added. In the "Members" section, specify a member that belongs to the group. Select the new user added in step "Step 4".

Add Group		×
Group Properties		
<u>N</u> ame	GroupA	
<u>D</u> escription	TestGroup	
Members		
group 'Owner'		
🗹 user 'Fred'		
user 'Owner'		
	OK Cancel]

10. Click the [OK] button.

The new group (GroupA) will be added to the "Groups" tab pane. User "Fred" is registered in GroupA as a member

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11. Click the [OK] button.

The "Project Settings" dialog box will be closed.

This completes the procedure for registering user "Fred" in group "GroupA". After the procedure is complete, the following groups and users exist in the project.

Group	User	Remarks
Owner	Owner	Group whose users can execute all operations
Everyone	Owner, Fred	Group in which all users are registered automatically
GroupA	Fred	Newly added group

i Info.

• User and group information can be exported in XML format. Click the [Export/Import] button in the "Users and Groups" setting pane and select the "Export users and groups" menu item". .users" files can be exported.

By selecting the "Import User and Group" menu item, you can import ".users" files.

10.3.3 Setting Operation Privileges

In the following example, privileges are set so that users belonging to GroupA can display a POU object (object name: POU_1).

Before performing the following procedure, add a POU object (object name: POU_1) to the project.

¹² Procedure

 From the menu bar, select Project>User Management>Permissions. The "Permissions" dialog box will be displayed.

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In the "Action" pane, select the operation to be permitted.
 Select Project Object>View>Device>Program Configuration>Application>POU_1.

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3. In the "Permissions" pane, set privileges to be assigned.

Select "Everyone" and click - Deny . "Reject" will be set.

Select "GroupA" and click **Grant**. "Approve" will be set. This enables only the users of group "GroupA" to display the object.

Permissions	
🕂 Grant 💻 Deny	y 💥 Clear
 Everyone 	
🕂 GroupA	

If the "Logon" dialog box is displayed, enter "Owner" in the "User name" field and leave the "Password" field blank before performing a logon.

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4. Click the [Close] button.

The "Permissions" dialog box will be closed.

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• Settings of operation privileges can be exported in XML format. In the "Permissions" dialog box, click the [Export/Import] button and then select the "Export All Permissions" menu item or "Export selected permissions" menu item". .perms" files can be exported.

By selecting the "Import Permission" menu item, you can import ".perms" files.

10.3.4 Performing Operation with Privileges Set

In the following example, an object (POU object: POU_1) is displayed.

Before performing the following procedure, check the status field to see that there is no user who is currently logged on the project.

If there are any users who are currently logged on the project, execute logoff by selecting **Project>User Management>User Logoff**.

Last build: 😮 0 😗 0	Precompile 🧹	CC .	Project user: (nobody)	
---------------------	--------------	------	------------------------	--

¹² Procedure

 Double-click the POU_1 object in the navigator pane. The "Logon" dialog box will be displayed with object display operations restricted.

Logon			×
P	In order to perform t member of one of the GroupA Owner	his action, you must logon as a user which is a following groups:	
	- -	er name and password Project: Untitled3	
	<u>U</u> ser name		
	Pass <u>w</u> ord		
	8	OK Cancel	

2. Enter appropriate values in the "User name" field and "Password" field, and click the [OK] button.

Enter the user name and password of the user added in "10.3.2 Creating a New User and Group".

Logon will be completed and the POU_1 object will be displayed.

The user name of the user who logged on is displayed on the status field.

Last build: 😮 0 🕐 0	Precompile 🧹	Cite in the second seco	Project user: Fred
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10.3.5 Device User Management

Device user management registers device users and allows only the authorized device users to log in to the device.

A user with user name "Administrator" and password "Administrator" is registered as a device user beforehand.

When you log in as an Administrator user for the first time, you must set any password.

¹² Procedure

 Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "8.5 Connecting to the GM1 Controller". The Device setting window will be displayed.

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 Click the "User and Group" tab. The "User and Group" pane will be displayed.

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Click the [] icon (Synchronization).
 A confirmation dialog box will be displayed.

GM Prog	rammer	\times
?	Currently, the user management is not activated on the device. Would you like to activate it now? Please note: When activating the user management you will be asked to login as 'Administrator' using the default password. Then you will be asked to enter a new password.	
	Yes <u>N</u> o	

- Click the [Yes] button.
 The "Device User Login" dialog box will be displayed.
- Enter "user name" and "password".
 Enter Administrator in the "User name" field and Administrator in the "Password" field.

Device	User Logon	8
P		not authorized to perform this operation on the device. Please enter the name f an user account which has got the sufficient rights.
	Device Name	Device (AGM1CSEC16)
	DeviceAddress	
	Uper Name	Administrator
	Password	•••••
	Operation: Object:	View "Device"
		OK Cancel

6. Click the [OK] button.

The "Password expired, please enter a new one" dialog box will be displayed.

7. Enter any password.

To set a password for the Administrator user, enter any password. If you forget your password, you cannot log in to the device.

Password expired, pleas	e enter a new one! X
<u>N</u> ame	Administrator
<u>P</u> assword	•••••
Con <u>f</u> irm password	•••••
Passwordstrength	Better 🛛 🗹 Hidepassword
	✓ Password can be changed by user
	Password must be changed at first login
	<u>O</u> K <u>C</u> ancel

8. Click the [OK] button.

The password will be set for the Administrator user and you will be logged in as an Administrator user.

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9. From the menu that is displayed, select **Online>Login**. You can log in to the device as an Administrator user account.

Device user: Administrator Last build: 😋 0 😗 0 Precompile 🧹 🔒 STOP	
--	--

f Info.

- To log off logged-in users, from the menu bar, select **Online>Security>Logoff Current Device** User.
- You can add or remove device users or change their passwords by using the "User and Group" pane.

To add device	e users: 🗢 Add	
To remove de	vice users: 🗢 Delete	
To change de	vice user passwords: 🗹 Edit	
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• Users registered by project user management can be imported as device users.

Clicking the button displays the "Import Users" dialog box. Select a user to be imported and click the [OK] button. In this case, passwords managed by project user management will not be imported. In the "Users and Groups" pane, click the [Edit] button and set a password for the user that has been imported.

• Device user management information can be exported.

In the "User and Group" pane, click the [I] icon (Export to Disk).

XML format files (".dum" files) can be saved.

To import ".dum" files that have been exported, click the [22] icon (Import from Disk).

- Device user management information can be initialized by resetting the device.
- If you forget your password, you cannot log in to the GM1 controller. In this case, reset the GM1 controller. For details on how to reset the GM1 controller, refer to the *GM1 Series User's Manual (Hardware Edition)*.

10.4 Security Function: Encryption

This section explains how to encrypt project files.

10.4.1 Encrypting Project Files

Project files can be encrypted using passwords. If a password is set, the password must be entered when a project file is opened.

¹² Procedure

- 1. From the menu bar, select **Project>Project Settings**. The "Project Settings" dialog box will be displayed.
- In the "Project Settings" dialog box, select the "Security" category. The "Security" pane will be displayed.

Project Settings		×
Comple uptions Compler warrings Page Satup Security Sinc Sathlocan Static Avelvass Light Users and Groups	Security Endperform Encomposition () Four project file is not protected from unauthorized access and data mempulation. B is highly recommended that you analyse the security feature.	
	DK Detail	

 Select the "Enable Project File Encryption" check box, select the Password option, and then enter a password.

		×
Security		1
If this option is activated, a dominiproject file. The user must plug as library reference.	gie is used to encrypt the content of the currently opened a dongle whenever the project is loaded, even if it is loaded tion password, your project file will be lost!	
	Enable Project File Encryption of this option is activated, a dom project file. The user must plug as library reference. If you forget the encryp It is not possible to rest New password(P):	Enable Project File Encryption(E) If this option is activated, a dongle is used to encrypt the content of the currently operad project file. The user must plug a dongle whenever the project is loaded, even if it is loaded as library reference. If you forget the encryption password, your project file will be lost It is not possible to restore the file contents in this case! New password(F):

4. Click the [OK] button.

The specified password will be set for project files.

This completes the password setting procedure.

When an attempt is made to open a project file, a window is displayed, asking the user to enter a password. In this situation, enter the specified password.

10.4.2 Encrypting the Communication Path: Encrypting Communications Using the Certificate Possessed by the GM1 Controller

Communications between GM Programmer and the GM1 controller can be encrypted using certificates.

This section explains how to encrypt communications by using the certificate possessed by the GM1 controller as a trusted certificate.

¹² Procedure

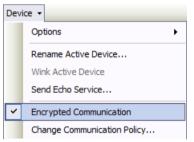
1. Double-click the [Device] object in the navigator pane.

Sample 1	-
Device (AGM1CSEC16T/P)	
😟 🗐 Program_Configuration	
EtherCAT_Master_SoftMotion	

The Device setting window will be displayed. Open the "Communication Settings" tab.

Communication Ontlings	stat tetures - Linkenty + Decks +	
Data and Time and Sathings	1	
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2. In the Device menu, select "Encrypted Communication".



If "Encrypted Communication" is selected, the connection lines between the integrated development environment, gateway, and controller will be displayed in yellow.

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3. Click the Network Scan menu.

The "Select Device" dialog box will be displayed.

Select Device		×
Select the network path to the controller:	45.5	
= A. Gateway-1(scarring)	Device Name:	Son Network
AGM1CSEC1ET/P [0015]	Galeway-1	(Witt (
	Driver: TOP/IP	
	8P-Address	
	localhest	
	Port	
	1217	
		Senod

4. Select the connected GM1 controller and click the [OK] button.

A message window will be displayed, indicating that the certificate of the GM1 controller is not certified with a trusted signature for encrypted communication.

 If the [OK] button is clicked, communications can be encrypted by installing the certificate indicated by the message in local store "Controller Certificates" on the PC to use it as a trusted certificate.

You can check the registered controller certificate in certmgr.msc in the C:\Windows \System32 folder.

When the certificate of the GM1 controller is used as a trusted certificate, the validity period of the certificate is 30 days.

f Info.

• If the certificate has already expired, the message window shown in step 4 above will be displayed, indicating that the certificate has expired.

By clicking the [OK] button, you can extend the validity period of the certificate.

10.4.3 Encrypting the Communication Path: Encrypting Communications Using a Created Certificate

Communications between GM Programmer and the GM1 controller can be encrypted using certificates.

This section explains how to create a trusted certificate for the GM1 controller and encrypt communications using the created certificate.



1. Open the device editor and select the "PLC Shell" tab.

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2. Enter the "cert-getapplist" command in the input field. All certificates that are used will be displayed.

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1	CONTRACTOR DOWNER	ADMONTON	74.0	2011	6-HT10-IB-51.0	2021-7-1172210-35.0
τ.	Cisp/Velsfer.vel	builtiant	FALSE	199		

 Enter the "cert-genselfsigned 1" command in the input field. Create a certificate for ComponentName "CmpSecureChannel".

```
cert-genselfsigned 1
Generate selfsigned certificate with given index (1). Check logger to see when finished.
```

4. Open the "Log" tab of the device editor and click the [Update Information] button. Check whether a certificate has been created.

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		14108-2012 121240-04282	Suche automations	On Owner Star	

5. In the device editor, open the "PLC Shell" tab and enter the "cert-getapplist" command in the input field.

Check whether a certificate has been created for ComponentName "CmpSecureChannel".

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Charlotter and the second seco	added .	TAIR	141		- Manufactures	-

6. Open the device editor and select the "Communication Settings" tab.

Communication Orthings	NEW INFORMATION - Device -	
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ruc shell	Port	Derivice Address:
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alk Deployment		194.9 3082
2 Mill		Taget type: 410
Information		Target Vand sit. Remarch : Corp system
		Tanget Varia ark 3.1.8.100

7. In the Device menu, select "Encrypted Communication".

Devi	ice 🗸
	Options
	Rename Active Device
	Wink Active Device
	Send Echo Service
~	Encrypted Communication
	Change Communication Policy

If "Encrypted Communication" is selected, the connection lines between the integrated development environment, gateway, and controller will be displayed in yellow.

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204.a		Twatt Teach 4152
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 Click the Network Scan menu. The "Select Device" dialog box will be displayed.

Select the network path to the controller: = 🚜 Gateway-1(scanning)	Device Name	Son litterix
AGMICSECIETAP [0015]	Gateway-1 Oviver: TOP/IP 8P-Address localhost Poet: 1217	

9. Select the connected GM1 controller and click the [OK] button.

A message window will be displayed, indicating that the certificate of the GM1 controller is not certified with a trusted signature for encrypted communication.

 If the [OK] button is clicked, communications can be encrypted by installing the certificate indicated by the message in local store "Controller Certificates" on the PC to use it as a trusted certificate. You can check the registered controller certificate in certmgr.msc in the C:\Windows \System32 folder.

When the created certificate is used as a trusted certificate, the validity period of the certificate is 360 days.

10.5 Security Function: Write-protection

This section explains how to implement write-protection for project files to prevent project files from being modified unintentionally by mistake.

10.5.1 Opening Files in Read-only Mode

Open a project file in read-only mode.

When selecting a project file to be opened, select the "Open in Read-only Mode" check box.

File <u>n</u> ame:	Sample1 project 🗸 🗸		Open
Files of type:	Project files(* project)		Cancel
	Dpen as read-only	_	

If a file is opened in read-only mode, it cannot be saved.

To save a project file, select "Project file cannot be saved. Click for options" on the menu bar and select an appropriate menu item that is displayed.

Project file cannot be saved. Click for options...

Save the project under a different file name on disk...

Leave the read-only mode.

Item	Description
Save the project under a different file name on disk	Allows the user to rename and save the project file as a writable file.
Leave the read-only mode	Leaves the project file open in read-only mode.

10.5.2 Setting the "Released" Flag

Set a "released" flag in project information in a project file.

If a "released" flag is set in a project file, changes made in the file cannot be saved.

From the menu bar, select **Project Project Information**, and open the "Summary" tab window and then select the "Released" check box.

Project Information		×
Summary File		
<u>C</u> ompany:		
<u>T</u> itle:		
<u>V</u> ersion:	✓ <u>R</u> eleased	
Library Categories:		
De <u>f</u> ault namespace:		
<u>A</u> uthor:		
<u>D</u> escription:	~ ~	
The fields in bold lett	ers are used to identify a library.	
Automatically generate	'Library Information' POUs	
Automatically generate	'Project Information' POUs	
	OK Cancel	

To save a project file in which the "Released" flag is set, select "Project file cannot be saved. Click for options" on the menu bar and select a menu item that is displayed.

$\ensuremath{\stackrel{\frown}{=}}$ Project file cannot be saved. Click for options	
Unset the "Released" flag in the Project Information.	

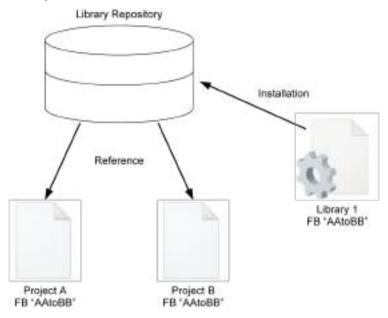
10.6 User Library Function

Combining created functions and function blocks as a library enables other projects to use these functions and function blocks.

The library that has been created must be installed in the library repository. Adding the library installed in the library repository to the project makes it possible to use the functions and function blocks in the library. Libraries in the project are managed by the "Library_Manager" object.

The following sections describe a procedure for creating a library, installing the created library into the library repository, and adding libraries to a project.

Example



10.6.1 Creating a Library and Adding to the Library Repository

This section explains the entire procedure from creating a project for libraries through to installing libraries in the library repository.

¹² Procedure

 From the menu bar, select File>New Project. The "New Project" dialog box will be displayed.

tot	1
garte	Templates Standard project
ontaining one device.	one application, and an empty implementation for MC_PRG
C:Willark	- <u>B</u>
	pests pests intaning one device, [unsRed]

2. Select "Libraries" in the Categories pane and then "Standard library" in the Template pane.

NevBe	tject	1
Celepanie Bio	zjecto	Jemplatus Starsbard Ibrary
Courses.		
Anstanda	id library	
An standa Nane	d Brary	

3. Click the [OK] button.

A project for libraries will be created. The extension of project files for libraries is "library". For libraries, the POU view is displayed in the navigator pane. Add objects required for creating libraries to the POU view.

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tim.	+ = =			_	_	_	-	-
Nime Distant Y Const Yorkey Project y formation Project designs								
		Messager - 1921 of 201 Training Constants	1 (©2400) † Fearings 0 (enter X				
) ©2000 (Planny) (0)	manjata 🗴	*	- Annot	•	

4. Double-click the "Project Information" object in the POU view.

The "Project Information" dialog box will be displayed.

If necessary, change the settings in the "Company", "Title", and "Version" fields. The information set in these fields will be displayed in the selection window when created libraries are added to the project.

If the "Release" check box is selected, a confirmation message will be displayed when an attempt is made to change a library.

Project information			
Garwy Fla			
Corepany	Company		
Title:	Tabe		
Yersite:	1.0.0.0		Enforced
Librery Estagore			40
0 diput nomesou	ee:		
distant.	1		
Queriation:			-
The Relds in Bol	fletters are used to i dant	haiten.	-
Automatically parts	ente Schrary Information' P	0La	
Actionatically game	rata Project Information I	NIN.	
		10	Const

- Click the [OK] button. The project information will be set.
- Right-click the <file name> object at the top of the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

The "Add POU" dialog box will be displayed.

POUs		→ ₽ X			
🖃 📄 Untitled 1	Ē.	Descrition			
Library Manager		Properties	•		
Project Information	***	Add Object	t 🕨	ک	DUT
Project Settings		Add Folder			External File
	_			۸	Global Variable List
				∽	Interface
				Ð	POU

7. Select the "Function block" check box, enter a name in the Name field, and select a programming language from the Implementation Language drop-down list. For details on functions blocks, refer to "6.6 Function and Function Block".

433 POU	3
🙆 coase a lana Pour (Maginal Iorg	estation swith
Same	
Sorek: Limory	
Text	
Otrepen	
· freetine block	
Citateros.	
Dippiesents	
⊡Roal ⊡Rapport	
gossopecter	
Behading-tenetoconi argiaga Destructar fancturi Chan CPU	
Operation	
Bearbox 100	
Inglementation Jacquege	
Structured Text (ST)	

8. Click the [Add] button.

An object of the function block will be added to the POU view in the navigator pane.

POLIA	* = X	A Sample Identy X
Contract Contract Contract Contract Contract Contract Contract Product Section	*	FREETER ALEEK Tangle, Likewarg VKC_DAUTY VGC_COTINT Emilian VGC_COTINT Emilian VGC_EXE

9. Enter a program in the function block.

After entering a program, from the menu bar, execute **Build>Check All Pooled Objects**. Build will be executed to perform a syntax check. After the above command is executed, if any error is displayed, correct the program and execute build again.

10. From the menu bar, select **File>Save Project and Install into Library Repository**. The library that has been created will be installed in the library repository.

11. From the menu bar, select **Tools**>**Library Repository**.

The "Library Repository" dialog box will be displayed. Check that the created library is displayed in the "Installed library" section.

* ******	Appendit in		. 3
Looston	System It: Brog antistelf-securit: Copie and Attentification of Lineary	8	tot Leaters
Installey 1			Febl.
	Centure	+	and a
- 51	Hacelle sova) The Communication		(iner)
			76
			Over.
1			Tatlaman
() Droke	do otegan		Danobran,
Libsery 7	rofiles_		tione

Clicking the [Detail] button enables the user to check information such as function blocks included in the library.

This completes the procedure for installing the library in the library repository.

1 Info.

• Difference between libraries (.library) and complied libraries (.compiled-library).

If a library is installed as a library file into the repository, the user can refer to codes by step-in execution during debugging and check execution details.

The user cannot execute codes in any compiled library while referring to the codes.

in pression	Trie	Value	Prepared value	Address	Consert.	
	Hi sargle		1. * 10 * 2.200 * 10* 2.2			
·	INT	12				
# 555	247	20				
100000						
• 2010			is possible in the	library by st	eo-in executio	
CONTRACTOR OF TAXABLE PARTY.	Instite PREAM			,.,.,	-	
spression	Туре	Vielue	Prepared value	Address	Convert	•
19 N	REFERENCE TO DIT	12				19
	Pdf	30				
*∳. QUT						

• Method for installing a compiled library

In Step 10, select **File>Save Project as Complied Library** from the menu. The library is saved as a complied library file (.compiled-library).

Then, click the [Install] button in the "Library Repository" dialog box and select the saved complied library file.

10.6.2 Using Created Libraries

This section explains how to add libraries installed in the library repository to the project.

¹² Procedure

- Open the project file and select the "Library Manager" object. The "Library Manager" window will be displayed.
- 2. Click the [Add Library] button.

The "Add Library" dialog box will be displayed, showing the libraries added to the library repository.

dd Library		
String for a fulltext search		(in)
Library * @m Application * @m Docs * @m Use Cases * @m Use Cases * @m (Miscellaneous)	Company	
Advanced		Cancel

Select a created library and click the [OK] button.
 The selected library will be added to the application in the project.

The title and company name specified when the library was created will be displayed.

String for a fulltext search	100 mg / 10
string tor a numeri search	20 m 13
Library	Company
* Application	
+ Decs	
I Use Cases	
Hiscellaneous)	
CiripErtMing	Panasonic Corporation
ChipPGShee	Panasonic Corporation
CripRTEXShm	Panasonic Corporation
CiripStateMing	Panasonic Corporation
Cmp5ysDetxMng	Panasonic Corporation
CripTimeMing	Panasonic Corporation
Panasonic_ETC	Panasonic Corporation
Panasonic_SM_System	Panasors: Corporation
Panasonic_MC	Panasonic Corporation
Parasonic_PG	Panaponic Corporation
Title	Company
1	1000000000
Advecced	Cancel

This completes the procedure for adding the library to the application. The function blocks in the added library can be used in the program.

10.7 POU for implicit checks

POU for implicit checks is an object with functions that check the range of array indexes or subrange type variables, validity of pointer addresses, and division by zero. Adding this object to the project makes it possible to automatically call these functions and perform checks, without calling the functions explicitly within the program.

10.7.1 Setting up POU for implicit checks

This section explains how to add POU for implicit checks objects.



 Right-click the [Application] object in the navigator pane and then select Add Object>POU for implicit checks from the context-sensitive menu that is displayed.

The "Add POU for implicit checks" dialog box will be displayed.

Add POU for implicit checks	×
Create special check functions for an application (for checking array bounds, divisions and pointer)	
Available functions	
Bound checks	
Division checks	
Range checks	
LRange checks	
Pointer checks	
Note: Adding a check function will provoke a full recompile and prohibit an online change	
Add Cancel	

2. Select the check box of a function that you want to add.

Multiple functions (objects) will be added, depending on the item that you select.

Check type	Function name (object name)
Bound checks	CheckBounds
	CheckDivDInt
Division checks	CheckDivLInt
	CheckDivLReal
	CheckDivReal
Panga abaaka	CheckRangeSigned
Range checks	CheckRangeUnsigned
L Danga ahaaka	CheckLRangeSigned
LRange checks	CheckLRangeUnsigned
Pointer checks	CheckPointer

3. Click the [Add] button.

The function (object) for the selected item will be added.

If necessary, edit the implementation section of the object that has been added.

The check details of each check item are as below.

Bound checks

Checks whether boundaries are violated.

Division checks

Checks whether anything is divided by zero.

Range checks

Checks whether values of DINT or UDINT subrange type variables are within the specified range.

LRange checks

Checks whether values of LINT or ULINT subrange type variables are within the specified range.

Pointer checks

Checks whether the returned pointer refers to a valid memory address or whether the contents of a memory address that is referred to match the variable type that refers to the pointer. For Pointer Checks, a program must be created for the function. Update the program by referring to online help.

10.8 Interface

The interface object defines common methods and properties that are used between different function blocks in the same way.

The interface object is one of the means of implementing object-oriented programming. The interface object contains only method and property declarations but does not contain implementation.

10.8.1 Setting up an Interface Object

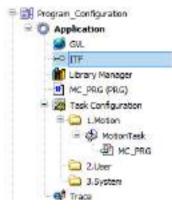
This section explains how to add an interface object.



 Right-click the "Application" object in the navigator pane and then select Add Object>Interface from the context-sensitive menu that is displayed. The "Add Interface" dialog box will be displayed.

Add Interface	×
⊶O Create a new interface	
Name	_
III III III III III III III III III II	
Inheritance	
Extends	
Add Cancel	

Enter a name and click the [Add] button.
 An interface object will be added.
 If the "Extends" check box is selected, the interface entered in the input field can be inherited and extended.



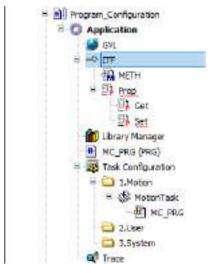
 Right-click the "ITF" object added to the navigator pane and then select Add Object>Interface property or method from the context-sensitive menu that is displayed. The "Add Interface property" dialog box or "Add Interface method" dialog box will be displayed.

Add Interface property	X Add interface method	
Enable a new property	Grante a new restrict	
Data .	Name United	
Beturn type	Betan type	
T		
Ī		

4. Enter a name and click the [Add] button.

For interface properties, be sure to enter a value in the "Return type" field. "Prop" or "METH" object will be added under the "ITF" object.

For



5. The added "METH" and "Prop" objects are used to define methods and properties, respectively.

This completes the procedure for creating an interface object.

10.8.2 Implementing in New Function Block

This section explains how to implement an interface in a new function block to be created.

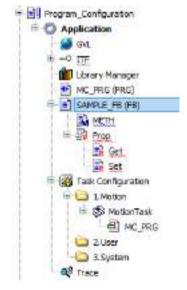
¹² Procedure

 Right-click the "Application" object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

The "Add POU" dialog box will be displayed.

Brit	
SAMPLE_PT	
Inc	
OBregram	
Function block	
Eganda	100
Tropienento ITT	Total I
Trivel Abgtract	
Atcampatfler	
Total Arrange	
Methodimplementationlenguage	
Structured Text (ST)	
Objection	
Eaturn type	(internet)
	111
Inplementation [anguage	
souchred fext (st)	

Enter a name. In the Type section, select the Function block option, select the "Implements" check box, and enter an interface to be implemented. Click the [Add] button.
 A function block with the interface implemented will be added under the "Application" object.



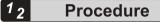
3. Open the respective editors for the added "METH" and "Prop" objects, and implement internal processing for the methods and properties.



• If methods and properties are added under the "interface" object later, they will not be automatically added to the function block with the interface implemented. Therefore, if they need to be added, perform the procedure starting from "Step 3" 3 in "10.8.3 Implementing in Existing Function Block".

10.8.3 Implementing in Existing Function Block

This section explains how to implement an interface in an existing function block.



1. Open the editor of the existing function block from the navigator pane.

Character string format



Table format

1.4.3	K./2	FUNCTION, BLOCK SAMPLE_FE						
	ipe -	Name	Address	Dutatype	initialization	Comment	Attributes	

 For character string format, add "IMPLEMENTS <interface name>" to the declaration header section. For table format, open the "Edit Declaration Header" dialog box, enter an interface name in the "IMPLEMENTS" field, and click the [OK] button.

Character string format



Table format

Edit Declaration Header	×
Dedaration	
FUNCTION_BLOCK V	
EXTENDS	
IMPLEMENTS ITF	
Comment	^ >
Automatically adapt all references on rename.	
Attributes OK	Cancel

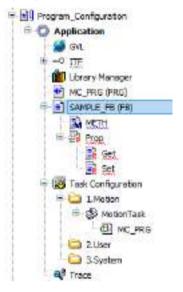
3. Right-click the existing function block in the navigator pane and select "Implement Interfaces" from the context-sensitive menu that is displayed.

The "Select implementation language" dialog box will be displayed.

는 🐼 Task Configuration 는 🍙 1.Mation 는 🚱 MotionTask - 전] MC_PRG 2.User 고 System	× 自由×	Cut Copy Paste Delete Browse	•
R ⁸ Trace		Implement interfaces	
RTEX_Master SoftMotion General Axis Pool Unit Configuration	-	Refactoring Properties	*
ID_Configuration ID_Configuration PWM_Configuration Counter_Configuration Counter_Configuration Empty1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Add Object Add Folder Edit Object	٠

Select Implementation Language	×
Method and property implementation language	
Structured Text (ST)	\sim
ОК	Cancel

4. Select a desired programming language and click the [OK] button. The method and property objects will be added under the function block object.



5. Open the respective editors for the added "METH" and "Prop" objects, and implement internal processing for the methods and properties.

D Note

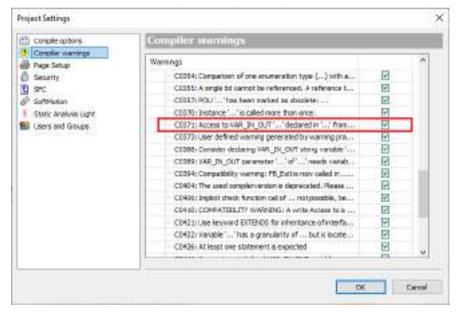
• If methods and properties are added under the "interface" object later, they will not be automatically added to the function block with the interface implemented. Therefore, if they need to be added, perform the procedure starting from Step "Step 3".

f Info.

• When methods and properties are implemented, warning messages are automatically implemented. Therefore, when compilation is executed, the following warning messages are displayed.

Proce mysla	- O 1 emorto + 5 werningiti	O message(I)	X X	
Description		Project	Chjett	Pasition
CE178 Add method implementation		10 theda	HETH (Devices Progr	Lite L(Ded)
CE375 Add property independential		UNITEda	set bester Woork	
CE373: Add property implementation		Unitied	Set Derice Propie	
CE373: Add property implementation		Uvitied	Get [Device: Program	
CEST2: Add property implementation		Limitation	Pros [Device: Pragr	ine L

These warning messages do not indicate any problems. However, to prevent particular warning messages from being displayed, from the menu bar, select **Project>Project Settings** and then clear the check boxes of the target warning messages in the Compiler Warnings pane.



10.8.4 Extending the Interface

Existing interfaces can be inherited and extended.

This section explains how to extend existing interface "ITFBase" and create new interface "ITFExtend".

In this example, when interface "ITFBase" exists, create a new interface as below.

¹² Procedure

1. Right-click the "Application" object in the navigator pane and then select Add Object>Interface from the context-sensitive menu that is displayed. The "Add Interface" dialog box will be displayed.

Add Interface			×
⊶O Create a	a new interface		
<u>N</u> ame			
ITFExtend			
Inheritance			
⊡ <u>E</u> xtends	ITFBase		
		Add	Cancel

 In the "Add Interface" dialog box, select the "Extends" check box and enter an interface to be inherited.

Interface "ITFExtend" will be created.



- Right-click the "ITFExtend" object added to the navigator pane and then select Add Object>Interface property or method from the context-sensitive menu that is displayed in order to add a property or method for the "ITFExtend" object.
- Right-click the "Application" object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.
 The "Add POU" dialog box will be displayed.

Name)
SAMPLE_FB		
Type		
Ogrogram		
Tunction bloc	k	
Egtenda		1221
2 Implementa	ITTExtend	
Final	Abgtract	10000
Access specifie	r.	
Terrar de serve		~
<u>M</u> ethod implem	entation language	51
Structured Text	: (ST)	
Eunction		
Estum type		and a
Implementation Jang	uage	
Structured Text (ST)	1	

5. Enter a name. In the Type section, select the Function block option, select the "Implement" check box, and enter "ITFExtend". Click the [Add] button.

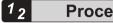
A function block with properties and methods for both interfaces "ITFExtend" and "ITFBase" will be added under the "Application" object.

10.9 External File Functions

The external file object allows text files, image files, and other files to be saved in the project.

10.9.1 Setting up an External File Object

This section explains how to add an external file object.



Procedure

 Right-click the "Application" object in the navigator pane and then select Add Object>External File from the context-sensitive menu that is displayed. The "Add External File" dialog box will be displayed.

Add External File	×
Create a reference to an external file	
[] e pati	1151.0
Nama	
External file	
What do you want to do with the external fie?	() () () () () () () () () ()
Remember the link Remember the link grid ended into project Ophded into project	
When the external Ric changes, that	
Subset the Resisterationly in proget whether to rebed the Re Spin-refers	
Queaks Fair P	incerties.
Add	Cancel

2. In the File path field, specify a file to be registered. In the Name field, enter the name of the file.

In the "What do you want to do with the external file?" section, select an appropriate option as the method for registering the external file in the project.

If you select the "Remenber the link and embed into project" option in the "What do you want to do with the external file?" section, select an appropriate option in the "When the external file changes, then" section to specify settings for update processing to be performed when the external file is changed.

"What do you want to do with the external file?":

"Remember the link"

Stores only the path to the file in the project.

If the file does not exist at the link destination, it cannot be used in the project.

"Remember the link and embed into project"

Saves a copy of the file and a link to the file to the project at the same time.

As long as the file exists at the link destination, the setting of the "When the external file changes, then" section applies.

If the file does not exist, a version of the file that is stored in the project will be used.

"Embed into project"

Saves a copy of the file to the project.

"When the external file changes, then":

"reload the file automatically"

Updates a copy of an external file in the project when the corresponding external file is changed.

"prompt whether to reload the file"

Opens a dialog box, asking whether to update a copy of an external file in the project, when the corresponding external file is changed.

0	*EliMark/ofuverir/21.GMP/30.Sampinicampik/26/Sampinitat
-	This the has been moothed outlide of OM Programmes.
	De you want to related it?

"do nothing"

Does not update a copy of an external file in the project even if the corresponding external file is changed.

3. Click the [Add] button.

The external file will be added under the "Application" object.

f Info.

• When the added external file is opened in GM Programmer, a copy of the file is temporarily created in the following folder:

C:\Users\<user name>\AppData\Local\Temp

• Files added as "external file" objects cannot be accessed from programs such as POU.

10.10 Servo Amplifier / Motor Operation Function (PANATERM Lite for GM)

You can start PANATERM Lite for GM, which allows you to check the settings of servo amplifiers, the operating states of servo amplifiers and motors, and the error status of servo amplifiers via the GM1 controller.

For details, refer to "15 Overview of PANATERM Lite for GM".

10.10.1 Starting PANATERM Lite for GM

This section explains how to start PANATERM Lite for GM from GM Programmer.

¹₂ Procedure

1. From the menu bar, select **Tools>PANATERM Lite for GM**. PANATERM Lite for GM will be started.

Tools Window Help

 Tools
 Window
 Help

 PANATERM Lite for GM...
 PANATERM Lite for GM...

11 Motion Control

11.1 EtherCAT Master Setting	
11.2 EtherCAT Slave Settings	
11.3 EtherCAT Axis Settings 11 11.3.1 Overview of EtherCAT Axis Settings 11 11.3.2 Basic Settings for EtherCAT Axes 11 11.3.3 EtherCAT Axis Extended Setting 11	1-12 1-12
11.4 Basic Preparations for Operation1111.4.1 Overview of Basic Preparations for Operation1111.4.2 Servo ON or OFF1111.4.3 Home Return1111.4.4 JOG Operation11	1-23 1-23 1-24
11.5 Single-axis Operation1111.5.1 Overview of Single-axis Operation1111.5.2 Position Control1111.5.3 Switching the Control Mode1111.5.4 Velocity Control1111.5.5 Torque Control1111.5.6 Stop11	1-38 1-38 1-45 1-46 1-48
11.6 Synchronous Operation	1-52
11.7 Multi-axis Operation 11 11.7.1 Overview of Interpolation Control 11 11.7.2 Linear Interpolation and Circular Interpolation 11 11.7.3 How to Use Interpolation Control 11 11.7.4 Registering a CNC Table 11 11.7.5 Overview of G-code 11 11.7.6 G-code Editor and Coding Rules 11 11.7.7 Movements Executed by Each G-code and Setting Methods 11 11.7.8 SMC_CNC_REF and SMC_OUTQUEUE 11 11.7.9 Interpolation Operation Programming: How to Create a Program for Executing Operation 11 11.7.10 Interpolation Operation Programming: Explanation of Function Block (FB) 11	1-61 1-62 1-63 1-64 1-75 1-77 1-78 1-90
11.7.11 Interpolation Operation Programming: Specifying the Starting Coordinates11	1-97

11.7.12 Interpolation Operation Programming: P-point Control and C- point Control	11-101
11.7.13 Interpolation Operation Programming: Settings in CNC Table for	
11.7.14 Interpolation Operation Programming: Settings in POU for P- point Control and C-point Control	11-104
11.7.15 Interpolation Operation Programming: Joining and Repeating	11-105
11.7.16 Interpolation Operation Programming: Changing Parameter Settings (Converting to Variables in CNC Table)	11-108
11.8 Motion Function Errors 11.8.1 Overview of Motion Function Errors	11-110
11.8.2 Error Check Method 11.8.3 Clearing Errors	

11.1 EtherCAT Master Setting

11.1.1 EtherCAT_Master_SoftMotion

Overview

The EtherCAT master must be configured as described below.

This section explains various tabs and settings of EtherCAT_Master_SoftMotion editor.

Devices		- 4	
	EtherCAT_Master_SoftMotion	-	
	MADHT11058A1		
	M SM_Drive_ETC_Panasonic_MD	NAS_ASB	

Set EtherCAT Master parameters on the General window.

General	Autocorfig Haster/Slaves		EtherCAT.
Senc Unit: Azai gement	EtherCAT NIC Setting	11.55a - 155a - 1	
EtherCAT IEC Objects	Destination address (MAC)	2 Broscicant	Trable returdency
2 star			
Information			
	# Distributed Clock	Di Options	
	Cycle time 1900 2 µt		
	A CONTRACTOR OF		

List of parameters

Name		Description
Automatic Master / Slave Configuration		When this parameter is enabled, it automatically performs configuration of the master and slave.
		When this parameter is disabled, all configuration settings for the master and slave must be made manually. Since configuration settings require expertise, it is recommended to set to automatic settings.
EtherCAT NIC Setting Storage location address (MAC)		Specifies the destination address.
	Broadcast	When this setting is enabled, a broadcast address (FF-FF-FF- FF-FF) is set in the storage location address (destination).
		When this setting is disabled, set a multicast address in the storage location address (destination).
Distributed Clock	Cycle Time	Sets the EtherCAT communication cycle. The MotionTask cycle is set.

11.1 EtherCAT Master Setting

Name		Description	
	Synchronous Offset	Sets the delay time between the DC reference time of the EtherCAT slave and the EtherCAT task (PLC's cycle start time).	
	Synchronous Window Monitoring	When this setting is enabled, it monitors slave synchronization.	
	Synchronous	Sets the synchronous window monitoring time	
	Window	When all slave's synchronizations occur within the set time, xSyncInWindow (IoDrvEtherCAT) turns to TRUE.	
Options	Use LRW instead of LWR / LRD.	When this setting is enabled, the LRW command (read/write) is used.	
		When this setting is disabled, the LRD command (read) and LWR command (write) are used as separate commands.	
	Enable message for every task.	When this setting is enabled, the PDO mapped variables are updated at the point of use of the POU.	
		When this setting is disabled, the PDO mapped variables are updated by a MotionTask.	
	Autostart slave.	When a communication breakdown occurs, automatically the master attempts to restart the slave immediately.	
Master Configuration		It can be set only when Automatic Master / Slave Configuration is disabled.	
	Image In Address	Sets the first logical address of the first slave used for PDO input data.	
	Image Out Address	Sets the first logical address of the first slave used for PDO output data.	

Sync Unit Assignment

In Sync Unit Assignment, multiple slaves can be grouped together and managed as a Sync Unit.

For example, one slave within a Sync Unit becomes unknown, the rest of the slaves in the Sync Unit are displayed as unknown. Since other Sync Units not affected remain operable, the unknown group can be promptly corrected using the device diagnostics.

General	Descervere	Spra Unit	Selects the Sync Unit group. (Default value: "Default"
Ryst Unit ApJopanant	record Longers	Articit	The Sync Unit group can be added by clicking the
Effectiv ^a (EC Objecto	Add button at the bottom of the list.		
Macua	Displays the names of slaves inserted In		
Information	EtherCAT_Master_SoftMotion in the Device tree.		
	Addati Tyre Umli Igric Unit Igric Unit		Deletes the selected Sync Unit. The Sync Unit to be deleted with slaves assigned as a group is reassigned to the default group.
			nter a Sync Unit name in the text field and click the

Status tab

Diagnostic messages of the EtherCAT_Master_SoftMotion device are displayed. They can be checked with the program using the "GetStatistics" method of "IoDevEtherCAT".

Germel	EtherCAT 4	(a) b	
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	LeviProveCourt Transiscourt		
	- Kathractaunt		
		100	
	BierCAT, Marker 1	n/a	

Item	Description
SendFrameCount	The number of EtherCAT send frames is displayed.
FramesPerSecond	The number of send frames per second is displayed.
LostFrameCount ^(Note 1)	The number of frame losses is displayed.
TxErrorCount	The number of send errors is counted.
RxErrorCount	The number of receive errors is counted.

(Note 1) Check the following when the number of frame losses is other than 0.

- Influence of noise
- Connection status with slaves
- Program load

11.2 EtherCAT Slave Settings

11.2.1 EtherCAT Slave Settings

Overview

The EtherCAT slave must be configured as described below. The description below explains how to set the servo amplifier (A5B: MADHT1105BA1) manufactured by Panasonic. Set EtherCAT slave parameters on the General window. In the Sync Unit cycle, the cycle set in MotionTask is set.

General	Attres			Addition	8		No. 631 (21)
Processo Data	Autoine address EtherCAT address	1011	**			peksettigs	Ether CAT.
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	Syncl:						
	C British Spec 1	-	-			Qc81miQ4	a
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	plenatication						
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	B boliot ževice dest	of called Lat	0.0009	0			
	Data West 22 Bytes			40.0 (has)		5	5404 ÷

List of parameters

Name		Description
Address		It can be set only when "Automatic Master / Slave Configuration " is disabled in EtherCAT master setting.
	AutoInc address	Sets a tentative address used before the master assign an EtherCAT address to the slave.
	EtherCAT address	Sets an EtherCAT address to the slave.
Add	Enable expert settings	When this setting is enabled, expert setting can be made. Since expert settings are not required for standard applications, it is recommended to disable the settings.
	Option	When this setting is enabled, the slave is defined as an option. As a result, an error message is not generated even when a device is

Name		Description
		not found in the bus system. When this setting is enabled, assign a unique ID in the setting for the identification section.
		Requirements for use
		 The "Automatic Master / Slave Configuration".parameter on the "General" tab of EtherCAT_Master_SoftMotion editor is enabled.
		 The EtherCAT slave supports this function.
Distributed Clock	DC selection	Sets the synchronization method between the master and the slave.
		Example:
		• FreeRUN: Non-synchronize with master's cycle time.
		• DC Sync0: Based on the time of the 1st axis, synchronize time information of other slaves.
Identification	Disable	Slave identification is not checked.
	Configured station alias value	Sets the address stored in the slave device EEPROM.
	Explicit device identification	Sets a device identification number for hardware such as a DIP switch of the slave device.
	Data word (2 bytes)	A 2-byte identification number is saved. (MINAS: Not supported)

Process data

PDO (Process Data Object) is data that is updated between the master and the slave for every EtherCAT communication cycle. The configuration of the PDO varies depending on the slave. Select an appropriate one for each axis control method. The selected PDO mapping is reflected on the "EtherCAT I/O mapping " and can be used in the program.

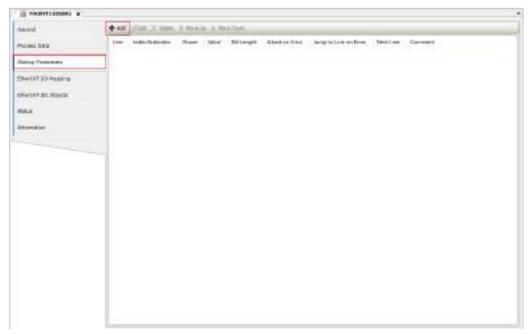
11.2 EtherCAT Slave Settings

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and the second s	Tegeseter	100	124420030	248 SANS Transmit PDI Hoppers	1200	
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Startup parameter

Using the SDO (Service Data Object), slave parameters can be set at the start of RUN.

1. Click "Add".



2. Enter object information to be changed.

The following explanation is provided for an example where "Acceleration time setting" is changed.

- Name: Any name
- Index 16#: 3312
- Sub-index 16#: 0
- Bit length: 16
- Value: 100

ndee:S.,	Nano	Flags	Туре	Default				
Neme	[contention	tine setup			1		
Name Indesc 16-		cceleration 1 312	time setup	Bit length	16		g	ĸ

3. Click the [OK] button.

ndec:S., Nam	Plags	Туре	Dofault		
Name	Acceleration	time setup			
Name Index: 16#	Acceleration 3312	time setup	Bitlength	16	OK

The data will be displayed as follows.

200		* Movelat * Movelan						
tine	InterSubindex	Nane	Value	Bit Length	Abort on Error	Jump to Line on Bron	NextLine	Comment
-1	1543312:15400	Acceleration time witup	100	18			0	

Online

When set to online, the status of the ESM (EtherCAT State Machine) can be changed and displayed, firmware files can be written or read, and configuration information can be written or read to EEPROM.

- Requirements for use
 - "Enable expert settings" on the "General" tab is enabled.
 - · You are already logged in to the controller.

Note

• Writing a wrong file or incorrect configuration information may cause the slave to operate in an abnormal manner. Be careful when using the online mode.

CoE online tab

Set values can be written or read from the ESI file or the object dictionary of the slave device.

- Requirements for use
 - "Enable expert settings" on the "General" tab is enabled.

• You are already logged in to the controller.

General	Base Objects	Auto apdata O office from est free	· Online from	t device	
Expert Pracess Data	Index Subilities	Name	Rags	Type	Value
	16/21300 (56/200	Cevice type	80	UDDIT.	121474
Process Data	18#1301:35#00	Error regator	RD	LENT	0
	1621308 36200	Hanufactures device-tanie	80	STRING	WADHT1205EA1
Salup Perenders	18#1802.35400	Neruñechurer hardware version	RD	STRING	VL00
	16/21005 (5/200	Nasufacturer cofficiale version	80	ETRING	V1.00
Online	+ 16#1110:15#00	Spreparameters	RD	ISPT	1
Cat Dritte	+ 16:218 sk s6:200	Identity abject	RD .	USINT	4
Car bridge	# 18#18#3:36#00	Diagronis halory	RO	LEDIT	29
Diag History	+ 16/1600 (6/200	Receive #00 reapping 1	- E64	LIGHT	4
alabirated.	# 18#1801/38#00	Receive FDD recepting 2	RM.	1/52NT	7
RENEAT 1/0 Mapping	+ 1601600 36000	Receive #DO mapping 3	RM	LISPIT	4
and the second	+ 18#1803-38#00	Redetive FDD mapping 4	E90	USINT	8
EtherCAT IEC Objects	* 16/18/00 16/200	Transpirt PDC scapping 1.	R1A	LISINT	8
	+ 18#1A01-18#00	Transmit PDC mapping 2	24	USINT	9
Zalva.	* 1621800 16200	Transret PDC wapping 2	Rati	HGhT	4
2 D	+ 16#1AC0-15#00	Transmit PDC mapping 4	585	USINT	3
Warnatian	* 1621000 16200	Sync manager consumization type	80	LIGRT	4
	+ 18#1C12:18#00	Sync manager dramel 2	RM	USBIT	1
	* 1621013/16200	Syrc manager downel 2	845	LISINT	1
	+ 18#1032-18#00	Sync manager 2 synchronidation	RD	USINT	32
	* 1621030-16200	Synt merager 3 cynchronization	80	LIGHT	32
	184/3807:16400	Por manufacturer's use	RM	P.F	đ
	1623001/36200	Control mode setup	Rin .	M.	4
	184/3802-38400	Real-time auto-gain turing riskup	614	14	0.
	16,20000 (4,200	Real-line auto-tuning nachine stiffliess setup	RM.	N	25
	18 #390 9 35 #30	Inertia ratio	RM	p.r	33
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	1	A POINT A POINT A POINT			11877

11.3 EtherCAT Axis Settings

11.3.1 Overview of EtherCAT Axis Settings

To use the motion function, you must configure axis settings for EtherCAT. This section explains how to set axis information for EtherCAT in GM Programmer.

f Info.

1

• For details on how to set up EtherCAT and add axes, refer to "5.3 Setting up Motion Control".

11.3.2 Basic Settings for EtherCAT Axes

• Be sure to configure settings for EtherCAT axes.

¹² Procedure

1. Double-click the servo amplifier object in the navigator pane.

😑 📆 Ethe	erCAT_Master_SoftMotion
÷ 🗃	MADHT1105BA1
	SM_Drive_ETC_Panasonic_MINAS_A58

The setting pane will be displayed in the main pane.

Oceand	Axis type and limits	software twins			Velocity name type
Seeling Pires ins	☐ Virtual mode () Module	4 divotei	Neurive [a]	0.0	Thirteold O Sn4
Commissioning	(E) finds		Potive(a)	1006.0	C) Quadratic
SH Drive ETC Fenalsonic HEMAE	AND CONTRACTOR	Seltmens error reactor Deceleration (1,105): 0			Quadratic (smooth)
M Drive ETC Potessists //EBAS_			Nax. circtaria (s.);	p	101 (F.
Shetun	Oynamic Insta Velocity (a/k)	Ameleosion [4/6 ²]	Deckeration (a/c-)	let jupij	Posturileg spenision Accelerated
information	5	101	LINC .	30800	Lag Inst (c): 1.8

General Settings

Select the "General" tab and set the following items.

(anata)	Acce type and leafs	Software leads			Velocity neeps to	SCR.
Rating/Happing	Vitailmode Ci Madato	Activited	Neprime (x):	0.4	Trapezoid	
Conservations in the internation	· · ·		Paultice (s)	1000. F	O Quedratic	
M Drive ETC PEAKSONE MINING	- Balleteining	Software error sea	Sce		() Quadratic((htoore)
Str 2D Mapping			Deceleration Jury*) [g	Development	
M. Crive_ETC_Pexaeonic_HENGR_ KSI: IEC Objects			Mark chatanics (u)	0	1D.	¢
Ratus	🕨 Oynamic basita				Pastoring to	arvistar -
1	Velocity (u(c))	Acceleration [4(17]	Deceleration [upp-2]	liwik (a/s1)	deschvated	
rizvetur	5	408	180	18080	Lag White (s):	1/0
	1.000					

(1) Virtual mode

You can set real axes or virtual axes.

Use of real axes: Real axes are used to actually control the servo amplifier.

Use of virtual axes: Virtual axes create and execute a virtual servo amplifier within the GM1 Controller.

(2) Modulo / Finite

The axis type can be specified.

Modulo

Modulo: The motor rotates infinitely (belt drive, etc.) without limiting the travel range.

- The value of the commanded position keeps looping between 0 and modulo value.
- The maximum settable modulo value is "255×units in application" (*1).
 - *1: For "units in application", specify settings in the "Scaling / Mapping" tab.
- A negative value cannot be set. (A warning is issued. If a download is performed without correcting the value, an error will occur when the GM1 Controller is started.

Axis type and limits		
Virtual mode	Modulo settings	
Modulo	Modulo value [u]:	8388608
○ Finite		

• Finite

The set value of the commanded position is a finite value.

Soft limits can be set. Note that an error will occur if a 32-bit real number is exceeded.

Axis type and limits	Software limits		
Virtual mode	Activated	Negative [u]:	0.0
Finite		Positive [u]:	8388608

(3) Soft limits

If the axis type is set to "Finite", soft limits can be set.

If the commanded position falls outside the soft limit setting range, an error stop will occur, causing the operation to stop.

If the operation is stopped because the soft limit setting range is exceeded, the value specified in "Deceleration" or "Max. distance" in "Soft error reaction" or the value specified in "Deceleration" in "Dynamic limits" will be applied, whichever is the shortest time from when deceleration starts until a stoppage occurs.

Axis type and limits	Software limits		
Virtual mode	Activated	Negative [u]:	0.0
Modulo Sinite		Positive [u]:	8388608
Finite			

(4) Software error reaction

Settings can be configured to stop operation when an error occurs.

Software error reaction		
	Deceleration [u/s²]:	8388608
	Max. distance [u]:	0

1 Info.

- If the mode is switched from run to stop during operation, an emergency stop will be executed, regardless of the settings in "Software error reaction".
- For stop operation that takes place when an error stop occurs or when the soft limit range is exceeded, one of the values specified in the following items is applied, whichever is the shortest time from when deceleration starts until a stoppage occurs.
 - "Deceleration" in "Software error reaction"
 - "Max. distance" in "Software error reaction"
 - · "Deceleration" in "Dynamic limits"
- If "Deceleration" and "Max. distance" in "Software error reaction" are set to 0, these settings will be disabled. In this case, operation is stopped according to the value specified in "Deceleration" in "Dynamic limits".

(5) Dynamic limits

"Velocity", "Acceleration", and "Deceleration" cannot be set to 0. If they are set to 0, a warning will be issued.

Dynamic limits			
Velocity [u/s]:	Acceleration [u/s²]	Deceleration [u/s²]	Jerk [u/s³]:
10	100	8388608	10000

The "SMC_CheckLimits" function block can be used to check whether the values set in "Dynamic limits" were exceeded during axis operations. Note that the "SMC_CheckLimits" function block cannot detect whether the value set in "Jerk" was exceeded. Therefore, do not use the "Jerk" field.

Scaling / Mapping Settings

Select the "Scaling / Mapping" tab and set the following items.

seneral	Mater Type Scaling Swat directs		317			
Staling Plapping	· Latary	192100800	mores	1		
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Drive STC Panasonik MENAS	Mapping					
98- BC Objects	Automatic n	10000				
tata.	(inputs)					
	Cytlic object		Desciourber	Address	1/1204	
nformation			1846841:36400	TWIE	1.017	
	actual president	(AA-Freiter)	1845003:31400	7607	TONF.	
	actual velocity.	(#Acfremoty)	LE-#501C 18:#03		7.007	
	actual terque ((ActForces)	8.45877:31.400	(† 1997) 1997 -	1917	
	Monhan of speets	(PC) yelgeb instead	18#5001:38#00	75217	SINT	
	digital result ()	(stary/latigital)	1245070-12400	75235	LODG'	
	Tatuft Pride S	etur -	8.#58932:31.#00	"%Z//6"	1.010	
	0.42mlb					
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	Circle opect		objectivanter	Address	Type.	
	and the second sec		16460-015400	1000	UNIT	
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			164680/1.35400	19087	'SINT'	
	and the second sec	And Parks			00.701	
	Markes of coera CautureControl		162688 1620	THOMAS .	UNIT	

(6) Scaling / Mapping

• Rotary type

When the axis type is set to "Modulo", the ratio in conversion from drive increments to the application unit is set.

The unit on the servo amplifier and the unit on the application (POU) are converted. Example:

One revolution of the MINAS A6B MADHT1105BA1 is 0x800000. To treat one revolution as 360 in the application, set this ratio to 360.

Motor Type	Scaling	on	
Rotary	16#800000	incrementa <-> motor turna	1
O Linear	1	motor turns <=> gear output turns	1
	1	gear output turns <=> units in application	360

Invert direction: The direction is reversed.

• Linear type

When the axis type is set to "Finite", the ratio in conversion from drive increments to the application unit is set.

Motor Type	Scaling		
 Rotary Unear 	16#800000	increments <=> units in application	360

Invert direction: The direction is reversed.

11.3.3 EtherCAT Axis Extended Setting

Configure extended settings as required.

Right-click the object in the navigator pane and then select "Edit Object" from the contextsensitive menu that is displayed. The "EtherCAT Axis Setting" dialog box will be displayed.

General	Asia type and limits	Software Inits		helacity ramp type			
italieg/Hoping	O module	addivated	Hegative [u]:	8.0	@ Trapezzoid		
Convertisioning	@Pats		Papetive [a]	0.0054	Quante		
SH, Dirine, ETC, Panaparic, HENHL, MEr DO Magaing	0.000000000	Software error read	tion Decembring July	. <u>.</u>	C Quedratic (emooth)		
SH_DIVINE_FTC_Penakovic_HDNLE_ ABE: TEC Objects			Max, distance (a)	1	ID: 1		
Detar	Dynamic knika Velikisty (Los)	Acceleration (Juster)	teceleiatua (kuori)	set (and)	Positian lag sapervision deactivated w		
afornatise	16	130	1.00	10008	Laglinit(s) LE		

Select the "General" tab and set the following items.

General	Asia type and invite	Software Inits			Velocity ramp type 🚽	- (2
Scaling/Happing	O Produka	Adivated	Negative (s):	6,0	® Tapensid O Se*	
Commissioning	(Efets		Pastove [k]	0.8004	Quante	
SH_Davie_ETC_Personanc_HUNHS_ AVE: DO Pressing		Software entry read	for Deceleration (14/81	þ. I	Querintic (errectit)	
SH_Dirive_ETC_Penansistic_HEbAd_ A16/ IDC Objects			Max. distance [4]	8	ID: E	I
Stotur	Dynamic Inite				Position leg supervision ┥	-(1
	Vehicly \$403	Azzalenstiko [4/87]	Deceleration (k/o ²)	Jan [4/4"].	dearmated =	
Moreaties.	5	100	100	LDGOB	Laplimit [a]: 1.0	

(1) Position lag supervision

The GM1 controller does not support position lag supervision.

(2) Velocity ramp type

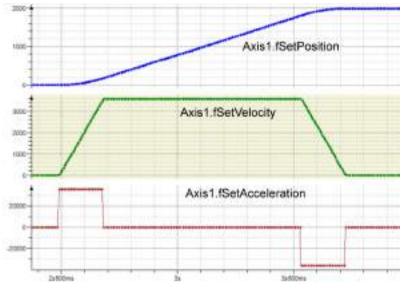
Velocity profiles are defined for each axis.

• Trapezoid

In the trapezoidal velocity profile, velocity continues linearly.

Therefore, acceleration can rise sharply.

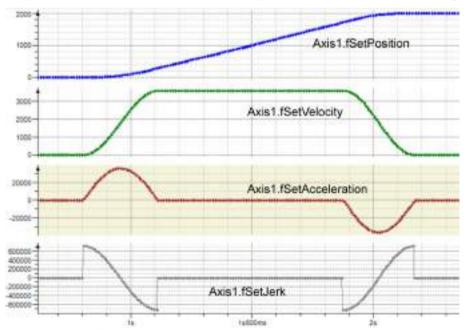
In this mode, jerk restriction does not work in each function block.



• Sin²

In the velocity profile defined with the Sin² function, transition motion within each section of the velocity profile is smooth and acceleration rises less sharply.

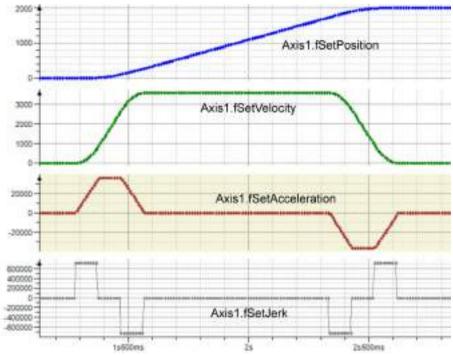
In this mode, jerk restriction basically does not work in each function block. However, jerk restriction works only when acceleration is not zero at the start of axis movement and suspended deceleration and acceleration ramps cannot be continued seamlessly.



• Quadratic

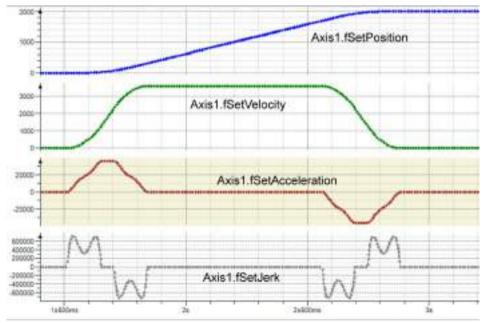
This is a trapezoidal acceleration profile with jerk restriction.

Acceleration changes partially linearly and continuously and jerk rises sharply. The maximum value of jerk can be limited by jerk values in each function block.



• Quadratic (Smooth)

This is similar to "Quadratic", except that jerk does not rise sharply. The maximum value of jerk can be limited by jerk values in each function block.



(3) Axis state window in online mode

When "Modulo" is selected

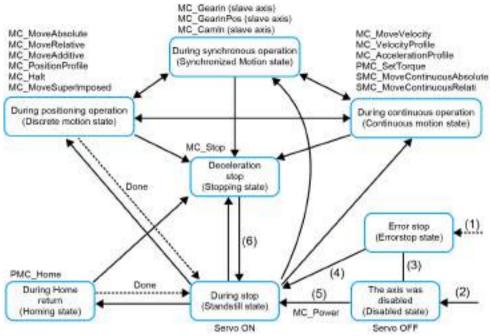
Axis type and limits	22/21 11/2					Velocity ramp to	ype.
Virtual mode	Nodulo settings					Trap ezold	
(i) Modelo	Modulo value [s]	1 99	1,0			() 5m²	
Finite						Quadratic	
	Sofbsare error read	tion				Quadratic 6	smooth)
		Dec	eleration [u/s	•];	5355608	Identification	
		Max	distance [u]		a :	ID;	0
Dynamic limits						Position lag sup	per vision
Velocity [u/s]:	Acceleration [u/a2]	Decele	ration [u/s2]	Jek	[u/e2]:	deactivated	1
10	100	B38860		8 35000		Leg limit [u]:	1.0
Acceleration (µ/s*) Forque (Nm)			Errora Axis Errori 0 (35#00000000)				
/			FB Error:				
			SMC_ERRO	R.94	CORR INVALID	POGRERIJOD	
(uiDrivalsta	face	Brian		
	~		100				
			strOriveInt		Constant in		
			Modula per	iod im	ald (c=0 or >)	of but hardwidth)	

When "Finite" is selected

Virtual mode Nodalo		W32				0.0	I Trapezoid	
	Software		asimode Adjusted Negat					
	South C	error reaction	Dece	eleration [u/s . distance [u]:		8388608 d	O Quadratic (Identification ID:	smooth)
Dynamic limits Velocity [u/s]:	Acceleratio	กโประโ	Deceler	ration [u/s=]	Terk	[1/5 ²]1	Position lag sup	ervision
10	105		8383508		30000		Lag limit (e):	1.0
Online								
variable se Position (J Velocity (Ju/a) Acceleration (Ju/a) Torque (Nin)	et value 0.00 0.00 0.00 0.00	actual valu	e 0.00 0.00 -0.12 0.00	Brrons Axis Erron 0 [16#0000 F0 Erron:	tionas 00000 IR. SM III. SM	C_HO_ERROR Error:	power_off	

(4) "Online" - "State"

This indicates one of the axis states in the following figure.



(5) "Online" - "Communication"

This indicates one of the following communication states.

Stopped
Variable initialized
Basic communication initialized
Drive initialized
Drive synchronization on standby
Initialization done
Operational
Re-initialized
Error
Unknown

(6) "Online" - "Error"

• FB error

The oldest error that occurred on the axis, "SMC_ERROR", is displayed.

This is the same error as the one that can be obtained by the "SMC_ReadFBError" function block.

• uiDriveInterfaceError / strDriveInterfaceError

This is an internal error in the GM1 controller.

(7) Scaling / Mapping

• Rotary type

When the axis type is set to "Modulo", the ratio in the conversion from the drive increment to the application unit is set.

Motor Type	Scaling	n	
Rotary	16#800000	increments <=> motor turns	1
O Linear	1	motor turns <=> gear output turns	1
	1	gear output turns <=> units in application	16#800000

Note: Invert direction: The direction is inverted.

• Linear type

When the axis type is set to "Finite", the ratio in the conversion from the drive increment to the application unit is set.

Motor Type	Scaling Invert direction		
○ Rotary	16#800000	increments <=> units in application	16#800000
Linear			

Note: Invert direction: The direction is inverted.

11.4 Basic Preparations for Operation

11.4.1 Overview of Basic Preparations for Operation

This section explains how to run and stop the motor.

11.4.2 Servo ON or OFF

To turn ON or OFF the servo motor, use the "MC_Power" function block.

Explanation of function block

For input "Axis", specify the axis corresponding to the servo motor.
 Example) In the case of SM3_Driver_EtherCAT_A6B_0, substitute
 "SM3_Driver_EtherCAT_A6B_0" for "Axis" of MC_Power.

EtherCAT_Master_SoftMotion
 MADHT1105BA1
 Mager SM3_Driver_EtherCAT_A6B_0

• When inputs "Enable", "bRegulatorOn", and "bDriveStart" are set to TRUE, the servo turns ON.

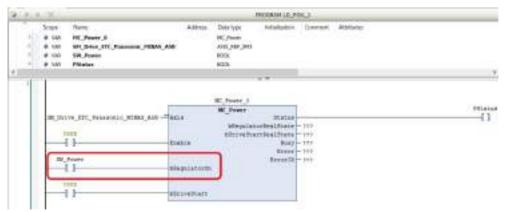
When input "bRegulatorOn" is set to FALSE, the servo turns OFF.

Program examples

The following are LD program and ST program examples that execute the "MC_Power" function block.

Setting variable "SW_Power" to TRUE turns ON the servo and setting it to FALSE turns OFF the servo.

LD program



ST program



i Info.

• When executing "MC_Power", confirm in advance that communication has been established. The communication state can be checked using the "SMC_CheckAxisCommunication" function block.

11.4.3 Home Return

Home return is an operation that returns the motor to its home position.

The GM1 controller supports various home return methods.

Home return can be achieved by executing the "MC_Home" function block.

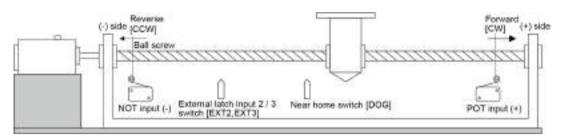
Types of home return

Home return is a function that moves the axis to the preset reference position (home position) and set the coordinates of the position to 0.

If an incremental encoder is used for the servomotor, the home return methods shown in the table below can be selected.



• The GM1 controller also supports home return using an absolute encoder. When implementing home return using an absolute encoder, use MINAS V1.24 or later.



Settings and operations of home return	Behavior overview
Edge detection of near home switch + Home position (Z phase) based on front edge	After the rising edge (front edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.
Edge detection of near home switch	The rising edge of the near home switch (DOG) is detected and the motor stops. The stopping position is set as the home position.
Edge detection of near home switch + Home position (Z phase) based on rear edge	After the falling edge (rear edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) in the home return direction is detected and the motor stops. The stopping position is set as the home position.
Edge detection of limit switch + Home position (Z phase) based on front edge	After the rising edge of the limit switch on the opposite side of the home return direction is detected, the rotation of the motor is reversed. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.
Edge detection of limit switch	The rising edge of the limit switch in the home return direction is detected and the motor stops. The stopping position is set as the home position.
Edge detection of home position (Z phase)	The axis moves from the current value toward the direction of home return. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.
Data set method	The current value is set as the home position.

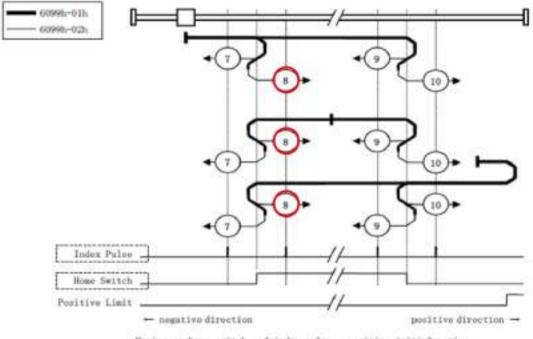
Edge detection of near home switch + Home position (Z phase) based on front edge

After the rising edge (front edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.

(Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a near home switch (DOG) will be started.

Method 8 (Home return direction: positive direction)

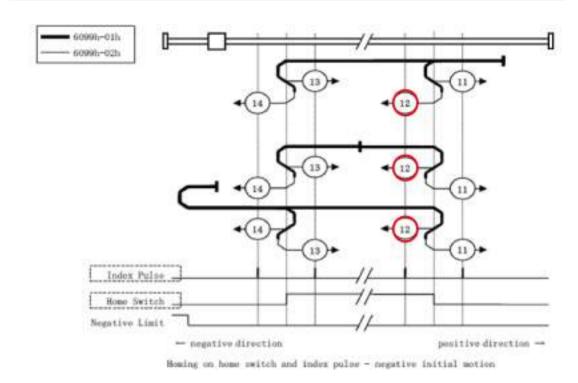
- This method uses the home switch (HOME) and the index pulse (Z phase).
- The initial motion direction is a negative direction when the home switch (HOME) is active at the start of operation.
- The home detection position is the index pulse (Z phase) near the rising edge or the falling edge of the home switch (HOME). (Refer to the following figure.)
- If HOME and NOT are not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



Homing on home switch and index pulse - positive initial motion

Method 12 (Home return direction: negative direction)

- This method uses the home switch (HOME) and the index pulse (Z phase).
- The initial motion direction is a positive direction when the home switch (HOME) is active at the start of operation.
- The home detection position is the index pulse (Z phase) near the rising edge or the falling edge of the home switch (HOME). (Refer to the following figure.)
- If HOME and NOT are not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.

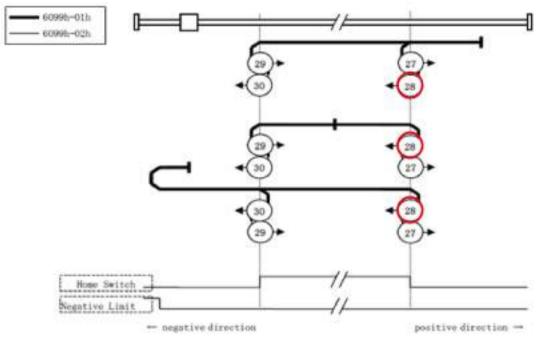


Edge detection of near home switch

The rising edge of the near home switch (DOG) is detected and the motor stops. The stopping position is set as the home position.

Method 28 (Home return direction: negative direction)

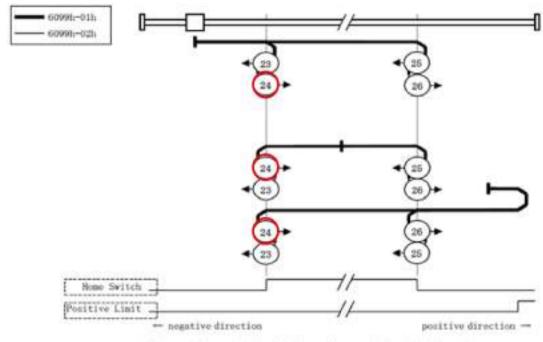
- This method uses the home switch (HOME).
- The initial motion direction is a positive direction when the home switch (HOME) is active at the start of operation.
- The home detection position is the position where the home switch (HOME) changes its state. (Refer to the following figure.)
- If HOME and NOT are not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



Homing on home switch and index pulse - negative initial motion

Method 24 (Home return direction: positive direction)

- This method uses the home switch (HOME).
- The initial motion direction is a negative direction when the home switch (HOME) is active at the start of operation.
- The home detection position is the position where the home switch (HOME) changes its state. (Refer to the following figure.)
- If HOME and NOT are not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



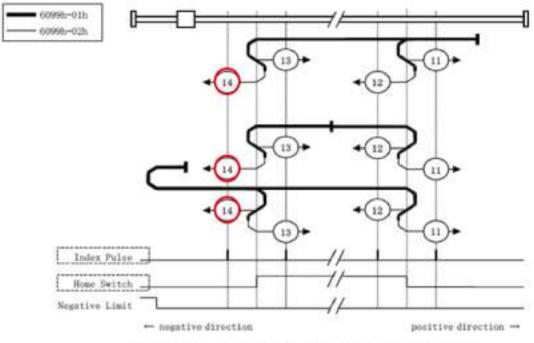
Homing on home switch and index pulse - positive initial motion

Edge detection of near home switch + Home position (Z phase) based on rear edge

After the falling edge (rear edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) in the home return direction is detected and the motor stops. The stopping position is set as the home position.

(Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a near home switch (DOG) will be started.

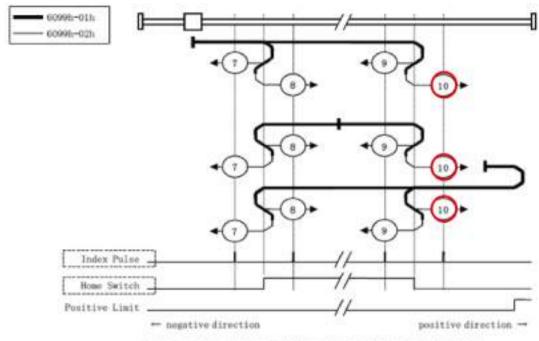
- Method 14 (Home return direction: negative direction)
- This method uses the home switch (HOME) and the index pulse (Z phase).
- The initial motion direction is a positive direction when the home switch (HOME) is active at the start of operation.
- The home detection position is the index pulse (Z phase) near the rising edge or the falling edge of the home switch (HOME). (Refer to the following figure.)
- If HOME and NOT are not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



Homing on home switch and index pulse - negative initial motion

Method 10 (Home return direction: positive direction)

- This method uses the home switch (HOME) and the index pulse (Z phase).
- The initial motion direction is a negative direction when the home switch (HOME) is active at the start of operation.
- The home detection position is the index pulse (Z phase) near the rising edge or the falling edge of the home switch (HOME). (Refer to the following figure.)
- If HOME and NOT are not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



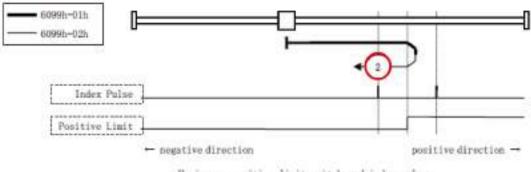
Homing on home switch and index pulse - positive initial motion

Edge detection of limit switch + Home position (Z phase) based on front edge

After the rising edge of the limit switch on the opposite side of the home return direction is detected, the rotation of the motor is reversed. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position. (Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a limit switch will be started.

Method 2 (Home return direction: negative direction)

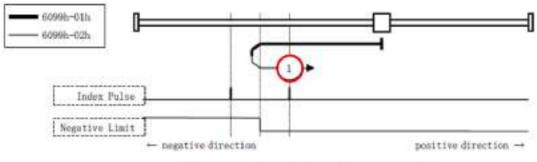
- In this method, the initial motion direction is a positive direction when the positive limit switch (POT) is inactive. (The inactive state is indicated as a low level state in the figure.)
- The home detection position is the first index pulse (Z phase) detection position on the negative side after the positive limit signal (POT) turns inactive. (Refer to the following figure.)
- If POT is not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



Homing on positive limit switch and index pulse

Method 1 (Home return direction: positive direction)

- In this method, the initial motion direction is a negative direction when the negative limit switch (NOT) is inactive. (The inactive state is indicated as a low level state in the figure.)
- The home detection position is the first index pulse (Z phase) detection position on the positive side after the negative limit signal (NOT) turns inactive.
- If NOT is not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



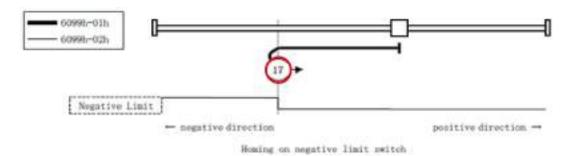
Homing on negative limit switch and index pulse

Edge detection of limit switch

The rising edge of the limit switch in the home return direction is detected and the motor stops. The stopping position is set as the home position.

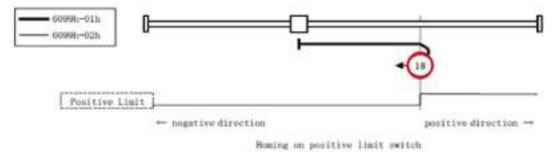
Method 17 (Home return direction: positive direction)

- In this method, the initial motion direction is a negative direction when the negative limit switch (NOT) is inactive. (The inactive state is indicated as a low level state in the figure.)
- The home detection position is the position where the negative limit switch (NOT) changes its state.
- If NOT is not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.



Method 18 (Home return direction: negative direction)

- In this method, the initial motion direction is a positive direction when the positive limit switch (POT) is inactive. (The inactive state is indicated as a low level state in the figure.)
- The home detection position is the position where the positive limit switch (POT) changes its state.
- If NOT is not assigned, an error occurs in the MC_Home function block. For details on signal assignment, refer to relevant manuals for the MINAS series.

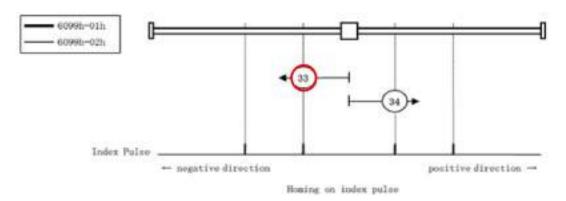


Edge detection of home position (Z phase)

The axis moves from the current value toward the direction of home return. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.

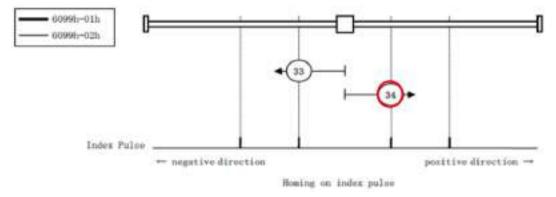
Method 33 (Home return direction: negative direction)

- This method uses only the index pulse (Z phase).
- The index pulse (Z phase) that is detected after operating in the direction shown in the figure is regarded as the home detection position.
- For detailed specifications, refer to relevant manuals for the MINAS series.



Method 34 (Home return direction: positive direction)

- This method uses only the index pulse (Z phase).
- The index pulse (Z phase) that is detected after operating in the direction shown in the figure is regarded as the home detection position.
- For detailed specifications, refer to relevant manuals for the MINAS series.



Data set method

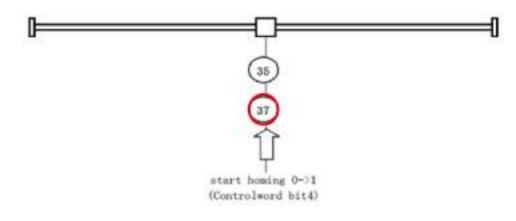
The current position is set as the home position.

- Method 37
- This method is used when setting the coordinate system (position information setting) of the servo amplifier.

The following objects are initialized (preset) based on the position where MC_Home is executed.

6062h (Position demand value) = 6064h (Position actual value) = 607Ch (Home offset) 6063h (Position actual internal value) = 60FCh (Position demand internal value) = 0

• For detailed specifications, refer to relevant manuals for the MINAS series.



Settings and operations of home return

Settings in GM Programmer

To use the home return function, set servo amplifiers of each manufacturer using the ETC_CO_SdoWrite function block and execute "MC_Home".

Specify the following settings according to the home return function to be used. The following is an example of setting the MINAS A6B.

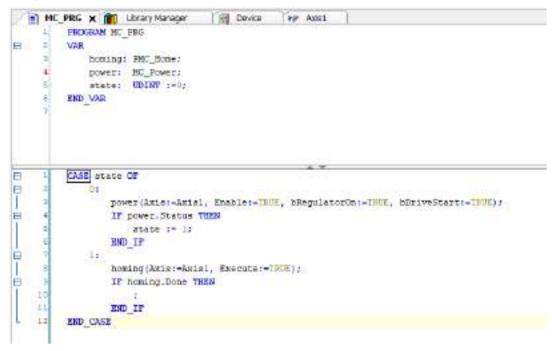
Index	Sub-Index	Name	Description
6098h	00h	Homing method	Home return method
6099h	01h	Speed during search for switch	Home return speed
6099h	02h	Speed during search for zero	Home return creep speed
609Ah	03h	Homing acceleration	Home return acceleration / deceleration



• For details, refer to relevant manuals for the MINAS series.

Home return is performed by executing "MC_Home" in POU.

Program example



11.4.4 JOG Operation

Executing a JOG operation continues to run the motor at the specified speed. JOG operation can be executed with the "MC_Jog" function block.

Explanation of functions

- While input "JogForward" is set to TRUE, the motor continues to run in the forward direction. While input "JogBackward" is set to TRUE, the motor continues to run in the reverse direction. If both "JogForward" and "JogBackward" are set to TRUE, JOG operation will be stopped.
- You can specify velocity ("Velocity", unit: u/s), acceleration ("Acceleration", unit: u/s²), deceleration ("Deceleration", unit: u/s²), and jerk ("Jerk", unit: u/s³) that are used during JOG operation.

Program examples

Example: ST program that executes JOG operation after the servo is turned ON

```
CASE Frocess OF
Ð
             Of C/Dervis Un
                 HC Power 01
                        Axis;+Axis] .
                         Enable := THUE .
                         hRegulatorOn:willing .
                         bDriveStart:=THUE
                 14
                 IF MC Power 0.Status = THUE THEN
                     Process i= 11
    11
                 END IF
    2.2
             11//Execute the MC Jog with JogForward
    11
                 HC Jog 0(
    11
                     Anier-Aniel ;
    15
                     JogForward:=THUE ,
                     JogBeckward: - FALSE .
                     Velocity1=360 .
    11
                     Acceleration + 1600 .
    1.5
                     Deceleration:=3600
    20
                 12
    2.1
                 HC ReadActualPosition 0(
    11
                                     Amist-Axisl ,
    23
                                    Enable:-fillE ,
    24
                 11
    10
                  IF NC ReadActualPosition 0.Valid - INUE THEN
                     IF MC_ReadActualPosition_0.Position > 1000 THEN
    37
                        Process 1= 22
    2.9
                     MND IF
                END IF.
    1219
    30
            21//Esscuts the MC Jog with BackPorward
    .
                HC_200_01
    11
                     Agist=Kgisl ;
                     Jogforward:-TALSE ,
    11
    3.4
                     JogBackward: = TRUE .
    35
                     Velocity:=T28 ,
    31
                     Acceleration:=3400 .
    111
                     Deceleration:+0400
    30
                 11
    11
         END CASE
```

JOG operation is started at the rising edge of "JogForward" or "JogBackward".

The "Busy" flag is set to TRUE during execution. While the "Busy" flag is set to TRUE, MC_Jog_0 must be called every cycle. Otherwise, the operation will terminate with an error.

"JogForward" and "JogBackward" must not be turned ON at the same time. Otherwise, JOG operation will terminate. As shown in this program example, if you want to switch the direction from "JogForward" to "JogBackward", set "JogForward" to FALSE and then set "JogBackward" to TRUE.

11.5 Single-axis Operation

This section explains single-axis operations using function blocks.

11.5.1 Overview of Single-axis Operation

The motion function of the GM1 controller supports position control, velocity control, and torque control as control modes.

While switching the control mode according to the purpose, you can use motion-related function blocks.

This section explains how to switch the control mode and how to do programming for typical control methods in each control mode.

For the detailed specifications of function blocks supported by the GM1 controller, refer to the instruction reference.

11.5.2 Position Control

Position control is control that runs the motor until the specified position or distance is reached. The "MC_MoveAbsolute" function block is used to specify a movement destination position ("Position") and the "MC_MoveRelative" function block is used to specify a movement distance ("Distance").

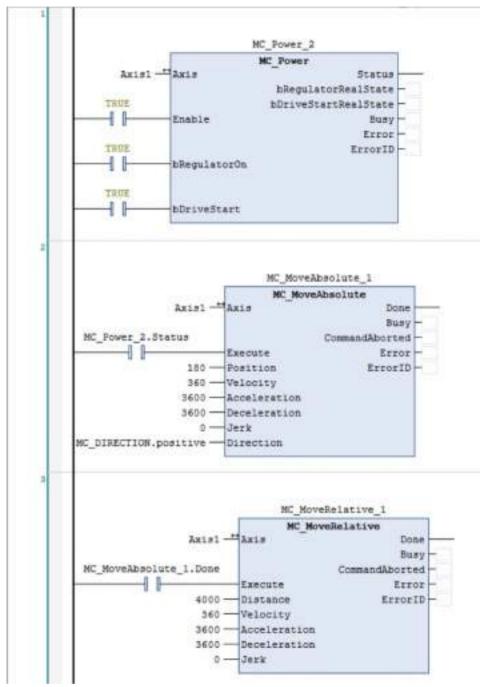
Program examples

In the following LD program example, the "MC_MoveAbsolute" function block is used to run the motor in the forward direction until position 180 is reached and the "MC_MoveRelative" function block is used to run the motor until distance 4000 is reached. Before executing the "MC_Absolute" function block, use the "MC_Power" function block to turn ON the servo corresponding to the target axis.

1 Info.

• For details, refer to the GM1 Series Reference Manual (Instruction).

LD program

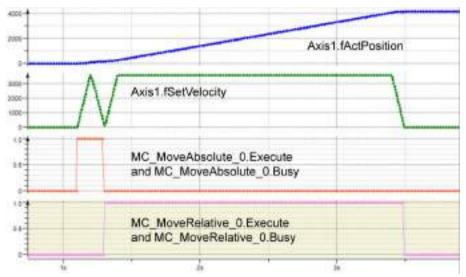


ST program

The following ST program example executes the same behavior as the LD program on the previous page.



"MC_MoveAbsolute" and "MC_MoveRelative" are started at the rising edge of the "Execute" flag. If processing is completed normally, the "Done" flag will be set to TRUE. In this program example, the actual position eventually becomes 4180.



The "Busy" flag is set to TRUE during execution. While the "Busy" flag is set to TRUE, an instance of the function block must be called every cycle. Otherwise, the operation will terminate with an error.

Motion function blocks for the GM1 controller allow the user to change parameters during operation.

To change parameter settings such as target positions ("Position") during operation, temporarily set the "Execute" flag to FALSE beforehand. After parameter settings have been changed, if the "Execute" flag is set back to TRUE, the changed parameter settings will be applied.

In the following example, "Position" in "MC_MoveAbsolute" is changed from 90 to 180. While "MC_MoveAbsolute" is being executed (Busy=TRUE), parameters can be switched.

11.5 Single-axis Operation

```
1
          CASE Process OF
8
     2
              0://Serve On
B
     3
                  MC Power 0(
     4
                           Axis:=Axis1 ,
     ٤.
                           Enable:=TRUE ;
     ŧ
                           bRegulatorOn:=IRUE ,
     -
                           bDriveStart:=TRUE
     .
                  1:
     3
IF MC_Power_0.Status = IRUE THEN
    10
                      Process 1= 11
    11
                  END IF
    12
              1://Execute the MC MoveAbsolute
    13
                  MC MoveAbsolute 0(
    14
                               Axis:=Axis1 .
    15
                               Execute:=TRUE ,
    14
                               Fosition:=90 .
    17
                               Velocity:=360 .
    1.8
                               Acceleration:=3600 .
    15
                               Deceleration:=3600 .
    20
                               Direction: =positive
    21
                  32
    22
                  IF MC_MoveAbsolute_0.Busy = THUE THEN
33
                      MC MoveAbsolute 0(
    24
                                   Axis:=Axisl ,
    35
                                   Execute:=FALSE
    26
                       17
    27
                      Process := 2;
    28
                  END IF
    29
              2://Change the position of the MC NoveAbsolute 0
33
                  MC MoveAbsolute 0(
    11
                               Agist=Agis1 ,
    82
                               Execute:=TRUE ,
    11
                               Position:=180
    24
                 35
    35
                  IF MC_MoveAbsolute_0.Done = TRUE THEN
Ð
    34
                      MC MoveAbsolute 0(
                                   Axis:-Axisl .
    37
    38
                                   Execute:=FALSE
    39
                      12
    42
                      Process := 3:
    41
                  END IF
42
              32//End
    43
                  //No Operation
    44
          END CASE
```

Motion function blocks for the GM1 controller can be overwritten with other instances during operation.

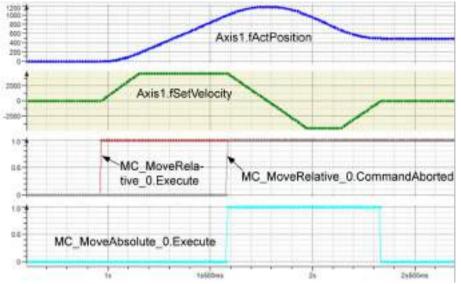
In the following example, an instance of "MC_MoveRelative" is overwritten with another instance of "MC_MoveAbsolute" during its execution.

During the execution of "MC_MoveRelative", when the actual position reaches 1000, its instance is overwritten with another instance of "MC_MoveAbsolute".

The "CommandAborted" flag of "MC_MoveRelative" is set to TRUE, causing the processing to be suspended and "MC_MoveAbsolute" to be executed.

```
E
     I
          CASE Process OF
E
     2
              0://Serve Co
B
     MC Power 01
     4
                           Axis: Axisl ,
     5
                           Enable: -THUE .
     z
                           bRegulatorOn:=THUE ,
     -
                           bDriveStart:=TAUE
     8
                  32
     4
                  IF MC_Power_0.Status - TRUE THEN
                      Process := 1;
    11
                  END IF
    12
              11//Execute the MC MoveRelative
    11
                  HC_HoveRelative_0(
    14
                               Anis:-Axis1 .
    15
                               Execute:=TRUE .
    14
                               Distance:=3000 .
    17
                               Velocity:=3400 ,
    18
                               Acceleration:=38000 ,
    1.9
                               Deceleration:=36000
    30
                   1:
E
    21
                  MC ReadActualFosition 04
    32
                                       Anis:=Anis! .
    15
                                       Enable:=THUE .
    14
                  11
    26
E
                  IF HC_ReadActualFosition_0.Valid = TRUE THEN
                      IF HC_ReadActualFosition_0.Fosition > 1000 THEM
    16
Ð
    37
                           Process 1= 27
    21
                       END IF
    25
                  END IF
    310
              21//Execute the MC NoveAbsolute
    31
                  MC_MoveRelative_0(
    12
                               Axis:-AxisI ,
    33
                               Execute: =TRUE .
    34
                   3.2
    32
Ξ
                  MC MoveAbsolute 0(
    34
                               Amis:-Axisl .
    37
                               Execute:=THUE ,
    39
                               Position:=500 .
    33
                               Velocity:=3600 ,
    60-
                               Acceleration:=3(000 .
    61
                               Deceleration:-36000 .
    42
                               Directiont=positive
    6.2
                   12
    44
                   IF MC MoveAbsolute 0.Done = IRUE THEN
    4.5
                      MC MoveAbsolute 0 (
    46
                                   Axis:=Axis1 ,
    41
                                   Execute:=FALSE
    60
                       12
    19
                      Process := 3;
    =0
                  END IF
              3t//End
Ð
    81
    6.2
                  //Wo Operation
    13
          END CASE
```

As shown below, if overwriting occurs when the "Execute" flag of "MC_MoveAbsolute" is set to TRUE, the "CommandAborted" flag of "MC_MoveRelative" will be set to TRUE during execution, causing the processing to be suspended.



"MC_ReadActualPosition" is a function block that acquires the actual position of the axis. For details on each function block, refer to the *GM1 Series Reference Manual (Instruction)*.

11.5.3 Switching the Control Mode

This function allows the user to switch the control mode between torque control, velocity control, and position control that can be used by the motion function of the GM1 controller. The control mode to be used can be switched using "SMC_SetControllerMode" of the "SM3_Basic" function block.

Explanation of functions

For the control mode to be used, specify one of the values of enumeration "SMC_CONTROLLER_MODE" that are shown in the following table.

Control mode	Value	Description
SMC_torque	1	Torque control mode
SMC_velocity	2	Velocity control mode
SMC_position	3	Position control mode



- For the GM1 controller, the default is position control mode.
- For program examples of velocity control mode, refer to "11.5.4 Velocity Control". For program examples of torque control mode, refer to "11.5.5 Torque Control".

11.5.4 Velocity Control

Velocity control is control that runs the motor at the specified velocity. Velocity control can be executed with the "MC_MoveVelocity" function block.

Explanation of functions

- When "Execute" is set to TRUE, the motor continues to run in the specified direction ("Direction") and at the specified velocity ("Velocity").
- You can specify velocity ("Velocity", unit: u/s), acceleration ("Acceleration", unit: u/s²), deceleration ("Deceleration", unit: u/s²), and jerk ("Jerk", unit: u/s³) that are used during control.

Program example

The following is an ST program example that performs velocity control in the forward direction at a velocity of 360 u/s, at an acceleration of $3,600 \text{ u/s}^2$, and at a deceleration of $3,600 \text{ u/s}^2$. Before executing the "MC_MoveVelocity" function block, use the "MC_Power" function block to turn ON the servo corresponding to the target axis.

ST program

Ð	1	CASE Process OF
B	2	0t//Servo On
Ð	3	HC_Fower_0(
	4	Axis:-Axis1 .
	5	Enable:=TRUE ,
	e	bRegulatorOnt=TRUE ,
	-	bDriveStart:=THUM
);
8	3	IF MC_Power_0.Status - TRUE THEN
-	10	Process t= 1:
	11	END IF
8	12	1t//Change controller mode to SNC velocity
-	38	SMC SetControllerMode 0 (
	14	Axis:=Axisl ,
	15	bExecute:=TRUE .
	14	
	17	nControllerMode:=SMC_velocity
B	18): TP SMC SarControllerMode & block - THIE THEN
-	19	IF SMC_SetControllerMode_0.bDone = TRUE THEN
	20	SMC_SetControllerMode_0(
	21	Axis:=Axis1 ,
	100	bExecute:=FALSE
	22);
	23	Process := 2:
-	24	END_IP
8	25	2://Execute the MC_MoveVelocity
B	26	MC_MoveVelocity_0(
	27	Axis:=Axis1 ,
	2.8	Execute:=THUE ,
	29	Velocity:=360 ,
	3.0	Acceleration:=3600 ,
	31	Deceleration:=3600 ,
	33	Direction:-positive
1.1	33	Here and the second sec
B	34	IF MC_MoveVelocity_0.InVelocity = IRUE THEN
8	35	MC_MoveVelocity_0(
	36	Axis:=Axis1 ,
	37	Execute:=FALSE
	36	11
	35	Process := 3;
	40	END_IF
E	41	3://Change Velocity to 0
B	42	MC_MoveVelocity_0(
	4.3	Axis:-Axisl ,
	44	Execute:=THIE ,
	48	Velocity:=0 ,
	46	Acceleration:=3600 ,
	47	Deceleration:=3600 .
	48	Direction:-positive
	49	17
	50	END_CASE

In the GM1 controller, "MC_MoveVelocity" is executed in position control mode or velocity control mode (Default: Position control mode).

In the program example, "SMC_SetControllerMode" is used to switch to velocity control mode (SMC_velocity).

In the program example, velocity control is started at the rising edge of the "Execute" flag of "MC_MoveVelocity".

The "Busy" flag is set to TRUE during execution. While the "Busy" flag is set to TRUE, "MC_MoveAbsolute_0" must be called every cycle. Otherwise, the operation will terminate with an error.

When the velocity of the axis reaches the target velocity ("Velocity"), the "InVelocity" flag is set to TRUE.

To change parameter settings such as target velocity ("Velocity") during operation, temporarily set the "Execute" flag to FALSE beforehand. After parameter settings have been changed, if the "Execute" flag is set back to TRUE, the changed parameter settings will be applied.

To stop the axis, change the setting of "Velocity" to 0 .

11.5.5 Torque Control

Torque control is performed at the specified torque.

Torque control can be executed with the "PMC_SetTorque" function block.

Explanation of functions

- While input "bEnable" is set to TRUE, torque control is executed with input "fTorque" (unit: %).
- Before executing the "PMC_SetTorque" function block, use the "MC_Power" function block to turn ON the servo corresponding to the target axis.

Program example

The following is an ST program example that executes torque control with a torque of 30%.

ST program

p.

B	1	CASE Process OF
Ē.	3	0://Servo On
8	1	MC_Power_0(
1	4	Axis:=Axis1 ,
	-	Enable:-TRUE ,
	Æ	bRegulatorOn:=TRUE .
	.7	bDriveStart:=TROE
	0	11
	.9	IF MC_Power_0.Status - IRUE THEN
	10	Process := 1:
	11	END IF
8	12	11//Change controller mode to SHC velocity
	13	SMC_SetControllerMode_0(
-	14	Axis:=Axisl ,
	18	bExecute:=TRUE ,
	16	nControllerMode:-SMC torque
	17);
8	18	IF SMC_SetControllerMode_0.bDone = THUE THEN
8	1.9	SMC SetControllerMode 0(
-	20	Axis:=Axisl ,
	31	bExecute := FALSE
	22) 7
	2.2	Process := 3;
	24	END IF
Ξ	25	2://Execute the PMC SetTorque
8	26	PMC_SetTorque_0(
-	27	Axis:=Axis1 .
	2.8	bEnable:=TRUE ,
	29	fTorque:=30
	10	11
	81	PMC ReadActualTorque 0(
-	32	Axis:=Axis1 ,
	33	Enable:=THUE
	34);
B	36	IF PNC_ReadActualTorque_0.Valid = TRUE THEN
B	36	IF PMC ReadActualTorque_0.Torque >= 30 THEN
8	37	PMC_SetTorque_0(
-	38	Axis:=Axisl .
	29	bEnable:=FALSE
	40)7
	41	Process := 3:
	42	END IF
	43	END IF
8	44	31//Change Torque to 0
	65	PMC SetTorque 0(
-	46	Axis:=AxisI ,
	47	bEnable:=TRUE ,
	48	fTorgue:=0
	49);
	50	END CASE
		1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 - 1000 -

In the GM1 controller, "PMC_SetTorque" is executed in torque control mode (Default: Position control mode).

In the program example, "SMC_SetControllerMode" is used to switch to torque control mode (SMC_torque).

The torque value is changed at the rising edge of the "Execute" flag.

To change the torque value ("fTorque") during operation, temporarily set the "Execute" flag to FALSE beforehand. After parameter settings have been changed, if the "Execute" flag is set back to TRUE, the changed parameter settings will be applied.

"MC_ReadActualTorque" is a function block that acquires the actual torque value of the axis. For details on each function block, refer to the *GM1 Series Reference Manual (Instruction Edition)*.

GI Info.

- In the torque control mode (SMC_torque), the axis cannot be stopped using "MC_Stop".
- To stop the axis, set "fTorque" to 0 and execute again.
- When performing torque control for MINAS A5B/A6B, the speed is limited by the Max motorspeed (16#6080:00) set in the PDO mapping. Set the speed in advance.

11.5.6 Stop

This function stops the motor.

Stop can be executed with the "MC_Halt" or "MC_Stop" function block.

Explanation of functions

- MC_Halt: Allows the user to execute another function block during stop processing.
- MC_Stop: Does not allow the user to execute another function block during stop processing. When input "Execute" is set to FALSE, this function allows the user to execute another function block.
- You can specify deceleration ("Deceleration", unit: u/s²) and jerk ("Jerk", unit: u/s³) that are used during stop processing.

Program examples

The following is an ST program example.

```
Ħ
     1
          CASE Process OF
2
              D://Servo On
Ð
                  MC Power 0(
     3
      4
                           Axis:=Axisl ,
     Ξ
                           Enable:=TRUE ,
      €.
                           bRegulatorOn;=THUE .
      7
                           bDriveStart:-TRUE
     8
                  11
     3
                   IF MC Power 0.Status = IRUE THEN
    10
                       Process := 1:
    11
                  END IF
    12
11//Execute the MC MoveBelative
13
                  MC MoveVelocity 0(
    14
                               Axis:=Axis1 ,
    15
                               Execute: -TRUE ,
    14
                               Velocity:=360 .
    17
                               Acceleration:=3600 ,
    18
                               Deceleration:=3600 .
    15
                               Direction:=positive
    3.0
                   12
    21
                   IF MC_MoveVelocity_0.InVelocity = THUE THEN
22
                       MC MoveVelocity 0(
    23
                                   Axis:=Axis1 ,
    24
                                   Execute:=FALSE
    25
                       11
    26
                       Process 1= 21
    27
                  END IF
    28
              1://Enecute the MC stop
Ð
    29
                  MC Stop 0(
    39
                       Axis:=Axisi .
    11
                       Execute:=IRUE .
    33
                       Deceleration:=1800
    33
                   12
                   IF MC_Stop_0.Done = TRUE THEN
Ð
    34
B
    35
                       MC Stop 0(
    3.6
                           Axis:=Axisl ,
    37
                           Execute:=FALSE ,
    38
                       11
    3.9
                       Process := 1:
    40
                   END IF
    41
          END CASE
```

In the program example, stop operation is started at the rising edge of the "Execute" flag of "MC_Stop".

The "Busy" flag is set to TRUE during execution. While the "Busy" flag is set to TRUE, "MC_Stop_0" must be called every cycle. Otherwise, the operation will terminate with an error. When the stop operation is completed, the "Done" flag is set to TRUE.

Unless the "Execute" flag of "MC_Stop" is set to FALSE, axis control cannot be executed by other function blocks.

11.6 Synchronous Operation

This section explains synchronous cam operation, synchronous gear operation, and synchronous phase operation that use function blocks.

11.6.1 Synchronous Cam Operation

To perform synchronous cam operation, you must set up a cam table.

Synchronous cam operation: How to use cam

This section explains how to change graphs in a cam table after adding a cam table object.

¹² Procedure

 Right-click the [Application] object in the navigator pane and then select Add Object>Cam table from the context-sensitive menu that is displayed. The "Add Cam table" dialog box will be displayed.

Add Cam table	×
Cam table	
Name:	1
	Add Cancel

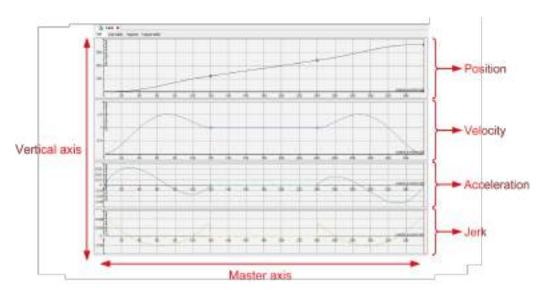
2. Enter a cam table name in the "Name" field and then click the [Add] button. A cam table object will be added.

The entered cam table name will be used when you specify a cam table with a function block.

The ""Cam" tab displays position, velocity, acceleration, and jerk graphs.

The horizontal axis represents the master axis and the vertical axis represents the slave axis.

The "Cam table" tab displays numerical values that represent the graphs displayed in the "Cam" tab.



f Info.

• You can change the minimum and maximum scale values on the horizontal axis (master axis) and vertical axis (slave axis) within a graph.

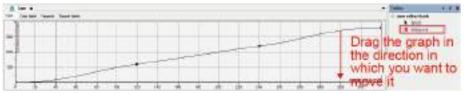
Right-click the [Cam] object in the navigator pane and then select "Properties" from the context-sensitive menu that is displayed. In the Properties window, click the "Cam" tab and change the values in the Dimensions section.

ommon Build Access Control		
Dimensions Master start position: 0	Master end position	: 360
Slave start position: 0	Slave end position:	360
Period		
Smooth transition	Slave period:	360
Continuity requirements		
Position Velocit	y 🖌 Acceleration	Jerk
Compile format		
polynomial (XYVA)		
○ one dimensional point arr	ray Elements:	256 🗸
🔿 two dimensional point arr	ау	

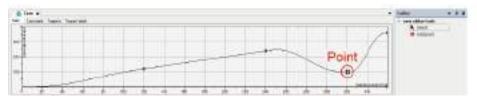
In the "Compile format" section, select "polynomial (XYVA)". Do not select another option.

3. Select "Add pointer" in Toolbox, click the graph and then drag it in the direction in which you want to move it.

A cam table object will be added.



A point will be added to the position at which you click the mouse and the graph will be moved in the direction in which you drag the point.



i Info.

- To delete the point, select the point and press the "Del" key.
- You can also check and change a cam table numerically, not in graph format. Select the "Cam table" tab. Numerical values that are changed will also be reflected in graphs in the "Cam" tab.

0	an table Tappet	s Tappet ta	ble-							
	x	Y	V.	A	- 3	Segme	min(Po	mas[P_+	max(V.,	max()A
	0	ψ	D.	0	÷ 0					
٠						Paty 5	· 0	120	1.5120	6.0328
	120	120	1	0	D					
•						Paly5	120	240	1	. 0
	240	240	- t	0	ŋ					
•						Foly5	100	247.11	3.7092	8.1726
	320.64	300	0	0	0					
٠						Poly5	300	360	12.587	1.9692
	.381	360	D	0	: D					

Synchronous cam operation: Cam control (POU programming)

After specifying the master axis and slave axis of the cam table with the "MC_CamTableSelect" function block, start synchronous cam operation with the "MC_CamIn" function block.

The following is an ST program example that moves the slave axis in conjunction with a cam table that is created.

For the cam table name, enter the object name of the cam table that has been added.

The following is an ST program example that moves the slave axis in conjunction with a cam table that is created.

For the cam table name, enter the object name of the cam table that has been added.

```
GASS Inniese OF
and a
     11
             In // Derver the.
                  HE POWER, H
     ×
                          Arist-Haster .
     ÷
                          England - THUR .
                          BRegulatorOn:=THE .
     ÷
                          hDriveStartr-THE
                 144
                  M. Down, 11
     Anist-Slamt .
                          Enablat-THUE .
                          hisquianarderstilli .
    1.0
                          BEFINEFEATL+1000
    14
                11.
    10
                  IF HC Preez, S. Status - THE MD HC Preez, L. Status - THE THE
                     Process in Lt.
                  880 17
    1.0
              printed the cas table along an machinemischedt.
    10
                 HC_CasTubleSelect_01
    24
                                  Mastari-Mastar .
                                  Blanet-Blane .
    -
                                   Castfabilmi-Cast .
    -
                                   Sativate := DICE .
    14
                                   Periodic: -THIM ;
    24
                                   Harrenhaduray-THUE
    24
                                   Slavedneolupe i-TRUE
                  3.2
    23
                  IF HC Casiallelelent d. Doke = 1808 THEM
    28
                      Troovers 1+ 21
     **
                  two ir
    64
             ht//ftart run montrol. fptc is complete start M Cashr M. httptc because 2001.
    84
                 HE CARDS IN
    912
                          Harter: Harter .
    н
                           Slaver-Slave .
    -
                          Esecuter-Term .
     .
                          Hastetüfflettell .
    -
                          ShaveOffset(w) .
    -
                          HasterScalingtel ,
    20
                          SlaveScaling:+1 .
     -
                          Starofide :- ramp_in .
    -
                          CustakleD) - HC Castakledelert S. CastakleDE,
    62
                          WelesityDiff:=040 .
    41
                          Accelerationia 100 .
    -
                          Deceleration:+0+0+
     -
                  24
    -
                IF NI CARDA A-LADANE - THER. THEN
    eri.
                      Fromas 1+ 11
                 880 IF
    41
              Si//Control the master alls with HC Howsheldstow and control the alarm ante sponteneously,
    414
    Are.
                  HE MINETERSOLARY 31
    11
                              AstateMarter .
                              Eserate - thit .
    ....
                              Websergege-carp ...
                               Acceleration:-OHH .
                              Deceleration:=0400 .
    14
                              Direction:-positive
    2.1
                  1.1
    10
                  HT_Cants_44
                          Master: Haster .
                          Slaversdlave .
    10
    41
                          Esenatel+Using .
                 21
    -
              41//Call MC Canfie As and spectromagation.
    100
                 HC Canits (1)
    14
                          Haster .- Haster .
    -
                          Slaves-Slave
    44
    -
                          Rescuter= (ALID .
                  hr:
                  MC Howwishichty 04
                              Asini-Baster
                              freinter-willigt.
                  1.1
                  MC dasdur ti
    14
                          Slavel-Slave .
                          Esecute:- (MCE
    -
                 31
          880 (USE
```

In the program example, the master axis is controlled by "MC_MoveVelocity" and the slave axis moves in sync with the master axis.

When the synchronous operation is completed, the "MC_CamIn_0.InSync" flag is set to TRUE.

The "Busy" flag is set to TRUE during execution. While the "Busy" flag is set to TRUE, "MC_MoveVelocity_0" and "MC_CamIn_0" must be called every cycle. Otherwise, the operation will terminate with an error.

To separate the slave axis from the master axis and finish the synchronous cam operation, use the "MC_CamOut" function block. When "MC_CamOut" is called, the synchronous operation is terminated and the slave axis continues to move at the same velocity as when the synchronous operation is terminated. Because the operation continues even after the slave axis is separated from the master axis, you must stop the slave axis with the "MC_Halt" function block or another function block.

11.6.2 Synchronous Gear operation

This function performs synchronous gear operation.

Synchronous gear operation: Gear control (POU programming)

Synchronous gear operation can be started and finished using the following function blocks.

- MC_GearIn: Specifies the gear ratio of the master axis and slave axis and starts synchronous gear operation
- MC_GearOut: Separates the slave axis from the master axis and finishes synchronous gear operation

Because the operation continues even after the slave axis is separated from the master axis, you must stop the slave axis with the "MC_Halt" function block or another function block.

The following is an ST program example that performs synchronous gear operation with a gear ratio of 2:1.

```
CLAR Process OF
a
    21//Jazvo 25
     HC Rowner 01
                          Acta: Haster .
     4
     Enable:-INTE .
                         DRegulatorOn - THIN .
     4
                         bOriveStart:-CHUE
     12
                 HC Power 11
     Asis-Slave .
                         Enable - THE .
                         ERegulatorOnt+THOE .
    18
                         bOriveStart:+CHIT
    14
                 11
                 IF HC_Power_S.Status = INNE AND HC_Power_1.Status =INNE TIME
    1.0
                     Process := 11
                 SHO IF
    11
             11//Control the marter axis with NC Move/Wincity and control the slave axis synchronously.
    1.00
               HC Gearin 0(
    201
                       HASterioNaster .
    11
                          SLaver-Slave ;
    22
                         Encouter=Thill .
                         RatioNumerator:=C
    24
                         RatioDecominator:=1 .
                         Acceleration + 3400 .
    18
    26
                         Deceleration:=3400
                 12
    70
                 HC HoveWelocity Di
    210
                            Aniscollaster .
                             Encuter-Chill .
    0.0
    21
                            Welcoltyp=300 ,
    ±Ξ
                             Acceleration:-1000 .
                            Seceleration:+1411 .
    14
                             Direction: sportive
    11
               115
    240
              IF HC Genrin 0.1nGear - THUE THEM
    11
                      //Dear to cll.
    38
               IND IF
    2.0
             3://Call MC GearGot to and synchronization.
    40
                HC_Searin_0(
                         Hasteri-Mester .
    41
    62
                         SLeve -SLeve .
    11
                         Descute:-TALAR
    44
                 12.1
    11
                 MC MiveVelocity 01
    44
                            katal-Mester .
    4.75
                             Execute:-Faller
    6.6
                 12 :
    4.3
                 MC GearDut 0 (
                         SlaveixGlave .
    11
                         Esecute = TACE
    8.2
                 15
    11
                 17 HC_GearOut_0.Done THEN
    24
                     //Gear Cam OK
    11
                 END IF
    1.1
         BND CASE
```

In the program example, the master axis is controlled by "MC_MoveVelocity" and the slave axis moves in sync with the master axis.

When the synchronous operation is completed, the "MC_GearIn_0.InGear" flag is set to TRUE. The "Busy" flag is set to TRUE during execution. While the "Busy" flag is set to TRUE, "MC_MoveVelocity_0" and "MC_GearIn_0" must be called every cycle. Otherwise, the operation will terminate with an error.

To separate the slave axis from the master axis and finish the synchronous gear operation, use the "MC_GearOut" function block. When "MC_GearOut" is called, the synchronous operation is terminated and the slave axis continues to move at the same velocity as when the synchronous operation is terminated. Because the operation continues even after the slave axis is separated

from the master axis, you must stop the slave axis with the "MC_Halt" function block or another function block.

11.7 Multi-axis Operation

This section explains multi-axis operations such as linear interpolation and circular interpolation.

11.7.1 Overview of Interpolation Control

Interpolation control is an operation that controls the loci of multiple axes by interlocking them. The GM1 controller supports the following interpolation controls.

Function			Description	Remarks
	Target position method	specification	Relative coordinates / Absolute coordinates	Relative: Value relative to the current value Absolute: Coordinates based on the machine zero point
Settings	Operation	Tools	CNC editor	
	setting method	Setting method	G-code input	
	Interpolation op	peration startup	Setting: CNC editor Operation startup: Startup by FB	
	Interpolation gr	ouping	Determining the axis to be used at the time of startup by FB	
Interpolation	Linear interpolation	Composite speed specification	Maximum 3-axis linear interpolation	Configuration parameters Target coordinates (X, Y, Z), velocity (F), acceleration / deceleration (E)
	Circular	Center point specification	Circular interpolation by specifying a center point	Configuration parameters Circular interpolation plane (XY, YZ, ZX) Target coordinates (X, Y, X), center point (I, J, K) Velocity (F), acceleration / deceleration (E)
	interpolation	Radius	Circular interpolation based on the current value, target coordinates, and radius	Configuration parameters Circular interpolation plane (XY, YZ, ZX) Target coordinates (X, Y, X), radius (R) Velocity (F), acceleration / deceleration (E)
	Helical interpol	ation	Circular interpolation + Helical axis	Same as circular interpolation (Center point and radius can be specified)
Coordinate conversion ^{(Not} e 1)	Absolute coord conversion	inate	Coordinates are converted by moving the coordinate system in parallel from the reference coordinate system or by rotating it using an absolute value.	Configuration parameters Coordinate system shift values (X, Y, Z) Coordinate system rotation values (A, B, C)

11.7 Multi-axis Operation

Function		Description	Remarks
	Relative coordinate conversion	Coordinates are converted by moving the coordinate system in parallel from the reference coordinate system or by rotating it using a relative value.	Configuration parameters Coordinate system shift values (X, Y, Z) Coordinate system rotation values (A, B, C)
	Coordinate system setting	Sets the coordinate system definitions using the absolute position for the current orientation and current position. (For coordinate system alignment calibration)	Configuration parameters Coordinate system shift values (X, Y, Z) Coordinate system rotation values (A, B, C)
	Coordinate conversion resetting	Resets from the state after coordinate conversion was performed as listed above to the reference coordinate system existed before the coordinate conversion was performed.	
	Dwell time	Specifying the waiting time between set movements	
Other movements	P-point/C-point operation	P-point operation: Proceeds to the next operation speed without stopping at every operation command. C-point operation: Proceeds to the next operation after pausing when an operation is completed.	Determined by the argument of SMC_CheckVelocities and the angle formed during operation.
	Jump	Jumps to the line number specified by the G code and repeats processing.	
Program- based movement change	Change of parameter settings such as target values	Using G-code to specify parameters to be changed and starting them from FB (New FB must be created)	Only SMC_CNC_REF can be used.
	Repetitive execution of CNC table	Executing a preset CNC table (interpolation settings) repeatedly	Dedicated FB is used (new FB must be added). Only SMC_CNC_REF can be used.

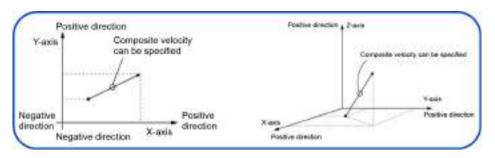
(Note 1) Use SMC_NCDecoder to execute coordinate conversion.

11.7.2 Linear Interpolation and Circular Interpolation

The GM1 controller supports linear interpolation, circular interpolation, and helical interpolation as interpolation controls.

Linear interpolation

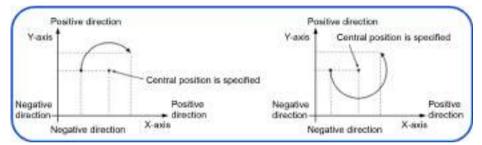
Linear interpolation can be used for two axes or three axes.



Circular interpolation

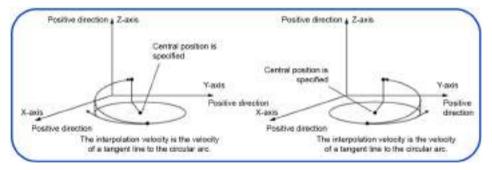
Circular interpolation can be used for two axes and each axis moves along to the locus of a circular arc.

For circular arcs, specify a center point or the radius of the circular arc.



Helical interpolation

Helical interpolation can be used for three axes. While performing circular interpolation, helical interpolation allows each axis to move in parallel with the central axis of the circular arc so that they can achieve helical motion.



11.7.3 How to Use Interpolation Control

To use interpolation control with the GM1 controller, you must configure settings and do programming as described below.

Setting up a CNC table

Setting up a CNC table makes it possible to perform continuous movements by combining interpolation controls. You can set up a CNC table using GM Programmer and transfer it to the GM1 controller by downloading the project.

For details on how to set up a CNC table, refer to "11.7.4 Registering a CNC Table".

Programming in POU

To perform interpolation control using a CNC table that has been set up, you must do programming using function blocks in POU.

The function blocks in the table below are available to perform interpolation control.

List of function blocks for interpolation control

PMC_NCDecoder	This function block decodes the specified SMC_CNC_REF type CNC table into a SMC_OUTQUEUE type CNC table. If a CNC table has been created using SMC_CNC_REF, execute this function block.
PMC_Interpolator2D	This function block executes 2-axis interpolation control using a predefined CNC table. For CNC tables for 2-axis interpolation control, execute this function block.
PMC_Interpolator3D	This function block executes 3-axis interpolation control using a predefined CNC table. For CNC tables for 3-axis interpolation control, execute this function block.

For details on function blocks for interpolation control, refer to "11.7.9 Interpolation Operation Programming: How to Create a Program for Executing Operation" to "11.7.16 Interpolation Operation Programming: Changing Parameter Settings (Converting to Variables in CNC Table)".

POU in which programming has been completed must be registered in MotionTask.

11.7.4 Registering a CNC Table

Set up a CNC table (operation patterns for interpolation control) using GM Programmer. Right-click the "Application" object in the navigator pane and then select **Add Object>CNC program** from the context-sensitive menu that is displayed.

 Application SVL 	略	Paste		
Ebrary Manager Mc_PRG (PRG) Employed (10	Add Object +	8	Cam table
	0	Add Folder	8	CNC program
	ĊĘ.	Login	6	CNC settings
		Delete application from device	94	DUT
AL MC_PR	G		1	External File
- 2.User			1	Global Variable List
3.System			-00	Interface
af Trace			т	Persistent Variables
RTEX_Master			Ð	POU
RTEX_AGN_1			æ	POU for implicit checks.
SoftMotion General Axis Poo	8		at	Trace

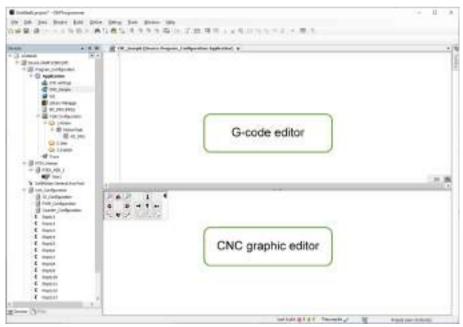
When "CNC program" is selected, the following window is displayed. Specify settings and click [OK].

Add CNC program	m	>
	prem.	
Name:		
CIVC_Sample		
Implementation:	Din66025	
Compile mode:	SMC_OutQueue]~
	1.0	

Setting item		Description		
Name	Settings	Specify a name for a CNC table to be created.		
Imple mentat ion	Din66025	[Recommended] A CNC table is created using G-code.		
	Table	[Not supported] A CNC table is created in simple table input format. Because this item is not supported by the GM1 controller, select "Din66025".		
Compi le mode	SMC_CNC_REF	[Recommended] All interpolation control functions of the GM1 controller can be used.		
	SMC_OUTQUEUE	[Not recommended] Movement speed is improved, but changing the settings in CNC tables, joining CNC tables, and other similar operations cannot be performed.		
	File	[Not supported] CNC tables are saved as external reference files. Because this mode is not supported by the GM1 controller, do not select.		

"CNC settings" and "CNC Program" will be created in the Device tree. "CNC Program" is displayed as the name registered earlier ("CNC_Sample").

The G-code editor and CNC graphic editor are displayed in the right pane of the GM Programmer screen.



G-code editor

Enter an interpolation control pattern using G-code. For details on the input method, refer to "11.7.6 G-code Editor and Coding Rules".

CNC graphic editor

The movements coded in the G-code editor are graphically displayed in real time. You can also rotate the display and change the scale.

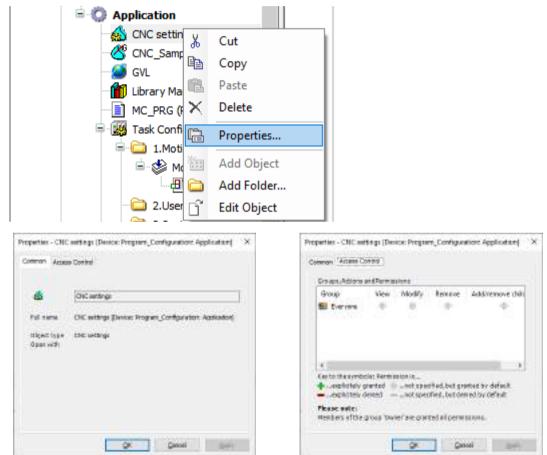
It is possible to change figures in this editor, but this will change codes in the G-code editor, making settings difficult. For this reason, do not change figures.

The respective properties of the "CNC Setting" and "CNC Program" objects displayed in the Device tree can be displayed and set by right-clicking each object and then left-clicking appropriate items.

Each window and setting items are explained below.

"CNC settings" - "Properties"

In the Device tree of GM Programmer, right-click **Application>CNC settings>Properties** in this order.



Setting item		- Description
Tab name	Settings	
Common	-	You can check the detailed settings of the CNC table.
Access Control	-	You can set access permissions.

"CNC settings" - Setting window

• "Path preprocessors" tab

th preprocessors Preinterpolation Table editor		
available function blocks	Active function block instances	
SMC_Avaid.org SMC_ExtandedWalodtyChecks SMC_LimitCincularVelacity SMC_UnitCincularVelacity SMC_RotateQueue3D SMC_RotateQueue3D SMC_SonothPath SMC_SmoothPath SMC_SmoothPath SMC_TooRedWaCom SMC_TooRedWaCom SMC_TooRedWaCom SMC_TooRedWaCom SMC_TooRedWaCom SMC_TooRedWaCom SMC_RecomputeJBCStopes SMC_RecomputeJBCStopes SMC_ReduceVelEndAtComer	SMC_Check/velocitien	
	Zammet.eta	

• "Preinterpolation" tab

🔬 CIIC settings [Device:	Program_Configuration: A	oplication] X	
ath preprocessors Preinterpol	ation Table editor		
Cycle time (Lis):	20000	4	
Velocity mode:	Trapie zoid	Ý	
Maximum Jark [u/s ³]:	4000	1.	

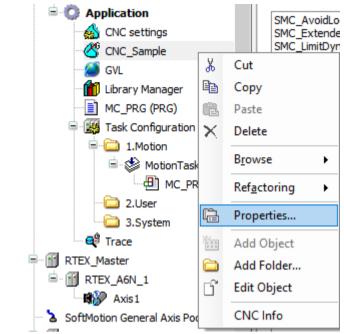
"Table editor" tab

th preprocessors Preinterpolation Table editor		
able columna		_
던 Nr	A.	A
7 Туря		_
2 Mode		V
2 Dent X		100
2 Det.Y		
Dest.2		
Dest.A		
Dent.S		
DetC		
Dent.P		
Dest.Q Dest.U		
] Dest.V		
Dest.W		
✓ Velocity [u/s] Acceleration [u/s ⁴]		
Deceleration [u/s ²]		
Tool redue D [u]		
Center point		
Start tangent		
Dest tangent		
Sorofie		
1 H functions		
□ Orientation		
A 1 Automotive	*	

Setting item		Description	
Tab name	Settings	Description	
		[Not supported]	
Faili preprocessors -		Use this item to perform preprocessing on devices for which interpolation control is to be performed. Because this mode is not supported by the GM1 controller, do not use.	
	Cycle time	Check that the time matches the time displayed in the "MotionTask" window.	
Preinterpolation	Velocity mode	[Unchangeable]	
		Check that the mode is set to "Trapezoid".	
	Maximum jerk	Specify a maximum value for jerk during interpolation control operation.	
Table editor	-	This tab is used to perform CNC in "table format". Because the GM1 controller uses G-code (Din66025), there is no need to configure settings in this window.	

"CNC Program" - "Properties"

In the Device tree of GM Programmer, right-click **Application>CNC_Sample>Properties** in this order.



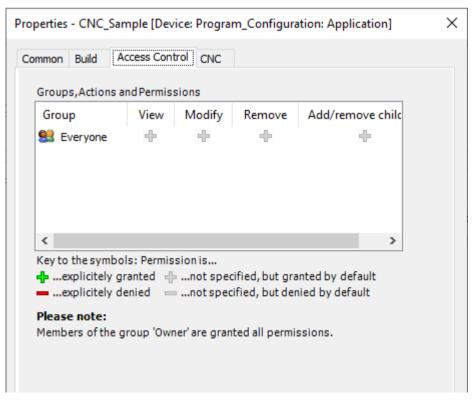
• "Common" tab

Properties - CNC	Sample [Device: Program_Configuration: Application]	×
Common Build	Access Control CNC	
G	CNC_Sample	
Full name	CNC_Sample [Device: Program_Configuration: Application]	
Object type Open with	CNC program CNC editor	
Build" tab		

WUME-GM1ETCOP-03

Properties - CNC_Sample [Device: Program_Configuration: Application]	×
Common Build Access Control CNC	
Exclude from build	
External implementation (Late link in the runtime system)	
Enable <u>s</u> ystem call	
Compiler defines	

"Access Control" tab



Setting item		Description	
Tab name	Settings	Description	
Common	-	This tab displays the CNC table name and object type. To change the CNC table name, change the CNC table name in the white field and click [OK].	
Build	-	If the created CNC table is not to be used, select the "Exclude from build" check box and click [OK].	
Access Control	-	You can set access permissions.	

• "CNC" tab

Implem	ientation:		Din66025		~
	e mode:		SMC_OutQue	eue	~
File nar			\$ObjectName		
	<u>s</u> ize [elements]:		100		÷
	lt values				÷
V <u>e</u> loc	ity (F) [u/s]:		0.000		
Accel	eration (E+) [u/s²]:		100.000		-
<u>D</u> ecel	eration (E-) [u/s²]:		100.000		
Defau	It values for fast for	ward (G	0)		
	ity (FF) [u/s]:		0.000		
	eration (EF+) [u/s²]	:	0.000		
Decel	eration (EF-) [u/s²]	:	0.000		*
<u>3</u> D-Mod	le 🗌				
	values of variables	:		Variables	
Start	position				
<u>×</u> :	0.00000	* *	<u>P</u> :	0.00000	*
<u>Y</u> :	0.00000	-	<u>Q</u> :	0.00000	▲ ▼
<u>Z</u> :	0.00000	-	<u>U</u> :	0.00000	•
<u>A</u> :	0.00000	-	<u>∨</u> :	0.00000	•
<u>B</u> :	0.00000	-	<u>w</u> :	0.00000	•
<u>C</u> :	0.00000	* *	A <u>6</u> :	0.00000	▲ ▼
	- line in a state of the		a are stared in	the "CNC setting	s"object

This window is used to configure initial settings for CNC operation.

Setting item	Description	
Implementation	[Recommended]Check that "Din66025" has been selected.If "Table" has been selected, change to "Din66025".	
Compile mode	 [Recommended] Check that "SMC_CNC_REF" has been selected. If "SMC_Outqueue" or "File" has been selected, change to "SMC_CNC_REF". 	
File name	[Not supported] Leave the default value unchanged. This item is not used.	
Queue size		
Default values	Specify default values for velocity, acceleration, and deceleration during interpolation control operation. Unless velocity, acceleration, and deceleration are specified using G-code, interpolation control will be performed using these default values.	
Default values for fast forward (G0)	[Not supported] Do not change the default value.	
3D-Mode	[Not supported] Do not change the default value.	
Start position	For the SMC_OUTQUEUE type, specify the coordinates from which interpolation control is to be started. Because the GM1 controller has the starting position controlled within function blocks, do not change the default values in this area.	

11.7.5 Overview of G-code

In the GM1 controller, G-code is used to set operation patterns for interpolation control.

G-code is a coding system used for machine NC programming. The GM1 controller complies with the "Din66025" standards.

For details on operations executed by each G-code, refer to "11.7.7 Movements Executed by Each G-code and Setting Methods".

The G codes listed in the following table are subject to the Warranty.

All other G codes not listed in the following table are not subject to the Warranty.

G- code	Function	Description	Remarks
G1	Linear interpolation	Executes linear interpolation	
G2	Circular interpolation (clockwise)	Executes circular interpolation (clockwise)	End point: X, Y, Z Center point: I (X), J (Y), K (Z)
G3	Circular interpolation (counterclockwise)	Executes circular interpolation (counterclockwise)	Radius: R
G4	Dwell time	Sets a time to wait until next movement is started	Specified time: seconds
G17	Plane specification (X / Y)	Specifies the plane in which circular interpolation is performed, as XY-plane	
G18	Plane specification (X/ Z)	Specifies the plane in which circular interpolation is performed, as XZ-plane	

11.7 Multi-axis Operation

G- code	Function	Description	Remarks
G19	Plane specification (Y/ Z)	Specifies the plane in which circular interpolation is performed, as YZ-plane	
G20	Conditional jump	Jumps to the line number specified by the G code and executes the described content in a loop unless the jump condition is other than 0.	Jump condition (K) Jump target line (L)
G36	Variable setting	Writes a value to the variable. The write variable can be used to specify the number of jumps for G20. Written to the internal variable unless a variable is specified. (The internal variable is 32-bit variable type: 0 to 4294967295.)	Set value (D) Set variable (O)
G37	Variable increment/ decrement	Increments or decrements the variable set with G36 by the specified value. Applies to the internal variable unless a variable is specified.	Increment/decrement value (D) Increment/decrement variable (O)
G53	Coordinate conversion resetting ^(Note 1)	Resets the decoder coordinate system (DCS) and returns to the reference coordinate system (MCS) existed before the coordinate conversion was executed.	
G54	Absolute coordinate conversion ^(Note 1)	Converts from the reference coordinate system (MCS) to the decoder coordinate system (DCS) using an absolute value.	Coordinate system shift values (X, Y, Z) Coordinate system rotation values (A, B, C)
G55	Relative coordinate conversion ^(Note 1)	Converts from the reference coordinate system (MCS) to the decoder coordinate system (DCS) using a relative value.	Coordinate system shift values (X, Y, Z) Coordinate system rotation values (A, B, C)
G56	Coordinate reference point resetting ^(Note 1)	Converts the current orientation and position of the reference coordinate system (MCS) to the specified decoder coordinate system (DCS).	Coordinate system shift values (X, Y, Z) Coordinate system rotation values (A, B, C)
G75	Timing synchronization with SMC_Interpolator	Synchronizes timing with SMC_Interpolator	
G90	Absolute coordinate specification	Specifies target coordinates as absolute coordinates (If G91 is not specified, absolute coordinate specification will be used.)	After G90 is set, absolute coordinate specification remains effective until G91 is set.
G91	Relative coordinate specification	Specifies target coordinates as relative coordinates	After G91 is set, relative coordinate specification remains effective until G90 is set.
G98	Absolute coordinate specification (center point)	Specifies the center point of circular interpolation as absolute coordinates	After G98 is set, absolute coordinate specification remains effective until G99 is set.

G- code	Function	Description	Remarks
G99	Relative coordinate specification (center point)	Specifies the center point of circular interpolation as relative coordinates (If G98 is not specified, relative coordinate specification will be used.)	After G99 is set, relative coordinate specification remains effective until G98 is set.

(Note 1) Use SMC_NCDecoder to execute coordinate conversion.

11.7.6 G-code Editor and Coding Rules

The following coding rules apply to input of G-codes used with the GM1 controller.

Line number

For G-code, always enter a line number (N^{**}) at the beginning of each line. Each line number must be unique.

Example:

<u>N10</u> G01 X0 Y0 Z0 F0

N20 G01 X100 Y100 Z100 F10

Lines can also be renumbered by selecting **CNC>Change CNC Program Numbers** from the menu bar of GM Programmer.

Only one G-code per line

For the GM1 controller, only one G-code can be entered in each line. Split each line as below.

Acceptable coding
 N01 G17

N02 G20 X Y I J F

 Unacceptable coding N01 G17 G20

Velocity, acceleration, and deceleration settings

Movement velocity, acceleration, and deceleration settings can be omitted. If they are omitted, the "default values" in the CNC table setting properties will be applied to movements.

To change velocity, acceleration, or deceleration settings in the CNC table, use G-code to set values as described below.

Set value	Code	Remarks
Velocity	Fxxx (xxx: Velocity)	Specify velocity in u/s.
Acceleration, deceleration	Exxx (xxx: Acceleration, deceleration)	xxx > 0: Acceleration specification xxx < 0: Deceleration specification

Velocity, acceleration, and deceleration can be specified in the following ways.

• Example 1: Batch specification

Once velocity, acceleration, and deceleration are specified, the same velocity, acceleration, and deceleration will be used until their values are changed.

N00 F100 E10 E-10

N10 G01 X100 Y50 Z10

• Example 2: Sequential specification

Velocity, acceleration, and deceleration are specified for each G-code. If velocity, acceleration, and deceleration are changed in the CNC table more than once, using this input method can prevent input mistakes.

N10 G01 X100 Y50 Z10 F100 E10 E-10

N20 G01 X150 Y100 Z50 F200 E5 E-5

11.7.7 Movements Executed by Each G-code and Setting Methods

This section explains movements executed by G-codes that the GM1 controller supports.

Linear interpolation (G01)

Setting rules for linear interpolation

The following rules apply when G-code is used to set linear interpolation for the GM1 controller.

- Settings for axes untargeted for interpolation
 For 2-axis control, set only parameters for the target plane. Do not set parameters for untargeted axes.
- Parameters set for linear interpolation

The following table shows parameters that must be set for linear interpolation.

Parameter name	Input value
X-axis	X xxx (xxx: Target coordinate)
Y-axis	Y xxx (xxx: Target coordinate)
Z-axis	Z xxx (xxx: Target coordinate)
Velocity	F xxx (xxx: Composite velocity [u/sec])
Acceleration / deceleration	E xxx (xxx > 0: Acceleration [u/sec ²]), (xxx < 0: Deceleration [u/sec ²]) * When E = 0, an error occurs.

Linear interpolation specification
 Linear interpolation can be specified with G-code.

G-code	Function
G01	Linear interpolation

Linear interpolation setting examples

Examples of setting linear interpolation with G-code are shown below. In these examples, target coordinates are set as absolute coordinates.

• 2-axis linear interpolation

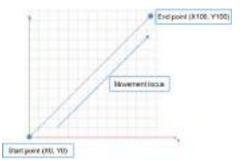
[Setting example]

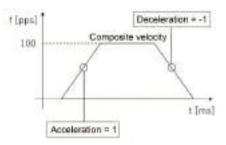
G-code setting example: N04 G01 X100 Y100 F100 E1 E-1 · Explanation of G-code

N04: The X-axis and Y-axis are specified to form an XY-plane. Linear interpolation can be set in the XY-plane according to the following values.

Current value (X0, Y0), end point (X100, Y100) Velocity 100

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



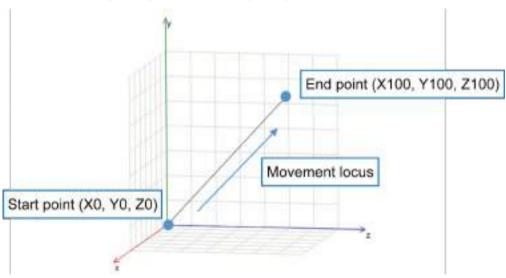


• 3-axis linear interpolation [Setting example]

G-code setting example: N11 G01 X100 Y100 Z100 F100 E1 E-1

• Explanation of G-code

N11: Linear interpolation is performed in the XYZ-plane according to the following values. Current value (X0, Y0, Z0), end point (X100, Y100, Z100) Velocity 100



Acceleration 1 [u/sec²], deceleration -1 [u/sec²]

Circular / helical interpolation (G02, G03) and plane specification (G17, G18, G19)

Setting rules for circular interpolation

The following rules apply when G-code is used to set circular interpolation for the GM1 controller.

• Specifying the coordinate plane for circular interpolation

For circular interpolation, it is necessary to determine the plane targeted for interpolation. If no plane is specified, the XY-plane will be set by default.

The coordinate plane can be switched according to the G-code specification.

G-code	Function
G17	Circular interpolation in the XY-plane
G18	Circular interpolation in the XZ-plane
G19	Circular interpolation in the YZ-plane

• Settings for axes untargeted for interpolation

For axes untargeted for interpolation (Z-axis in the XY-plane), do not enter parameters (for coordinates).

Note that if axes untargeted for circular interpolation (Z-axis in the above example) are specified, "helical interpolation" will be set. For details on helical interpolation, refer to "Helical interpolation setting examples (operation settings)".

• Parameters set for circular interpolation

The following table shows parameters that must be set for circular interpolation.

Parameter name		Input value	
	X-axis	X xxx (xxx: Target coordinate)	
Target coordinates	Y-axis	Y xxx (xxx: Target coordinate)	
	Z-axis	Z xxx (xxx: Target coordinate)	
	X-axis	I xxx (xxx: Center point coordinates)	
Center point	Y-axis	J xxx (xxx: Center point coordinates)	
	Z-axis	K xxx (xxx: Center point coordinates)	
Radius		R xxx (xxx: Circle radius)	
Velocity		F xxx (xxx: Composite velocity [u/sec])	
Acceleration / deceleration		E xxx (xxx > 0: Acceleration [u/sec ²]), (xxx < 0: Deceleration [u/sec ²]) * When E = 0, an error occurs.	

f Info.

- For circular arcs, it is necessary to specify a start point and target position, as well as a radius (R) or center point (I, J, K). Set either a center point or radius.
- Specifying the rotational direction of circular arc

The rotational direction of a circular arc can be switched by specifying a G-code.

G-code	Function
G2	Circular interpolation (clockwise)

G-code	Function
G3	Circular interpolation (counterclockwise)

• Determining a coordinate specification method

The target position and center point of circular interpolation can be specified as relative coordinates or absolute coordinates. For details on how to set relative coordinates or absolute coordinates, refer to "Absolute coordinate specification (G90)" or "Relative coordinate specification (G91)".

Circular interpolation setting examples (center point specification)

Examples of setting circular interpolation with G-code are shown below. In these examples, target coordinates are set as absolute coordinates and center point coordinates are set as relative coordinates.

For circular interpolation, it is necessary to specify the coordinate plane targeted for interpolation. When using circular interpolation, specify a coordinate plane.

• Circular interpolation (XY-plane)

The following is an example of circular interpolation using an XY-plane.

[Setting example 1]

G-code setting example: N03 G17 N04 G02 X100 Y0 I50 J0 F100 E1 E-1

• Explanation of G-code

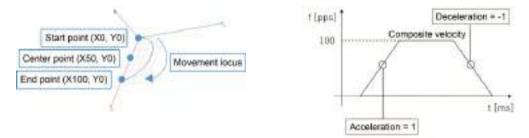
N03: An XY-plane is selected. (This can be omitted when there is no need to change the plane.)

N04: Circular interpolation is performed in the XY-plane according to the following values. Current value (X0, Y0), end point (X100, Y0)

Center point (X50, Y0)

Velocity 100

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



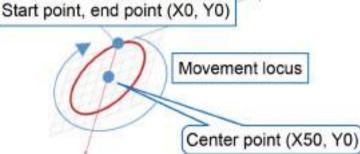
* A round circle can be specified by omitting an end point or entering the same coordinates for the start point and end point as below. (For center point specification only) [Setting example 2] (When end point is omitted)

G-code setting example: N03 G17 N04 G02 X100 Y0 I50 J0 F100 E1 E-1

[Setting example 3] (When start point = end point)

G-code setting example: N03 G17 N04 G02 X0 Y0 I50 J0 F100 E1 E-1

 Explanation of G-code
 N03: An XY-plane is selected.
 N04: Circular interpolation is performed in the XY-plane according to the following values. Current value (X0, Y0), end point (X0, Y0 or omitted)
 Center point (X50, Y0)
 Velocity 100
 Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



* Circular interpolation can be specified with a radius instead of a center point, as below. [Setting example 1]

G-code setting example: N03 G17 N04 G02 X100 Y0 R50 F100 E1 E-1

• Explanation of G-code

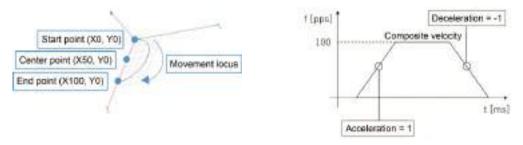
N03: An XY-plane is selected.

N04: Circular interpolation is performed in the XY-plane according to the following values. Current value (X0, Y0), end point (X100, Y0)

Radius 50

Velocity 100

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



• Circular interpolation (XZ-plane)

The following is an setting example of circular interpolation using an XZ-plane. [Setting example 4]

```
G-code setting example:
N11 G18
N12 G02 X100 Z0 I50 K0 F100 E1 E-1
```

Explanation of G-code

N11: An XZ-plane is selected.

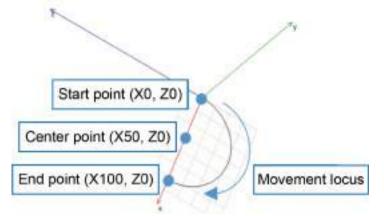
N12: Circular interpolation is performed in the XZ-plane according to the following values.

Current value (X0, Z0), end point (X100, Z0)

Center point (X50, Z0)

Velocity 100

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



• YZ-plane

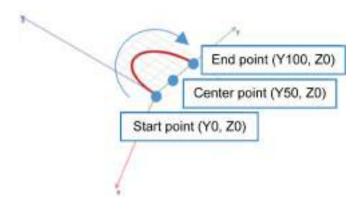
The following is an setting example of circular interpolation using an YZ-plane. [Setting example 5]

```
G-code setting example:
N10 G19
N11 G02 Y100 Z0 J50 K0 F100 E1 E-1
```

Explanation of G-code

N10: An YZ-plane is selected.

N11: Circular interpolation is performed in the YZ-plane according to the following values. Current value (Y0, Z0), end point (Y100, Z0)
Center point (Y50, Z0)
Velocity 100
Acceleration 1 [u/sec²], deceleration -1 [u/sec²]





• Note that if axes other than those in the target plane are selected and used, helical interpolation will be performed. For details on helical interpolation, refer to "Helical interpolation setting examples (operation settings)".

Helical interpolation setting examples (operation settings)

Examples of setting helical interpolation with G-code are shown below. [Setting example 1]

G-code setting example: N10 G17 N11 G02 X0 Y0 Z100 I50 J0 F100 E1 E-1

• Explanation of G-code

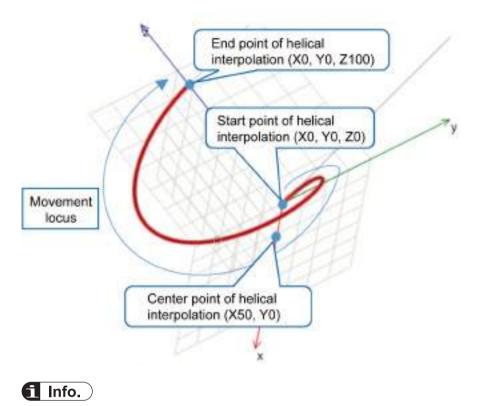
N10: An XY-plane is selected. (This can be omitted when there is no need to change the plane.)

N11: Circular interpolation is performed in the XY-plane according to the following values. Current value (X0, Y0, Z0), end point (X0, Y0, Z100)

Center point (X50, Y0)

Velocity 100

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



• There is no need to enter the center point (K) of the Z-axis.

Absolute coordinate specification (G90)

Absolute coordinate specification is a method that specifies coordinates as absolute coordinates based on a predetermined origin (coordinate value: 0).

To use absolute coordinate specification, specify G90. Because absolute coordinate specification is the default value for target position settings for the GM1 controller, absolute coordinate specification will be used unless G91 (relative coordinate specification) is specified.

G-code	Function	Description	Remarks
G90	Absolute coordinate specification	Specifies target coordinates as absolute coordinates (If G91 is not specified, absolute coordinate specification will be used.)	After G90 is set, absolute coordinate specification remains effective until G91 is set.

Absolute coordinate specification setting example (operation settings)

[Setting example]

```
G-code setting example:
N10 G90
N20 G01 X50 Y50 F100 E1 E-1
N30 G01 X100 Y50 F100 E1 E-1
```

• Explanation of G-code

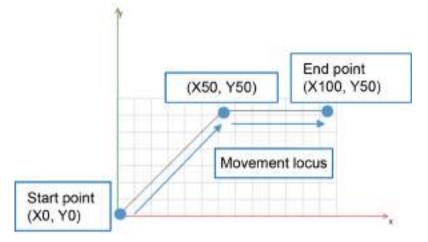
N10: Absolute coordinate specification is set.

N20: Linear interpolation is performed according to the following values. Current value (X0, Y0), end point (X50, Y50)

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]

N30: Linear interpolation is performed according to the following values. Current value (X50, Y50), end point (X100, Y50)

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



Relative coordinate specification (G91)

In relative coordinate specification, the current value is used as the base and a movement distance from the current value is specified as relative coordinates.

To use relative coordinate specification, specify G91. Note that if G91 is not specified, absolute coordinate specification will be used.

G-code	Function	Description	Remarks
G91	Relative coordinate specification	Specifies target coordinates as relative coordinates	After G91 is set, relative coordinate specification remains effective until G90 is set.

Relative coordinate specification setting example (operation settings)

[Setting example]

```
G-code setting example:
N10 G91
N20 G01 X50 Y50 F100 E1 E-1
N30 G01 X50 Y0 F100 E1 E-1
```

Explanation of G-code

N10: Relative coordinate specification is set.

N20: Linear interpolation is performed according to the following values.

Current value (X0, Y0), end point (X+50, Y+50)

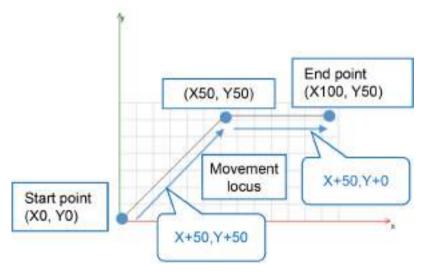
Acceleration 1 [u/sec²], deceleration -1 [u/sec²]

N30: Linear interpolation is performed according to the following values.

Current value (X50, Y50), end point (X+50, Y+0)

Actual end point (X100, Y50)

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



Center point relative / absolute coordinate specification (G98, G99)

As is the case with target coordinates, center point coordinates can also be specified by selecting relative coordinates or absolute coordinates.

Center point coordinates are specified by selecting G-code G98 or G99.

G-code	Function	Description	Remarks
G98	Absolute coordinate specification (center point)	Specifies the center point of circular interpolation as absolute coordinates	After G98 is set, absolute coordinate specification remains effective until G99 is set.
G99	Relative coordinate specification (center point)	Specifies the center point of circular interpolation as relative coordinates (If G98 is not specified, relative coordinate specification will be used.)	After G99 is set, relative coordinate specification remains effective until G98 is set

Notes on center point coordinate specification

- For relative and absolute coordinate specifications, different G-codes are used for target coordinates and center point coordinates.
- We recommend that relative coordinates (default setting) be used for center point coordinates, as using relative coordinates makes input easier.

Center point relative coordinate specification (G99)

Center points can be specified as relative coordinates, as below. Coordinates other than center point coordinates are specified as absolute coordinates.

[Setting example]

G-code setting example: N00 G90 N01 G01 X100 Y100 F100 E1 E-1 N02 G99 N03 G17 N04 G02 X200 Y100 I50 J0 F100 E1 E-1

• Explanation of G-code

N00: The target position is specified as absolute coordinates. (This specification can be omitted if the default setting of G90 is applied.)

N01: Movement to X100 / Y100 coordinates (linear interpolation) is performed.

N02: A center point is specified as relative coordinates.

N03: An XY-plane is selected.

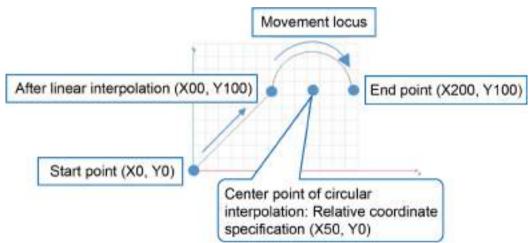
N04: Circular interpolation is performed in the XY-plane according to the following values.

Current value (X100, Y100), end point (X200, Y100)

Center point entered as relative coordinates (X50, Y0)

Velocity 100

Acceleration 1 [u/sec²], deceleration -1 [u/sec²]



Center point absolute coordinate specification (G98)

Center points can be specified as absolute coordinates, as below. Coordinates for all movements including center point coordinates are specified as absolute coordinates. [Setting example]

```
G-code setting example:
N00 G90
N01 G01 X100 Y100 F100 E1 E-1N02 G98
N03 G17
N04 G02 X200 Y100 I150 J100 F100 E1 E-1
```

• Explanation of G-code N00: Absolute coordinate specification is set. (This specification can be omitted if the default setting of G90 is applied.)

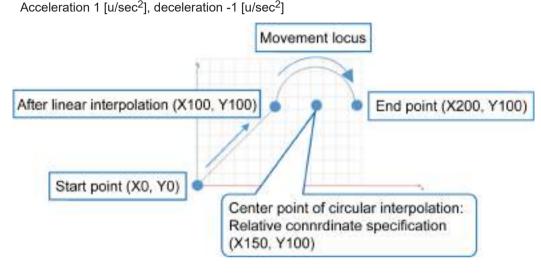
N01: Movement to X100 / Y100 coordinates (linear interpolation) is performed.

N02: The center point is specified as absolute coordinates. (This specification can be omitted if the default setting of G90 is applied.)

N03: An XY-plane is selected.

N04: Circular interpolation is performed in the XY-plane according to the following values.

Current value (X100, Y100), end point (X200, Y100) Center point (X150, Y100) Velocity 100



Dwell time (G04)

Setting rules for dwell time

Dwell time is a time to wait until next interpolation operation is executed. It is used for purposes such as waiting for a particular operation. For dwell time, enter G-code "G04" in a position where you want to set waiting time.

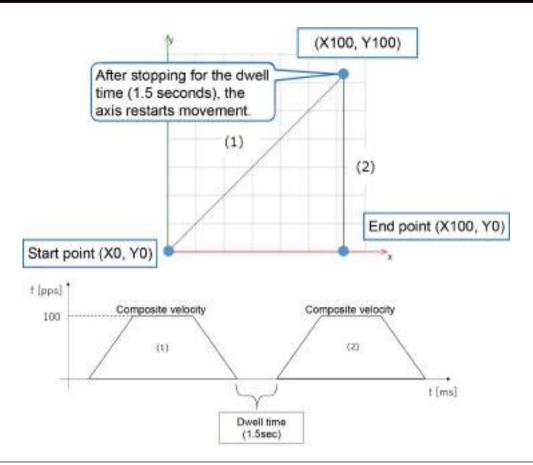
Dwell time setting example

[Setting example]

G-code setting example:	
N00 E1 E-1	
N10 G01 X100 Y100 F100	
N20 G04 T1.50	
N30 G01 X100 Y0 F100	

• Explanation of G-code

N00: Acceleration (1 [u/sec²] and deceleration (-1 [u/sec²]) are set collectively.
N10: Linear interpolation (X100, Y100) is performed. (Section (1) in the figure below)
N20: The system waits for the dwell time (1.5 seconds).
N30: Linear interpolation (X100, Y0) is performed. (Section (2) in the figure below)



11.7.8 SMC_CNC_REF and SMC_OUTQUEUE

Two compilation modes are available for CNC tables. They can be selected when a table is created.

For details on how to set compilation mode, refer to "11.7.4 Registering a CNC Table".

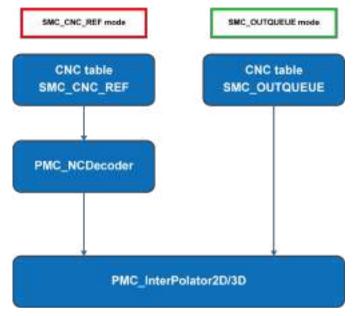
SMC_OutQueue (Pre-registration mode)

- Data structure is generated during compilation.
- A CNC table that has been set up can be specified directly in PMC_Interpolator2D or PMC_Interpolator3D.
- Because calculations are performed during compilation, high-speed operation can be achieved.
- Operation cannot be changed using programs.
- CNC tables cannot be joined or repeated.

SMC_CNC_REF

- After being decoded with PMC_NCDecoder, a CNC table that has been set up must be executed in PMC_Interpolator2D or PMC_Interpolator3D.
- Operation can be changed using programs (refer to "11.7.16 Interpolation Operation Programming: Changing Parameter Settings (Converting to Variables in CNC Table)").

- CNC tables can be joined and repeated (refer to "11.7.15 Interpolation Operation Programming: Joining and Repeating CNC Tables").
- Because calculations are performed for each execution, more processing time is required.



11.7.9 Interpolation Operation Programming: How to Create a Program for Executing Operation

Programming / execution procedure

To perform interpolation operation with the GM1 controller, you must configure settings, do programming, and execute the program using the following procedure.

1. CNC table and POU settings

To perform interpolation operation using the CNC table that has been set up in Section 11.7.3, you must do programming by using function blocks in a Program Organization Unit (POU).

You must use dedicated function blocks to perform interpolation operation. The GM1 controller supports the following three function blocks: PMC_NCDecoder, PMC_Interpolator2D, and PMC_Interpolator3D. For details on each function block, refer to "11.7.10 Interpolation Operation Programming: Explanation of Function Block (FB)".

Programming in POU Do programming in POU and register the POU in MotionTask. For details, refer to "7.9 Tasks".

3. Executing the program

When the program is completed, execute "build". When the build process is completed, execute "login". After executing login, select "Login with download" in the "Options" section and then click "OK". When the GM1 controller is connected, the program is downloaded automatically. For details, refer to "7.8 Build".

When download is completed, start executing the program.

f Info.

• Before executing "build", check the confirmation items and notes in the following sections.

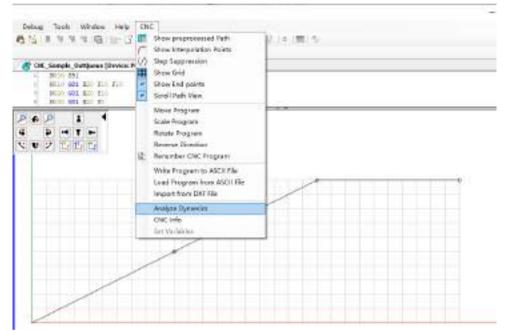
Confirmation items during programming

To ensure normal operation, check the following items.

• Dynamical analysis for CNC table

CNC tables that have been created can be subject to dynamical analysis to preliminarily check how each axis moves.

- · Verification method for dynamical analysis
 - 1. In the CNC table editing window, from the menu bar, select CNC>Analyze Dynamics.



2. The "Dynamical Analysis" window will be displayed. Specify appropriate settings in the "Axis", "Cycle time", "Velocity mode", and "Maximum jerk" fields.



🖌 Note 🔾

- If variables are used in CNC tables, the "Dynamical Analysis" window cannot be displayed. For details on how to convert to variables in CNC tables, refer to "11.7.16 Interpolation Operation Programming: Changing Parameter Settings (Converting to Variables in CNC Table)".
- If starting coordinates are specified or CNC tables are joined or repeated in POU, actual movements will differ from the results of dynamical analysis.
- Checking the CNC table
 - 1. Check that the CNC table to be used is registered in **Program Configuration>Application** in the Device tree.
 - Check that the CNC table is SMC_CNC_REF type. For details, refer to "11.7.4 Registering a CNC Table".
- Checking registration of target axes

Check that the target axes for interpolation operation have been registered beforehand. Axis setting example)

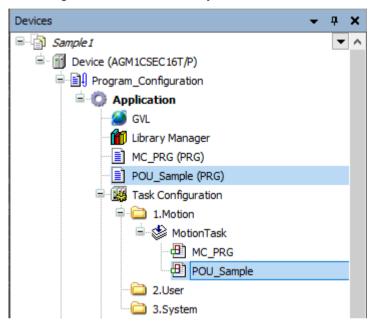
In this example, the names of axes used in the function block are "X_Drive and Y_Drive".

In "EtherCAT_Master_SoftMotion" in the Device tree, "X_Drive and Y_Drive" are registered in "EtherCAT_A6B_1 and EtherCAT_A6B_2", respectively. (For three axes, "Z_Drive" is also registered.)



Notes on POU registration

Created POU ("POU_Sample" in the example) must be registered in **Program Configuration>Application>Task Configuration>1.Motion>MotionTask** in the Device tree. Do not register it in "2.User" or "3.System".



Confirmation items of MotionTask cycle

Check the cycle time (control cycle) of EtherCAT_Master_SoftMotion. The cycle time (control cycle) of EtherCAT_Master_SoftMotion can be checked by double-clicking "EtherCAT_Master_SoftMotion" in the Device tree and then checking "EtherCAT parameter". Enter the confirmed cycle time (control cycle) of EtherCAT_Master_SoftMotion into the "dwlpoTime" input section in the "PMC Interpolator2D/3D" function block.

11.7.10 Interpolation Operation Programming: Explanation of Function Block (FB)

Types of function block

This manual supports the following function blocks.

Name	Function	Overview
PMC_NCDecoder	Decode	This function block decodes the SMC_CNC_REF type CNC table into an SMC_OUTQUEUE type CNC table.
PMC_Interpolator2D	2-axis interpolation operation	This function block executes 2-axis interpolation operation according to the specified SMC_OUTQUEUE type CNC table.
PMC_Interpolator3D	3-axis interpolation operation	This function block executes 3-axis interpolation operation according to the specified SMC_OUTQUEUE type CNC table.

(Note 1) Do not use the standard function blocks supported by CODESYS.

PMC_NCDecoder (decode)

This function block decodes the SMC_CNC_REF type CNC table into an SMC_OUTQUEUE type CNC table.

For the specifications of PMC_NCDecoder, refer to the *GM1 Series Reference Manual* (*Instruction Edition*).

For the programming method, refer to "PMC_Interpolator2D (2-axis interpolation)".

PMC_Interpolator2D (2-axis interpolation)

This function block (FB) performs 2-axis interpolation control according to the specified CNC table.

For the detailed specifications of the function block, refer to the *GM1 Series Reference Manual* (*Instruction Edition*).

Programming method for PMC_Interpolator2D

[Setting example 1] ST program example: SMC_CNC_REF type CNC table

G-code (SMC_CNC_REF): CNC_Table1 N01 G01 X10 Y10 F10 E1 E-1

Variable declaration section:		
//FB instances		
NCDecoder	: PMC_NCDecoder;	
Interpolator2D	: PMC_Interpolator2D;	
ReadSetPosition	: SMC_ReadSetPosition	//Read current value
//Variables		
buf	: ARRAY[010] OF SMC_GEOINFO;	//Buffer for decoding
fSetXPosition	: LREAL;	//Current value on X-axis
fSetYPosition	: LREAL;	//Current value on Y-axis
bStart	: BOOL;	//Execution flag

- Explanation of declaration section
 - In Lines 2 to 4, function blocks to be used are defined by assigning arbitrary names to them.
 - In Line 5, a buffer to be used for PMC_NCDecoder is defined.
 Paths in the CNC table that are as many as arrays can be stored. (In the above example, 11 paths can be stored.)
 - * Note that if the buffer size is 5 or less, PMC NCDecoder cannot be executed.
 - In Line 6, a flag for starting execution is defined.

Control section:

IF bStart THEN

ReadSetPosition(Axisx:=X_Drive,Enable:=TRUE, Position=>fSetXPosition) ReadSetPosition(Axisy:=Y_Drive,Enable:=TRUE, Position=>fSetYPosition) NCDecoder(nSizeOutQueue := SIZEOF(buf),pbyBufferOutQueue := ADR(buf), dXStartPosition:=fSetXPosition,dYStartPosition:=fSetYPosition, ncprog :=CNC_Table1,bExecute:=TRUE);

	Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=TRUE,
	poqDataIn:=NCDecoder.poqDataOut,dwIpoTime:=1000,);
END_IF	

- Explanation of control section
 - When the "bStart" flag is set to TRUE, NCDecoder and Interpolator2D start being executed.
 - PMC_NCDecoder and PMC_Interpolator2D must be executed at the same time.
 - For dXStartPosition and dYStartPosition in PMC_NCDecoder, specify the respective positions on the X-axis and Y-axis when interpolation control starts being executed. (For details, refer to "11.7.11 Interpolation Operation Programming: Specifying the Starting Coordinates".)

[Setting example 2] ST program example: SMC_OUTQUEUE type CNC table

 G-code (SMC_OUTQUEUE): CNC_Table2

 N01
 G01 X10 Y10 F10 E1 E-1

 Variable declaration section:

 //FB instances

 Interpolator2D
 : PMC_ Interpolator2D;

 //Variables

 bStart
 : BOOL;

- Explanation of declaration section
 - In Line 2, a function block to be used is defined by assigning an arbitrary name to it.
 - In Line 4, a flag for starting execution is defined.

Control section:
IF bStart THEN
Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=TRUE,
poqDataIn:=ADR(CNC_Table2),dwIpoTime:=1000,);
END_IF

- Explanation of control section
 - When the "bStart" flag is set to TRUE, Interpolator2D starts being executed.
 - For PMC_Interpolator2D, specify the address of the SMC_OUTQUEUE that has been created.
 - In PMC_Interpolator2D, match the position at the start of operation and the current value. (For details, refer to "11.7.11 Interpolation Operation Programming: Specifying the Starting Coordinates".)

PMC_Interpolator3D (3-axis interpolation)

This function block (FB) performs 3-axis interpolation control according to the specified CNC table.

For the detailed specifications of the function block, refer to the *GM1 Series Reference Manual* (*Instruction Edition*).

- When executing multiple interpolation controls, do not use the same buffer for different instances.
- When executing multiple interpolation controls at the same time, do not use the same table for different instances. Otherwise, normal operation may not occur. (If the same table is used for different instances, create multiple tables with the same contents.)
- Do not execute single-axis operation function blocks such as MC MoveRelative. MC Stop, and MC Halt during interpolation control.
- Do not change any variables within the SMC CNC REF or SMC OUTQUEUE structure in POU.

i Info.

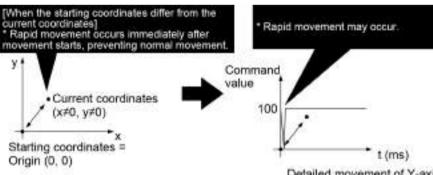
Stop

- When PMC NCDecoder and PMC Interpolator2D or PMC Interpolator3D are executed at the same time, the contents of the buffer are rewritten according to the operation execution. Therefore, even if the buffer size is not large enough to store the number of paths in the CNC table, normal operation will occur.
- If PMC Interpolator2D or PMC Interpolator3D is executed after the processing of PMC NCDecoder is complete, define a buffer size that can store all paths in the CNC table.

11.7.11 Interpolation Operation Programming: Specifying the Starting Coordinates

In CNC tables programmed in G-code, by default, the starting coordinates are defined as the origin (0, 0). Normally, if the starting coordinates in the CNC table are identical with the operation starting coordinates (current coordinates), normal operation will occur.

If the operation starting position (current coordinates) is not the origin, when operation is started from the current coordinates, rapid movements may occur from the current coordinates through to the origin immediately after startup, thereby preventing normal operation from being performed.



Detailed movement of Y-axis

To achieve normal operation, therefore, if the starting coordinates in the CNC table differ from the operation starting coordinates (current coordinates), they must be matched. In such a case, specify starting coordinates.

The method for specifying starting coordinates differs between SMC CNC REF and SMC OUTQUEUE.

* In the following descriptions, the starting coordinates in the CNC table are referred to as "starting coordinates" and the coordinates at the start of interpolation control operation are referred to as "operation starting coordinates".

For SMC_CNC_REF

Starting coordinates can be specified in PMC_NCDecoder when decoding is executed.

Variable declaration section:		
//FB instances		
NCDecoder	: PMC_NCDecoder;	
Interpolator2D	: PMC_ Interpolator2D;	
ReadSetPosition	: SMC_ReadSetPosition	//Read current value
//Variables		
buf	: ARRAY[010] OF SMC_GEOINFO;	//Buffer for decoding
fSetXPosition	: LREAL;	//Current value on X-axis
fSetYPosition	: LREAL;	//Current value on Y-axis
bStart	: BOOL;	//Execution flag

Control section:

-	
IF bStart 1	ſHEN
	ReadSetPosition(Axisx:=X_Drive,Enable:=TRUE, Position=>fSetXPosition)
	ReadSetPosition(Axisy:=Y_Drive,Enable:=TRUE, Position=>fSetYPosition)
	NCDecoder(nSizeOutQueue := SIZEOF(buf),pbyBufferOutQueue := ADR(buf),dXStartPosition:=fSetXPosition,dYStartPositon:=fSetYPosition,
	ncprog := CNC_Table1,bExecute:=TRUE);
	Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=TRUE,
	poqDataIn:=NCDecoder.poqDataOut,dwIpoTime:=1000);
END_IF	

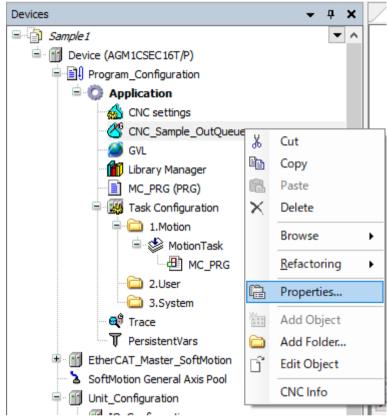
• When operation is started, SMC_ReadSetPosition reads the current coordinates and PMC_NCDecoder specifies the coordinates as starting coordinates.

Note

• If the specified starting coordinates differ from the operation starting coordinates, there is a risk that rapid movement may occur.

■ For SMC_OUTQUEUE

1. Right-click a CNC table that has been created and select "Properties" from the contextsensitive menu that is displayed.



2. Click the "CNC" tab in the upper section of the Properties window that is displayed.

Implementations		Dev64003			
Campile incde:		PE_O/Quie			
Nix name:		10tyer/Servel.cm			
Queue suz (elemental)		100		ļ,	
Defe	ut salari				
Veta	oty (*) [a/s]		8.080		
Acti	ierettan (2+) (4/94	8	100.000		景
Dela	Analises (G-3) palari	8 - I	200.000		法
Orfe	uit values for Fast i	iner 15	-05		
Webschy OFFIDAND		8.080		- (8)	
Acceleration (29+15-014)		8.000			
Deuterstram (07-) [w/s*]		B-090		2	
20.44	de [1] eb				
Office	values of variable	- CH			
100	pealan				
*	3.00000	4	Pt	0.00000	4
	8.00080	法	(Q)	0.00000	換
2	3.00000	0	01	10.00006	10
	8.00000	4	- 11	0.90800	0
	8.00000	0	w	0.00000	0
0	8.00000	4	.481	0.00000	4
Press	an loation wide 0	- 222	_	40.000	

3. In the "Start position" section, specify the respective operation starting coordinates for the X, Y, and Z axes and then click [OK].

Implementation			Ov65025		÷
Complia mode:			INC. OLLOW	68	
File na	ne:		Sobjectives	e£σι:	(*)
Quese	size (elements)		100		4
Defa	ult values				
Velo	aty (P). [u/#]:		0.000		12
Acce	ieration (0+) (u/1*);		100.000		\$
Dete	$= \{ 1 \ a \ b \ a \ b \ a \ b \ a \ b \ a \ b \ b$		100.000		1
Defe	uit values for fast for	nard (S	00		
Velo	aty (??)[u/s]:		8.909		4
Acceleration (8++) (a/a*):			0.000		0
Deceleration (EF-) [s(s*)			0.005		
1D-Ho	de 🗔				
offine	values of variables:				
Start	position				
10-1	0.00000		Pi .	0.00000	4
π.	0.00000	4	Q:	0.00000	(\$)
21	0.00000		Ut	0.00000	
41	0.00000	4	N.	0.0000	4
10	00000.0	1	101	0.0000	1
0	0.00000	÷	AG:	0.00000	4
1.0	oplication-wide CNI.	_	1.5/2		

Start interpolation control operation using the starting coordinates specified in the window.



• If the specified starting coordinates differ from the operation starting coordinates, there is a risk that rapid movement may occur.

11.7.12 Interpolation Operation Programming: P-point Control and C-point Control

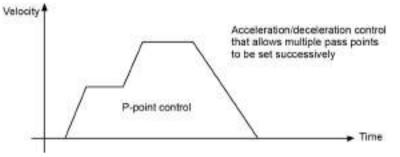
When composite interpolation operations are executed by the GM1 controller, continuity between interpolated movements becomes an issue.

The GM1 controller supports C-point control from the following two types of control.

P-point control

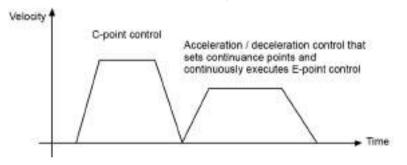
P-point control refers to control passing through a "Pass Point". In this manual, this control is referred to as "P-point control" for the sake of convenience.

This method is used when target multi-stage velocities are specified in a sequence of motions.



C-point control

C-point control refers to control passing through a "Continuance Point". In this manual, this control is referred to as "C-point control" for the sake of convenience. This method is used to execute consecutive E-point controls by one-time startup.



i Info.

- When one movement is completed, it stops and then next movement is started.
- This also applies to movements when dwell time is set. (If dwell time is set to 0 ms, continuous movements will occur without waiting time.)

For C-point control, the GM1 controller supports the use case patterns shown in the table below.

C-point control for connection between paths

This refers to connection between movements within a single CNC table.

C-point control for connection between CNC tables

This refers to connection between movements across CNC tables.

Use case	Applicable function block	Restriction	Remarks
C-point control for connection between paths	PMC_Interpolator2D/3D	You cannot change movements only in a particular path connection section. (Changes must be unified within C-point control.)	Specify relevant parameters for PMC_Interpolator2D or PMC_Interpolator3D. There is no need to create a new use case. Refer to "11.7.14 Interpolation Operation Programming: Settings in POU for P-point Control and C-point Control".

Use case	Applicable function block	Restriction	Remarks
C-point control for connection between CNC tables	PMC_NCDecoder		For details, refer to "11.7.15 Interpolation Operation Programming: Joining and Repeating CNC Tables".

11.7.13 Interpolation Operation Programming: Settings in CNC Table for Cpoint Control

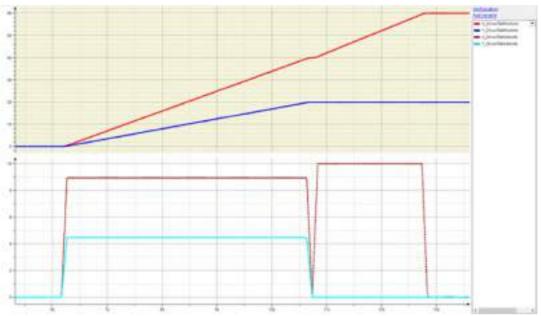
The GM1 controller basically uses C-point control to perform operation and uses P-point control only when paths are connected linearly.

Operation example

[Setting example] C-point control







- P-point control is used when paths are connected linearly (with no angle), as shown in the connection between Path (1) and Path (2).
- C-point control is used when paths are connected with an angle, as shown in the connection between Path (2) and Path (3).

* Even if paths are connected linearly, if G-code is used to set the dwell time between paths to 0, the respective composite velocities of the X-axis and Y-axis will converge to zero, causing the interpolation control to switch to C-point control.

[Setting example]



11.7.14 Interpolation Operation Programming: Settings in POU for P-point Control and C-point Control

Settings for connection between each path

By setting the bSingleStep parameter in PMC_Interpolator2D or PMC_Interpolator3D, connection between each path can be achieved by C-point control.

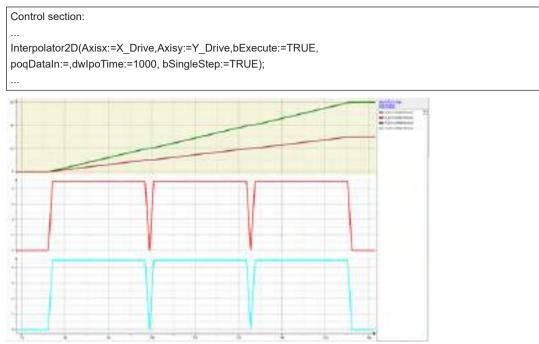
[Setting example]

G-code is set so that connection between paths is achieved by P-point control (linear connection).

N00 G91
N10 G01 X20 Y10 F5
N20 G01 X20 Y10

N30 G01 X20 Y10

In PMC_Interpolator2D, bSingleStep is set to TRUE.



Connection between each path is achieved by C-point control.

11.7.15 Interpolation Operation Programming: Joining and Repeating CNC Tables

Joining CNC tables

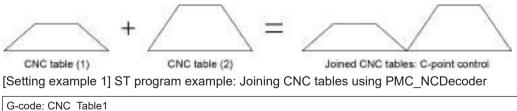
• PMC_NCDecoder

CNC tables can be joined by setting the "bAppend" join flag in PMC_NCDecoder to TRUE and decoding each table to be joined in order.

Movements between each CNC table are performed by C-point control.

SMC_OUTQUEUE which is output is executed as a CNC table in PMC_Interpolator2D or PMC_Interpolator3D.

For joining CNC tables, the GM1 controller supports the following use case patterns. **Joining CNC tables: C-point control**



N01 G01 X10 Y10 F10 E100 E-100

G-code: CNC_Table2 N01 G01 X20 Y20 F	10 E100 E-100			
Variable declaration se	ection:			
//FB instances				
NCDecoder	: PMC_NCDecoder;			
Interpolator2D : PMC_Interpolator2D;				
//Variables				
buf: ARRAY[010] OF	SMC_GEOINFO;	//Buffer for decoding		
iSequence:	: INT;	//Execution control No.		

Control se	ection:
Case iSe	quence OF
1:	
	NCDecoder(nSizeOutQueue := SIZEOF(buf),pbyBufferOutQueue := ADR(buf),
	ncprog := CNC_Table1,bExecute:= TRUE, bAppend:=TRUE);
	Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=TRUE,
	poqDataIn:=NCDecoder.poqDataOut,dwIpoTime:=1000,);
	IF Interpolator2D.bDone THEN
	iSequence:=2;
	END_IF
2:	
	NCDecoder(nSizeOutQueue := SIZEOF(buf), pbyBufferOutQueue := ADR(buf),
	ncprog := CNC_Table1, bExecute:= FALSE, bAppend:=TRUE);
	Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=FALSE,
	poqDataIn:=NCDecoder.poqDataOut,dwIpoTime:=1000,);
	iSequence := 3;
3:	
	NCDecoder(nSizeOutQueue := SIZEOF(buf),
	ncprog := CNC_Table2, bExecute:= TRUE, bAppend:=TRUE);
	Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=TRUE,
	poqDataIn:=NCDecoder.poqDataOut,dwIpoTime:=1000,);
END_CAS	SE
T I C	

- The first CNC table is specified in PMC_NCDecoder, which is then executed together with PMC_Interpolator2D.
- After the first instance of PMC_NCDecoder is completed, the second CNC table is specified in PMC_NCDecoder, which is then executed again.

Repeating CNC tables

• PMC_NCDecoder

Movements between each CNC table repeated are performed by C-point control.

SMC_OUTQUEUE which is output is executed as a CNC table in PMC_Interpolator2D or PMC_Interpolator3D.

Joining CNC tables: C-point control [PMC_Interpolator 2D(3D)]

 \land

CNC table (1)

N times (N > 0)

Repetitive execution of CNC table: C-point control

[Setting example 1] ST program example: PMC NCDecoder

G-code: CNC_Table N01 G01 X10 Y0 F10 E100 E-100 N02 G01 X10 Y10 N03 G01 X0 Y0

Variable declaration section:					
//FB instances					
NCDecoder	: PMC_NCDecoder;				
Interpolator2D	: PMC_ Interpolator2D;				
//Variables					
buf: ARRAY[06] OF SMC_GEOINFO;		//Buffer for decoding			
iSequence: : INT;		//Execution control No.			
bDec	: BOOL;	//Decode flag			
bStart	: BOOL;	//Interpolation control execution flag			
iCount	: INT:=0;	//Specified number of repetitions			

```
Control section:
```

```
NCDecoder(nSizeOutQueue := SIZEOF(buf),pbyBufferOutQueue := ADR(buf),

ncprog := CNC_Table,bExecute:= bDec, bAppend:=TRUE);

Interpolator2D(Axisx:=X_Drive,Axisy:=Y_Drive,bExecute:=bStart,

poqDataIn:=NCDecoder.poqDataOut,dwIpoTime:=1000,);

Case iSequence THEN

1: bDec:=TRUE;

bStart:=TRUE;

IF NCDecoder.bDone THEN

iCount := iCount + 1;

IF iCount < 3 THEN

bDec:=FALSE;

END_IF

END_IF

END_CASE
```

• NCDecoder is executed the specified number of repetitions. (In the above example, NCDecoder is repeated three times.)

f Info.

- If NCDecoder is repeated, set the buffer size to 7 or more. If the buffer size is less than 7, normal operation may not occur.
- If NCDecoder is repeated, do not set a buffer size that is too large for the number of paths in the CNC table (for one execution). If a too large buffer size is specified, normal operation may not occur.

11.7.16 Interpolation Operation Programming: Changing Parameter Settings (Converting to Variables in CNC Table)

This section explains how to edit G-codes in CNC tables to convert arbitrary parameter settings (such as target values) to variables and change them to arbitrary target values.

Notes on changing parameter settings

The following method is used to change parameters.

Variable reference type:

Parameter variables are set beforehand and used by reading them when necessary.

D Note

- Use the SMC_CNC_REF compilation type.
- Change variables before starting PMC_NCDecoder.

Parameters such as target values

If you want to make parameter changes supported by the GM1 controller, the following parameters are applicable.

Applicable parameter	Variable name (global variable)	Variable name (specific for CNC tables)
X-axis	g_x	\$g_x\$
Y-axis	g_y	\$g_y\$
Z-axis	g_z	\$g_z\$
Velocity	g_f	\$g_f\$
Acceleration	g_accel	\$g_accel\$
Deceleration	g_decel	\$g_decel\$

(Note 1) If you want to make parameter changes using variables, you must declare parameter variables to be used as global variables.

(Note 2) If you want to use variables in CNC tables, enclose each variable parameter with \$.

Changing parameters such as target values

The following is a programming example of variables for parameters to be changed.

- Define variables for parameters to be changed as global variables.
- Each variable of parameters to be changed in a CNC table must be enclosed with \$.

CNC table example:

N01 G01 X\$ g_x \$ Y\$ g_y \$ Z\$ g_z \$ F\$ g_f \$ E\$ g_accel \$ E\$ g_decel \$

Explanation of G-code

N01

Values to be set are specified as variables. [Setting example 1] ST program

```
Example of global variable declaration section:
VAR_GLOBAL

g_x : REAL := 100;

g_y : REAL := 100;

g_f : REAL := 100;

g_accel : REAL := 100;

g_decel : REAL := -100;

END VAR
```

Explanation of program:

- All variables are defined as global variables. All variables are the REAL data type.
- Values to be substituted for variables can be specified as either variable values or constants.

Changing parameters during operation (using G75)

The variable reference type allows parameters to be changed during operation. G75 can synchronize timing with PMC_Interpolator2D or PMC_Interpolator3D. Using this function makes it possible to perform the following operations.

- Parameters can be changed while the variable reference type of the parameter change function is being executed. (However, only parameter changes where G75 is specified and subsequent changes are applied.)
- During the execution of a CNC table, the contents of variables are reacquired when the line where G75 is specified is executed. The contents of variables that are reacquired are reflected in the next line. In this processing, re-decoding is not required.

```
CNC table example:
N01 G01 X$ g_x $ Y$ g_y $ Z$ g_z $ F$ g_f $ E$ g_accel $ E$ g_decel $
N02 G75
N03 G01 X$ g_x $ Y$ g_y $ Z$ g_z $ F$ g_f $ E$ g_accel $ E$ g_decel $
```

Explanation of G-code

N01

Values to be set are specified as variables.

N02

G75 is specified to synchronize timing with PMC_Interpolator2D or PMC_Interpolator3D.

N03

Values to be set are specified as variables. The contents of all parameters are also reacquired and updated.

11.8 Motion Function Errors

11.8.1 Overview of Motion Function Errors

Motion function errors can be classified as below.

Function block (FB) errors

These errors occur when motion function blocks are executed. They are defined as SMC_ERROR in CODESYS.

Errors can be classified as below.

• Errors resulting in errorstop

In CODESYS, if an error that is judged to be operation non-continuable occurs, the axis state will be set to "errorstop" and control for the relevant axes will stop.

In a function block that is being executed, the "CommandAborted" flag is set to TRUE, causing the function block to terminate.

The "errorstop" state is released by executing the MC_Reset function block.

• Errors not resulting in errorstop

In CODESYS, if an error that is judged to be operation continuable (an error that can be cleared by re-executing the function block, such as a parameter error to the function block) occurs, the "Error" flag of the function block will be set to TRUE and an error code will be set in ErrorID. The error is cleared by setting the "Execute" flag in the function block to FALSE, enabling the function block to be re-executed.

DriveInterfaceError

Errors that occur in SM_Drive_ETC_Panasonic_MINAS_A5B are output as DriveInterfaceError. DriveInterfaceError is an internal error.

Amplifier alarm

Alarms and warnings occur in servo amplifiers.

11.8.2 Error Check Method

Online monitor in the axis setting window for SM_Drive_ETC_Panasonic_MINAS_A5B

Status:	SMC_AXIS_STATE.power_off
Communication	operational (100)
Errors	
Axis Error:	
0 [16#0000000	00]
FB Error:	
SMC_ERROR.SI	MC_NO_ERROR
ulDriveInterrac	ceerror:
0	
strDriveInterfa	ceError:

The oldest error is displayed in the "FB error" field. This is the same error result as that output by the MC_ReadFBError function block.

* Some FB errors are not displayed (SMC_RP_REQUESTING_ERROR, etc.).

Device log

bernyelidei tettegi Besari Traari Settegi		Constant Constant	• profession () taken mark - 1 merers	- Lager -Columper	· 10 8.5 ×
igt store	Deservit O	Time Manap et al. Ande yn de 20.407	Description Million Interior XI Holds prod todal (1) Dat - 148 Subsection(1)	Dampanent Kalifater	
ing -	0	0.11.0001038-01.008	Here to and a today and matched in the balances.	10 ¹⁰⁶ /001	
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larma (hydra					
NC94					
ALC THE MARKET					
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nh-					
printman of					

All errors that occurred in the past are displayed. This is regardless of whether "errorstop" occurred.

* Some FB errors are not displayed (SMC_RP_REQUESTING_ERROR, etc.).

Errors that can be output to programs

Return value to function block	When an FB error occurs, the "Error" flag is set to TRUE and the error ID of SMC_ERROR is output to ErrorID.
MC_ReadFBError	FB errors that occurred are displayed, regardless of "errorstop". Some FB errors are not displayed (SMC_RP_REQUESTING_ERROR, etc.).

Amplifier alarm	ETC_CO_SdoRead FB or PDO mapping "Error code"
L	

11.8.3 Clearing Errors

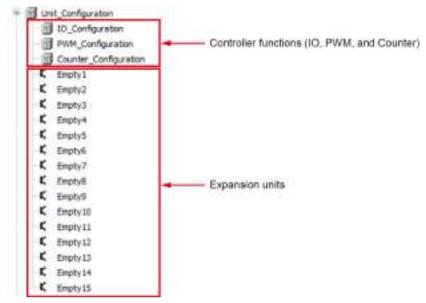
When errorstop occurs	Execute MC_Reset.
When an error returns to a function block	Execute the same function block with the "Execute" flag set to FALSE.
When an amplifier alarm occurs	Execute SMC3_ReinitDrive.

12 Unit Control

This chapter explains unit control for the GM1 controller. 12.1 Overview of Unit Control......12-2 12.4 General-purpose I/O12-5 12.4.2 Setting Parameters with GM Programmer 12-5 12.4.3 Setting Items of IO Configuration Parameters 12-6 12.4.4 I/O Mapping for General-purpose I/O 12-7 12.5 PWM Output12-9 12.5.2 Setting Output Ports with GM Programmer 12-9 12.5.4 Data Update Timing (Output Frequency)...... 12-11 12.5.6 PWM Output Setting Example 12-12 12.6.1 Overview of High-speed Counter Function 12-18 12.6.2 Setting Parameters with GM Programmer 12-19 12.6.3 Counter Parameter Setting Items 12-22 12.6.4 I/O Mapping for High-speed Counter Output 12-25 12.6.5 Operation Ready Request 12-28 12.6.8 External Output Function 12-47

12.1 Overview of Unit Control

Unit control provides control for the controller functions (I/O, PWM, and counter) and expansion units.



12.2 IO Parameters for Unit Control

The parameter window is used to set up parameters for the controller functions (I/O, PWM, and counter) and each expansion unit.

This section explains I/O mapping, using IO_Configuration as an example.

In the navigator pane, double-click the "IO_Configuration" object. The "IO_Configuration" pane will be displayed.

In the "IO_Configuration" pane, click the "IO Parameters" tab. The parameter settings sub-pane will be displayed. Change the settings according to your need.



12.3 I/O Mapping for Unit Control

The I/O mapping window is used to allocate variables to I/O mapping for the controller functions (I/O, PWM, and counter) and each expansion unit.

This section explains I/O mapping, using IO_Configuration as an example.

Click the "I/O Mapping" tab in the Device pane. The I/O mapping pane will be displayed.

Register variables directly from the variable or I/O mapping window declared in the Application object.

C parameter	field.		Filtar Show al	(+	
D. D.D. Millioporte	Variable	Mapping	Charviel	Address	ξρø	Own	Description	~
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firmation:			104,344	%0138.3	1018.		100,3401	
			00,040	5215.2	600.		0.0,000	
			1941,31423	90118.5	1018A		10.341	
			CHI_DARK	5015.4	0005		00,001	
			OU.MIT	92138.8	10.16		0.348	
			200,000	5015.8	6001		120,246	
			291,047	50118.7	8143		clea, and r	
			201,210	942117,0	800.		00,348	
			19123-029	.%(817.1	1015		CH0.3478	
			00,010	%0137.2	8000		010,043	
			CH1.2+11	9012.3	1003		00.311	
			1291_3912	16012.4	1071		6340,3810	
	7		DMD, IN [7]	\$2117.5	HEAT.		CH0_3+13	
			(290), (sup+	14112.4	8000		00,009	
			1040.0429	50177	803.		00,341	Allocate variable
	= •		Output/waa	NQMI			Output area	1
	- *e		CH0_Dut	74246	YICHD		00,04	
	· · ·		Ch0_0U80	%QK12.0	1001		04,0408	
			CH0,0x400	940(11.1	8000		00,0001	
	· ·		110,0482	. %Q111.1	1033		chd_outol	
	· ·		CHO_OUIDS	9/0012.5	8000		Ch0_Gu803	
	10		100_0404	90014	8033.		120,0404	
	· · ·		Ch0_Du605	%QX12.5	500.		010_0405	
			DRC_Dubble	190812.0	893.		100,0408	
	· · ·		Ch0_0x87	%QXI27	800.		00,0407	
			CNC_DuRB	10(0110.0	800.		010_0408	
			Ch0_0u609	942413.1	800.		00,0.00	
	· · · ·		cks_tk(s)	%QX13.2	HOUR.		00,0418	
			Ch0_Gatti	50013.0	800.		00,0451	
			CNO_DM12	NGK15-4	8008		00,0412	
			00,0410	%QX13.5	8005		Drive, 040	
			060_06114	902013.6	800.		00.0491	
			CHO_Out15	500117	800.		00,0415	1

Select the I/O Mapping tab

12.4 General-purpose I/O

12.4.1 Overview of General-purpose I/O Function

The general-purpose I/O function allows use of up to 16 input points and 16 output points.

* However, the general-purpose I/O function shares some ports with the high-speed counter function and PWM output function. Therefore, use IO parameter settings to select functions to be used.

Specification overview

Item	Specifications	Remarks
Number of input ports	Max. 16 points	X0 to X3 are shared with the counter function. Use IO parameter settings to select functions to be used.
Number of output ports	Max. 16 points	Y0 to Y3 are shared with the counter function and Y4 to Y7 are shared with the PWM output function. Use IO parameter settings to select functions to be used.
Input port number	X0 to X15	
Output port number	Y0 to Y15	

12.4.2 Setting Parameters with GM Programmer



Procedure

1. In the navigator pane, double-click the "IO_Configuration" object. The general-purpose IO setting pane will be displayed.

le-ter	 II In.Configuration :		
Singer Annual State (State) Singer Annual State (State) Singer Annual State (State) Singer Annual State S	II possible II III forma Orma Information	Previnds: fettinging)	Boxe (HC364_Indfe] BIC364_Indfe]

2. Set up general-purpose IO parameters.

Select an IO parameter to be changed and then select a desired item from the drop-down list.

D paraneter	Revenution Set Regulation		• 3
	E General-Parpose signif take	(sectant	
D DI MAKANG	Taiput time constant:	Base	
2.7	El lapat-part configuration		
Catala .	20	20(Ch0_3x00)	Lie .
And and a second	24	SOLON DATA	
efy matcol	NT .	COMMENT (CND _CONTROLD)	
	- 10	toricara aneraj	
	El Catavit port configuration		
		SOCCER GUEDED	
	V1.	ID(Ch-0duk03)	
	72.	to(che_matta)-	
	12	HO(Chill_Guesol)	
	14	1000b@_0ut041	
	15	IDCCk0 Que05)	
	10	DOLCHO, GUEDEL	
	47	m(rka_damy)	
	80		
	(D)CHR_BORL Cramber(DHR_Comb	1 90	

3. Select the "IO I/O Mapping" tab and set the correspondence (mapping) between the channel and variable in the mapping setting pane.

Click the "Variable" column corresponding to the channel to be used by the program and enter a variable name.

Clicking the mark in the "Mapping" column allows you to change the type of mapping.

10 paneter	Ave.		ARE SHARE	1			i de antennos d
0001400-0	Sariable %a	Mappin	Chernel	Addees Nation	3 ₀ m	1/68	Description.
Server			(10,0) Output here	1000 1000	1076		Chips.
Drumatus	1 To 100		che,tue che,tuest	10018 100123	5/561		cle,tut coe,tuell
			CHI, DARE	94912.1 94912.2	833.		che_cum: che_cum:
			CHE_DURES CHE_DURES	10212.0 10212.4	800.		CHI DURI CHI DURI



• You can copy the variable name set in the Channel column.

Select a channel (CH0 or CH1) in the "Category Selection" column, right-click, and then select [Copy] from the context-sensitive menu that is displayed. Next, select another channel, right-click, and then select [Paste] from the context-sensitive menu that is displayed.

12.4.3 Setting Items of IO_Configuration Parameters

IO parameters

Setting item	Setting item	Settings	Default value	Description
General-purpose	Input time	None	None	Input time constant
input time constant	constant	0.1 ms		
		0.5 ms		
		1 ms		
		5 ms		
		10 ms		

Setting item	Setting item	Settings	Default value	Description
		20 ms 70 ms		
Input function setting	X0	IO(Ch0_In00) Counter(Ch0_Control0)	IO(Ch0_In00)	Select X0
	X1	IO(Ch0_In01) Counter(Ch0_Control1)	IO(Ch0_In01)	Select X1
	X2	IO(Ch0_In02) Counter(Ch1_Control0)	IO(Ch0_In02)	Select X2
	Х3	IO(Ch0_In03) Counter(Ch1_Control1)	IO(Ch0_In03)	Select X3
Output function setting	Y0	IO(Ch0_Out00) Counter(Ch0_ExternalOutp ut0)	IO(Ch0_Out00)	Select Y0
	Y1	IO(Ch0_Out01) Counter(Ch0_ExternalOutp ut1)	IO(Ch0_Out01)	Select Y1
	Y2	IO(Ch0_Out02) Counter(Ch1_ExternalOutp ut0)	IO(Ch0_Out02)	Select Y2
	Y3	IO(Ch0_Out03) Counter(Ch1_ExternalOutp ut1)	IO(Ch0_Out03)	Select Y3
	Y4	IO(Ch0_Out04) PWM(Ch0_PWM_Output)	IO(Ch0_Out04)	Select Y4
	Y5	IO(Ch0_Out05) PWM(Ch1_PWM_Output)	IO(Ch0_Out05)	Select Y5
	Y6	IO(Ch0_Out06) PWM(Ch2_PWM_Output)	IO(Ch0_Out06)	Select Y6
	Y7	IO(Ch0_Out07) PWM(Ch3_PWM_Output)	IO(Ch0_Out07)	Select Y07

12.4.4 I/O Mapping for General-purpose I/O

Channel	Туре	Description	Remarks
Ch0_In	WORD	Ch0_ln	
Ch0_Out	WORD	Ch0_Out	

Ch0_In

Channel	Туре	Description	Remarks
Ch0_In00	BOOL	Ch0_ln00	
Ch0_In01	BOOL	Ch0_In01	

12.4 General-purpose I/O

Channel	Туре	Description	Remarks
Ch0_In02	BOOL	Ch0_In02	
Ch0_In03	BOOL	Ch0_ln03	
Ch0_In04	BOOL	Ch0_In04	
Ch0_In05	BOOL	Ch0_ln05	
Ch0_In06	BOOL	Ch0_ln06	
Ch0_In07	BOOL	Ch0_ln07	
Ch0_In08	BOOL	Ch0_In08	
Ch0_In09	BOOL	Ch0_ln09	
Ch0_In10	BOOL	Ch0_In10	
Ch0_In11	BOOL	Ch0_In11	
Ch0_In12	BOOL	Ch0_In12	
Ch0_In13	BOOL	Ch0_In13	
Ch0_In14	BOOL	Ch0_In14	
Ch0_In15	BOOL	Ch0_In15	

Ch0_Out

Channel	Туре	Description	Remarks
Ch0_Out00	BOOL	Ch0_Out00	
Ch0_Out01	BOOL	Ch0_Out01	
Ch0_Out02	BOOL	Ch0_Out02	
Ch0_Out03	BOOL	Ch0_Out03	
Ch0_Out04	BOOL	Ch0_Out04	
Ch0_Out05	BOOL	Ch0_Out05	
Ch0_Out06	BOOL	Ch0_Out06	
Ch0_Out07	BOOL	Ch0_Out07	
Ch0_Out08	BOOL	Ch0_Out08	
Ch0_Out09	BOOL	Ch0_Out09	
Ch0_Out10	BOOL	Ch0_Out10	
Ch0_Out11	BOOL	Ch0_Out11	
Ch0_Out12	BOOL	Ch0_Out12	
Ch0_Out13	BOOL	Ch0_Out13	
Ch0_Out14	BOOL	Ch0_Out14	
Ch0_Out15	BOOL	Ch0_Out15	

12.5 PWM Output

12.5.1 Overview of PWM Output

The PWM output function enables up to 100 kHz of PWM output to be obtained within a range of 0% to 100%.

Outline of specifications

Item	Specifications	Remarks
Number of output channels	Max. 4 channels	
Output port number	Y4 to Y7	
Output frequency	1 Hz to100 kHz (Settable by 1 Hz) ^(Note 1)	
Output duty ratio	0% to 100% (Settable by 0.1%)	
Control input	Enable request or start request	

(Note 1) This specification applies when push-pull is set and output current is 0.1 A. It varies according to loads.

12.5.2 Setting Output Ports with GM Programmer

You can set output ports for PWM output via **IO_Configuration>Edit Object** in GM Programmer.



1. From "Device view" in the navigator pane, double-click "IO Configuration".

🖻 - 🖬	Device ((AGM1CSEC16T/P)
	Dig the second	(nor received to the f

- 🖹 🗐 Program_Configuration
 - EtherCAT_Master_SoftMotion
 - 🍐 SoftMotion General Axis Pool
- Unit_Configuration
 - IO_Configuration
 - Counter_Configuration
- 2. Click the "IO Parameters" tab.

10_Configuration X	
IO parameter	Parameter Settings(<u>C</u>)
IO I/O Mapping	
Status	Output port configuration
Information	

3. If necessary, change Y4 to Y7 in "Output port configuration" to PWM(Ch0_PWM_Output) to PWM(Ch3_PWM_Output), respectively.

General-Purpose inp	out time constant
Input port configura	tion
Output port configure	ration
YO	IO(Ch0_Out00)
Y1	IO(Ch0_Out01)
Y2	IO(Ch0_Out02)
Y3	IO(Ch0_Out03)
Y4	PWM(Ch0_PWM_Output)
Y5	PWM(Ch1_PWM_Output)
Y6	PWM(Ch2_PWM_Output)
Y7	PWM(Ch3_PWM_Output)

12.5.3 I/O Mapping for PWM Output

The high-speed counter function is controlled by user programs.

InputArea (input area)

Channel	Туре	Description	Remarks
PwmStatusRegister	WORD	Input area	-

PwmStatusRegister (PWM status register)

Channel	Туре	Description	Remarks
Ch*_PwmStatus	BOOL	Ch* PWM output status	Indicates the PWM output state. FALSE: OFF TRUE: ON

OutputArea (output area)

Channel	Туре	Description	Remarks
PwmRequestRegist er	WORD	PWM request register	-
Ch*_FrequestValue	UDINT	Ch* frequency set value	Unit: Hz (0 to 100,000 Hz)
Ch* DutyValue	UINT	Ch* duty ratio set value	Unit: 0.1% (0 to 100.0%)

PwmRequestRegister (PWM request register)

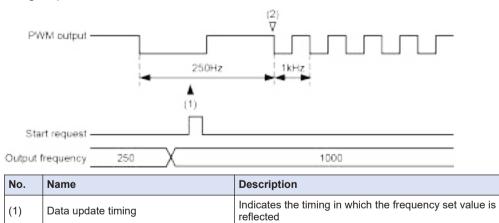
Channel	Туре	Description	Remarks
Ch*_PwmStartRequ est	BOOL	Ch* start request	PWM output is started at the rising edge.
Ch*_PwmEnableRe quest	BOOL	Ch* enable request	FALSE: Disables PWM output TRUE: Enables PWM output

12.5.4 Data Update Timing (Output Frequency)

The data update timing for output frequency during PWM output is descried below.

Data update at the rising edge of start request bit

In this mode, the frequency value to be changed is written to the frequency set value and updated with data at the point in time when the start request bit is switched from OFF to ON. The frequency value changed in this timing is reflected at the falling edge of the pulse that is being output.



Indicates the timing in which the changed frequency is

reflected as actual output

Output update timing

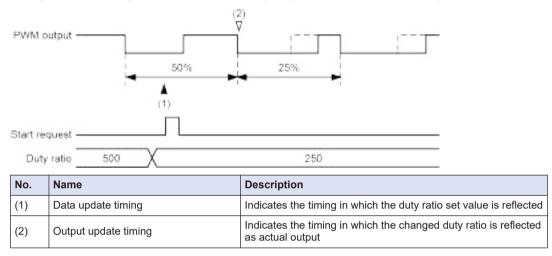
(2)

12.5.5 Data Update Timing (Duty Ratio)

The data update timing for duty ratios during PWM output is descried below.

Data update at the rising edge of start request bit

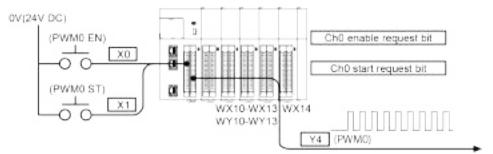
In this mode, the duty ratio to be changed is written to the duty ratio set value and updated with data at the point in time when the start request bit is switched from OFF to ON. The duty ratio changed in this timing is reflected at the falling edge of the pulse that is being output.



12.5.6 PWM Output Setting Example

Overview

PWM output is performed. It is controlled by the switch input (X0 or X1) connected to the GM1 controller. If the start request bit is turned ON when the enable request bit is ON, PWM output will be started.



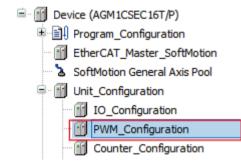
Settings in GM Programmer

For example, to set PWM output for Y4, use the procedure in "12.5.2 Setting Output Ports with GM Programmer" to configure settings as shown below.

IO parameter	Parameter Settings(C)	
ID 1/0 Mepping	E General Purpose in D Input port configura	
	XD	10(Ch0_1n00)
Status	X1	10(Ch0_1n01)
	X2	IO(Ch0_1e02)
Information	X3	IO(Ch0_In03)
	E Output port configu	ration
	YD	10(Ch0_Out00)
	IY .	10(Ch0_Out01)
	YZ.	IO(Ch0_OutOZ)
	Y3	IO(Ch0 Out03)
		PWH(Ch0 PWH Output)
	Y5	IO(Ch0_Out05)
	YE	IO(Ch0_Out06)
	¥7	10(Ch0 Out07)

Next, perform I/O mapping for variables created in POU.

1. From "Device view" in the navigator pane, double-click "PWM_Configuration".



The "PWM_Configuration" window will be displayed.

PWM I/O Mapping	Find	Filter
Statua	Variable + 3%	
Information	4.50	

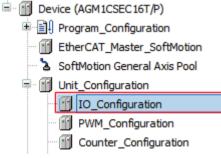
2. In the "PWM_Configuration" window, click the "PWM I/O Mapping" tab.

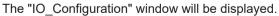
PWM_Configuration X	
PWM I/O Mapping	Find Filter :
Status	Variable
Information	

3. In this example, variables with the same name as the channel name are mapped to the channels required for PWM Ch0 (the name of sample POU is created as "PWM").

larisble	Mapping	Channel	Address	Type	Unit	Deloription
· · · ·		219464168	THEW ID			triput area
		Partitulation	5000	WITED		Perthtulager
Supplication PRMLCh0_PMMstate	4	dw.Postata	5-31-33-D	800		ChD Powerstatus
		-Ovi, Permillantar	%D320.1	5000		: Chill Pormariantum
- ¥		Oil Footbala	%D20.2	8006		Chil Permittahat
*		(UI) Prividiatai	10223.3	5000		Chairtwinistation.
		OutsidArea	1NQ04			Opportune
		PureRequestRegister	RIVGUR	WORD		Para request register
Application XMM.OHD PWMERartRequest	3 #	On Prestativenet	N-QKHLE	BOOL		Ch07vim start request
		Ont_PortStartRequest	%QX35.1	2002		Chi Pvim etertmequeet
10		dig hvistartrequest	TKR.05.1	BOXE.		ch2 Pwinistart request.
10		ChS PoreStartRequest	NOK16.3	BOOL		Ch3 Permittert request
Application PNMiCh0_PinMExableRequest		(http://www.cableRespect	Automat 4	ROOL		Chill Point erüble request
- 0		Onl_ProtenableRequest	94203.5	500.		Ch1 Pvim enable request
10		012,PvnEnableRequest	%QX85.6	5001		Ch2 Pvin enable request
- 10	101	this invite all inclusions	TKR36.7	5000		that twin evable request.
 Application PRIPLENC Prequestilates 		Ch0_Prequency/view	940015	LICENT		ChD Pressenty art
		Chit_Prequency/Velue	NQD6	LICENT		Chill frequency set
19 ·		Ch2_PrequencyWelker	94007	UCENT		Ch2 Requency set
		did frequency/situal	1vQ00	UCINT		Ch3 frequency set
· * Application PhilPLCHS_purivisate		cho_putywake	1001100	UBNT		Cho Kuny set
		Ch1_Duty/alus	5vQ15.29	LONI		Childrey set
'9		(Di2_DutyValue	NQM20	LONT		(h0 duty set
		Ch3_DutyValue	NOVIZI	1.017		Ch3 duty set

4. From Device view in the navigator pane, double-click "IO_Configuration".





30 parameter	Find	Filter Show all				
10 ¥0 Mapping	Variable	Mapping	Channel Diputária	Address %2WB	Туре	
Status			Ch0_2H	5574/6	WORD	
	* Application PVIM.10_X0	10	010,3100	*LIX15.0	1001	
Information	M Application PWM.30_K0	30	010_3101	94D416-1	100	
	- >		170,197	362(16.2	800	
	*		010,2103	%D(15.3	8005	
	*		(20.3-04	%D(15.4	1008	

5. Click the "IO I/O Mapping" tab.

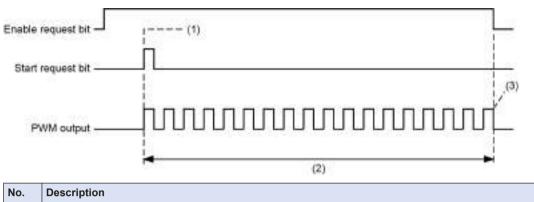
0 parameter	Find	Filter Show all			
10 1/0 Mapping	Variable 15-30	Mapping	Channel Diputersa	Address %2WB	Туре
90 million in 1990 and	14 Np		210,21	5676/15	WORD
	* Application PWM.30_X0	30	010_3100	4.1×15-0	1005
Information	Mapplication PWM.30_80	30	010,3101	96D416-1	100
	- 7		170,197	%2X16.2	800
	*		CH0_2=03	%D(16.3	8005
	- 19		(20.3-04	%D(15.4	1001
	1222				

6. Variables will be mapped.

30 parameter	Find	Find Variable 15 Ap		Filter Show all			
10 ¥0 Mapping	27/02/03			Channel Diputérea	Address %2WB	Туре	
Status	4			C10,2H	5676/15	WORD	
		* Application PWM.30_X0	10	001_9100	*LIX15-0	1001	
Information		Application PWM 30_N0	- 30	010,3101	\$60×16-1	100	
		-79		00,000	360(16.2	1003	
		*		CH0,2+03	%D(16.3	8005	
		- *		120.3-04	%D(15.4	8001	

Timing chart

If the rising edge of the start request bit is detected when the enable request bit is ON, Y4 will start PWM output. When the enable request bit is set to OFF, PWM output stops.



NO.	Description
(1)	If the rising edge of the start request bit is detected when the enable request bit is ON, PWM output will be started.
(2)	PWM output is performed with a duty ratio of 50% and at a frequency of 100 Hz.
(3)	When the enable request bit turns OFF, PWM output stops.

Sample program

The following are LD program and ST program examples for sample POU (PWM). The state of X0 is output to the Ch0 Enable Request bit.

Ch0 frequency and Ch0 duty ratio are set at the rising edge of X0.

The state of X1 is output to the Ch0 Start Request bit.

LD program

INCOME IN THE			
(7 IN I/O Herridy	NATURAL CONTRACTOR		
19,30	1 BOOLD	17 Realtin Impress	
20 84	I BODLI	37 start seguest.	
11 Die 1/d Supply	variable .		
Chi Penfratus	1 8005.1	W day out the Deput Status	
Chil Freightstowning	I TRUNTS	At the Presence Service Witney	
Chi_DutyNalue	I DENTI	(7) the Burty Watts Bet Halles	
Ch0_PymltActPages	1 800Lr	W. Col Start Segnart	
Chil_PredisableRepar	1006 1 80051	of the Eastern Separat	
EU_1204	E_TRIG:	Ar 30 Burn Detection	
ED_V/0			200
3			
10,40	10_3010 1 9335 14 9355	HANE EX INC	Cht. Productiele
	141	- Ch0_FrequestTalas NOC-	- (3/0_DUC/VA)

ST program

1	PROGRAM FWH				
	VAL				
	// IO I/O Mapping vari	eble			
- 4	10_00	: 200L:	5	// Enable Request	
1	TO_XI	: BOOL:	t	// Start Regunat	
4	// FWN I/O Mapping var	isble			
7	Ch0_PvmStatus	: BODL:		// ChD JWN Output Status	
1	Ch0_FrequestValue	: UDIN	Pa -	// Ch0 Frequency Setting	Value
. 3	Ch0_DutyValue	I UINT.	r	// Ch0 Buty Batio Ret Val	ue .
10	Ch0_PwmStartRequest	÷ 8000.;	t	// ChD Start Request	
11	Ch0_PwmEnableRequest	: BOOL:	ŧ .	// ChQ Enable Request	
12					
19	X0_TRIG	: R_TRI	tGr	// XO Rise Detection	
14	END_VAR				
15					
L	Ch0_PwmEnableRequest 1= 10	_203	77 Out;	put X0 status to Ch0 enable reg	uest
	Contraction Contraction of the				
1	X0_TRIG(CLK:=I0_X0);		V/15ab		
-4	IP NO_TRIG.Q - THUE THEN			rise detection	
1	Ch0_FrequestValue := 1			frequency to 100HI	
1.4	Ch0_DutyValue := 500;		// Duby	y ratio set to 501	
1	END_IF				
			110/203		5216
1	Ch0_PemStartRequest := IO_	X17	77, Opt;	put 31 status to Chi start requ	4.22

12.6 High-speed Counter Function

12.6.1 Overview of High-speed Counter Function

Two 4-MHz, signed 32-bit high-speed counters are provided

- High-speed counting of input signals is available for up to the maximum frequency 4 MHz (or 16 MHz for 2-phase input 4 multiple). Two-phase input (phase differential input), individual input, or direction identification input can be selected according to the input device such as encoders or sensors.
- 24 VDC, 12 VDC, and 5 VDC inputs and line driver input are supported
- The count input circuit supports both open collector output and line driver output (differential output: equivalent to AM26LS31).

Ring counter or linear counter can be selected

• Both the ring counter and linear counter are supported. Both types can use the Z-phase of an encoder as count reset timing.

Internal clock counting is possible

• Internal clocks can be selected as count input signals. High-accuracy time measurements can be made with a maximum resolution of 0.25 μ s. Selectable internal clocks are 0.25 μ s (4 MHz), 1 μ s (1 MHz), 10 μ s (100 kHz), and 100 μ s (10 kHz).

Capture function and sampling capture function are provided

- It is possible to store the count value at the moment of the occurrence of a trigger assigned to a capture flag. Count values can be checked, independently of I/O refresh.
- The capture function executes capturing at the rising and falling edges of a capture flag. The sampling capture function executes capturing at every sampling time according to the input of a capture flag.

Various counter operations can be selected

- 1. Enable count operation
- 2. Reset count operation
- 3. Preset count operation
- 4. Enable reset count operation
- 5. Enable preset count operation

Band comparison function and target value match comparison function are provided

- The band comparison function allows up to 16 pairs of upper and lower limits to be set for each counter. Up to 16 comparison match flags can be turned ON or OFF for each comparison condition.
- The target value match comparison function allows up to16 target values to be set for each counter. Target values can be set or reset individually according to the direction of counting (incrementation or decrementation) when the count value reaches the target value or when

up to 16 comparison match flags for each comparison condition match their respective target values.

- For each counter, up to two comparison match flags and external output signals can be linked with each counter.
- ON hold time setting (for band comparison function only)
- The ON state of external output signals is retained for the set time (1 to 1,000 ms).

Input time constant (noise filter)

• Input time constants can be set as input signals (A-phase, B-phase, and Z-phase) and control signals for each counter.

12.6.2 Setting Parameters with GM Programmer

You can set parameters for the high-speed counter via Couter_Configuration in GM Programmer.

¹² Procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
 - Device (AGM1CSEC16T/P)

 Program_Configuration
 EtherCAT_Master_SoftMotion
 SoftMotion General Axis Pool
 - Unit Configuration
 - IO_Configuration
 - PWM_Configuration
 - Counter_Configuration

The "Counter_Configuration" setting window will be displayed.

Counter_Configuration 🗙	
Counter parameter	Category Selection(\underline{T})
Counter I/O Mapping	⊡ Ch0 ⊡. Count function
Status	Comparison match leading edge reset Comparison match trailing edge reset
Information	···· Comparison function ··· External output function
	Capture function

2. In the "Counter_Configuration" window, click the "Counter parameter" tab.

Counter_Configuration X						
Counter parameter	Category Selection(T)					
Counter I/O Mapping	⊡ Ch0 					
Status	Comparison match leading edge reset Comparison match trailing edge reset					
Information	Comparison function External output function					
	Capture function					

3. Set up parameters of each function for each counter.

Counter function

Extegury Selection()	* Parameter Getting (E)	
6-000	Farancia	Soluc
Count Sector	Counter type	Linear countar
Comparison motify trailing edge neurt	Eroble(Dicable overflav) underflow	Dicatón
Competition function	Citoriter upper limit	2,947,483,647
External culput Surction Capture Punction	cause leve lint	2.147,483,648
= Chi	Tuesdy count direction	Court is normal sheetion
ID Count function	Select count reput	Court signal
Comparison molidir leading edge reset Comparison molidir trailing edge reset	Count restinol Input 2 signal function as ting	Zerhese input: 1 m./kple
Comparison function		Not steel
External output function	Cantrol & signal function restory	Phot asset
Capitarie Fariettari	Cantrol 1 signal function astrong	Plot used
	Default value	0
	Front A signal (nout 9 signal mount time constant	2.00803086-01
	thout a signal insuctive constant	ZOLACIONAL
	Central signal insult time constant	2.0ms

Comparison match rising edge reset / Comparison match falling edge reset

E cha	Perometer	Value	
Company of the state	Comparison match 0 flag	Pict result.	_
- Comparison setth training edge reast	Comparison woldh 3 flag	Plat-read	
Comparison function	Comparison match 3 ftag	That read	
- Esternel autout function - Capiture function	Concersor watch 3 flag	not reset	
E-Dh1	Compension wetch + flag	hot reset.	
Count Function	Comparison motion 3 fleg	Not react.	
Comparison match leading edge reset Comparison wotch trailing edge reset	Comparison match 5 flag	Rot reset	
Comparison Motors example age react	Cosperient metch 7 flag	Not result	
 extend autout function 	Comparison match it flag	Fict reset	
- ceiture function	Compartation match & flag	Prot reset	
	Comparison metch 30 flag	Piot reset	
	Comparison match 11 flag	Peak ranat	
	Comparison match \$2 flag	Pict realt	
	Compension watch 13 fee	not reset.	
	Comparison watch 34 Feg	not reset.	
	Concertaon motor 35 Ray	Plot resel.	

Comparison function (band comparison)

Cabegory Selection ()	•	Personalar Setting (8)		
E Chú	ń.	Raranesei	Villam	
Comparison motion		Select comperison function	Band comparison	
Comparison motors training edge reset		Select competition input	Caurtivalue	
in corporar function		Sat number of comparison data	16	
 Comparison data o Comparison data o 				

Comparison function (band comparison) comparison data

Category Selection()		Paramater Satsing (3)		
Count Function Comparison match leading edge near Comparison match training edge weet		Perandist	Volue	
		Laver lieit	1	
		upper tant	1	
Comparison Surction Comparison data 1 See patient () Comparison data 1				

Set patterns for comparison function (band comparison) comparison data

Catagory Salection())	* *	Pereneter Setting (S)	
B-040	6	Paraneter	Value
Contraction Contraction match leading edge reset		Corparison match ii flag	CH+
Comparison metch trailing edge reset		Comparison match 1 flag	CH.
E Comparison function		Corpetion natch 1 flag	200
E Comparison dolo 0		Conservation match 3 Rep	017
e concersor data 1		Companison watch 4 flag	OFF.
Ecosparison data 2		Corparison match 5 Rag	OFF
Comparison data 3		Companian watch 6 flag	OFF
Comparison data 4 Recomparison data 5		Comparison watch T Rag	OFF
#- Comparation data 6		Companison watch & Bag	CHE
Entropy data 7		Companion eatch # flag	CHT.
Comparison data 8 R Comparison data 9		comparison watch to flag	
IR: Comparison data 10		corpasion watch 11 fee	340
 comparison data (1) 		Contraction works 12 flag	CHT.
Coleparione data 12		Consistion motion 13 Res	000
Comparison data 12 Comparison data 14		Comparison match 14 Reg	CPP
# Conperior data 15		Comparison match 15 flag	OP?
- External culput function		Contractor and and	

Comparison function (target value match comparison)

Category Selection(3)	(*)	Peremeter Setting (3)	
Chú Concertor natór leading etigs read Concertor natór leading etigs read Concertor natór haling etigs read Concertor Nacion Concertor Nacion Concertor Nacion Concertor Nacion	n.	Pacanotei	Value
		Select comparison Fanctum	Tanget value match comparison
		Select comparison input	Count yelue
		Set number of comparison data	18.
		And a second second second second	

Comparison function (target value match comparison) comparison data

Caregory Selection(1)	+ -	Removator Satting (E)		
E Claunt function Comparison match leading edge reter	*	Faraneter	Feler	
		Target tala	D.	
Comparison nutch trailing edge recet			1952	
🗎 Camparison data ()				

Set / reset patterns for comparison function (target value match comparison) comparison data

stega iv Selection []]	運用	Persenator Satting (E)	
19-CH0	*	Paramoter	Value
Count Suction		Companison watch I flag	Pin drauge
Comparison motify trailing edge meant		Companison statute 1 flag.	ha duege
E Comparison function		complement match 1 flag	no diange
6- Comparison data 0		Comparison match 3 flag	no diange
Add ten reset pettern		Corportion wotch + llog	Pla drange
- Subtraction ast pattern		Comparison match 5 Reg.	No drange
Subtraction resist partients		Corportson motule II Reg	No drange
Comparison data 1 If Concentration data 1		Completions match T flag	No change
18 Comparison doto 3		Corparison match 8 flag	Pita change
e Comperison data +		Corpetitor match 8 Reg	rita chiange
Ecomparison data 5 Ecomparison data 6		Companison eatch 30 flag	nio duarge
- Comparison data 7		Comparison watch 11 flag	For drawge
Coleparadol data 9		Comparison suture 12 flag	no drange
Comparison data 9 Economison data 10		CONDENSOR MATCH 12 Sec	na dange
6 Compensor data 11		companion watch 14 flag	no drange
- Comparator data 12		Consistion workshi 15 Reg	No drange
12. Deservations data 13			

External output function

On Our flactor Conserver muth leading edge reset Conserver muth leading edge reset Conserver muth haling edge reset. Demonstrative	Paralecter	Nalue	
	Enternal autput 3 rignal setting	Not autput	
	External subput II agree CN held delay	P	
	Esternel subsit i signel setting	Not august	
- Extern Extension	External subut 1 sgnal OK hold delay	0.000	

Capture function

8-CH0	Partnesser	1.No.W
Count function Comparison match leading edge reset Comparison match leading edge reset Comparison function External outputs function	Capitary O setting	Not use capture 0 function
	Cepture Leeting	Not use capture 1 function
	Cepture function operation setting	Continuous prenation
	Sensing time	L.

f Info.

• You can copy the parameter set in a counter. To do so, select a channel (Ch0 or Ch1) in the "Category Selection" column and click the [Copy] button.

Next, select another counter and click the [Paste] button.

• For details on each parameter, refer to "12.6.3 Counter Parameter Setting Items".

12.6.3 Counter Parameter Setting Items

Count function (Settable for each counter)

Setting item	Settings	Default value
Counter type	Linear counter / Ring counter	Linear counter
Enable/Disable overflow/ underflow	Disable / Enable	Disable

Setting item	Settings	Default value	
Counter upper limit	-2,147,483,647 to 2,147,483,647	2,147,483,647	
Counter lower limit	-2,147,483,648 to 2,147,483,646	-2,147,483,648	
Specify count direction	Count in normal direction / Count in reverse direction	Count in normal direction	
Select count input	Count signal Internal clock 0.25 μs (4 MHz) Internal clock 1.00 μs (1 MHz) Internal clock 10 μs (100 kHz) Internal clock 100 μs (10 kHz)		
Count method	2-phase input 1 multiple / 2-phase input 2 multiple / 2- phase input 4 multiple / Individual input 1 multiple / Individual input 2 multiple / Direction detection input 1 multiple / Direction detection input 2 multiple	2-phase input 1 multiple	
Input Z signal function setting	Not used		
Negative logic preset operation Not used Positive logic enable operation Negative logic enable operation Positive logic enable operation Positive logic enable operation, reset operation at rising edge Negative logic enable operation and reset operation at falling edge Positive logic enable operation and preset operation at falling edge Negative logic enable operation and preset operation at rising edge		Not used	
ontrol 1 signal function setting Positive logic enable operation Negative logic enable operation		Not used	
Default value	Overwrites the count value with the default value when the power is turned ON	0	
Input A signal/Input B signal input time constant	No input time constant / 0.1 µs (2 MHz) / 0.2 µs (1 MHz) / 0.5 µs (500 kHz) / 1.0 µs (250 kHz) / 2.0 µs (100 kHz) / 10.0 µs (10 kHz)	2 0 up (100 kHz)	
Input Z signal input time constant	No input time constant / 0.1 µs (2 MHz) / 0.2 µs (1 MHz) / 0.5 µs (500 kHz) / 1.0 µs (250 kHz) / 2.0 µs (100 kHz) / 10.0 µs (10 kHz)	- 2.0 µs (100 kHz)	
Control signal input time constant			

(Note 1) The control 0 signal and control 1 signal cannot be assigned to the capture function if they are assigned to the enable operation.

Setting item	Settings	Default value
edge reset / Comparison match	Selects a comparison match flag that resets the count value at the rising edge or falling edge. Not reset / Reset	Not reset

Comparison function (Settable for each counter)

Setting item	Settings	Default value
Select comparison function	Not use / Band comparison / Target value match comparison	Not use
Select comparison input	Count value	Count value
Set number of comparison data Sets the number of data items to be compared Setting range: 1 to 16 Setting range: 1 to 16		16

If you select "Band comparison" or "Target value match comparison" for "Select comparison function", set parameters for each comparison data item.

Setting item	Settings	Default value
Comparison data 0 to Comparison data 15 (for band comparison)	Specifies the lower and upper limits for each comparison data ^(Note 1) Setting range: -2,147,483,648 to 2,147,483,647	0
	Specifies the state of the comparison match flag when the current value falls within the specified band ON / OFF	OFF
Comparison data 0 to Comparison data 15 (for target value match comparison)	Specifies target values for each comparison data Setting range: -2,147,483,648 to 2,147,483,647	0
	Comparison match flags to be set or reset can be selected for each status (incrementation or decrementation) of comparison data that has reached the target value. • Addition set pattern: Set / No change	No change
	Addition reset pattern: Reset / No change	
	Subtraction set pattern: Set / No change	
	 Subtraction reset pattern: Reset / No change 	

(Note 1) Lower and upper limits can be set within the range between the lower and upper limits for the counter. For linear counters, set each limit so that the lower limit is less than the upper limit. For ring counters, lower and upper limits can be set in any range.

External output function (Settable for each counter)

Setting item	Settings	Default value
External output 0 signal setting	Not output / Output	Not output
External output 0 signal ON hold time	Setting range: 0 to 1,000 (ms)	0 ms
External output 1 signal setting	Not output / Output	Not output

Setting item	Settings	Default value
External output 1 signal ON hold delay	Setting range: 0 to 1,000 (ms)	0 ms

(Note 1) "ON hold time" is enabled only when the band comparison function is used.

■ Capture function (Settable for each counter)

Setting item	Settings	Default value	
	Not use capture 0 function		
	Capture function at rising edge of control 0 signal		
	Capture function at falling edge of control 0 signal		
	Capture function at rising edge of control 1 signal	Not use capture 0 function	
	Capture function at falling edge of control 1 signal		
Capture 0 setting	Control 0 signal positive logic sampling capture function		
ouplate e courig	Control 0 signal negative logic sampling capture function		
	Control 1 signal positive logic sampling capture function		
	Control 1 signal negative logic sampling capture function		
	Output relay (Y relay) sampling capture function		
	Not use capture 1 function		
	Capture function at rising edge of control 0 signal		
Capture 1 setting	Capture function at falling edge of control 0 signal	Not use capture 1 function	
	Capture function at rising edge of control 1 signal		
	Capture function at falling edge of control 1 signal		
Capture function operation setting	One operation / Continuous operation	Continuous operation	
Sampling time (ms)	1 to 65,535	1	

(Note 1) If any value related to the sampling capture function is selected for "Capture 0 setting", "Capture 1 setting" will be disabled.

12.6.4 I/O Mapping for High-speed Counter Output

The high-speed counter function is controlled by user programs.

InputArea (input area)

Channel	Туре	Description	Remarks
Ch*_StatusRegister	WORD	Ch* status register	-
Ch*_ComparisonMat chRegister	WORD	Ch* comparison match flag	-
Ch*_CountValue	DINT	Ch* count value	-
Ch*_Capture0Value	DINT	Ch* capture 0 value	-
Ch*_Capture1Value	DINT	Ch* capture 1 value	-

Channel	Туре	Description	Remarks
Ch*_CaptureDifferen ceValue	DINT	Ch* capture differential value	Stores the value (Capture 1 value - Capture 0 value)

■ Ch*_StatusRegister (Ch* status register)

Channel	Туре	Description	Remarks					
Ch*_OperationRead yStatus	BOOL	Ch* operation ready status	Indicates whether the count function is ready to run. 0: Getting ready, 1: Ready					
CH*_CountEnableSt atus	BOOL	Ch* count enable status	Indicates whether count operation is in progress. 0: Stopped, 1: Operation in progress					
Ch*_CountDirection Status	BOOL	Ch* count direction status	Indicates the direction of counting. 0: Reverse rotation (decrementation direction), 1: Forward rotation (incrementation direction)					
Ch*_Capture0Status	BOOL	Ch* capture 0 status	Indicates that the count value is stored as capture 0 value at the rising edge or falling edge of the control signal, whichever is enabled.					
Ch*_Capture1Status	BOOL	Ch* capture 1 status	Indicates that the count value is stored as capture 1 value at the rising edge or falling edge of the control signal, whichever is enabled.					
Ch*_ExternalOutput 0Status	BOOL	Ch* external output 0 status	Indicates the output status of external output 0 signal. 0: Output OFF, 1: Output ON					
Ch*_ExternalOutput 1Status	BOOL	Ch* external output 1 status	Indicates the output status of external output 1 signal. 0: Output OFF, 1: Output ON					
Ch*_InputAStatus	BOOL	Ch* input A status	Indicates the input status of input A signal. 0: Output OFF, 1: Output ON					
Ch*_InputBStatus	BOOL	Ch* input B status	Indicates the input status of input B signal. 0: Output OFF, 1: Output ON					
Ch*_InputZStatus	BOOL	Ch* input Z status	Indicates the input status of input Z signal. 0: Output OFF, 1: Output ON					
Ch*_Control0Status	BOOL	Ch* control 0 status	Indicates the input status of control 0 signal. 0: Output OFF, 1: Output ON					
Ch*_Control1Status	BOOL	Ch* control 1 status	Indicates the input status of control 1 signal. 0: Output OFF, 1: Output ON					

■ Ch*_ComparisonMatchRegister (Ch* comparison match flag)

Channel	Туре	Description	cription Remarks					
Ch*_ComparisonMat ch0Status to	BOOL	Ch* comparison match 0 flag	Outputs the result of the band comparison function or target value match function. 0: Unmatched, 1: Matched					

Channel	Туре	Description	Remarks
Ch* ComparisonMat		to Ch* comparison	
ch15Status		match 15 flag	

OutputArea (output area)

Channel	Туре	Description	Remarks
Ch*_RequestRegist er	WORD	Ch* request register	-
Ch*_TemporaryPres etValue	DINT	Ch* temporary preset value	Stores the value to replace the preset value. -2,147,483,648 to 2,147,483,647
Ch*_TemporaryCurr entValue	DINT	Ch* temporary current value	Stores the value to replace the count value. -2,147,483,648 to 2,147,483,647

Ch*_RequestRegister (Ch* request register)

Channel	Туре	Description	Validity condition	Remarks		
Ch*_OperationRead yRequest	BOOL	Ch* operation ready request	Level	Specifies whether to enable operation preparation for the count function. 0: Disable, 1: Enable		
Ch*_CountEnableRe quest	BOOL	Ch* count enable request	Level	Specifies whether to enable count operation. 0: Disable, 1: Enable		
Ch*_ResetRequest	BOOL	Ch* reset request	ON edge	Specifies whether to reset the count value. 0: Do not reset 1: Reset		
Ch*_PresetRequest	BOOL	Ch* preset request	ON edge	Specifies whether to change the count value to a preset value. 0: Do not change, 1: Change		
Ch*_ResetEnableRe quest	BOOL	Ch* reset enable request	Level	Capture function: Specifies whether to enable reset count operation for the input Z signal or comparison match flag. 0: Disable, 1: Enable Sampling capture function Specifies whether to enable reset count operation. 0: Disable, 1: Enable		
Ch*_CurrentValueC hangeRequest	BOOL	Ch* current value change request	ON edge	Specifies whether to change the count value to a temporarily current value. 0: Do not change, 1: Change		
Ch*_PresetValueCh angeRequest	BOOL	Ch* preset value change request	ON edge	Specifies whether to change the preset value to a temporarily preset value. 0: Do not change, 1: Change		

Channel	Туре	Description	Validity condition	Remarks
Ch*_CaptureEnable Request	BOOL	Ch* capture enable request ^(Note 1)	Level	Capture function: Specifies whether to enable the capture function. 0: Disable, 1: Enable Sampling capture function Used as a capture flag.
Ch*_ExternalOutput 0ForcedONRequest	BOOL	Ch* external output 0 forced ON request	Level	Relay to forcibly turn on the external output 0 signal
Ch*_ExternalOutput 0ForcedOFFReques t	BOOL	Ch* external output 0 forced OFF request	Level Relay to forcibly turn off texternal output 0 signal	
Ch*_ExternalOutput 1ForcedONRequest	BOOL	Ch* external output 1 forced ON request	Level	Relay to forcibly turn on the external output 1 signal
Ch*_ExternalOutput 1ForcedOFFReques t	BOOL	Ch* external output 1 forced OFF request	Level	Relay to forcibly turn off the external output 1 signal
Ch*_ErrorClearRequ est	BOOL	Ch* error clearing request	ON edge	Specifies whether to clear the error. 0: Do not clear, 1: Clear

(Note 1) The behavior of the "Ch* capture enable request" bit differs according to the function to be used.

12.6.5 Operation Ready Request

Operation ready request program

To enable the settings of the high-speed counter function, you must configure parameter settings with GM Programmer and issue an operation ready request.

Ensure that the following operation ready request is issued before the high-speed counter is used.

Example: A program to request preparation for CH0 operation of the high-speed counter function

First, perform I/O mapping for variables created in POU.

From "Device view" in the navigator pane, double-click "Counter_Configuration" and select the "Counter I/O mapping" tab.

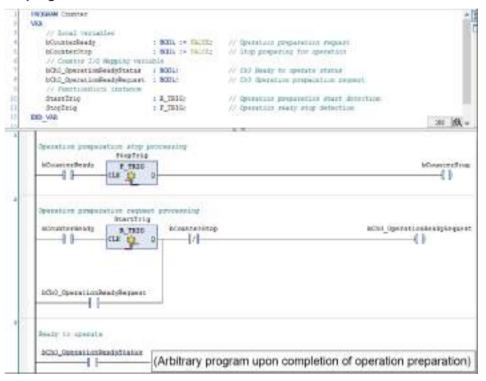
0.000 + 4 K	Cienter_Lostigura for	A LAND	10					TIP-SLUM	
A B Device Address of M	Storter parameter	10.4		Film Store at				· · · · · ·	the COLUMN NEWS
Bill Propert, Configuration Bill Intercomplete Joshen Johnson Schleiner Groups Assolution Bill Unit, Schleiner Assolution Bill Unit, Schleiner Ann Bill Unit, Schleiner Ann	Youries 30 Mapping	Variable a. 14	Macaing	Chartell Inscitore	Address NEH	1, ja	the	Description.	
	Sec.			DX.ButAnis	100			Children and	
	Muthéor								
Counter_line#gatesteri									
C then? C analyt									

In this example, variables are mapped to the channel used for high-speed counter Ch0 (the name of sample POU is created as "Counter").

Variable	Mapping	Chartered	Libber	- Type	Link	Descrip	phan .
- 7		1912bee	1424			(spile	
+ *		U.C. NokuReptici	10000	NOR:		100.94	kai-rupht
P Applester County SCHO, Operator Rest/State	1	CHI Joursen Augusta	NALSES	1. 990		10000	
*		Oit burth Millinks	5030.5	303.		Oli Over (endle state:	
Kaviahle	Mapping	Description		Address	Type	Wet	Optimiphine ;
		191210		1428			\$100 amo
- 14		0.6xiAres		1000			Delay Lines
+ 14		CHO. AnsuerReprint		9-(342)S	WOND		Unit Request regater
*# AppRoblem Centres (2019) Operator Real /Report		CHO_OperatorPassAReagent		Topold.	0006		0.0 Operator many reason
*		Ch0_Coandhedeforgant		50044.1	8008		Ord Count analytic replacet

The following are LD program and ST program examples for sample POU (Counter). When the "OperationReadyRequest" flag is set to TRUE, operation preparation is started.

LD program



ST program

	- A	TROORAM Counter		
8	2	700		
	1.0	// Socal variables		
		bCounterDeady	+ BOOL 1= TALEES	37 Operation preparation request.
		bCounterStop	· BOOL I- TALIES	Ar stop preparing for operation
	- 6	// Counter L/D Mapping Varia	el-in	
	1.7	bCh0_OperationReadyStatus	I BOOL	// Chil Ready to (persite status
		bCh0_OperationReadyRepuest	A BODL:	(3) Chil Operation preparation request
		// FunctionWinet instance		
	10	DiscTrig	t R_TRIG;	// Operation preparation start detection
	11	StopTrig	: F_TRIG;	// Operation ready stop detection
	218	SND VAR		
	1	The second secon		
	-	77 Operation preparation step p StopTrig(CLE:=bCounterReady);		
		bCounterStop := StopTrig.Q:		
	1.4			
	1.4	And a state of the	t management in the	
	4	27 Operation preparation request		
	*	<pre>// Openative perpendition reports StartTrig(CLE:=bCounterReady)</pre>	a second s	Denstroßestrentert MD 079 (ConterStor)
	44.4.4	<pre>// Openative perpendition reports StartTrig(CLE:=bCounterReady)</pre>	a second s	_OperationReadyRequest) 400 807(bCounterStop))
	a 4 6 a	<pre>// Operation preparation reques StartIrig(CLE:=bCounterReary) bCR0_OperationReadyRegnest :=)</pre>	a second s	_OperationReadyRequest) 488 907(DCounterStop);
	1.4 1 2 4	<pre>// Operation preparation reques StartIrig: CLE:=bConterReady) bCh0_OperationReadyRequest := () // Ready to operate</pre>	/ StastIrig.Q DB bChi	_OperationReadyRequest) 400 909(DCounterStop);
	*****	<pre>// Operation preparation reques StartIrig(CLE:=bCounterReary) bCR0_OperationReadyRegnest :=)</pre>	/ StastIrig.Q DB bChi	_OperationReadyRequest) 400 909(bCounterStop);
	11. 4 5 5 4 4	<pre>// Operation perpendion reques StartTrig(CLE:=bCounterReady) bCh0_OperationReadyRequest := 1 // Ready to operate IF bCh1_OperationReadyStatum =</pre>	f StaatTrig, 0 08 pChi 1976 THE	
	*****	<pre>// Operation preparation reques StartIrig: CLE:=bConterReady) bCh0_OperationReadyRequest := () // Ready to operate</pre>	f StaatTrig, 0 08 pChi 1976 THE	

Downloading IO parameters

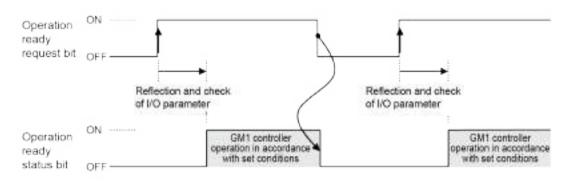
The IO parameters of the high-speed counter function are downloaded to the GM1 controller together with user programs.

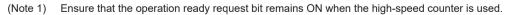
When an operation ready request is issued in RUN mode and the operation ready status bit turns ON, each function of the high-speed counter function is enabled.

Behaviors when operation ready request program is executed

When the operation ready request program is executed and each behavior set in the GM1 controller becomes executable, the operation ready status bit turns ON.

Behaviors of operation ready request bit





i Info.

• If the default value or preset value is out of range, the operation ready status bit will not turn ON.

12.6.6 Count Function

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter Parameters" tab.
- 3. For each channel, select the count function and set up each parameter.

1 Info.

• For details on how to set up parameters, refer to "12.6.2 Setting Parameters with GM Programmer".

Counter upper limit and Counter lower limit

Set the upper limit and lower limit values for each counter.

Counter upper limit: Any value between -2,147,483,647 and 2,147,483,647 can be set (Default value: 2,147,483,647)

Counter lower limit: Any value between -2,147,483,648 and 2,147,483,646 can be set (Default value: -2,147,483,648)

Specify count direction

Set the rotational direction of count input.

Count in normal direction: Counts in the direction stated in the manual

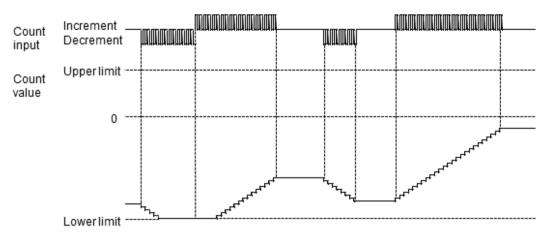
Count in reverse direction: Counts in the direction reverse to the one stated in the manual

Counter type

The counter behavior differs according to the type of the counter as below.

Difference in behavior between counter types

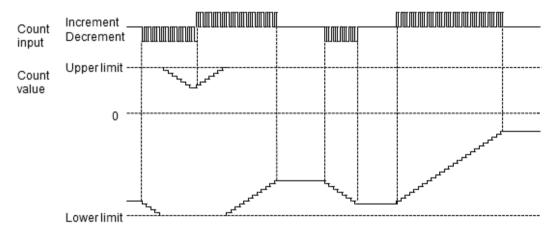
Item	Linear counter	Ring counter
Behavior image	Lower limit Upper lin Count value Underflow Increment Over	mit Upper limit Lower limit Increment Roll over Count value



Behavior example of linear counter

Behavior example of ring counter

- If the count is decremented from the lower limit, the counter will roll over the count and continue a decremental count from the upper limit.
- If the count is incremented from the upper limit, the counter will roll over the count and continue an incremental count from the lower limit.



Enable / Disable overflow / underflow (for linear counters only)

Set the counter behavior to be performed when the count value reaches the specified upper limit or lower limit.

Disable: Continues counting within the countable range for the system (-2,147,483,648 to 2,147,483,647) even if the specified upper limit or lower limit is reached.

Select count input

- To import input signals from external devices, select "Count input".
- To measure the frequencies of external input signals or time based on the internal clock, select "Internal clock".
- For internal clocks, you can select from 0.25 μs (4 MHz), 1.00 μs (1 MHz), 10 μs (100 kHz), and 100 μs (10 kHz).

Count method

- You can select from the three types shown in the table below according to the input device to be connected.
- The count behavior changes according to the settings of a multiplication factor, as described on the following pages.

Count method

Method	Connected	Count
2-phase (Phase differen ce)	High-speed counter unit Phase A pulse input encoder Phase B pulse input Phase Z input (reset input)	For 2-phase input, the input A signal and input B signal of each counter are connected to phase A and phase B, respectively, in the encoder. The count direction depends on the phase difference between phases A and B. When phase A is ahead of phase B by 90 degrees in terms of the electrical angle, the count value is incremented. When phase A is behind phase B by 90 degrees in terms of the electrical angle, the count value is decremented.
Individu al	High-speed counter unit High-speed counter unit Incremental encoder or pulse generator Increment pulse input Decrement pulse input	For individual input, the counter is incremented when the level of the input A signal rises or falls, and decremented when the level of the input B signal rises or falls.
Directio n	High-speed counter unit	For direction detection input, the count signal is connected to the input A signal. The count direction is controlled by the direction signal level of the input B signal.
detectio n	SensorO Input B	When the input B signal is OFF, the counter is incremented when the level of the input A signal rises or falls. When the input B signal is ON, the counter is decremented.

Count operation of 2-phase input (Phase difference input)

Multiplic	Timing chart									
ation		Incrementation	Decrementation							
Multiply by 1	Input A									
Multiply by 2	Input A									

Multiplic	Timing chart								
ation		Incrementation	Decrementation						
Multiply by 4	Innot B								

Count operation of individual input

Multiplic	Timing chart													
ation			In	creme	ntatio	n				Dec	reme	ntatio	n	
Multiply	- Innut A	on f		f		f	7	4						
by 1	Incut #	OFF							f	-	f	_	f	
		0 X	1	X	2	X	3	-	x	2	X	1	X	0
Multiply by 2	Intervent A		-	f	+	_	-	1						
,	Internet III	ON OFF						_	f	+	f	-		-
		0)	1 1	2)	3)	4) 5)	6	1	5 (4)	3)	2)	1)(0

Count operation of direction detection input

Multiplic		Timing chart										
ation		Incrementation	Decrementation									
Multiply by 1	Input A											
Multiply by 2	Input A											

Input time constant

Input time constants can be set for input signals (phases A, B, and Z) and control signals.

Input signal name	Settings
Input A signal, input B signal	No input time constant / 0.1 μs (2 MHz) / 0.2 μs (1 MHz) / 0.5 μs (500 kHz) / 1.0 μs
(The same time constant for both signals)	(250 kHz) / 2.0 μs (100 kHz) / 10.0 μs (10 kHz)
Input Z signal	No input time constant / 0.1 μs (2 MHz) / 0.2 μs (1 MHz) / 0.5 μs (500 kHz) / 1.0 μs (250 kHz) / 2.0 μs (100 kHz) / 10.0 μs (10 kHz)
Control signal	No input time constant / 2 µs / 5 µs / 10 µs / 20 µs / 50 µs / 100 µs / 500 µs / 1.0 ms / 2.0 ms / 5.0 ms / 10.0 ms

Types of count operation

Enable count operation

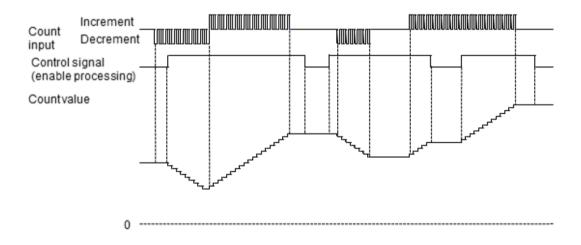
- Enable count operation is used by allocating the enable function to the control flag. Count operation is performed while the control flag is enabled.
- Enable count operation can be set using the methods shown in the following table.

Types of control flag (enable processing)

O'run al		Enable condition			
Signal	Setting method using the Counter_Configuration parameters		ON OFF-		
Count enable request bit	- (No need to set)	•			
Control 0 signal	Setting the enable operation conditions by setting up the control 0 signal function	٠	•		
Control 1 signal	Setting the enable operation conditions by setting up the control 1 signal function	•	•		

(Note 1) If you set the control 0 signal or control 1 signal as the enable operation condition, do not use the count enable request bit.

Count enable operation example



Reset count operation

- Reset count operation is used by allocating the reset function to the control flag.
- The count value is reset to 0 according to the change (rising, falling, positive logic, or negative logic) of the control flag.
- Reset count operation can be set using the methods shown in the following table.

Types of control flag (reset processing)

	Setting method using the Counter_Configuration parameters	Reset condition						
Signal		01~_f~	01	ON - OFF	ON OFF -			
Reset request bit	- (No need to set)	٠						

O'rea al	Setting method using the Counter_Configuration parameters	Reset condition						
Signal		01 - f	01	ON -	ON OFF-			
Input Z signal	Setting the reset operation conditions by setting up the input Z signal function	•	•	•	•			
Comparison match status bit	Setting the "Comparison match rising edge reset" or "Comparison match falling edge reset" function to "Reset"	•	•					

⁽Note 1) If you set the control 0 signal or control 1 signal as the enable operation condition, the count enable request bit will be disabled.



• To use the input Z signal and comparison match flag as reset signals, turn ON the reset enable request bit through user programs.

Preset count operation

- Preset count operation is used by allocating the preset function to the control flag.
- Preset count operation rewrites the count value as the preset value according to the change (rising, falling, positive logic, or negative logic) of the control flag.
- Preset count operation can also be used to start counter operation from the preset value.
- Preset count operation can be set using the methods shown in the following table.

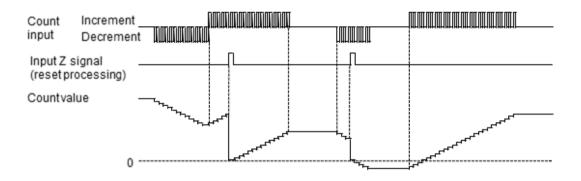
Types of control flag (preset processing)

Olara d	Setting method using the	Preset condition				
Signal	Counter_Configuration parameters		01	ON -	ON OFF-	
Preset request bit	- (No need to set)	•				
Input Z signal	Setting the preset operation conditions by setting up the input Z signal function	•	٠	•	•	

1 Info.

• To set a preset value, you must use a user program to set a temporary preset value and turn ON the preset value change request bit.

Reset (preset) count operation example



Enable reset count operation

- Enable reset count operation is used by allocating the enable function and reset function to the control flag.
- The count value is reset to zero when the counter becomes enabled due to the change of the control flag (enable reset processing).

Types of control flag (enable reset processing)

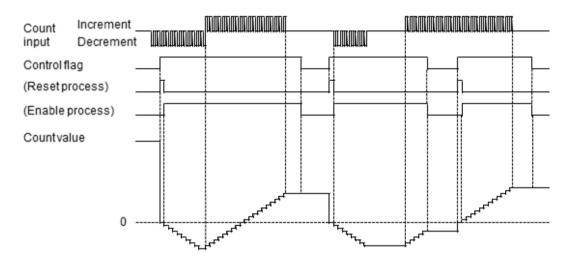
Olara I	Setting method using the	Reset c	ondition	Enable condition		
Signal	Counter_Configuration parameters	01~_f~	01	ON -	ON OFF -	
Control 0 signal	Setting the following conditions by setting up the control 0 signal function					
	Positive logic enable operation and reset operation at rising edge	•	•	•	•	
	Negative logic enable operation and reset operation at falling edge					

Enable preset count operation

- Enable preset count operation is used by allocating the enable function and preset function to the control flag.
- The count value is set as a preset value when the counter becomes enabled due to the change of the control flag (enable preset processing).

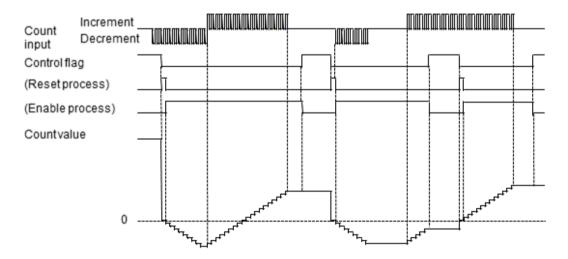
Types of control flag (enable preset processing)

a	Setting method using the	Preset c	ondition	Enable condition		
Signal	Counter_Configuration parameters	01~_f~	01- - - -	ON -	ON	
Control 0 signal	Setting the following conditions by setting up the control 0 signal function					
	Positive logic enable operation and preset operation at rising edge	•	•	•	•	
	Negative logic enable operation and preset operation at falling edge					



Positive logic enable operation and reset (preset) operation at rising edge

Negative logic enable operation and reset (preset) operation at falling edge



Reading the count value or changing the current count value or preset value

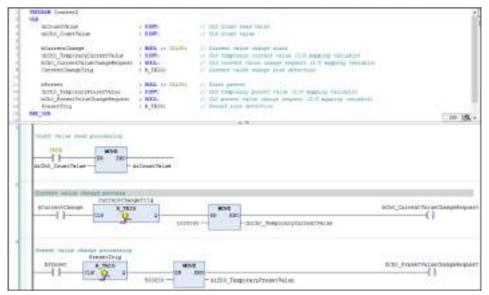
• To read and write channel data, variables are mapped to channels in the same way as in "12.6.5 Operation Ready Request". In this example, variables are mapped to channels used for reading the count value of Counter Ch0 and changing the current count value and preset value.

erieti's	Matoing	Channel	Address	Topic	0nit	Description
7		170.09.00	9(2)4			304 8101
		ChC_1101uFingettet	9629/26	WDD:		OV/1014/1988
1.9		CO_Onterior Perofflagete	9679/17	W092		OG Clerken into mehh register
*P Application Counter 7 (Chill Countries		OG, Swittige	1000	0917		0.0 Guint unlet.
Application, Counter 2, dDNL_Chartury Online		COL Capitulation	INDER.	190		OD Capter C-ske

	Managered.	Channel	2.86,991	T _p ie	Lint	Descriptions
		bas devel	16216			Sadara
		De des Universit	NgDLL .			Substance.
 March March 1998 (2019) 112 (2019) 		dio resembly and	NUMBER .	NOTE:		CM Notalet weiter
"# Ipstation Cost in 2013 Constanting Property		DiO_OperationResol/Tenues/	40,0048-0	acits.		Chil Campation mails temporal
-		the control of the second seco	: togetA (803.		che pouré enaite request
14		DC (restilling as a	HighHigh	BOD.		Cisi Repri report
- 14		DD_PresBig.ell	14(14.2	BOSS.		UNIT Propert teacent
- W.	11-2-2	OND.PassetEndel/Answert	462344.4	900.		Oil Aster analia request
* Hearts Stor, Counter 2 SCH _ Curve that will be get water	3	Did Cole durative getweent	NOTES.	803.		ON CURINE HAVE INVOLVED
*# apiliater Const 2500 Practical athorp Percent		0.0.Prosthala@wooRcoant	14484446	900.		ON Preset rate thereir visuels:
74		CHC_CopturationAdmiculation	19(2)44.2	BOD.		che captur-soliti reavet
14		010,538ma0uput/firest04kapati	14045-0	9000		Oil Enerth/ subject information meaning
14		the joan-acupumodermaquest	10010.2	805.		cliet purported suspect to for part of the page of
-76		OrldsteneOutput/fersetOklasset	40H12	.900.		Chil External subjut a forsich Dri separat.
· *		DID SYSHVED AND PROVODER AGAIN.	14044.4	803.		che bowiel subject i forsici diministration
174		00.2tmDarkstart	54216.7	900.		Oil from their velocent
P System Daries 3,404, Segma-Providue		DO, Terps in Prescilial, a	440040	2007		Od Tespine presidents
9 aggination Charles 2 (RCM, Temperard Constitute	3	00,7etpb and/one-these	ALC: NO DE LA COLORIZA	DWT		Chill Tanges and patront salars

- The following are LD program and ST program examples for sample POU (Counter2).
 - In this example, count values are read for each scan.
 - When the current value change start bit is set to TRUE, the current value of Ch0 is set to 1000000.
 - When the start preset bit is set to TRUE, the preset value of Ch0 is set to 500000.

LD program



ST program



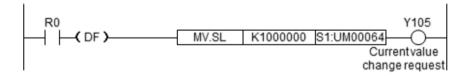
Count value when the power is turned on

• When the power is turned on, the count value is "0".

Changing the current count value

- The current count value can be changed to any value as necessary.
- Set a value in the temporary current value channel and turn ON the current value change request bit.

Example: A program to change the current value of CH0 to 1000000



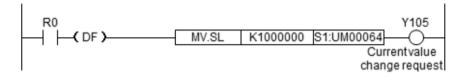
i Info.

• Count values cannot be written directly to the count value channel (Ch*_CountValue).

Changing the preset value

- The preset value can be changed to any value as necessary.
- Set a value in the temporary preset value channel and turn ON the preset value change request bit.

Example: A program to change the preset value of CH0 to 1000000



i Info.

• Preset values that are set cannot be read by programs.

12.6.7 Comparison Function

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter Parameters" tab.
- 3. For each counter, select the comparison function and set up each parameter.

i Info.

• For details on how to set up parameters, refer to "12.6.2 Setting Parameters with GM Programmer".

Types of comparison function

This function compares the current value of the high-speed counter with a preset target value and, when these values match, it reflects the value in the comparison match flag.

- There are target value match comparison and band comparison.
- A total of 16 comparison data items can be set.
- Comparison results can be output externally.
- Comparison methods can be selected for each counter.

Comparison match function specifications

Item	Specifications			
Set number of comparison data	Up to 16 data items for each counter (Comparison data 0 to comparison data 15)			
Comparison match flag	Up to 16 flags for each counter (Comparison match 0 flag to comparison match 15 fla Behaviors of 16 comparison match flags can be set for a single comparison data iten			
Select comparison	Target value match comparison Sets or resets the comparison match flag when the elapsed value matches the target value.			
function	Band comparison Turns ON or OFF the comparison match flag when the elapsed value falls within the range between the lower and upper limits that are set.			
External output function	Up to two flags for each counter			

Item	Specifications
	Comparison match 0 flag or comparison match 1 flag can be allocated to external output.
	ON hold time can be set only when the band comparison function is used. ON hold time: 0 to 1,000 ms

f Info.

- Only the comparison match 0 flag or comparison match 1 flag can be set as the external output function.
- By default, the external output 0 and external output 1 signals are set to "Not output". When necessary, change the setting in the Counter_Configuration parameter window.
- There is no need to arrange comparison data items in ascending or descending order.

Target value match comparison and band comparison

The main differences are as below.

Main differences in characteristics

Item	Target value match comparison	Band comparison
Setting of comparison value data	Comparison value data is specified as a target value.	Comparison value data is specified as a band (lower and upper limits).
	One of the following four options is specified as the comparison match flag behavior to be performed when the target value is reached. "Addition set pattern": Sets the flag when the current value and comparison value match at the time of incrementation	
Setting for comparison value data match	"Addition reset pattern": Resets the flag when the current value and comparison value match at the time of incrementation	ON or OFF is specified as the behavior of the comparison match flag when the current value falls within the specified band.
	"Subtraction set pattern": Sets the flag when the current value and comparison value match at the time of decrementation	
	"Subtraction reset pattern": Resets the flag when the current value and comparison value match at the time of decrementation	
Behavior when comparison value data matches	The behavior that is performed when the current value matches the same comparison value data may differ between incremental count and decremental count, depending on the settings.	The behavior that is performed when the current value matches the same comparison value data is the same for incremental count and decremental count.
External output signal ON hold time	Cannot be set	ON hold time: 0 to 1,000 ms

Parameter settings for target value match comparison

Parameter setting procedure

1. Click **Counter parameter>Counter (Ch0 or Ch1)>Comparison function**, change the "Select comparison function" parameter to "Target value match comparison", and execute "Set number of comparison data".

- 2. Click Counter parameter>Counter (Ch0 or Ch1)>Comparison function>Comparison data and specify target values for each comparison data item.
- Select "Addition set pattern", "Addition reset pattern", "Subtraction set pattern", and "Subtraction reset pattern" separately and set ""No change", "Set output", or "Reset output"" for each comparison match flag.
- Comparison data 0 Addition set pattern 0 Addition reset pattern 0 Subtraction set pattern 0 Subtraction reset pattern 0 Comparison match 0 flag Comparison data 15 Subtraction set pattern 15 Subtraction reset pattern 15
- 4. Configure these settings for each comparison data item.

i Info.

- Settings can be configured individually according to the count direction (incremental or decremental direction) at the time of comparison data match.
- A total of 16 comparison match flags can be set separately for "Addition set pattern", "Addition reset pattern", "Subtraction set pattern", and "Subtraction reset pattern".
- For details on how to set up parameters, refer to "12.6.2 Setting Parameters with GM Programmer".

Setting example for target value match function

Output setting example

Compariso n data	Target value	Output setting	Compariso n match 0 flag	Compariso n match 1 flag	Compariso n match 2 flag	Compariso n match 3 flag
		Addition set pattern		0		
0	+500	Addition reset pattern	0			
0	+500	Subtraction set pattern				
		Subtraction reset pattern		0	0	0
		Addition set pattern			0	
1	+1,250	Addition reset pattern		0		0
	+1,250	Subtraction set pattern				
		Subtraction reset pattern				
2	+2,500	Addition set pattern				0

12.6 High-speed Counter Function

Compariso n data	Target value	Output setting	Compariso n match 0 flag	Compariso n match 1 flag	Compariso n match 2 flag	Compariso n match 3 flag
		Addition reset pattern				
		Subtraction set pattern		0		0
		Subtraction reset pattern				
		Addition set pattern		0		
3	+3,750	Addition reset pattern			0	
3	+3,750	Subtraction set pattern				
		Subtraction reset pattern				0
		Addition set pattern				
4	LE 000	Addition reset pattern				0
4	+5,000	Subtraction set pattern			0	0
		Subtraction reset pattern	0	0		
		Addition set pattern			0	
5	+6.250	Addition reset pattern				
5	+0,230	Subtraction set pattern				
		Subtraction reset pattern				0
		Addition set pattern	0			0
6	+7,500	Addition reset pattern		0		
0	+7,500	Subtraction set pattern	0	0		
		Subtraction reset pattern				
		Addition set pattern				
7	+9.750	Addition reset pattern			0	
	+8,750	Subtraction set pattern				0
		Subtraction reset pattern				

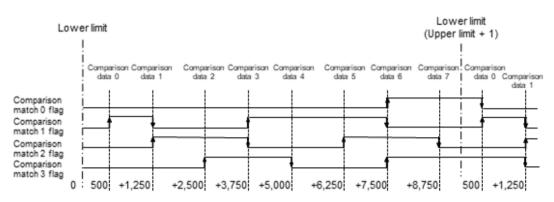
f Info.

- The behavior of the comparison match flag that is performed when the count value reaches the target value can be changed separately for incrementation and decrementation.
- If the contents of comparison data 0 to 15 are duplicated and reset conditions are different, comparison data is prioritized in the following order.

(High) 0 > 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9 > 10 > 11 > 12 > 13 > 14 > 15 (Low)

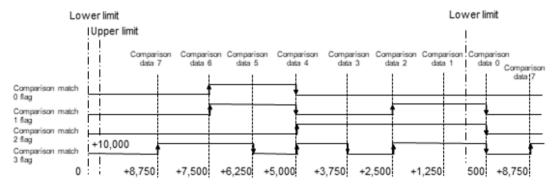
Behavior of comparison match flag during incremental count

When the current value matches the comparison data, the comparison match flag behaves according to the setting of "Addition set pattern" or "Addition reset pattern".



Behavior of comparison match flag during decrementation count

When the current value matches the comparison data, the comparison match flag behaves according to the setting of "Subtraction set pattern" or "Subtraction reset pattern".



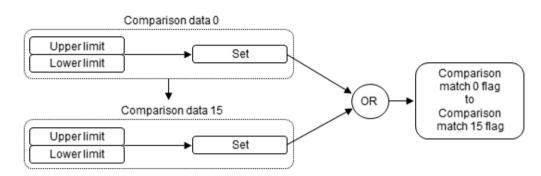
1 Info.

• For ring counters, comparison data can be set in an area including the lower and upper limits where count values are rolled over.

Parameter settings for band comparison

Parameter setting procedure

- Click Counter parameter>Counter (Ch0 or Ch1)>Comparison function, change the "Select comparison function" parameter to "Band comparison", and execute "Set number of comparison data".
- 2. Click Counter parameters>Counter (Ch0 or Ch1)>Comparison function>Comparison data and specify upper and lower limits for each comparison data item.
- 3. Set whether to turn ON or OFF the comparison match flag when the count value exists in the zone (between the upper and lower limits).
- 4. Configure these settings for each comparison data item.



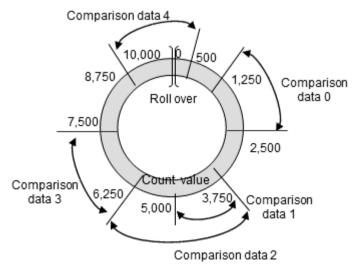


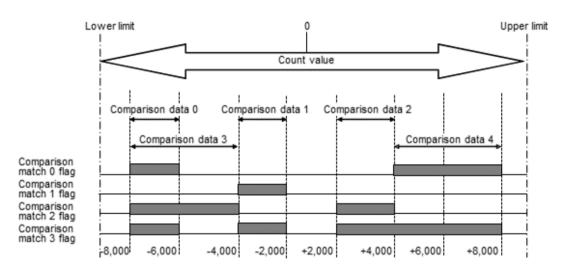
- A total of 16 comparison match flags can be set separately for each comparison data item.
- Multiple comparison data items can be set for the same band.
- For details on how to set up parameters, refer to "12.6.2 Setting Parameters with GM Programmer".
- Setting example for band comparison

Output setting example

Compa	Band compa	arison value	Output	Compariso	Compariso n match 1	Compariso	Compariso	
rison data	Lower limit	Upper limit	setting	setting flag		n match 2 flag	n match 3 flag	
0	+1,250	2,500	Set	ON	OFF	OFF	OFF	
1	+3,750	+5,000	Set	OFF	ON	OFF	ON	
2	+3,750	+7,500	Set	OFF	OFF	OFF	ON	
3	+6,250	+7,500	Set	ON	ON	ON	ON	
4	+8,750	+500	Set	OFF	OFF	ON	OFF	

Behavior of comparison match flag during band comparison





i Info.

• For ring counters, comparison data can be set in an area including the lower and upper limits where count values are rolled over.

Parameter settings for external output function

- The comparison match 0 flag and comparison match 1 flag can be output externally using parameter settings.
- The Counter_Configuration parameter window is used to allocate the comparison match 0 flag and comparison match 1 flag to the external output function.



• For details on how to set up parameters, refer to "12.6.2 Setting Parameters with GM Programmer".

12.6.8 External Output Function

Overview of external output function

The comparison match 0 flag and comparison match 1 flag can be output externally using parameter settings.

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter parameter" tab.
- 3. For each counter, select "External output function "and set up each parameter.

Counter_Configuration parameter setting example

Lategory Selection []	* T Parameter Setting (E)	
8-010	Peraneter	Value
Count function Comparison match leading edge nexe!	External output II signal setting-	Ovput ~
-Comparison reality trailing edge veset	Enternal surport il signal ON hold delay	0
Comparison function	Esternal subsit 1 signal setting	Plet subpet
Cepture function	External surput 1 signal ON hold delay	4
Ort Count function Comparison function External output function Capture function Capture function		

ON hold time (for band comparison only)

When the band comparison function is used, ON hold time can be set as an output signal.

Differences in behavior between settings

ON hold time	Timing chart for comparison match flag and external output signal
0	Comparison ON match 0 flag (input contact) OFF ON External output 0 signal OFF
1 to 1,000 ms	Comparison match 0 flag (input contact) OFF External output 0 signal OFF ON hold time ON hold time ON hold time

Forced output function

- If the Ch* external output 0* forced ON / OFF request bit is used, the external output 0 signal and external output 1 signal can be turned ON or OFF through user programs.
- The forced output function can be used to check wiring and for other purposes.

12.6.9 Capture Function

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter Parameters" tab.
- 3. For each counter, select "Capture function" and set up each parameter.

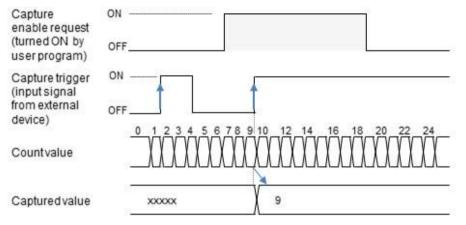
i Info.

• For details on how to set up parameters, refer to "12.6.2 Setting Parameters with GM Programmer".

Types of capture function

Capture function

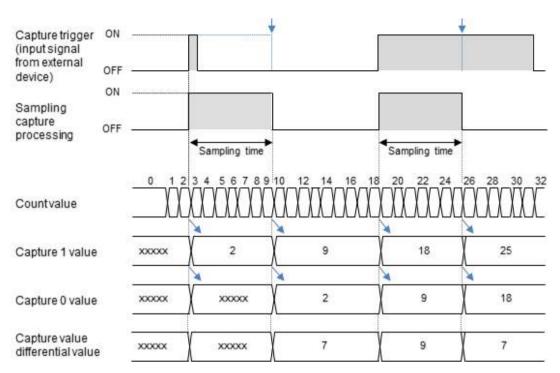
• The count value at the point in time when the input signal from an external device changes is stored in the capture 0 value or capture 1 value register.



Sampling capture function

- The count value when the specified sampling time elapses after the input signal from an external device changes is stored in the capture 0 value or capture 1 value registers.
- The count value equivalent to the sampling time can be monitored by reading the capture differential value.

12.6 High-speed Counter Function



Comparison between capture function and sampling capture function

Available conditions differ between the functions.

Comparison between both functions

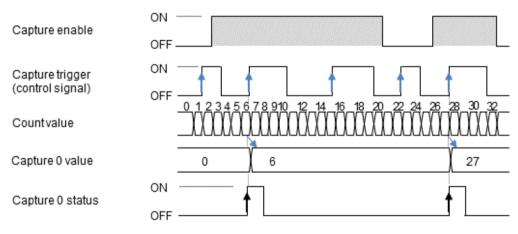
Item		Capture function	Sampling capture function	
Number of points that can be used		Max. 2 points	Max. 1 point	
		The capture function cannot be used when the sampling capture function is used.		
		Capture 0 value: 1 register (2 words)	Capture 0 value: 1 register (2 words)	
		Capture 1 value: 1 register (2 words)	Capture 1 value: 1 register (2 words)	
Registers used		These registers can be used individually.	These registers are used simultaneously.	
		Capture differential value: 1 register (2 words)		
Enable condition		The capture function is enabled while the capture enable request bit is ON.	Always enabled	
		The Counter_Configuration parameter window is used to allocate capture flags.		
	Control 0 signal	Used as a trigger for capture 0 or capture 1.	Used as a trigger for the sampling capture function	
Capture flags	Control 1 signal	Used as a trigger for capture 0 or capture 1.	Not use	
	Validity condition	Activated when either of the following conditions is met.	Activated when either of the following conditions is met.	
		At rising edge of control 0 / 1 signal	Control 0 signal (positive logic)	
		At falling edge of control 0 / 1 signal	Control 0 signal (negative logic)	

Item	Capture function	Sampling capture function
	By allocating one of the control signals to the same capture number, the capture function can be allocated as the rising or falling edge of the signal.	Capture enable request bit (positive logic)
Clearing the capture * status b	The capture * status bit is cleared automatically each time I/O refresh occurs	

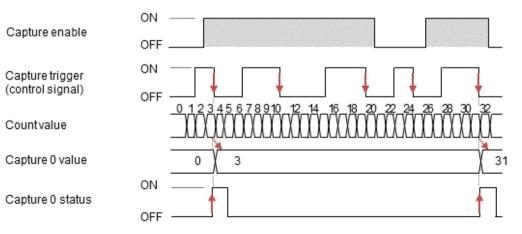
One operation

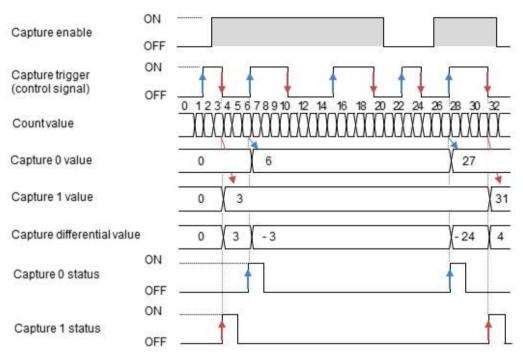
- When the capture enable request bit enables the capture function, capture is executed when the first capture flag becomes enabled.
- The behaviors differ according to the validity condition (rising edge or falling edge) of the capture flag to be enabled, as below.

When "rising edge" is specified as the capture trigger condition



When "falling edge" is specified as the capture trigger condition





When "rising edge" and "falling edge" of the same signal are specified as the capture trigger conditions

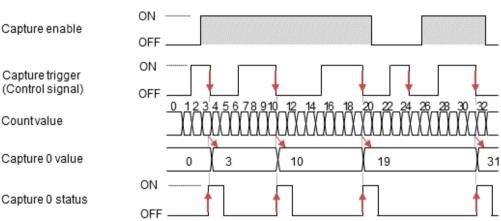
i Info.

• The sign of the capture differential value changes according to the sequence of the capture enable request bit and capture flag.

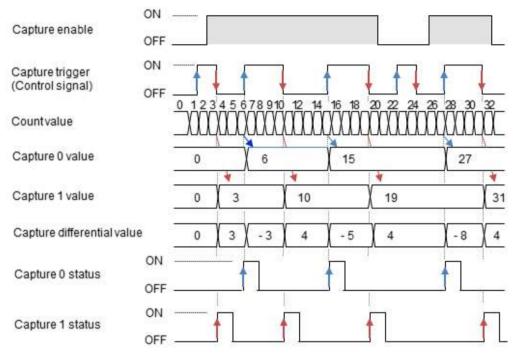
Continuous operation

- When the capture enable request bit enables the capture function, capture is executed every time a capture flag becomes enabled.
- The behaviors differ according to the validity condition (rising edge or falling edge) of the capture flag to be enabled, as below.

ΟN Capture enable OFF ON Capture trigger (control signal) OFF 0 Countvalue 6 Capture 0 value 0 15 27 ΟN Capture 0 status OFF When "falling edge" is specified as the capture trigger condition



When "rising edge" is specified as the capture trigger condition



When "rising edge" and "falling edge" of the same signal are specified as the capture trigger conditions

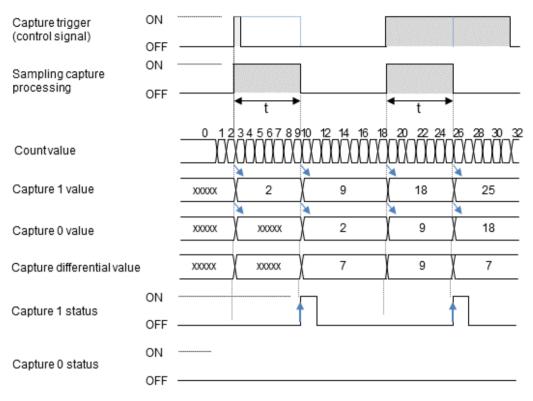
i Info.

- The sign of the capture differential value changes according to the sequence of the capture enable request bit and capture flag.
- For continuous operation, capture 0 value, capture 1 value, and capture differential value are overwritten each time a capture operation is completed.

Sampling capture function (one operation)

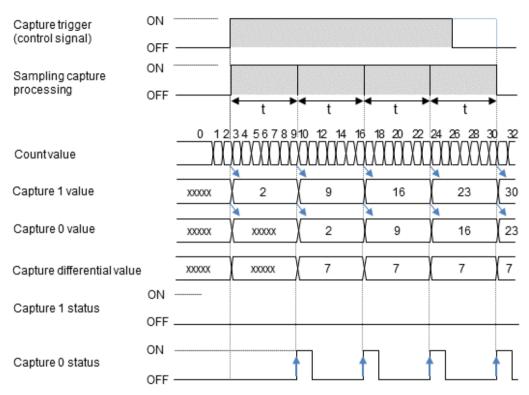
- When the specified sampling time elapses after the capture flag turns ON or OFF, the count value is stored in the capture 0 value and capture 1 value registers and the differential value is stored in the capture differential value register.
- The sampling capture function is always executable when the control 0 signal is allocated to the sampling capture function.
- The trigger condition that starts sampling capture can be selected from control 0 signal (positive logic), control 1 signal (negative logic), and capture enable request bit (positive logic).
- For one operation, the capture 1 status bit is activated. Note that the capture 0 status bit is not activated.

Timing chart



- Sampling capture function (continuous operation)
- Each time the specified sampling time elapses after the capture flag turns ON or OFF, successively, the count value is stored in the capture 0 value and capture 1 value registers and the differential value is stored in the capture differential value register.
- The sampling capture function is always executable when the control 0 signal is allocated to the sampling capture function.
- The trigger condition that starts sampling capture can be selected from control 0 signal (positive logic), control 0 signal (negative logic), and capture enable request bit (positive logic).
- For continuous operation, the capture 0 status bit is activated. Note that the capture 1 status bit is not activated.

Timing chart



Reading captured data

Areas where captured data is stored

- The latest captured data is stored in the capture 0 value and capture 1 value registers.
- Captured data is stored as signed 32-bit data (-2,147,483,648 to 2,147,483,647).

Sample program

To read and write channel data, variables are mapped to channels in the same way as in "12.6.5 Operation Ready Request". In this example, variables are mapped to the channel used for reading captured data for Counter Ch0 (the name of sample POU is created as "Counter3").

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+ *		CV, Satullageer	53/28	11100		21-0. Date regime
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P Japanesian, Danesin LaDid, Caphorofficiala		Diff, Cartorilliana	W0000-4	and the		20-0 Capitory Calaboa.
*	10.0	Drill Carriere Mature	943612/8	800.		40-0 Capitore Lynkins
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*		the health and	963632,1	8001		1941 Daniel Dorsman
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*		the formation	9(2013.4	100		10-0 Carteri I MARK
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	20 30	the Capture trake	762042	CHE		Chill Cacherel Livelan

LD program

- 14	PROGRAM Counter3
2	VAR
=	// Local variables
4	diCaptureValue : DINT: // Capture value read variable
2	// Counter I/O mapping variables
	bCh0_Cepture0Status : BCDL: // Cb0 cepture0 status
	diCh0 Capture0Value : DINT; // Ch0 capture0 value
	END VAR
-	-
	1

ST program

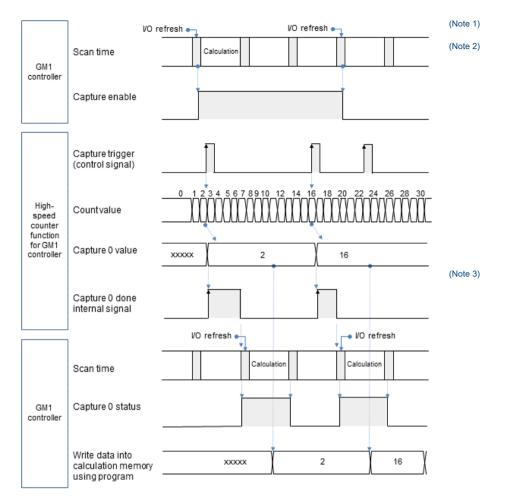
1	PROGRAM Counter3
1	VAR
3	// local variables
4	diCaptureValue : DINV; // Capture value read variable
£.	// Counter 1/0 mapping variables
6 .	bCh0_Capture0Status : BOOL: // Ch0 capture0 status
7	diCh0_Capture@Value : DINT: // Ch0 capture@ value
8	END VAR
÷	
	// Capture 0 status is ON and read the capture value
	1r bCh0_Capture0Status = 180E THEN
4.	diCaptureValue := diCh0_CaptureOValue;
4	END IF

Behaviors and read operations of capture * status bits

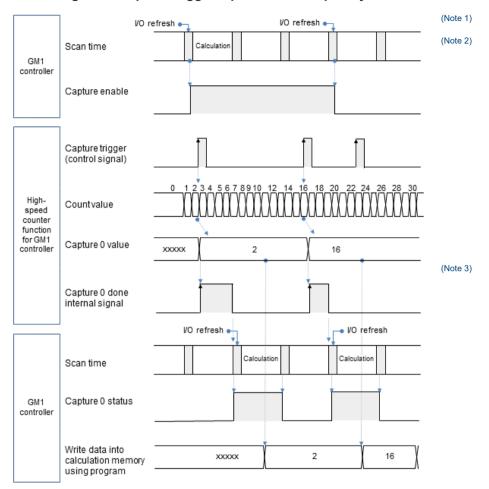
Basic behaviors

- When capture is completed, it is reflected in the capture * status bit for each I/O refresh.
- For the capture function, the capture * status bit is reset when the capture enable request bit turns ON.

12.6 High-speed Counter Function



- (Note 1) The capture enable request bit is turned ON by a user program.
- (Note 2) Each time a capture flag turns ON, a capture operation is performed asynchronously with user program execution. The capture completion internal flag used by the system is reset each time an I/O refresh is performed.
- (Note 3) Capture * status bits are reflected each time an I/O refresh is performed. Capture * status bits are used to read capture 0 value, capture 1 value, and capture differential value as arbitrary variables through user programs. These values are read at the time of relevant calculation processing.



Processing when capture trigger input occurs frequently

- (Note 1) The capture enable request bit is turned ON by a user program.
- (Note 2) Each time a capture flag turns ON, a capture operation is performed asynchronously with user program execution. The capture completion internal flag used by the system is reset each time an I/O refresh is performed.
- (Note 3) Capture * status bits are reflected each time an I/O refresh is performed. If multiple capture operations are performed continuously, the capture 0 completion status bit or capture 1 completion status bit will remain ON.



• If control signals used as capture triggers are input frequently, the capture 0 completion status bit or capture 1 completion status bit will remain ON. Take care when reading multiple captured data items.

12.6.10 Unit Error

Overflow and underflow errors with the counter unit are operation stop errors.

To continue the operating status when an error occurs, change the value of PLC parameter "A unit error occurred" to "Continue operation".



1. From "Device view" in the navigator pane, double-click the "Device" object.



2. Click the "PLC parameters" tab in the Device window.



3. Change the value of "A unit error occurred" to "Continue operation".

Palameter	Type	Value	Detault Value Unit	Description
A unit enar accurred	Enimeration of ENTE	Cantinue operation	Etop operation	Please select the operation often a unit error accurred.
		and the state of t		Network setting

12.7 Settings of I/O Unit

Expansion I/O units are classified into 64-point input, 64-point output, and 32-point I/O units. This section explains 32-point I/O units as an example.

Setting Parameters with GM Programmer



12.7.1 Parameter Settings

Parameter

Setting item	Settings	Default value	Description
Input time constant	None	None	Input time constant
	0.1 ms		
	0.5 ms		
	1 ms		
	5 ms		
	10 ms		
	20 ms		
	70 ms		

12.7.2 I/O Mapping for I/O Unit

Channel	Туре	Description	Remarks
Ch0_In	WORD	Ch0_In	
Ch1_In	WORD	Ch1_In	
Ch0_Out	WORD	Ch0_Out	
Ch1_Out	WORD	Ch1_Out	

■ Ch*_In

* represents 0 or 1.

Channel	Туре	Description	Remarks
Ch*_In00	BOOL	Ch*_In00	
Ch*_In01	BOOL	Ch*_In01	
Ch*_In02	BOOL	Ch*_In02	
Ch*_In03	BOOL	Ch*_In03	
Ch*_In04	BOOL	Ch*_In04	
Ch*_In05	BOOL	Ch*_In05	
Ch*_In06	BOOL	Ch*_In06	
Ch*_In07	BOOL	Ch*_In07	
Ch*_In08	BOOL	Ch*_In08	
Ch*_In09	BOOL	Ch*_In09	
Ch*_In10	BOOL	Ch*_In10	
Ch*_In11	BOOL	Ch*_In11	
Ch*_In12	BOOL	Ch*_In12	
Ch*_In13	BOOL	Ch*_In13	
Ch*_In14	BOOL	Ch*_In14	
Ch*_In15	BOOL	Ch*_In15	

Ch*_Out

* represents 0 or 1.

Channel	Туре	Description	Remarks
Ch*_Out00	BOOL	Ch*_Out00	
Ch*_Out01	BOOL	Ch*_Out01	
Ch*_Out02	BOOL	Ch*_Out02	
Ch*_Out03	BOOL	Ch*_Out03	
Ch*_Out04	BOOL	Ch*_Out04	
Ch*_Out05	BOOL	Ch*_Out05	
Ch*_Out06	BOOL	Ch*_Out06	
Ch*_Out07	BOOL	Ch*_Out07	
Ch*_Out08	BOOL	Ch*_Out08	
Ch*_Out09	BOOL	Ch*_Out09	
Ch*_Out10	BOOL	Ch*_Out10	
Ch*_Out11	BOOL	Ch*_Out11	
Ch*_Out12	BOOL	Ch*_Out12	
Ch*_Out13	BOOL	Ch*_Out13	
Ch*_Out14	BOOL	Ch*_Out14	
Ch*_Out15	BOOL	Ch*_Out15	

(MEMO)

13 Communication Function

13.1.1	rview of Communication Function Adding Network Communication Devices Adding Serial Communication Devices	13-2
13.2.1	eral-purpose Communication General-purpose Communication (Ethernet) General-purpose Communication (Serial)	13-6
13.3.1 13.3.2 13.3.3 13.3.4	DBUS What is Modbus TCP? Modbus-TCP Master Communication Modbus-TCP Slave Communication Modbus-RTU Master Communication Modbus-RTU Slave Communication	13-24 13-24 13-28 13-30
13.4.1 13.4.2 13.4.3 13.4.4 13.4.5 13.4.6 13.4.7	erNet/IP What is EtherNet/IP? Cyclic Communication Function EtherNet/IP Scanner Function Setting up the EtherNet/IP Scanner Function EtherNet/IP Scanner Operation EtherNet/IP Adapter Function Setting up the EtherNet/IP Adapter Function EtherNet/IP Adapter Operation	13-42 13-42 13-42 13-42 13-49 13-51 13-51

13.1 Overview of Communication Function

The GM1 controller allows general-purpose communication, Modbus communication, and EtherNet/IP communication with external devices via COM and LAN ports.

The following table shows the functions supported by each port.

Port	Supported protocol	Maximum number of connections
COM port	General-purpose Communication MODBUS-RTU (Master / Slave)	1 port
LAN port 1	General-purpose Communication MODBUS-TCP (Master / Slave)	16 connections
LAN port 2	General-purpose Communication MODBUS-TCP (Master / Slave) EtherNet/IP (Scanner / Adapter)	32 connections



• The IP address of the LAN port can be changed using the "PLC Parameters" tab in the Device setting window.

For details, refer to "5.2 Setting up the GM1 Controller".

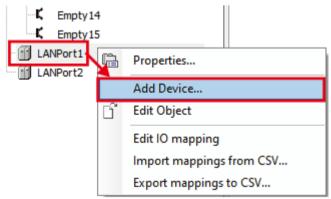
13.1.1 Adding Network Communication Devices

Add a communication device object to the device object of a LAN port.

For example, use the following procedure to add "ModbusTCP Slave Device" to LAN port 1.



- Right-click the "LANPort1" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

🗃 Aatlaske	ed
beicai Lavrota	
Norre:	
 Interface TCP Peopler Interface Device 	
fam:	1
	Add Devitin Canvol

2. Select "ModbusTCP Slave Device".

Add Desire	
Sevice LENPLINE	
Norw	
+ 🗇 relibuero	
 Bill Modeut Bill Modeut TCF Poster 	
# ### ModburtOP Sizes Innex	
2 Northurt OF Gave Tensor	
ModeuTO Serv Device	
1	Ald Deiter Carest
	the second second second

Any device name can be assigned.

3. Click the [Add Device] button.

The selected "ModbusTCP_Slave_Device" object will be added to the navigator pane.

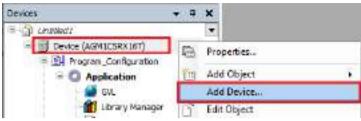


For details on how to set up Modbus TCP, refer to "13.3 MODBUS".

13.1.2 Adding Serial Communication Devices

¹² Procedure

1. Right-click the "Device" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

Add Device	
Device: Device	
Name	
🖃 🔠 rieldbuses	
🖻 💷 Modbus	
 Modbus Senal Port Modbus COM 	
a notice con	
ame;	
	Add Device Gencel

2. Select "Modbus COM".

Addanice 🗑	ិង
Denical Desice	
Nome D I Padduces = Elf Modus = Elf Modus Total Pad Padbar 2001	
Thebuildon	
Network Peddeur, COM	

3. Click the [Add Device] button.

The selected "Modbus_COM" object will be added to the navigator pane.

10	LANPort1	
- 197	LANPort2	
	Medbus_COM	

4. Right-click the "Modbus_COM" object and then select "Add Device" from the context-sensitive menu that is displayed.

LAPerti LAPert2 Modus_COM	Øta Cepy ●ta Cepy ■ Parts ➤ Delete
	Properties.
	Add Device_
	Edit Object

The "Add Device" dialog box will be displayed.

Add Device	
Device: Modbus_COM	
Name	
🗏 🗐 Pieldbuses	
e Cat Modbus	
Community Modbus Serial Device Modbus Serial Master	
amei	
	Add Device Gancel

5. Select "Modbus_Serial_Device".

🗃 AalOnice	×
beece Padax_000	
Nerve: Preditaces	
Name: Hodeus, Senia (Senia	
	Add Deviter Ganeel

6. Click the [Add Device] button.

The selected "Modbus_Serial_Device" object will be added to the navigator pane.



For details on how to set up, refer to "13.3 MODBUS".

13.2 General-purpose Communication

13.2.1 General-purpose Communication (Ethernet)

This section explains how to use the CAA NetBaseServices library, in the following order.

- 1. Library Manager
- 2. TCP CLIENT processing example
- 3. TCP SERVER processing example
- 4. UDP processing example

Double-click Library_Manager in the navigator pane.



The Library Manager setting window will be displayed.

Library_Manager

Check that the following CAA NetBaseServices library is registered in Library Manager.

Name	Namespace	Effective version
🛙 🔛 Stillense = Stillense, 3.5.14.0 (St - Snart Software Solutions Ostin)	_M_LICENSE	3.5.14.0
🖲 📴 BreakprintLogging = Breakpoint Logging Punctures, 3.3.3.2 (35 - Stvart Saftware Sokutore Gebri)	(PLog	3.5.5.0
🗄 📒 CAA Pile = CAA Pile, 3.5. 15.0 (CAA Technical Workgroup)	73.5	3.5.15.0
CAA NeBaseSrv = CAA Net Base Services, 3.5, 15.0 (CAA Technical Workgroup)	NES	3.5.15.0
🗄 📴 CAA SerialCom = CAA SerialCon, 3.5. IS 0 (CAA Technical Workgroup)	COM	3.5.15.0
🕷 📴 SoShutthernet = Lidnytthernet, 3.1. 13.0 (35 - Smart Software Solutions Grid#)	2:OrvOherriet	3.5.15.4
IobriekTEX = IobriekTEX, di 6.8.2 (Parasonic Corporation)	SOD+GRITER:	0.6.6.2

TCP CLIENT processing example

The following is a processing example of data transmission / reception via TCP when the local unit is TCP CLIENT.

This processing example assumes the following operating environment.

The second	A 100 MIL
10000	unu.
the fair where a	

Local unit	Destination unit		
TCP/IP	TCP/IP		
Client	Server		
IP address: 192.168.2.5 PORT: 60000	IP address: 192.168.2.50 PORT: 60001		

Processing for data transmission / reception

The processing for data transmission / reception is as follows:

TCP client connection processing

- Reception start processing
- Transmission processing

Explanation of variables

Process

When the value is rewritten, the following processing is executed. After the execution is completed, the variable is set to 0 (invalid value).

- 1 = TCP client connection processing
- 2 = Reception start processing
- 3 = Transmission processing

ClientAddr

The IP address of the destination unit is set.

Port

The port number of the destination unit is set.

TimeOut

A connection timeout period is set.

SendData

Data to be sent is set.

RecvBuf

Received data is stored.

RecvCount

The number of receptions is stored.

RecvSize

The size of received data is stored.

Result

The result of processing execution is stored. (TRUE: Error occurrence, FALSE: Normal termination)

If the result of processing execution is abnormal, check the error code of each processing.

- NBS_ClientError: Result of TCP client connection processing
- NBS_WriteError: Result of transmission processing
- NBS_ReadError: Result of reception start processing

Operation example

The TCP client connects to the TCP server.

• The value of "Process" is changed to 1.

The local unit is ready to receive data. In this state, the local unit can receive data from the destination unit.

- The value of "Process" is changed to 2.
- The local unit sends data to the destination unit. 10-byte data is sent to the destination unit.
- The value of "Process" is changed to 3.

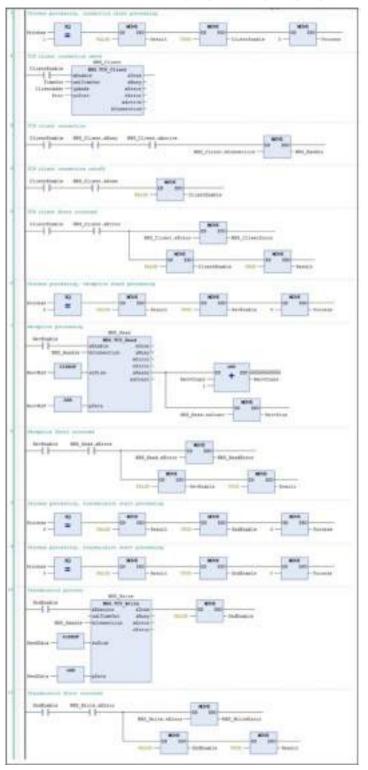
Declaration section (common to ST and LD programming languages)

```
PRINCEAM TOP_Client
     VAIL
                        : UINT := N: // 1+TCF client contection , 2+Start receiving , 3+Send
         Process
         Result .
                       : BOOL:
                                          // Implementation repuit (FALGE-normal , THUE-ainormal)
4
        ClientAddr : HBS.TF_ADDR := (sAddr:='150.16F.2.50'): // Partner station TP address
        // FB Declaration
        HBS_Client | MBS.TCF_Client/
       HDS_Nrite : HDS.TCP_Write;
HDS_Bead : HDS.TCP_Read/
HDS_Bandle : HDS.CAA.RANDLE;
11
14
         MMS_ClientEreor : HMS.ERROR:
14
14
         RSS_WriteError : RBS.ERROR;
     MAS_ReadError : NBS.ERROR:
14
       ClientEnable : BOOL := TALST:
TimeOut : UDINT := 1020000;
Port : UDINT := 60001;
1.8
                                                     // fimeout isecond
// Partner station port number
13
        // Trainmission data
        11
2.4
11
14
        BevEnable | BOOL i= FALSE:
         RecvBut : ARRAY [1.,10] GF BYTE: // Deceive Buffer
RecvBite : NES.CAA.SITE: // Receive site
i''
         RecyCount : UINT := 0:
11
                                                              1/ Repetre count
10
     END VAR
```

Implementation section (ST programming language)



WUME-GM1ETCOP-03



Implementation section (LD programming language)

TCP SERVER processing example

The following is a processing example of data transmission / reception via TCP when the local unit is TCP SERVER.

This processing example assumes the following operating environment.

Local unit	Destination unit
TCP/IP	TCP/IP
Server	Client
IP address: 192.168.2.5 PORT: 60000	IP address: 192.168.2.50 PORT: 60001

Processing for data transmission / reception

The processing for data transmission / reception is as follows:

- TCP server open processing
- TCP connection processing
- Reception start processing
- Transmission processing

Explanation of variables

Process

When the value is rewritten, the following processing is executed. After the execution is completed, the variable is set to 0 (invalid value).

- 1 = TCP server open processing
- 2 = TCP connection processing
- 3 = Reception start processing

4 = Transmission processing

MyAddr

The IP address of the local unit is set.

MyPort

The port number of the local unit is set.

SendData

Data to be sent is set.

RecvBuf

Received data is stored.

RecvCount

The number of receptions is stored.

RecvSize

The size of received data is stored.

sClientAddr

The IP address of the connected data destination is stored.

Result

The result of processing execution is stored. (TRUE: Error occurrence, FALSE: Normal termination)

If the result of processing execution is abnormal, check the error code of each processing.

- NBS_ServError: Result of TCP server open processing
- NBS_ConErrorr: Result of TCP connection processing

- NBS_ReadError: Result of reception start processing
- NBS_WriteError: Result of transmission processing

Operation example

The TCP server is opened and connected to the TCP client.

• The value of "Process" is changed from 1 to 2.

The local unit is ready to receive data. In this state, the local unit can receive data from the destination unit.

• The value of "Process" is changed to 3.

The local unit sends data to the destination unit. 10-byte data is sent to the destination unit.

• The value of "Process" is changed to 4.

Declaration section (common to ST and LD programming languages)

```
1
      PROGRAM ICP Server
     VAR
-
         Process : UINT := 0; // Innerver open , Deconnect , JaStart receiving , GaSend
        Besult | BOOL:
                                  // Implementation result (FALSS-normal , INVE-absormal)
4
 5
        HyAddr : HB5.IF_ADDR := (aAddr:='193.160.2.3'); // Ovn station IP address
 0
 MyPort : UINT 1- #0006;
                                                              // Ove station port sumber
 .
// TE Declaration
       NBS_Server | NBS.TCP_Server;
       HBS_Connection : HBS.TCP_Connection;
       NBS_Read : NBS.TCP_Read;
NBS_Write : NBS.TCP_Write;
13
14
       NB5_Bandle : NB5.CAA.MANDLE:
NB5_ServError : NB5.ERROB:
15
16
       NBS_DEVELEVE I NBS.ERROR;
NBS_ConFrror : NBS.ERROR;
NBS_ReadError : NBS.ERROR;
NBS_WriteError : NBS.ERROR;
17
1.0
15
       // Transmission data
22
       SendData | ARRAY [1...10] OF BYTE := [1,2,3,4,5,6,7,0,9,10];
23
       ServerEnable: BOOL := TALMI: // Server part open process in progress
24
25
        ConEnable | BOOL |= EALSE;
                                                 // In process of connecting
        SndEnable : HOOL := FALSE:
26
                                                  // Sending in progress
        BevEnable : BOOL := FALSE:
27
                                                  // Hereive processing
         BecvSuf : ARRAY [0..10] OF BYTE: // Receive buffer
BecvCount : 0187 := 0; // Humber of receive
28
                                        // Humber of receptions
2.5
20
        RecvSipe
                     T MES.CAL.SIZE:
                                                   // Received data size
        ClientAddr : MBS.SysSocket.IMADOR:
11
                                                   // IP address of the client
82
        sClientAddr : STRING;
                                                   // Destination IF address
22
    END VAR
```

Implementation section (ST programming language)

```
Server plat spen penings
      HIS Server | sfrable: ServerEnable , ipAddr: HyAddr , uiFert := HyDort );
 .
      IF Servertable - THE TEES
 .
              Convertion configuration
           IF HES_Server.sfritts = THE THES
                                                              // Erris coursed
             HE ServError in SES_Server.eError: // Error information riceage
               Serverfinable |= TALSEI
              Result 1= INNER
         DED IF
     IND IF
     // Waining for socception completion
     MIS_Connection( sInable:-Confinable , hServer:-HBS_Server.hServer );
140
     IF S85_Connection. sActive = INIX THIS
           NES_Manuale := NES_Connection_SConnection; // Connection Annula
           ClientLody := NBS Connection. IFAddress;
                                                               2/ Set the IP address of the connection destination
           aClientAddr := NBS.UEINT_TO_FFETRING( udilTRAddress := ClientAddr.uLAddr );
                                                            of 12 efferer translation
          IF RES_Competition.sError = 7801 THEM // Error socurred
REG_Compering := RES_Competition.eErrory // Error information stronge
     BLAIF HES_Connection.sfreer = THIE THEN
1.81
           Confinencie := Talifi;
          Repuit := INIT:
     END IF
14
      (/ Reception enabled
     HSS_Read( sfmahle:=Revfmahle , hConnection:=NSS_Bandle , pCata := ADR(RevvFmf) , stdice:= SIIBOF(RevvFmf)):
     IF RevEnable - CHIE THEM
           Anomight confirmation
          IF HES_Read. sheady = THE THE

        Bet/Count := Res/Count + 1;
        // Ressived counter update

        Bet/Sim := 105_Sead.stCount:
        // Resive counter

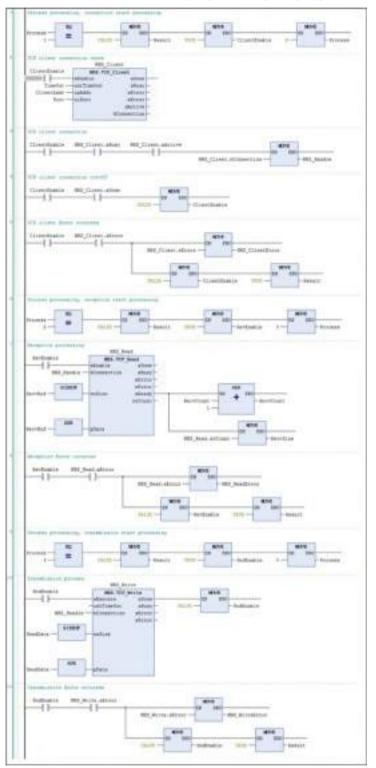
        Bat/Sim := 105_Sead.stCount:
        // Resive counter

        Bat/Simon := 105_Sead.stCount:
        // Resive counter

        Bat/Simon := 105_Sead.stCount:
        // Invo: counter

        Bat/Simon := 105_Sead.stCount:
        // Invo: counter

              Berfinshie := TALTY
14
-
               BERGIN I= INUCL
          11_013
     200 17
      // Trenamination completion process
      HBE_Mrite( sEseruis:=SodErable , hOwnertion:=SSS_Needle , plate:=ADR(SendDets) , srlire:=SIIDOF(SendDets));
                                           1
41
    IF Sudfrable = THUE 7858
          IF PES_Nelse.aDone - THU THEM
                                                         // pind completely
               Indinance re TRLIF,
          MARY HES Scite.sfreer = THUE THEM // from comment
               125 MeitsError is 125 Write sErrors // Erner information oberuge
               motioshie (* TALEE)
               Result in THIL!
          END IF
     IND IF
      CASE Process OF
          11 // 202 permanagent
               Surverfinable := INTER
               Result 1= Fairty
               Process to it.
          24 // Dif complet.
               Congnamie (- THITE
               Result := FALST?
              Strideas to 07
           At 1/ Sevention start passessing
               RevEnable 1+ THURLE
               Regult := FALSEr
              Process in th
          AV // Transmission proceeds.
               FodEnable := (HITE:
               Repuir := Faller/
               Exocean l= 0(
      IND CASE
```



Implementation section (LD programming language)

When multiple clients are connected simultaneously to the same port, multiple TCP_Connection instances are created. The hServer handle acquired by one TCP_Server is set to the multiple TCP_Connection instances.

Example: When two clients are connected simultaneously to the same port

Declaration section

iServer: NBS.TCP_Server;// TCP_Server instance

iConnection: ARRAY [0..1] OF NBS.TCP_Connection; // TCP_Connection instance (two instances)

Implementation section

iServer(xEnable:=TRUE , ipAddr:=ipAddr , uiPort:=uiPort); // Server opened // Omitted (Waiting for TCP_Server completion)

iConnection[0](xEnable := TRUE , hServer := iServer.hServer); // For 1st client

iConnection[1](xEnable := TRUE , hServer := iServer.hServer); // For 2nd client

UDP processing example

An example of processing for data transmission / reception via UDP is as follows: This processing example assumes the following operating environment.

Local unit	Destination unit		
UDP/IP	UDP/IP		
IP address: 192.168.2.5	IP address: 192.168.2.50		
PORT: 60000	PORT: 60001		

Processing for data transmission / reception

The processing for data transmission / reception is as follows:

- Port open processing
- Reception start processing
- Transmission processing

Explanation of variables

Process

When the value is rewritten, the following processing is executed. After the execution is completed, the variable is set to 0 (invalid value).

- 1 = Port open processing
- 2 = Reception start processing
- 3 = Transmission processing

MyipAddr

The IP address of the local unit is set.

MyPort

The port number of the local unit is set.

SendAddr

The IP address of the destination unit is set.

SendPort

The port number of the destination unit is set.

SendData

Data to be sent is set.

RecvBuf

Received data is stored.

RecvCount

The number of receptions is stored.

RecvPort

The port that received data is stored.

RecvSize

The size of received data is stored.

RecvlpAddr

The IP address of the received data destination is stored.

Result

The result of processing execution is stored. (TRUE: Error occurrence, FALSE: Normal termination)

If the result of processing execution is abnormal, check the error code of each processing.

- NBS_PeerError: Result of port open processing
- NBS_RecError: Result of reception start processing
- NBS_ReadError: Result of transmission processing

Operation example

The port is opened and the local unit is ready to receive data. In this state, the local unit can receive data from the destination unit.

• The value of "Process" is changed from 1 to 2.

The local unit sends data to the destination unit. 10-byte data is sent to the destination unit.

• The value of "Process" is changed to 3.

Declaration section (common to ST and LD programming languages)

```
PRINCIPAN UDP
 1
       VAR
                         : UIST := 0: // 1-Fort open , D-Bernive start , S-Sead
 Process
 4
            Besult
                           1 BOOLI
                                                  // Implementation result (FALSE-normal , INVS-abnormal)
 E.
           MyipAddz : MB3.IP_ADDB := (aAddz:='192.100.2.5'): // Ovn station IF address
SendAddz : MB3.IP_ADDR := (aAddz:='102.160.2.50'): // Partser station IF address
 4
 τ
 e.
           MyPort : UINT := 00000;
                                                                                      // Own station FOR7 number
 .
           SendPort : UINT := COODI;
                                                                                      // Partner station PORT number
             // FB Declaration
12
           NBS_Peer | NBS.UDP_Peer:
            ND5_Receive : ND5.UDP_Receive:
14
          NBS_Send : NBS.UDP_Send:
18

      NBS_Bandle
      : NBS_CAA.BANDLE;
      // PONT Annole

      NBS_DestError
      : NBS_EBBOR;
      // UDP_Peer Error information

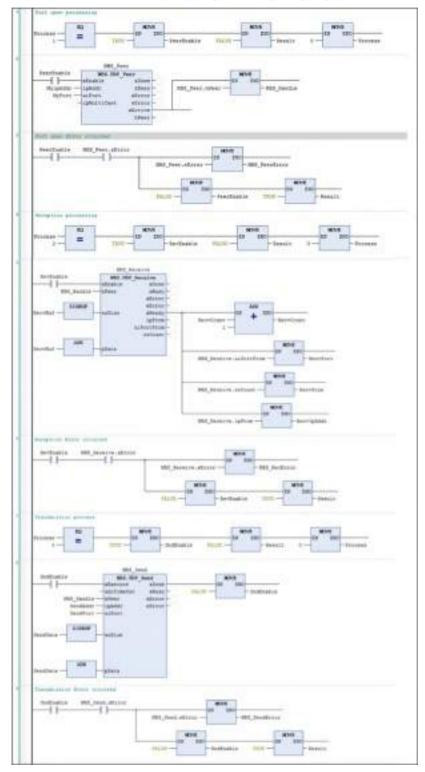
      NBS_RecError
      : NBS.EBBOR;
      // UDP_Beceive Error information

      NBS_SendError
      : NBS.EBBOR;
      // UDP_Send Error information

14
18
15
10
           // Transmission data
            SendData : ARRAY [1..10] OF BITE := [1,2,3,4,5,6,7,5,9,10];
2.5
16
          PeerEnable : BOOL :- FALSE:
          SndEnable r BOOL := FALHER
BevEnable : BOOL := FALHER
15
16
iτ
           RecyDif : ARRAY [1.,10] OF BYTE: // Receive buffer
10
            RecvCount : UINT := 0; // Recuire count
RecvFort : UINT; // Recuire port
27
          RecvSize : MSS.CAA.SIZE; // Deceive size
RecvIpAddr : BSS.IP_ADDR; // Destination IP address
10
       END VO.B.
```

Implementation section (ST programming language)

```
Port open processing
     RBS_Feer( #Enable:=PeerEnable , ipAddr:=HyipAddr , uiFort:=HyFort ()
     IF PeerEnable = THUE THEN
IF HBS_Deer.skctive = THOE THEN
                                                1/ Successful port spening
                                               // Get Aanale
// Error conurred
            NBS Handle (= MBS Peer.hPeer;
         BLAIF HDS Peer. sError - THUE THEN
÷
            HES_PeerError := HES_Peer.eError : // Error information storage
ŝ
             PeerEnable 1- FALSE:
             Result := THUE;
        SID IF
    END IF
13
     // Heception processing
24
     HSS Beceive( mEnable)-RevEnable , hPeer:-NBS Handle , pData:-ADR(BecvBuf) ,
18
                 stSize:=SIZECF(RecvEut)):
     IF RevEnable - THUE THEN
                                             // Received data available
       IF BBS Receive, sReady = THDE THES
18
            RecvCount := RecvCount + 1:
                                                  // Received number update
             RecyFort := SB5_Receive.uiFortFrom: // Destination PORT
            RecvSize := SB5_Receive.spCount; // Receive size
       RecvIpAddr := NBS Receive.ipFrom: // Destination 22 address
ELSIP NBS Receive.sError = INCE THEN // Error occurred
             HES_RecError := HES_Receive.eError; // Error information storage
24
             Revinable := Thist;
             Regult :- THURS
       END IF
   END IF
27
24
21
     // Transmission process.
    NEG_Send( xEmerute:=SndEnable , hPeer:=NES_Handle , ipAddr:=SendAddr ,
               uiFort:-SendFort , pData:-ADB(SendData) , sifire:-SIZEOF(SendData));
     IF SodEnable = THUE THEN
1.1
        IF SES Send. shone - THUE THEN
                                                  17. Successful transmission.
            SudEnable (- FRLSE;
2.4
                                                // Transmission processing stopped
                                                 // Error conurged
14
       ELSTF HDS_Send. EError = THIE THEN
14
             HES_SendError := HES_Send.eError: // Error information storage
in the
             SadEnable (= EkLSE)
                                                  // Transmission processing stopped
             Begalt 1+ THUE!
10
in,
         END IF
10
     ESD IF
44
42
     CASE Process OF
4.3
      11 22 Post open processing
             PeerEnable := TRUE;
14
16
             Besult := FALVER
44
             Process := 0;
é.
4.0
       21 // Beception processing
12
             RevEnable := TRUE;
             Regult := TALSE:
            Process I= 01
10
       3: // Transmission process
14
             Sudfrable := THUE:
             Result in FRISE?
10
             Frocess := 11;
57
     END CASE
                                                                                  +80 H
```



Implementation section (LD programming language)

13.2.2 General-purpose Communication (Serial)

This section explains how to use the CAA SerialCom library, in the following order.

- 1. Library_Manager
- 2. COM transmission / reception processing example

Library_Manager

Check that the following CAA SerialCom library is registered in Library_Manager.

Nome	Namespace	Effective version
🕈 🌄 352/cerse = 262/cerse; 3.6.14.0 (36 - Snart Software Solutions GubH)	_35_1702-66	3.5.14.9
🗄 📴 Breekpoint.opping – Dreekpoint Lopping Planchone, 1.5.5.0 (25 - Smart Software Solutions Goldton	101.00	3.5.5.0
CAA File = CAA File, 3.5.15.0 (CAA Technical Morkgroup)	FILE	3.5.15.0
CAA NetBaseSrv = CAA Net Base Services, 3.5.15.0 (CAA Technical Workgroup)	nes	3.5.15.0
CAA SeriaCon = CAA SeriaCon, 3.5.15.0 (CAA Technical Workgroup)	COM	3.5.15.0
🕴 📴 InDrichtharma) = 3xDrichtharmal, 3.5.15.0 (25 - Seart Softwara Solutiona Enliff)	3dDrvtthernet	19.15.0
E LoomRTEX = InDMRTEX, 0.6.8.2 (Panisonic Corporation)	10Dov#TEX	0.682

COM transmission / reception processing example

Send and receive data via SerialCom.

Specify communication settings as below.

COM number	1
Baud rate	115200 bps
Data bits	8
Parity bit	Odd
Stop bit	1

Processing for data transmission / reception

The processing for data transmission / reception is as follows:

- Serial port open processing
- Serial port close processing
- Reception processing
- Transmission processing

Explanation of variables

Process

When the value is rewritten, the following processing is executed. After the execution is completed, the variable is set to 0 (invalid value).

- 1 = Serial port open processing
- 2 = Reception processing
- 3 = Transmission processing
- 4 = Serial port close processing

SendBuf

Data to be sent is set.

SendBufLen

The length of data to be sent is set.

RecvBuf

The buffer to store received data is set.

ReadBufLen

The length of receiver buffer is set.

ReadSize

The size of received data is stored.

Result

The result of processing execution is stored. (TRUE: Error occurrence, FALSE: Normal termination)

If the result of processing execution is abnormal, check the following error code.

• ComErr: COM processing result

Operation example

Serial port is opened.

• The value of "Process" is changed to 1.

Received data is read.

• The value of "Process" is changed to 2.

10-byte data is sent.

• The value of "Process" is changed to 3.

Serial port is closed.

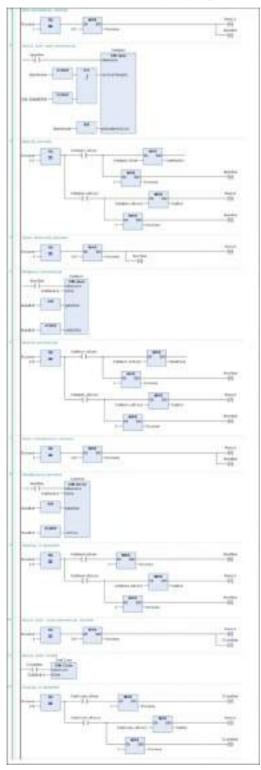
• The value of "Process" is changed to 4.

Declaration section (common to ST and LD programming languages)

```
PRODUCT IN HARDONY
1020
                  : UTNY 1+ 1r // 1+CM ONTH 3+EECT 3+CDD 4+CM CLOSE
   Stocess:
                               // implementation provid (rabit-modes) / THUE-shoureaff
   Reduit.
                  1 800L)
   Compen : COM.Open;
    Compliant r Com. Close;
   Condead : CON. Write:
    ConRecv : Citt.Reed:
   Conduction CON.COA. Alabha -- () // IDM device handle
   COMET I CON.ENDOR:
                                     // CON error mobil
    11 Communication parameters
   OpenFaram : ARRAY [1...,7] OF COM. BARABETER := [
       IndiFereneterId := COM.CALFereneter_Constants.tdiFort.
                                                               addWalter on 11.
       (universetering i= (DH.CAA_Perspects/_Constants.unibeusiste, usiVelue := 11111),
       (will resenter 14 (= CON, CAR_Texameter_Costers. will reliave a start to COUNT (CON, FARJIY, COO)).
       (ediferenterid >= COM.CAR_Terester_Constants ediftoplits, udiValue := INT TO CONST(COM.STORET.ONISTOTET)).
       indiFarameterId is COM. CDA Farameter Constants. uniTimerot. uniValue is ().
       (adiPeraneteriti := CON.CRA_Peraneter_Constants.odiBytefile, udiValue := 0),
       (udiPerameterId := 00H.CRA_Perameter_Constants.udiDinary, uddValue := 0)
   11
   Openine : BOOL := FALSE;
   Necytae : BOOL :- FALSE;
Seedlas : BOOL :- FALSE;
   Closefge : BOOL := TALST:
   Reality + MOVE [14:10] OF SYTE
ReadSize + UDINT:
                                            W Beau Patter
                                            Af Band data rise
    IND VAR
```

Implementation section (ST programming language)





Implementation section (LD programming language)

13.3 MODBUS

13.3.1 What is Modbus TCP?

The GM1 controller can communicate with HMI and controllers via the Modbus protocol. Master communication or slave communication can be performed by adding a master or slave device for Modbus to the project file.

13.3.2 Modbus-TCP Master Communication

The Modbus-TCP master function can be used to send commands to slave devices in the following two ways.

- 1) When device object settings are used
- Transmission method based on slave initialization
- Transmission method
 - · Cyclic
 - Rising edge
 - Application (ModbusChannel function block)
- 2) When device object settings are not used
- A method by which a user program (ModbusRequest function block) generates and sends commands



• For details on how to use ModbusRequest, refer to the *GM1 Series Reference Manual* (*Instruction*).

The method in 1) is explained below.

¹² Procedure

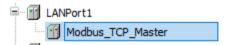
1. Right-click the "LANPort1" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

add0edce	
beicai Lawora	
Norret II- III Padiason - Elli Nodas - Elli Nodas TCP Peoler - Elli Nodas TCP Peoler - Elli Nodas TCP Peoler	

 Select "Modbus TCP Master" under "Modbus" and click the [Add Device] button. "Modbus_TCP_Master" will be added to the "LANPort1" object.

Example: When master communication is performed via LAN port1



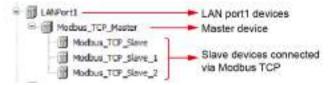
 Right-click the "Modbus_TCP_Master" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

and and a set a se	- 3
Descai Padias_TDF_Pacer	
Norre: In Structures In Module In Module TCP Sove Stadaut TCP Sove	
Network 1	
	Add Deviter Canesi

 Select "Modbus TCP Slave" under "Modbus TCP Slave" and click the [Add Device] button. "Modbus TCP Slave" will be added to the "Modbus TCP Master" object.

Example: When master communication is performed via LAN port1



5. Open the device (AGM1CSR16T1) of the GM1 controller, select the "PLC' Parameters" tab, and set the IP address of LAN port1.

torenorse mitrigi	Fearsdar	Type	Talue .	Salasithasa, Unit	Deception
hate and Time and Settings	# A unit lense secantal # 07 Resurs sectors	Cromanalism of 10172	Steawin	Sea speakor	Passe adopt the operation when a unit entit repaired retrievel, string
toptotium.	+ @LMipet3				UM parts releases artilitys
and the second s	# th Address	175.701	100.088.18	'181, MIR.), N	specify the producer for LWI parts.
ing .	# Submit front	078296	155.255.255.0	135,265,281,8	2040F/ #4 AD140 mail for LAY pirt1.
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incess Rights	# Submitteek	\$783%G	355-263-295 V	158-285-285 #	Specify the admentment for DAV port2
	# Select Gateway	5720hG	2041	10.6.9	Specify the default patenies for (10) peril.
RCONT					
PLI Parameters					
Ten Doorevhant					

6. Double-click "Modbus_TCP_Slave" in the navigator pane. The "Modbus_TCP_Slave" object will be displayed.

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7. Select the "Modbus Slave Channel" tab.

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8. Click the [Add Channel] button.

The "Modbus Channel" dialog box will be displayed.

Enter information for channels to be used. Up to 100 channels can be set.

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iame	Channel 0		
Access type	Read Holding Registers (Function Code	50	×
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Comment			
EAD Register			
Offset	0x0000		~ ~ ~
ength	1		
Error handling	Keep last Value 🔍		
WRITE Register			
lffsat	0x0000		2
ength	1		

Access type:

Select an access type (function code) and change the value of the READ or WRITE register parameter according to the selected access type.

Function code	Access type	Description
1	Read Coils	Reads from coils
2	Read Discrete Inputs	Reads from discrete inputs
3	Read Holding Registers	Reads from holding registers
4	Read Input Registers	Reads from input registers
5	Write Single Coil	Writes to single coil
6	Write Single Register	Writes to single register
15	Write Multiple Coils	Writes to multiple coils
16	Write Multiple Registers	Writes to multiple registers
23	Read / Write Multiple Registers	Reads from or writes to multiple registers

Trigger:

Select conditions for command transmission.

Access type	Description
Cyclic	Commands are sent periodically. Enter a transmission interval in the Cycle time field.
Rising edge	Commands are sent at the rising edge of a Boolean trigger variable. The trigger variable area is defined in the I/O Mapping tab.
Application	Commands are sent using the ModbusChannel function block in a user program.

READ register settings

Item	Description
Offset	Specifies the starting address from which read operation is to be started.
Length	Specifies the number of registers to be read from. The value of the parameter depends on the function code.
Error handling	Defines data that identifies communication errors."Keep last value": Holds the last value that is read"Set to ZERO": Sets 0

WRITE register settings

Item	Description
Offset	Specifies the starting address from which write operation is to be started. For SP15, do not specify offset "65535".
Length	Specifies the number of registers to be written to. The value of the parameter depends on the function code.

This completes the device object settings for the method for sending commands based on slave initialization and the method for sending commands based on channel settings.

13.3.3 Modbus-TCP Slave Communication

This section explains how to use the Modbus-TCP slave function. The slave function is used by setting up the device object.

¹² Procedure

1. Right-click the "LANPort1" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

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		Add Deviter General

2. Select "ModbusTCP Slave Device" under "ModbusTCP Slave Device" and click the [Add Device] button.

The "ModbusTCP_Slave_Device" object will be added to the "LANPort1" object.



3. Double-click "ModbusTCP_Slave_Device" in the navigator pane. The "LANPort1" object will be displayed.

Select the "General" tab and set appropriate values for each item.

HodbusTCP_Slave_Device						
General	Configured Parameters					
Redbus TCP:Bave Device 1/0	- Watchdog	50	- 7	(ma)		
Mapping	Savepot	502	1	1		
Hadaus TCP Save Device IBC Objects	Unit.ID			1		
Rodbus TCP Sieve Device Peremeters	Holding registers	30			www.teable	
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Status						
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	Discrete inputs	8	1			
	Holding register	a				
	Drowt, register	0	4			
	10.0003030	1				
	Holding- and Hou	cregister data are	sas sver	ser .		
Item	Description					
Watchdog	If no valid com the holding reg Settable value:	ister (%IW)	will be		e master during the prozero.	eset time period
Slave port	Port number us Settable value:	-	lave (l	local ur	it)	
Unit ID	A station numb Settable value:					
Holding registers (%IW)	The number of Buffer size of h				i	
Input registers (%QW)	The number of	input registe	ers is	set.		
	Buffer size of in	nput register	: 1 to	4096		

 Select the "Modbus TCP Slave Device I/O Mapping" tab. You can allocate variables to holding registers and input registers.

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information								
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Registers correspond to each access type (function code)

Function Access type		Register			
code		When the check box is not selected ^(Note 1)	When the check box is selected ^(Note 1)		
1	Read Coils	Holding register	Input register		
2	Read Discrete Inputs	Input register	Input register		
3	Read Holding Registers	Holding register	Input register		
4	Read Input Registers	Input register	Input register		
5	Write Single Coil	Holding register	Holding register		
6	Write Single Register	Holding register	Holding register		
15	Write Multiple Coils	Holding register	Holding register		
16	Write Multiple Registers	Holding register	Holding register		
23	Read / Write Multiple Registers	Holding register (Read/ Write)	Input register (Read) Holding register (Write)		

(Note 1) The register to be used is changed according to whether the "Holding register data area overlay and input register data area overlay" check box is selected.

13.3.4 Modbus-RTU Master Communication

The Modbus-RTU master function can be used to send commands to slave devices in the following two ways.

- 1) When device object channel settings are used
- Transmission method based on slave initialization
- Transmission method based on channel settings
 - · Cyclic
 - Rising edge
 - Application (ModbusChannel function block)
- 2) When device object channel settings are not used (Note 1)
- A method by which a user program (ModbusRequest function block) generates and sends commands

(Note 1) Device object registration is required.

The method in 1) is explained below.

¹² Procedure

1. Right-click the "Device" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

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 Select "Modbus COM" under "Modbus Serial Port" and click the [Add Device] button. The "Modbus_COM" object will be added to the "Device" object.

	LANPort1
···· 🗊	LANPort2
🖸	Modbus_COM

3. Right-click the "Modbus_COM" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

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Network Mediana, Materia J. Colm, Fort	
	Add Device Cancel

4. Select "Modbus Master, COM Port" under "Modbus Serial Master" and click the [Add Device] button.

The "Modbus_Master_COM_Port" object will be added below the "Modbus_COM" object.



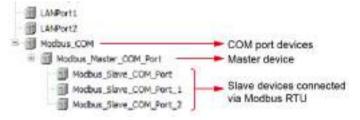
5. Right-click the "Modbus_Master_COM_Port" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

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6. Select "Modbus Slave, COM Port" under "Modbus Serial Slave" and click the [Add Device] button.

The "Modbus_Slave_COM_Port" object will be added below the "Modbus_Master_COM_Port" object.



Double-click "Modbus_COM" in the navigator pane.
 "Modbus_COM"object will be displayed.
 Select the"General"tab and set appropriate values for each item.

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Item	Description	
COM port	Settable value: 1 to 99	
	The COM port of the GM1 controller is fixed at 1.	

Item	Description
Baud rate	Can be selected from 9600, 19200, 38400, 57600, and 115200
Parity	Can be selected from EVEN, ODD, and NONE
Data bits	Data bit length between start bit and stop bit Settable value: 7 bits and 8 bits (Settable: 0 to 255) The default value of Modbus is 8 bits.
Stop bit	Settable value: 1 bit and 2 bits The default value of Modbus is 1 bit.

 Double-click "Modbus Master, COM Port" in the navigator pane. The "Modbus_Master_COM_Port"object will be displayed. Select the "General"tab and set appropriate values for each item.

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(Automotion)			

項目	内容
Transmission mode	RTU: Binary transmission ASCII: ASCII code transmission (Not supported)
Response timeout [ms] [065535]	Waiting time for response from slave * If a response timeout period is set in the slave device, the settings in the slave device will take effect.
Time between frames [ms] [065535]	Time period during which master transmission is paused from when the last response is received until the next command is sent.
Auto-restart communication	When the check box is selected: After a communication error occurs, the communication status is automatically checked. When the communication is restored, reconnection is performed. When the check box is not selected: After a communication error occurs, reconnection is not performed.

"ModbusGenericSerialMaster I/O マッピング"tab: Select a bus cycle task that performs Modbus communication.

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Margaret In			

9. Double-click "Modbus Slave, COM Port" in the navigator pane. The "Modbus_Slave_COM_Port"object will be displayed. Select the "General"tab and set appropriate values for each item.

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Item	Desc	cription
Slave address [1	247] Spec	cifies the address (station number) of the sla

Slave address [1247]	Specifies the address (station number) of the slave device.
Response timeout (ms)	Waiting time for response from slave
[265535]	* The response timeout value for the master device is overwritten.

10. Select the "Modbus Slave Channel" tab.

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11. Click the [Add Channel] button.

The "Modbus Channel" dialog box will be displayed.

Enter information for channels to be used. Up to 100 channels can be set.

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Length	1				
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WRITE Register					
Office.	04000				
Length					

Access type :

Select an access type (function code) and change the value of the READ or WRITE register parameter according to the selected access type.

Function code	Access type	Description
1	Read Coils	Reads from coils
2	Read Discrete Inputs	Reads from discrete inputs
3	Read Holding Registers	Reads from holding registers
4	Read Input Registers	Reads from input registers
5	Write Single Coil	Writes to single coil
6	Write Single Register	Writes to single register
15	Write Multiple Coils	Writes to multiple coils
16	Write Multiple Registers	Writes to multiple registers
23	Read/Write Multiple Registers	Reads from or writes to multiple registers

Trigger :

Select conditions for command transmission.

Access type	Description
Cyclic	Commands are sent periodically. Enter a transmission interval in the Cycle time field.
Rising edge	Commands are sent at the rising edge of a Boolean trigger variable. The trigger variable area is defined in the I/O Mapping tab.
Application	Commands are sent using the ModbusChannel function block in a user program.

READ register settings

Item	Description
Offset	Specifies the starting address from which read operation is to be started. For SP15, do not specify offset "65535".

Item	Description
Length	Specifies the number of registers to be read from. The value of the parameter depends on the function code.
Error handling	Defines data that identifies communication errors."Keep last value": Holds the last value that is read"Set to ZERO": Sets 0

WRITE register settings

Item	内容
Offset	Specifies the starting address from which write operation is to be started.
Length	Specifies the number of registers to be written to. The value of the parameter depends on the function code.

12. Select the "Initialize Modbus Slave" tab.

Slave devices can be initialized.

Slave initialization is executed once when a slave is activated at the time of startup or RUN mode.Click the [New]button and enter information for channels to be used. Up to 20 commands can be added for each device.

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General Nocilias Illive Charper	Line Access Type	WRITE Offset	District Velus	Length	Comment		
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584							
Information							
	Vereup	More Dove			ñis-) []	Lot_

List of access types (function codes)

Code	Access type	Description		
5	Write Single Coil	Writes to single coil		
6	Write Single Register	Writes to single register		
15	Write Multiple Coils	Writes to multiple coils		
16	Write Multiple Registers	Writes to multiple registers		

13. Select the "ModbusGenericSerialSlave I/O Mapping" tab.

Read areas, write areas, and trigger variable areas are defined according to the channel information created in Step 10. Allocate variables as necessary.

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Information							
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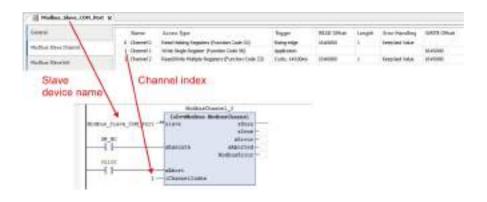
Update settings for I/O variables

Communication and the Service	Always up dot evariables line parent device setting variable				
Item	Description				
Use parent device settings	Updates I/O variables according to the parent device settings				
Enable 1 (Bus cycle task if not used by any tasks)	Updates I/O variables in the bus cycle if not used by any other task				
Enable 2 (Always use bus cycle task)	Updates all I/O variables in each cycle of the bus cycle task				

This completes the device object settings for the method for sending commands based on slave initialization and the method for sending commands based on channel settings.

The following is an example of creating an LD program that sends commands when a trigger is set as an "application" in channel settings.

The ModbusChannel function block is used for command transmission. The slave device added to the navigator pane is specified in the slave operand, and the index of the channel that has been added to the "Modbus Slave Channel" tab and that is used to send commands is specified in the iChannelIndex command.



13.3.5 Modbus-RTU Slave Communication

This section explains how to use the Modbus-RTU slave function. The slave function is used by setting up the device object.

¹² Procedure

1. Right-click the "Device" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

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	Add Devite Caneel

 Select "Modbus COM" under "Modbus Serial Port" and click the [Add Device] button. The "Modbus_COM" object will be added to the "Device" object.

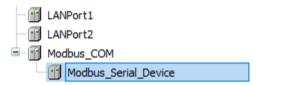
···· 👔	LANPort1	
🗊	LANPort2	
···· 🕤	Modbus_COM	

 Right-click the "Modbus_COM" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed. The "Add Device" dialog box will be displayed.

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	Add Devite Careel

4. Select "Modbus Serial Device" under "Modbus Serial Device" and click the [Add Device] button.

The "Modbus_Serial_Device" object will be added below the "Modbus COM" object.



5. Double-click "Modbus_COM" in the navigator pane.

The "Modbus_COM" object will be displayed.

Select the "General"tab and set appropriate values for each item.

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Octobal .	Senal Port Configuratio	ń	
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	saud rate	9600 v	
Difermation	P(#33)	CIEN V	
	pata bits	8	
	Stapista	[1]	

Item	Description
COM port	Settable value: 1 to 99 The COM port of the GM1 controller is fixed at 1.
Baud rate	Can be selected from 9600, 19200, 38400, 57600, and 115200
Parity	Can be selected from EVEN, ODD, and NONE
Data bits	Data bit length between start bit and stop bit Settable value: 7 bits and 8 bits (Settable: 0 to 255) The default value of Modbus is 8 bits.
Stop bit	Settable value: 1 bit and 2 bits The default value of Modbus is 1 bit.

 Double-click "Modbus_Serial_Device" in the navigator pane. The "Modbus_Serial_Device"object will be displayed. Select the "General"tab and set appropriate values for each item.

Hudbes_serial_Device X					
General	UnelD	1	8		
Matthes Seriel Device UO Matalana	C Watcheop	810	1		
Madbas Seriel Device IBC Objects	Holding registers (%TW)	20	(%L2%)	Writeshie	
deformation .	Input registers (%QM)	10	di cuquo		
Rata					
	Startaddresses				
	Colle	1			
	Diseretarings.ta:	1	10		
	Helding/egister	á.,	12		
	lagut keguter	1	4		
4					

Item	Description
Watchdog	If no valid command is received from the master during the preset time period, the holding register (%IW) will be set to zero. Settable value: 500 to 200000
Unit ID	A station number is set. Settable value: 1 to 247
Holding registers (%IW)	The number of holding registers is set. Buffer size of holding register: 1 to 500
Input registers (%QW)	The number of input registers is set. Buffer size of input register: 1 to 500

 Select the "Modbus Serial Device I/O Mapping" tab. You can allocate variables to holding registers and input registers.

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Mode as Schol Device UV Massing Notifies Schol Device IEC Objects Information	verteken n Mys n Mys	Mapping	Charnel Syscits Outputs	Antonia 92000 92000 92000	Type array (o. a) OF word werver (o. a) OF word		Deccipitice Modius holing repores Modius root registers	
24.0								
		T III YASA	Parry		pôdaratidies (asside	ent devices		

Registers correspond to each access type (function code)

Function code	Access type	Description
1	Read Coils	Holding register
2	Read Discrete Inputs	Input register

Function code	Access type	Description
3	Read Holding Registers	Holding register
4	Read Input Registers	Input register
5	Write Single Coil	Holding register
6	Write Single Register	Holding register
15	Write Multiple Coils	Holding register
16	Write Multiple Registers	Holding register
23	Read/Write Multiple Registers	Holding register (Read/Write)

13.4 EtherNet/IP

13.4.1 What is EtherNet/IP?

EtherNet/IP (Ethernet Industrial Protocol) is an industrial multi-vendor real-time Ethernet system that executes a communication protocol for controlling the Common Industrial Protocol (CIP) in the application layer implemented over standard Ethernet.

For details on CIP, refer to ODVA documentation.

13.4.2 Cyclic Communication Function

After the scanner device connects to an adapter device and a connection is established, the cyclic communication function allows them to send data mutually at the requested packet interval (RPI).

- Scanner device: Controllers such as PLC
- Adapter device: Robot controllers, encoders, I/O devices, etc.

The EtherNet/IP function of the GM1 controller consists of the scanner function and adapter function.

Supplementary note: About GM1 controllers used as adapter devices

- Adapter devices are classified into the following two types: Adapter devices connected under the control of the GM1 controller used as a scanner device and adapter devices that are the GM1 controller itself. To avoid confusion, the following two different terms are used in this manual.
 - · Local adapter

Adapter device that is the GM1 controller itself

Remote adapter

Adapter device connected to the GM1 controller used as a scanner

13.4.3 EtherNet/IP Scanner Function

The EtherNet/IP scanner function allows the GM1 controller to communicate with EtherNet/IP adapter devices.

Communication settings for an adapter device to be connected can be configured by loading the EDS file of the adapter device. Multiple adapter devices can be connected to a scanner device.

13.4.4 Setting up the EtherNet/IP Scanner Function

This section explains how to set up the EtherNet/IP scanner function.

Adding devices

Add an EtherNet/IP scanner device and remote adapter device to the Device tree, as described below.

¹² Procedure

- 1. Add an EtherNet/IP scanner device.
 - **1-1** Right-click the "LANPort2" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.

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	1	Add Device
	5	Edit Object
		Edit IO mapping Import mappings from L3V
	1.1	Export mappings to CSV

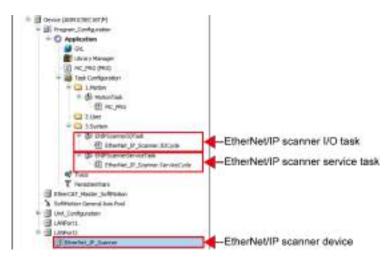
The "Add Device" dialog box will be displayed.

1-2 Select "EtherNet_IP_Scanner" and click the [Add Device] button.

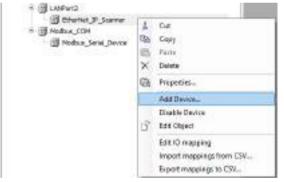
🖟 🛆 đã Device	3
levice: LXNPort3	
Name Redbaren Redbaren	
and there P.Stern	

Image of added device and tasks

After an EtherNet/IP scanner device has been added, a device and tasks are added to the Device tree, as shown below.



- 2. Add a remote adapter device.
 - **2-1** Right-click the "EtherNet/IP scanner device" object added in "Step 1" and select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

2-2 Select a remote adapter device to be added and click the [Add Device] button.

🗐 Add Deve	C#	
Device: D	futbd_P_3cene	
	Etwenter(17 Etwerter(17 Remote Adapter Etwerter(17 Remote Adapter Fr-SH-CONTROL UNIT AFFIN-CRUETCRUET Provide contract, unit AFFIN-CRUETCRUET	
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Name: PTA	PULINIT AMPROPRIE	
Device Jus	alation.	Add Device Ognicel

A new remote adapter device can also be added by selecting an EDS file. Click the [Install Device] button and select a desired EDS file.

Device tree after devices are added



Setting up an EtherNet/IP scanner device

Set up an EtherNet/IP scanner device as below.

¹² Procedure

- 1. Double-click "EtherNet_IP_Scanner" in the navigator pane.
- In the "General" tab, select the "Auto-reestablish connections" check box. When the check box is not selected: The device is stopped in the event of a communication error.

When the check box is selected: The device is reconnected automatically in the event of a communication error.

General	Options	
ElferNet/IF Scarper Parameters	Auto-reastablish convections	EtherNet/IP
EtherNet/IP Sciencer (/C Mapping		
EtherNat/IP Scare er IEC Objects		
Status		
Information		

Setting up a remote adapter device

Set up a remote adapter device, as below.

Setting items for remote adapter devices differ according to the EDS file. The following procedure is explained, using Panasonic "AFP7CPS31E" as an example.

¹² Procedure

- **1.** Double-click "FP7CPU_UNIT_AFP7CPS31E" in the navigator pane.
- 2. In the "General" tab, set an IP address and items to be checked at the time of connection.

	Address Settings	
Convections	(1) Paddress 152. 168. 0. 2	Ethen Vet/IP
Assevbies	1100	
User Defined Foreneters	(2) Electronic Keying Kering Cottons	
EtherNet/IP Parameters	Competibilitycheck	
EtherNet/IP IEC Objects	E Strict identito check	
the weyle lies collects	Check device type 12	
Statua	Check sendsr 3D 215	
Information	Check product code	
	Check major revision	
	Check minor revision	
	Flatters A Character conductor	
Set the I Select ite Comp The a In this Strict	P address of the adapter device.	ty check.
Set the I Select ite Comp The a In this Strict	P address of the adapter device. c Keying ems to be checked at the time of connection patibility check dapter device executes its own compatibili c case, the user can select only the "Check identity check ser specifies check items individually. , it is OK to use the default values.	ty check.
Set the I Set the I Select ite • Comp The a In this • Strict The u Normally et a connection	P address of the adapter device. c Keying ems to be checked at the time of connection patibility check dapter device executes its own compatibili c case, the user can select only the "Check identity check ser specifies check items individually. , it is OK to use the default values.	ty check. device type" check box.
Set the I Set the I Select ite • Comp The a In this • Strict The u Normally et a connection	P address of the adapter device. c Keying ems to be checked at the time of connection atibility check dapter device executes its own compatibili c case, the user can select only the "Check identity check ser specifies check items individually. , it is OK to use the default values. point.	ty check. device type" check box.

The second secon

Paramaters Nets Unit Data Spa Minimum Maximum Default Holp Sning

The "New Connection" window will be displayed.

Additionations

configuration costs

Fact and pages [2] Hart Summer D

3-2 Set up parameters required for connection.

the Colorado and

Biarla, Pitranaise Biarla, Pitri, Schum

Definite:

3.

Geretic connection Predefined connect polos of Connection	freely configurable) on (EDS file)				
Connection Name	O>T Size (Byte	() T>O Size (Bytes)	Praxy Config	Site (Bytes)	Target C-
Input Only (Tag t	the second se	2			
Input Only (ID by	м) D	2			
t eneral Perameters				1	>
Connection Path	20 04 34 01 30 PE 30 00 5	400			
Tripger type	Cycle	69°I (ma)	50	÷	
Transport type	Enput only	Timeout mult	plier 4	~	
nner to Target (Du	avit)	Target to Scarv	er (Inpul)		
Q->T size (bytes)	a	T->0 sus (b	(14A) 2		
	ytes) 0				
Prove canfig size (b					
	nytez) (g	-			
Target config aloa (rytez) 0 Paint to Point	Connection t	ne Multo	st	ŵ.
Tanget config alos) Connection type	Point to Point	Connection t	and		w w
Proxy carify size() Target config size() Connection type Connection Priority Fixed/Variable	Paint to Point	-	nante solied		
Target config alos) Connection type Connection Priority	Paint to Point ocheskiled	Convectionp	nante sched e Fixed		

This section displays the connection points that are supported by the adapter device according to the EDS file.
 Select a connection point to be used.

Example: Select "Input Only (ID type)".

(2) The parameters in the "General parameters" section differ according to the selected connection point.

Example: Set "RPI" to 10 (ms) and "T \rightarrow O size" to 16 (bytes).

f Info.

• For tag connection, uppercase English letters cannot be used for tag names.

4. In the "Assemblies" tab, set up a data configuration.

If "T \rightarrow O size" in the "General parameters" section is set to 16 bytes, the default data configuration will be as shown below.

Deraid .	Orrecting.				
CHINESONE .		Sax Byteri Proxy-Config Sax	Bytest 7	egit Cenfig Size (5)/sci	
CONTRACTOR OF	Libert Oriv El Spri 0 55				
Inter-Oxford Parameters		(13) 13(1) 13(1)	10.000		
Bardad/P Persona	Datter HeavyDy 'Duter' (D-94)	Post Asserbly Tran		and the second second	
	Add to famout the Marry Lin & Marry Marry	Add 3/ Teleter	and the second second	second in the second se	10.00
New York/19 1/10 Name ing	Harry Tota Type Still Longity Halp String	ALC: N	Data Type	RATINGS Held 20	140
	12730-9 DOAZHLE DOZOG 534 BALA 2796 (K. 1	bya.t./mard	10.4	4	
Nor-Ves/1P IEC Objects		Paul, Pavel	516	1	
		Inout_Pieroni]		*	
Pater		Inst.Paul			
		Sput_Paramit	370	1.8	
Montal Int		True Paul		1. Contract of the second s	
		Vo.t_Permi			
		Shriftman)		1.4	
		Port Parent		1.1	
		- 293.2, P#300			
		Dys.4_Paramill		1	
		lip.i./www.ll		3	
		Doug. Parami		1	
		Mo.t.Peret II		1.5	
		Pput_Perantif			
		True, Perset1	0.5	1.0	

To change the data structure, click a relevant data type and select a desired data type. In the following example, the BYTE type (16-byte data structure) is changed to the WORD type (4-word data structure) and the DWORD type (2-word data structure).

ave	Data Type	Stiegh	Help States					
inst, Parano	EVTE -	- 10 m						
Induk Perend	UREAL	6			Input Amentaly Traut	C (7 - 1-20)		
- keid ywierd	NER.	14			1.202.00	Contraction in the later		
Input Persend	STACKS I	0			Add Collector	ir Mandilla	· Marris Disno	1
TRACTWARK .	WCHC:				Name	Data Type	Bit Length	Help String
Inst. Perent	LINT-	a.			TANK Discoution In 11	1.0.3	and the second sec	Link sound
hast.Parent	LDENT	8			input_Paran0	MORD	16	
light (Rear)	LINDET	a.			Input Parant	MORD	16	
- Ins.4_Perend	UNIT UNIT	8		, r	Input Peremi2	UCRD:	16 16	
Text, Parameter					Input_Peren3	WORD.	16	
Inst Permit	ALLE	10			11120005000000			
- Ins.4, parameter	80710	*			Isput_Param4	DIVORD	32	
Inst Permit	0/70	16			Input_Paran5	DWORD	32	
· SoldPermit	BCTC:							
insut, Parantsk	6175							
Input Penentill	BITE .							

- 5. In the "EtherNet/IP I/O Mapping" tab, map data to variables in the application POU, as below.
 - **5-1** In the POU, create variables to which data is to be mapped.

TROCEVE LINET APP NOPS		10.1	nc)	nku S	x
VAR wToDeta	i.e	JARAY	(11)	OF	VCR0.
dvCoData	- 4	JARA Y	11	or	DMCBD1

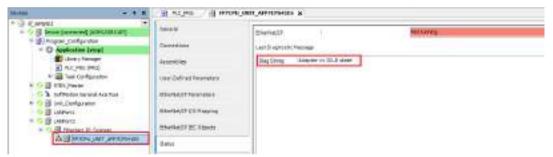
5-2 Map I/O data to each variable that has been created.

General	find	fitt Deval			7.49.60	相权	O Chamial.
Connections	Validate = Calificant Only CD transi	Mapping	Channel	Address	Type	Unit	Decolptice
Amarttha	 W specific unit, previouslas (i) 		Tot. Faces	-	WORE-		
	StateGate, 319, 319, and states \$	70	Fest/Fermi	1000	WORD.		
User-DelivedParameters	# spekator.PtC_8PS.sTobeta(3)	10	inst Pereid	8.2W04	WORD		
	* application of a	7	TOUL/REALT	-	WORD		
standy have been	* Application-PLC_RPS-dvFaCet(1)		Indust Parami	84218	OVICED		
	Papelcation/LC_BPG.dvTaDaraCE		Input Parters	142212	ON/ORD		
CherNet/FI UO Peba no			Ind.Pagel	9,0900	ave.		
A			Inst Past 7	4,7361	007		

13.4.5 EtherNet/IP Scanner Operation

When a project in which EtherNet/IP scanner settings have been configured is downloaded to the GM1 controller and then an adapter is connected, cyclic communication is started, regardless of whether the GM1 controller is set to RUN or STOP mode.

When the GM1 controller is set to STOP mode, the remote adapter is placed in "Adapter in IDLE state" and displayed as \triangle in the Device tree.



When the GM1 controller is set to RUN mode, the remote adapter is placed in "Adapter running" and displayed as O in the Device tree.

- 1 E	H HALING (1) HANDA	U UNIT APPRESSION &	
Constant (C	Televelane	Cherrier, 17	Ramp
Liney Surger	documentary.	Had String VARION (LANIA)	
 ・ ・ ・	Vale Ordinat Resentation		
Or D Soffworen General Aca Hos Or D Softworen Or D Softworen	Shink(Fiverage)		
- O B (MPort) - O B Hanlet P Jonese	Sherbed P BC Stores		
C) 📓 HICH, JAN, MITCHES	0.etu		

To perform a status check or reset using a program, use I/O of the remote adapter device. The following is an example of adapter operation using device I/O.

Declaration section (common to ST and LD programming languages)

PROGRAM PLC_PRG		
VAR		
eState	: loDrvEtherNetIP.AdapterStat e;	
		// Remote adapter status

13.4 EtherNet/IP

	xDiagnosticAvailable	: BOOL;	// TRUE if there is diagnostic information
	sDiagString	: STRING;	// Diagnostic string
	xAcknowledge	: BOOL := FALSE;	// Approve diagnostic information
	xReset	: BOOL := FALSE;	// Remote adapter reset
END_VAR			

Implementation section (ST programming language)

eState := FP7CPU_UNIT_AFP7CPS41ES.eState;
xDiagnosticAvailable := FP7CPU_UNIT_AFP7CPS41ES.xDiagnosticAvailable;
sDiagString := FP7CPU_UNIT_AFP7CPS41ES.sDiagString;
FP7CPU_UNIT_AFP7CPS41ES.xAcknowledge := xAcknowledge;
FP7CPU_UNIT_AFP7CPS41ES.xReset := xReset;

Implementation section (LD programming language)

1	. Get Beente adapter statue	
	FPCH2_BEIT_AFPOCH41EE.elvate - HMS eltate	
1	Get alaptophic infranction	
	TYTCPL_NUT_APTCPLIATion_Compositionsiable	disporticipaliste
	Bet Disposition etcing	
	FITCH _ MAX	
	Augente disperation information	
	skicknowlettpe 1 1	HALL THE PARTY PAR
	Austria adapter auses	
	aleriet	##91090_0807_A##9107043333.abbaes

The current state of the remote adapter is stored in eState.

Exampl	When line is connected	RUNNING
е	normally:	ENCAPSULATION CONFIG
	When line is disconnected:	

If an error occurs, xDiagnosticAvailable will be set to TRUE and a message will be found in sDiagString.

If xAcknowledge is set to TRUE, xDiagnosticAvailable will return to FALSE.

If xReset is set to TRUE, the line will be closed temporarily and then reconnected.

(To reset all remote adapters simultaneously, use xReaset of the EtherNet/IP scanner device.)

13.4.6 EtherNet/IP Adapter Function

The EtherNet/IP adapter function allows the GM1 controller to communicate with EtherNet/IP scanner devices.

13.4.7 Setting up the EtherNet/IP Adapter Function

This section explains how to set up the EtherNet/IP adapter function.

Adding devices

Add a local adapter device and module device to the Device tree, as described below.

¹² Procedure

Add a local adapter device.
 A local adapter device serves as a connection point to which the scanner device connects.

1-1 Right-click the "LANPort2" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.

I UNITARIZ Madbur, SOM Madbur, Jamal Davas	-92	Froperties_
	1	Add Device
	Ū,	Edit Object
		Edit IC mapping Import mappings from CSV
		Export mappings to CSV

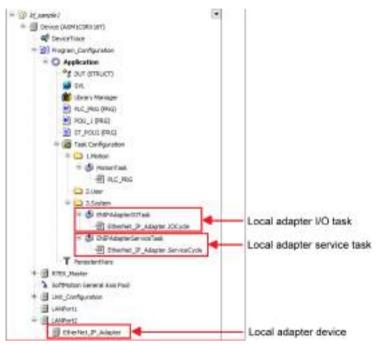
The "Add Device" dialog box will be displayed.

1-2 Select "EtherNet_IP_Adapter" and click the [Add Device] button.

📑 Add Device	
Device: LKNPort2	
Name Parts Par	
Nerse Starfiel, JT, Adarbs	
	Kat Device Cancel

Image of added device and tasks

After a local adapter device has been added, a device and tasks are added to the Device tree, as shown below.



2. Add a module device.

A module device defines data to be transferred via cyclic communication.

2-1 Right-click the "Local adapter device" object added in "Step 1" and select "Add Device" from the context-sensitive menu that is displayed.

therliet, P., Adapte Modus, COM Modus, Send, Janka	A B B X	Cut Copy Parts Datate
	-	Properties
		Add Device-
	3	Disable Device Edit Object
		Edit IC mapping Import mappings from CSV Export mappings to CSV

The "Add Device" dialog box will be displayed.

2-2 Select the "EtherNet/IP Module" object to be added and click the [Add Device] button.

🖉 Add Divice		
Device: EtherNet_P_Adepter		
Name		
= 🔂 Nebburen = 🏎 Efretrestik		
= thereau		
Enerey/P House		
ene: [theriet_P_Mobile		_
	Adt Device	Cancel
		-

Image of added devices

Multiple module devices can be added within a local adapter device.

The following is an example of four module devices added to a local adapter device.



Settings of local adapter device

Check the settings of the local adapter device.

¹² Procedure

- 1. Double-click "EtherNet_IP_Adapter" in the navigator pane.
- 2. In the "General" tab, check the settings of the local adapter device.

Seneral	EDS File		
BherNet/IP Adapter Parameters	Vendernene	Parasaric Industrial Devices SURX Co.	EtherNet/IP
thefiet/IP Adapter UII Mapping	Vender 20	338 🗘	Etherneon
	Product name	AGMILCSRX16	(1)
ChierNat/IP Adapter IEC Objects	Product code	8 2	1.16
Ratuo	Majormation	4 🔹	
Information	Minor revision	1. 学	

(1) The settings of the local adapter device are shown below. However, the settings cannot be changed.

Vendor name: Panasonic Industrial Devices SUNX Co., Ltd. Vendor ID: 216 Product name: AGM1CSEC16 Product code: 6 Major revision: 1 Minor revision: 1

(2)

- For the following items, the settings cannot be changed.
 Install to Device Repository
 The remote adapter device specified here is registered as a device in CODESYS.
- Export EDS File The EDS file specified here is output. For scanner device settings, use the EDS file provided by Panasonic ("PanasonicGM1CSEC16_0006_0101.eds").

Setting up a module device

Set up a module device, as below.

¹² Procedure

- 1. Double-click "EtherNet_IP_Module" in the navigator pane.
- 2. In the "General" tab, set module information.

Gevenal	Modula Informat	128	
EtherNet/IPModule Revenuebers (1)	Madule	Ryte Topul Hadde	EtherNet/IP
Dherholy'P Madule VO Mapping	Vendor neme	Parasonic Industrial Devices 13/MX Co., 1	
CherNet/IP Module EC Objecto	Verail D	246 (1)	
2818 (2)	Pedatterre	Byte Input Module	
1 million (1 million (Product code	162 (
afameton	Major revision	4	
	Piter / William	1	

2-1 (1) Select a desired module type from the following 10 types.

Module type	Size	Direction
Byte Input	1 byte	O→T
Byte Output	1 byte	T→O
Word Input	1 word (2 bytes)	O→T
Word Output	1 word (2 bytes)	T→O
DWord Input	1 double-word (4 bytes)	O→T
DWord Output	1 double-word (4 bytes)	T→O
Real Input	1 single-precision real number (4 bytes)	O→T
Real Output	1 single-precision real number (4 bytes)	T→O

Module type	Size	Direction
Big Input	509 bytes	O→T
Big Output	505 bytes	T→O

By generating multiple module devices and setting module types, data structure can be created within cyclic data.

Example) T \rightarrow O data: 8 bytes, O \rightarrow T data: 6 bytes

		T-C	0 data: 8 by	les
Module 1	Word Output		WORD	2 bytes
Module 2	Word Output		WORD	2 bytes
Module 3	DWord Output		DWORD	4 bytes
		0	T data: 6 by	108
Module 4	Word Input		WORD	2 bytes
Module 5	Real Input		REAL	4 bytes

Note

- The maximum data length within a single connection point is as follows:
 O→T data: 509 bytes
 T→O data: 505 bytes
- **2-2** There is no need to set all items in (2), as values cannot be entered.
- **3.** In the "EtherNet/IP Module I/O Mapping" tab, map data to variables in the application POU, as below.
 - **3-1** In the POU, create variables to which data is to be mapped.



3-2 Map I/O data to each variable that has been created. Double-click the section indicated by (1) and select a variable to which I/O data is to be mapped.

Vendle						AALIN BUILD CLASSEL	
(1) + "+ spiper All (2)	Maiping	Channal Overclam	Address Ngivos	3p+ #040	54	Oescription	
Bia Anat Tr Huode Cro Macang							

13.4.8 EtherNet/IP Adapter Operation

When a project in which EtherNet/IP adapter settings have been configured is downloaded to the GM1 controller and then RUN mode is invoked, the adapter device responds to a ForwordOpen packet from the scanner device and cyclic communication is started.

The following shows the respective states of the local adapter device and module devices during normal operation.

Derese V N	Previer_IP_Med.AL	Bharlick_D_Adaptor x	
 Classes Classes Repart Lowested (APPCR0101) Repart Lowested (APPCR0101) Conjunction (and) Conjunction (and) Classes <li< td=""><td>Gerand Attention(19 Adapter Heranden) Diserver(19 Adapter 10) Herping Attention(19 Adapter 10) Objects Status Diservative</td><td>Rhadian P Adama i Lantin ag unit (Passage Dag Strog 1967</td><td> Surring</td></li<>	Gerand Attention(19 Adapter Heranden) Diserver(19 Adapter 10) Herping Attention(19 Adapter 10) Objects Status Diservative	Rhadian P Adama i Lantin ag unit (Passage Dag Strog 1967	Surring

The local adapter device and module devices are displayed with "O" symbol in the Device tree and the status of the local adapter device is displayed as "Adapter running". The local adapter device can be connected from multiple scanner devices.



• ExclusiveOwner connection (using O→T data) is allowed for only one scanner device. This is to prevent the same variable from being overwritten with input data from multiple scanner devices.

14 Other Controller Functions

14.1 SD Card Access.14.1.1 Overview of SD Card Access Function14.1.2 File Manipulations Using the CAA File Library.	
 14.2 Time Function	14-10 14-10
14.3 Trace Function	14-11
 14.4 Recipe Manager Functions	14-16 14-17

14.1 SD Card Access

14.1.1 Overview of SD Card Access Function

The GM1 controller allows directories and files to be written to and read from the SD card via the CAA File library.

Preparation for SD card access

- 1. Before starting operation using the CAA File library, always use the following function of the Panasonic_GM_System library to check whether the SD card can be accessed.
 - a) SYS_GetSDAccessRdy: Reads the mount state of the SD card

TRUE: SD card is accessible. An SD card has been inserted.

FALSE: SD card is inaccessible. No SD card has been inserted.

- 2. Considering situations such as removal of the SD card during operation, use the following function to check whether the SD card cover is open or closed.
 - a) SYS_GetSDCoverState: Reads the open / closed state of the SD card slot cover TRUE: The SD card slot cover is closed.

FALSE: The SD card slot cover is open.

When the SD card slot cover is open, the SD card can be removed safely by stopping processing such as writing or reading directories or files using the CAA File library.

	Prepared value	Value	Type	Expression
		FALSE.	8000	bMount
		TRUE	8003.	# bCover
		TRUE		# bCover

14.1.2 File Manipulations Using the CAA File Library

This section explains how to use the CAA File library to access files on the SD card, in the following order.

- 1. Library_Manager
- 2. Example of file write processing
- 3. Example of file read processing

1. Library_Manager

Check that the following CAA File library is registered in Library_Manager.

Name	Nerrespace	Effective version
🕴 🌍 25. janua – 25. janua, 3. 5. j.4.0 (25 Start Taftware Salutions GebH)	_35_11039458	3.3.34.0
🕴 🔁 Grankpolet.opping – Breikmiert.opping Flasstarin, 1.5.5.0 (33 - Seart Gebiene Goldani Gebie)	HR.co	13.1.6
* CAA File = CAA File, 3.5.150 (CAA Technical Illorkgroup)	FILE	3,5,15,0
🗧 📒 CAA NetBaseSry = CAA Net Base Services, 3.5.25.0 (CAA Technical Workgroup)	185	3.5.15.D
🕴 🔁 CAA SenatConi = CAA SenatConi, 3.5 15.0 (CAA Technical Workgroup)	COM	3.5.15.0
🕏 💆 SucryEthernet = SucryEthernet, 3.8.15.0 (SE - Smart Suffware Substora Grahm)	DOvEnerie!	3-3,25,0
Indeviation = Indeviation, 0.6.6.2 (Personalized)	InDevR200	6.8.8.0

2. Example of file write processing

SampleDir/SampleFile.txt is created in the SD card and specified data is written to the file.

File write processing sequence

The file write processing sequence is shown below.

- File open processing (overwrite mode, insert mode)
 - Overwrite mode: For existing files, the contents of the file are cleared.
 - Insert mode: For existing files, the contents of the file are not cleared.
 - When write is executed, data is written following the end of the previous data.
- File write processing
- File close processing

Explanation of variables

uiProcess:

Executes processing when file open processing is set to 1 (overwrite mode) or 2 (insert mode). After the execution is completed, the variable is set to 0 (invalid value).

sFileName:

Specifies a directory or file name.

sWriteData:

Sets data to be written.

bResult:

Substitutes the result of processing execution. (TRUE: Error occurrence, FALSE: Normal termination)

If the result of processing execution is abnormal, check the error code of each processing.

- eOpenResult: Result of file open processing
- eWriteResult: Result of file write processing
- eCloseResult: Result of file close processing

Operation example

- In this example, operations are performed by setting the value of uiProcess to 1, 2, and 2 in this order.
- The contents of SampleFile.txt which is output are as follows:

NEW_DATA ADD_DATA1 ADD_DATA2

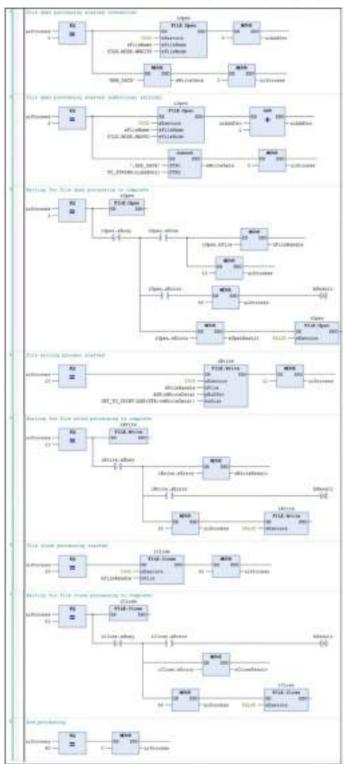
• Sample program

Declaration section (common to ST and LD programming languages)

4	PROGRAM FileWrite		
	VOIR		
	bResult	T BOOL IN FALSE?	(/ Protessing result (TALLE-contral TROD-absormal)
1.4	eOpenDesals	FILE, ERROR (// Film specific
1.4	eWgiteRegult) FILL ERROR:	// File waits shault
	*CloseResult	t FILE.ERROR:	// Tile times popult
	offileNeme	(STRENUETD) 1- There	slwffig/faceplwffile.com*g
			// The name of the file to year
an	sWriteDate	: STRENG(150):	// Date to white
144	ui.keeCot.	+ UINT)	W Addition write count
1.1			
1.0	uiFrocess.	± UINT 1= 0/	// Troomszing comber(Derverweite mode) Derrite-come mode)
24	hFileHendle.	FILE CAA BANDLE	// File handle
2.1	iOpen.	: FILE.Opens	// Fils open Function Black instance
1.0	INcite	: FILE.Mriter	// File read Function Block instance
12	1Close	r FILE.Close;	of File Close Instance of FunctionFlock
17	BD WAR	NAMES AND ADDRESS OF ADDRESS OF ADDRESS	

Implementation section (ST programming language)

CASE ul.Fridenie OF	
10 // file ges produces started invert	
efileHode as FILE.HODE HEALTH .	(/ file met generating statted
stilliate in stilliant in	
eMiniteDeta := "NEW VATA":	22 Hale extrage to asile
ULANCEL (= ()	// initialize the humber of somitional writes
mifroness (= h)	// franciting to culting for file may proveeding magistics
- 3) // file aper processing started inditio	
idpin sizeoute - Title -	// file open processing statted
wFileNode := FILE.NODE.SAVPO .	// Atlentin anis
aftlefete og aftlefete tr	ov ette new
Afiledane := afiledane); uiAbdCrt := uiAbdCrt + 1;	() Abholden arite court emists
sWriteDets := CONTAT (* . ACC_INTA*, TO STR.	TWE dut addCet ht r
	11 lists settings to write
uiFromes := Sr	// Transition to waiting for file upts processing completion
10 // Berting for file open processing to t	
afgleSandle is iOpen.bfiler	AV del file Annile
edpestesuit := iOpen.efance;	22 File open proceeding regult acquinition
alfrocess (= 11/	(7) File uses completed scinally (7) Det Tile Annula (7) File uses proceeding result acquisition (7) Transition to File scile processing
(Spek) affactute (= F1238 b)	// File upon proceeding Filiated
BLAIF LODGELARDONS - TRUE TREE	// file oper processing entry surgered
edpendenuit >+ 10pmeturns;	27 file open parameters annull acquisition
alfroques 14 Mar	// Transition to and generating
passit :- JPER:	27 Annormality
iOpen (sEsecute 1+ EALIE);	1) Tile open prochasing finished
BHD IF	
At: // File valing process started	
iRoita sinacina := 1000 .	// File swad processing shutted
hfile (= hfileHendle)	// fily havefir optained by opening a file
pBuffer := ADB(sMriteDate) .	
ecSize := INT TO UDINT (LED (STR:-	
Contraction of the Contraction o	// Write data dige offer character stains!
ulfrootss to Ili	20 Transition to valuate for file white proceeding completion
111 // Waiting for file seits processing to	
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estiteBestit == 18rite.eErpor:	W tite and a literature manys wederstates
alfrooms 1+ 13:	// file write processing result sequinities // Transition to file closing process
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eWriteSteeds == LWrite.eErrort	 7118 writing process completed 7118 write processing envir conspond 7128 write processing result arguinities 7200 write processing results arguinities
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Implementation section (LD programming language)

3. Example of file read processing

Data in SampleDir/SampleFile.txt in the SD card is read into the buffer.

The effective range of data read into the buffer is judged from the data size information that is output after read processing.

File read processing sequence

The file read processing sequence is shown below.

- File open processing (read mode)
- File read processing
- File close processing

Explanation of variables

uiProcess:

Executes processing when the variable is set to 1 (read mode).

sFileName:

Specifies a directory or file name.

sReadData:

Sets a buffer into which data is to be read.

szReadSize:

Stores the size of read data after read processing.

bResult:

Substitutes the result of processing execution. (TRUE: Error occurrence, FALSE: Normal termination)

If the result of processing execution is abnormal, check the error code of each processing.

- eOpenResult: Result of file open processing
- eReadResult: Result of file read processing
- eCloseResult: Result of file close processing

Operation example

• In this example, operations are performed according to the following contents of SampleFile.txt.

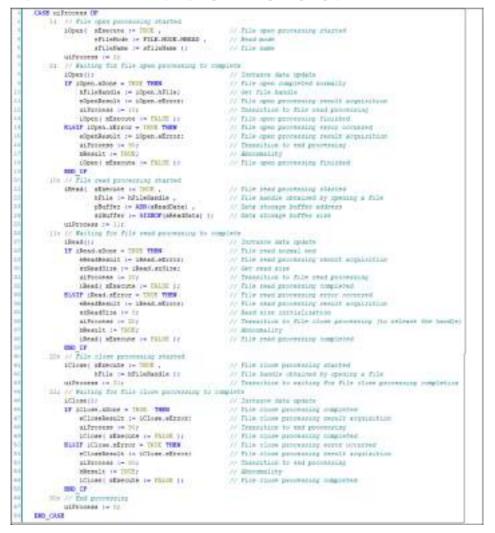
NEW_DATA ADD_DATA1 ADD_DATA2

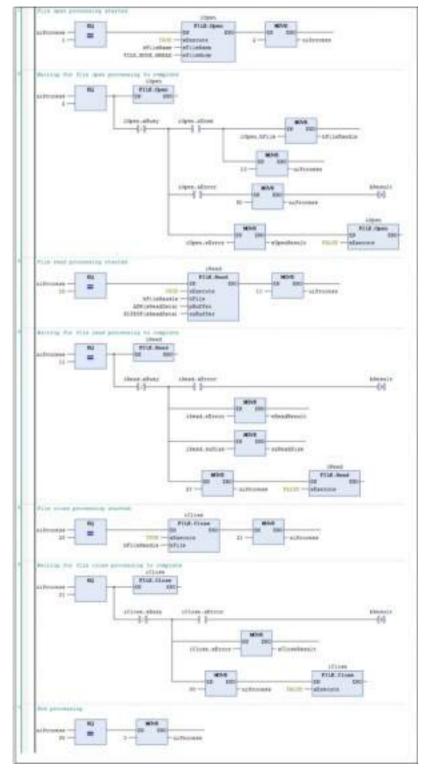
- Read data and data size are as below.
 Data (STRING type): 'NEW_DATA\$R\$NADD_DATA1\$R\$NADD_DATA2\$R\$NADD_DATA3'
 Data size: 41
- Sample program

Declaration section (common to ST and LD programming languages)

1	PROGRAM FileRead		
1	VAR		
4	bRegult	I BOOL IN THINKS	// Proversing result (FALSD-normal , fROE+abnormal)
1.	eOpenResult	I FILE.ERBOR:	// File open result
	effeedHesult	I FILE. ERNOR:	// File read result
1	eCloseSeguit	: FILE ERROR;	// Bile close result
10.	afileName	: STRING[87] := "Earg	teDir/famplefile.vmt';
2			// The same of the file to sead
4.0	scReadSize	1 FILE CAA. SIZE/	// Seed data size
+1	sinadData	+ STRENG[350]/	// Smail date
12			
18	ulFudcess	1 HINT 1= Cr	// Process number(1-read made)
14	hfileHandle	FILE.CAR.HANDLE;	// File handle
1.6	10pen	1 FILE.Open:	// File open Function Slack instance
16	iRead	; FILE.Read;	// Fils read Function Block instance
17	iClase	: FILE.Close;	// File Class Instance of FunctionBlock
1.0	END VAR		Sectores of the monthly of the sector

Implementation section (ST programming language)





Implementation section (LD programming language)

14.2 Time Function

14.2.1 Overview of Time Function

This section explains the time function that uses date and time settings in GM Programmer and function blocks.

14.2.2 Settings Based on GM Programmer

Date and time settings and monitoring for the GM1 controller can be performed using the "Date and Time Settings" window of GM Programmer. Connect to the GM1 controller and select the "Date and Time Settings" tab of the "Device" window.



Date and Time Settings pane

	1		
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lerme Fights			
hi ber		Cel mate/laws from FC(D)	Automatic input of dat
1.00			and time from PC
Pull Paramatary		10040	40.

The "Device Date and Time" frame on the left side of the pane displays the date / time information of the GM1 controller. To set date and time, enter date and time in the "Date and Time" frame on the right side of the pane and click the [Update] button. The entered date and time will be set in the GM1 controller.

If the "Get date / time from PC" check box is selected, the date/time information of the PC will be automatically set in the GM1 controller. In this case, the time zone of the PC will be automatically set in the GM1 controller.

14.2.3 Settings Based on Function Blocks

For details on how to use this function, refer to the GM1 Series Reference Manual (Instruction).

14.3 Trace Function

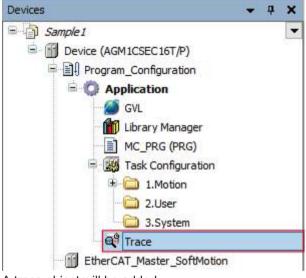
The trace function allows the variable value histories in the GM1 controller to be checked in GM Programmer. Trace start timing can be specified with options. Recorded data can be checked in the form of a graph. Data obtained by the trace function can also be saved in XML, text, or CSV format.

14.3.1 Setting up Trace

To use the trace function, after adding a trace object, you must register variables to be traced.



1. Double-click the Trace object in the main pane.



A trace object will be added.



This completes the procedure for adding a trace object.

Next, the procedure for registering a task and variable to be traced is explained.

2. Click the "Configuration" link.

The "Trace Configuration" dialog box will appear with the "Record Settings" pane displayed.

Race Configuration		3
Trace Record Trace	Record Settings Bijsblie Tripger	
	Truper variable +	
	tilggergdge -	
	Brattrigge Gamples	
	Tripper Lovel	
	Ibsk 😐	×
	Record condition	
	Cogment	
Presentation (diagrams)		
Tirte ada		
	Resolution -	
	Regolution mu 🗸	
	advanced	
ddWatabla	Result Display is effortige	OK Carol

 In Record settings>Task field, select a task to be traced. You can select a task from a list of tasks registered in the project. Select a task that you want to trace.

Record Settings		
Enable Trigger		
Trigger variable 🔹		
Trigger edge	~	
Posttrigger (samples	0	
Trigger Level		
Task 🗧	×	
Record condition	MotionTask 🖉	
Comment		

- Click the [OK] button.
 The selected task will be registered in the trace object.
- 5. Click the "Add variable" link.

The "Trace Configuration" dialog box will appear with the "Variable settings" pane displayed.

Trace Record	Variable settings	
- Trace	Variable 😔	
-	Graph golor 🗾 Blue	*
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	Addresse trassmust warring	
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 Diagram t Yawip 	and Theorem 1	
= Showe variables		
1 - -		

6. In Variable settings>Variable field, enter a variable to be traced.

Either directly enter a variable to be traced or click the ... button to display the "Input Assistant" dialog box and then select a desired variable from the dialog box.

In the Variable settings field, you can set a graph color, types, and other items for the variable.

Example: Entering variable iVar0 for ST_POU object

Variable settings			
Variable	•	ST_POU.iVar0	
Graph <u>c</u> olor		Blue	-
Line type		/ Line	-
Point type		• Dot	/

7. Click the [OK] button.

The entered variable will be registered in the trace object.

8. Repeat steps "Step 5" to "Step 7" to register other variables to be traced. The entered variable will be registered in the trace object.

Example: Entering variables iVar1 and iVar2 for ST_POU object

-		Configuration Add Variable
-	No sencies nave been recorded	51_P0U.War0 51_P0U.War1 51_P0U.War1 51_P0U.War2
-10-		ST_POLLNW2

This completes the procedure for registering variables to be traced in the trace object.

14.3.2 Executing Trace

By executing a trace, you can check the variables registered in the trace object.

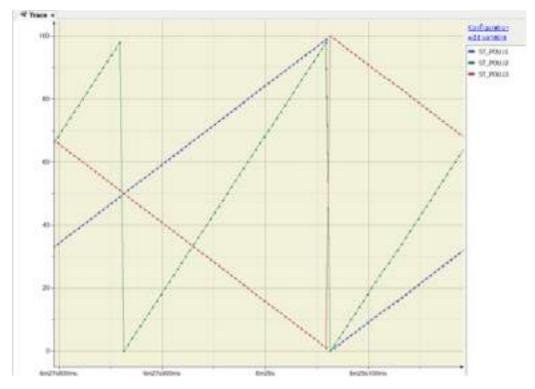
¹ 2 Procedure

1. Connect the PC where GM Programmer is installed and the GM1 controller and log in to the GM1 controller.

For details, refer to "8.5 Connecting to the GM1 Controller".

2. From the menu bar, select **Trace>Download Trace**.

A trace will be started. After a cycle task is executed, the values of the variables registered with the trace object are recorded and displayed in the trace object.



From the menu bar, select Trace>Stop Trace.
 The trace will be stopped. To start a trace again, from the menu bar, select Trace>Start Trace.

i Info.

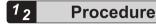
- With respect to the trace display window, you can use "View" and other menus to zoom in or out, expand or shrink the time axis, or adjust variables. From the menu bar, select "Trace" and then select an appropriate menu item for the operation to be performed.
- Traced data can be saved. From the menu bar, select **Trace**>**Save Trace**. With "File type", you can select a file format for the trace file to be saved.

14.4 Recipe Manager Functions

With the Recipe Manager, you can add recipes and alos switch and control the recipe data.

14.4.1 Setting the Recipe Manager

This section explains how to add and set Recipe Manager objects.



 Right-click the "Application" object in the navigation pane and select Add Object >Recipe Manager from the context-sensitive menu that is displayed.

The "Add Recipe Manager" dialog box will be displayed.

	# Recipe M	anager	
Name			
Expetition			

- 2. Click the [Add]button.
- The Recipe Manager setting window will be displayed. The default settings can be used as is. You can also make settings if necessary.

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Veputh		1	-
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NOR HOL			
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(spara	*-	01	
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valiable Columns	1.2.1	Selected Columns	
Type:	- 100	Current take	
Comment			
Maximal Value:	Sec.		

Name	Function
Storage type	Select a character string.
File path	Specify the path to store a recipe file.
File extension	Possible to set a desired name with up to 10 characters.
Separator	Specify the delimiter within the recipe file. Example) AAA (variable name): = 1 (value) BBB (variable name): = 12 (value)

14.4.2 Setting the Recipe Definition



Procedure

 Right-click the "Recipe Manager" object and in the navigation pane and select Add Object>Recipe Definition from the context-sensitive menu that is displayed. The "Add Recipe Definition" dialog box will be displayed.

Nate		
100020		

- **2.** Enter a recipe definition name and click the [Add] button. Possible to set a desired name with up to 35 characters.
- **3.** Move the cursor to below the variable, enter a variable name you want to add to the recipe definition.

🔍 SettingData	×					
Variable	Type	Name	Comment	Minimal Maloe	Maximal Volum	Current Volum
GiL.stSettingData	1-11					

If you enter an array or structure, a list of developed variables is automatically registered. However, since it takes time for the development if the number of elements is large, implement this only after saving the project in advance.

Vertable	Type	Nare	Continent	Minimal West	Maximal Value	Curtent Value
OVL stSettingCata.ivt_val[0]	int					
OVL stSettingCeta int_val[1]	1917					
GVL stdettingData.int_val[2]	DIT					
GVL.stSettingData.int_val(1)	INT					
GVL.stSettingData.trt_sal[4]	1547					
GVL.stSettingCata.int_val[5]	INT					
GVL.stSettingCuta.int_val[6]	DIT					
GVL.stSettingData.int_val[7]	IMT					
GVL.stSettingCata.int_val[8]	INT					
EVI. stSettingData.ivt_val[9]	INT.					
(W. stSettingData real_val)())	REAL					
(VL stSettingData real_val[1]	REAL					
0VL stSettingCata real_val[2]	REAL					
SVL stSettingData real_val[3]	REAL					
OVL stSettingData.real_val[4]	REAL					
UVL stSettingData.real_val[5]	REAL					
GVL stSettingCata.real_val[6]	REAL					
GVL stSettingData.real_val[7]	REAL					
5VL.stSettingData.real_sal[8]	REAL					
GVL.stSettingData.real_sal[9]	REAL					

14.4.3 Recipe Operation Using the GM Programmer

1₂ Procedure

- **1.** After setting the recipe definition according to the procedures described in "14.4.2 Setting the Recipe Definition", log into the GM1 Controller and download the settings.
- 2. In the login state, the current value of the variable registered is displayed in the current value.
- **3.** In the login state, move the cursor to the recipe definition and select "Add New Recipe". The "New Recipe" dialog box will be displayed.

14.4 Recipe Manager Functions

Vsriab4e	Type	Name		-Comment	Minimal Value	Maximal like	Current Volue	11853
04.stetingData.int_va[0]	DIT						0	
Gil. itSettingData.int_yal[]	307	10				-	0	
CA. HistoryDala.nt_vaEl	1917	14	A			_	0	
O/LatSettingData.int_val[3]	DIT .	10	Copy				0	
GVL-stSettingData.int_ral[4]	1941	10	Pute.				4	
GVL inSettingData_int_yie[5]	347	2	Delete				ð.	
OVLISSESSINGData.int_val(8)	194T		Select	6.9		_	4	
GVL.stSettingData_int_oa[7]	INT	-07	Same In			_	0	
G/L stSettingDieta.int_va[8]	DIT.	10	New B	makpoint			0	
GVL.stSettingData.int_val[9]	INT.	1.1	Teople	Break point			0	
G/L.#SettingData.real_yal[0]	REAL	1	Auto	a hite		-	0	
tivi, stSettingData real, valiti	REAL		1.				0	
G/L.stSettingData.real_val[2]	REAL	1	Set No.	et Statement		0		
04.40emplata.rell,vill8	PIEAL		Unforc	e All Values of The	vice.Application		0	
GVL.stSettingData.reak_vel(H)	REAL			a fan de s		-	8	
tivi, stšetnogData,reak, valijij	REAL		Display	Wode			0	
G/L.stSetSingData.veal_val(6)	REAL	- + 5	insert \	/arisble			0	
UVL.stSettrqData.real_val[7]	REAL	-10	Atto	and the second			a	
GVL.stSettingData_real_val10[REAL	- 10					0	
01L-s/SettingData.real_ywl[0]	REAL	3		Structured Variat		à		
		-	Addel	New Neuge				
		10	0.00000	e Racipe				
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			Lord R	in par-				
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		10	Aug 5	and pro-				
		47	Head a	od Save Net pr				
		-	Witer	lecture				
		10	tion a	un Wile Norge .				
		0	Thinks	Recipes from De	vice :			

4. Enter a name for the new recipe and select OK to add the recipe as show in the above figure.

Possible to set a desired name with up to 35 characters.

Norne	Gata	
Copy from existing	«Create Enpts»	ų,

5. Move the cursor to the added recipe and right-click to switch and control the recipe data.

Q SettingRote #								
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tin, attemption real year)	HDAL.						100	
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DL allelaydd arag ydd (10.5							Dapley Mode
In. etamopata kakure(4	REAL					18		Onplay Mole
Dit. #SettingSets.mail.cni03	254					4	- 14	light Veldie
TL UTHING WARMA JACK	184					.9		dated (Dollar
Plantetrigowarea_ad()	REN.							
H. Eletropleta Nal (HK)	HEN.						9	
HL-stormspieseek, viets	164						3	
							2	Add a New Percipe
							9	Partove Rospe
							1	Livel first (ps.,
							1	Save for you.
							- 34	Passi Recipe
							3	Read and fave fields
							3	Virte Rocen
							10	Lost and Vine Relips.
							-3	Upbel/NopeshonOence

i Info.

• The following operations can be performed using the GM Programmer. Items that can be operated are different depending on whether the mode is offline or online. GM Programmer

Item	Offlin e	Onlin e	Function
Insert Variable	0	0	Inerts a new variable in the recipe definition.
Add Child	0		You can add a child array that can be used in the structured view and that has not been registered in the recipe definition.
Add Sibling	0		You can add a brother array that can be used in the structured view and that has not been registered in the recipe definition.
Update Structured variable	0	0	If there are any items that are not registered in structure, they are reflected on the variable list.
Add a New Recipe	0	0	Adds a new recipe to the recipe definition.
Remove Recipe	0	0	Deletes the selected recipe.
Load Recipe	0	0	Loads the recipe file in the operating PC and write to the selected recipe.
Save Recipe	0	0	Saves the selected recipe in the operating PC as a recipe file.
Read Recipe		0	Reads the current value to the recipe data.
Read and Save Recipe		0	Reads the current value to the recipe (within the tool) and saves the recipe file in the operating PC.
Write Recipe		0	Writes the current value to the recipe data.
Load and Write Recipe		0	Loads data from the recipe file to the recipe (within the tool) and write it in the current value.

14.4 Recipe Manager Functions

Item	Offlin e	Onlin e	Function
Upload Recipes from device		0	Reads the recipe within the controller device and reflects it on the recipe within the tool.
Display mode (Decimal/ Hexadecimal)		0	-

• Switch to list view/structured view

derinder	Type	Risme	Comment	Manimul Value	Maximal West	Current Value
- GVL						
iii allatingData						
ii bt_cal						
int_rw(0)	21/7					
[2]bec_hve	247					
mt_no[[2]	347					
[5]Mac_214	25/7					
10_14E9	1107					
ht_46[0]	947					
int_x4003	161					
44_14(7)	BUT					
(S)lair_hri	1947					
178_ual[3]	2547					
= real_val						
resi_vol(2)	REAL					
real_val(s)	REAL .					
real_val(z)	NEAL					
res(_vol(3)	REAL					
real_val[4]	REAL					
(R)inv_iam	REAL					
real_vol(5)	SEA.					
(Rel_108(7)	REAL					
real_val(a)	NEAL					
rest_vo(2)	REAL					

15 Overview of PANATERM Lite for GM

15.1 System Requirements	.15-3
15.1.1 Operating Environment of PANATERM Lite for GM	
15.2 Installation and Uninstallation	.15-4
15.2.1 Installing PANATERM Lite for GM	
15.2.2 Uninstalling PANATERM Lite for GM	
15.3 Basic Operations	
15.3.1 How to Start	
15.3.2 How to Exit	
15.4 Component Names	
15.4.1 Menu Bar	
15.4.2 Toolbar	
15.4.3 Navigation Pane	
15.4.4 Main Pane 15.4.5 Status Field	
15.5 Window Operations.	
15.5.1 Moving the Pane Location 15.5.2 Switching the Tab of the Main Pane	
0	
15.6 Selecting the Device to Connect	
15.6.1 Configuring Servo Amplifier Communication Settings 15.6.2 Setting up the Servo Amplifier Connected to the GM1 Controller	
15.6.3 Editing Settings without Connecting to the GM1 Controller	
15.7 Parameter Window	
15.7 Parameter Window	
15.7.2 Setting Parameters	
15.7.3 Copying Parameters	
15.7.4 Switching the Input Format of Parameter Values	
15.7.5 Setting I/O Pin Assignment	15-31
15.8 Object Window	.15-33
15.8.1 Configuration of Object Window	
15.8.2 Setting Objects	
15.9 MINAS Parameters for the GM1 Controller	.15-38
15.10 Monitor Window	
15.10.1 Configuration of Monitor Window	
15.10.2 Checking the Monitor Window	15-41
15.11 Alarm Window	
15.11.1 Configuration of Alarm Window	15-43

15.11.2 Checking Alarms	
 15.12 Other Functions	15-47 15-47
15.13 Troubleshooting for Servo Amplifiers and Motors	
15.13.1 I Cannot Set up	
15.13.2 I Cannot Communicate	
15.13.3 I Cannot Print	
15.13.4 I Cannot Set up Axes	
15.13.5 PANATERM Lite for GM Does Not Behave Norm	nally 15-50
15.13.6 The Parameter Window Does Not Behave Norm	ally 15-50
15.13.7 The Object Window Does Not Behave Normally	15-51
15.13.8 The Monitor Window Does Not Behave Normally	y 15-51
15.13.9 The Alarm Window Does Not Behave Normally.	

15.1 System Requirements

15.1.1 Operating Environment of PANATERM Lite for GM

Programming software

Product name	Version	Applicable language
PANATERM Lite for GM	Ver.1.1	Japanese / English / Chinese

(Note 1) When GM Programmer is installed, MINAS setup support software "PANATERM Lite for GM" is installed at the same time.

Software operating environment

Item	Description
OS	Microsoft(R) Windows(R) 10: 32bit / 64bit
PC	 PC with the following software installed: Microsoft.NET Framework 4.6.1 or later Microsoft Visual C++ 2010 SP1 Redistributable Package (x86) Microsoft Visual C++ 2010 SP1 Redistributable Package (x64) Microsoft Visual C++ 2013 Redistributable Package (x86) Microsoft Visual C++ 2013 Redistributable Package (x64) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x86) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x64)
HDD	At least 4 GB of free space
Memory	At least 8 GB
Communication port	LAN port (for Ethernet connection) USB 2.0 port (for USB connection)

15.2 Installation and Uninstallation

15.2.1 Installing PANATERM Lite for GM

When GM Programmer is installed, PANATERM Lite for GM is also installed at the same time.

15.2.2 Uninstalling PANATERM Lite for GM

When GM Programmer is uninstalled, PANATERM Lite for GM is also uninstalled at the same time.

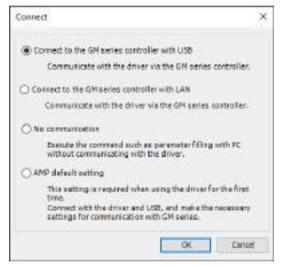
15.3 Basic Operations

This section explains how to start and exit PANATERM Lite for GM.

15.3.1 How to Start

- ¹² Procedure
- 1. Click the [Start] button in the Windows task bar and select **Panasonic Corporation>PANATERM Lite for GM**.
- 2. The "Connect" dialog box will be displayed.

Select a communication setting option and click [OK].



3. The "Series Setting" dialog box will be displayed.

Series setting	×
MINAS-A5B MINAS-A5N MINAS-A6B MINAS-A6N	
	OK Cancel

Note

When the "Selection of Aircraft Types" dialog box is displayed, select a model and click the "OK" button.

MINAS-A6BSelection of Aircraft Types	—		×
MINAS-A6BE standard MINAS-A6BF standard			
	ОК	Cance	

4. PANATERM Lite for GM will be started.

PANATERM.		 D	х
Bie Yew Jook 1	έ¢		
• • @ 0.0 D	14.		
) X		
ID: HEMAS-AGEP	^		
	-		
	(*)		

15.3.2 How to Exit

• Note that all information will be lost if you close the program without saving settings, collected data, or other information.

¹² Procedure

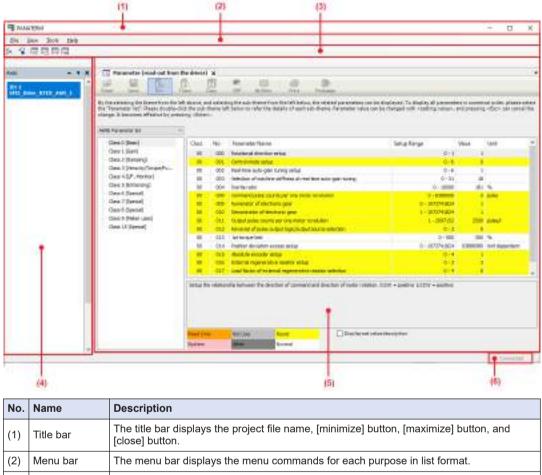
1. From the menu bar, select File>Exit. PANATERM Lite for GM will be closed.

1 Info.

• You can also close PANATERM Lite for GM by clicking the [x] button on the title bar.

15.4 Component Names

This section explains the components and displays of PANATERM Lite for GM.



(3)	Toolbar	The toolbar displays each command as an icon.
(4)	Navigator pane	This pane displays a list of axes.
(5)	Main pane	This pane displays the Parameter window, Monitor window, Alarm window, and other windows. The window can be switched by selecting a desired tab.
(6)	Status field	This field displays the status of connection to the GM1 controller.

15.4.1 Menu Bar

The menu bar displays the following menus:

File View Tools Help

File

Item	Function
Settings	Used to set up an amplifier with the amplifier connected or with a model selected. Select Model: Select an amplifier to be connected.
	Connect Amplifier: Select either the connection via PC or the direct connection for connecting the GM1 controller and the amplifier order to set up an amplifier.
Exit	Closes PANATERM Lite for GM

View

Item	Function
Axes	Displays a list of axes
Parameter	Displays the Parameter window
Monitor	Displays the Monitor window
Alarm	Displays the Alarm window

Tools

Item	Function
English	Switches the display language of GM Programmer to English
日本語	Switches the display language of GM Programmer to Japanese
中文(簡体)旧版	Switches the display language of GM Programmer to Chinese

Help

Item	Function
About	Displays version information
PANATERM Lite for GM Help	Displays the manual

15.4.2 Toolbar

The toolbar displays the following icons:

3x 🗳 🐻 🖪 🖪	60
------------	----

Name	lcon	Function
Select the drive series	8×	Sets up an amplifier with the amplifier unconnected
Opens the connrct dialog	07 •	Select either the connection via PC or the direct connection for connecting the GM1 controller and the amplifier order to set up an amplifier.
Opens the Axis view		Displays a list of axes
Opens the Alarm view		Displays the Alarm view

Name	lcon	Function
Opens the Parameter view	Ep	Displays the Parameter view
Opens the Monitor view	KS	Displays the Monitor view

15.4.3 Navigation Pane

The navigation pane displays the following tree:



No.	Name	lcon	Function
(1)	Auto Hide		Always shows the navigation pane.
		P	Minimizes and hides the navigation pane.
	Close	×	Closes the navigation pane.
(2)	Axes		Displays a list of axes downloaded to the GM1 controller

15.4.4 Main Pane

The main pane displays the following sub-panes:

15.4 Component Names

	ing xi	10				
lead laws for the selecting the theme from the in "Presenter" Int". Please double- enge, it becomes effective by pre-	eft elsevel, e Sol the sub- solve villeter	nd palet the local of 2 y	CP Backes Intel Plantage op the side default before, the related parameters are table to refer the default of each side-there. Personality series t	be displayed. To deplay all parameters an be changed with coarting releacy.	ent pressing	al érder, pleasea «Discr car cárica
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Class I (Marc) Class I (Marc)	Cless	No	Faranseler Name	Setup Range	Value	Unit
Class 2 (Centry)	82	000	Retritional Brection getax	0-1		
class z (revisit)/To/s AM	80	081	Carrient mode solup	.0.1		
Oper-4 (), P., Monitor)	80	081	wai-dra alto-gan bring artig	0-6		
class tribinariong)	80	011	Selector of machine stiffness at real-time acts gain funing	-8+50		
Date 6 (Special) 00 class 7 (Special) 00 Date 6 Concoll 00		00+	Devite Libe	I - 10000		18
		00	Convend public courts per one mater revolution	0-6388604		pulse.
		0.00	Number of Westions (pre-	8-10109-000		
		0.0	Committees of electronic pair	L-LODOUES		1000
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	80	034	Positien denterten scroppe retup	E - 197374(82)		Unit: Approvident
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	80	0.6	External representative mainter extra conditional representative research admittation	0-1		
	80	110	The manufacture of endering responsibility results and they	0-1		
		144	The restance state	4-1		_
			dig between the decision of constant and decidies of make relation			
	Stated root		there have limburght	manhatription		
			Figure 1			

No.	Name	
(1)	Toolbar	In each window, the toolbar displays commands as icons.
(2)	Main view	The main view displays the Parameter window, Alarm window, Monitor window, and other windows.

15.4.5 Status Field

The status field displays the current communication status.

Display	Description
	Indicates that there is no communication with the GM1 controller.
Connected	Indicates that there are communications with the GM1 controller.

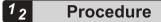
15.5 Window Operations

This section explains common window operations for PANATERM Lite for GM.

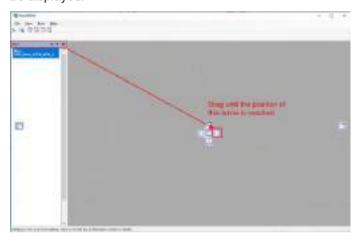
15.5.1 Moving the Pane Location

You can freely change the layout of each pane of PANATERM Lite for GM.

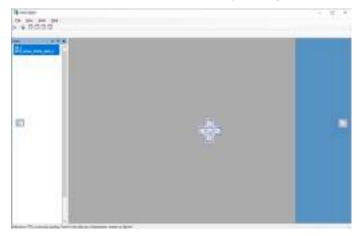
Example: Moving the navigator pane from the left edge to the right edge of the window



 Click the title bar of the navigator pane and then drag it to the main pane. The navigator pane will stay in a floating state and arrows indicating movable directions will be displayed.



2. Drag the navigator pane in the direction in which you want to move it. The relocation destination will be displayed in light blue.



3. Release the left mouse button.

The navigator pane will be docked into the existing pane and the relocation will be completed.



15.5.2 Switching the Tab of the Main Pane

You can switch the tab of the main pane.

12	Procedure
· 2	I I OCCUUIC

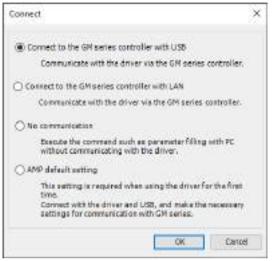
 Press the <Ctrl> key + <Tab> key simultaneously. The window for switching the tab of the main pane will be displayed.

ctive Views	Active Editors	
- Aves	Nonitor	
5 MACS	alam	
	Parameter (read-out from the driver)	

- 2. While holding down the <Ctrl> key, press the <Tab> key until the desired tab is selected.
- Release the <Ctrl> key. The window corresponding to the selected tab will be displayed.

15.6 Selecting the Device to Connect

After you start PANATERM Lite for GM or when you select **File>Settings>Connect Amplifier**, a dialog box for selecting the device to be connected will be displayed.



The following options will be displayed.

- · Connect to the GM series controller with USB
- · Connect to the GM series controller with LAN
- No communication
- AMP default setting

The following section describes operations when each option is selected.

When you use the servo amplifier for the first time after it was purchased, you must establish a communication between the GM1 Controller and the servo amplifier. Connect the PC and the servo amplifier with a USB cable and execute "Configure amplifier communication settings".

Then, with the servo amplifier and GM1 Controller connected, set up the servo amplifier.

15.6.1 Configuring Servo Amplifier Communication Settings

¹ 2 Procedure

 Start PANATERM Lite for GM. The "Connect" dialog box will be displayed.

Connect	×
○ Connect to the GM series controller with USB	
Communicate with the driver via the GM series controller.	
O Connect to the GM series controller with LAN	
Communicate with the driver via the GM series controller.	
○ No communication	
Execute the command such as parameter filling with PC without communicating with the driver.	
AMP default setting	
This setting is required when using the driver for the first time. Connect with the driver and USB, and make the necessary	
settings for communication with GM series.	
OK Cancel	

2. Select "AMP default setting" and click [OK].

The "Model confirmation" dialog box will be displayed.

			Number	Number
Ver.3.2	MADHT1105BA1	MEMD SAZG 1A	15120001	15300038

3. Check the software version of the servo amplifier for which settings are to be changed and then click [OK].

The "Parameter change" dialog box will be displayed.

Cass	No	Parameter Name	Setup Range	Value
07	-40	Station alias setting(higher)	0.25	
07	41	Stabon alias selection	0-2	
_				
ts the u	pper 8 b	ts of the Station alias.		
ts the u	pper 8 b	ts of the Station alias.		

When Pr7.41 is set to 0, set value of the rotary switch on the front panel of the servo amplifier and the set value of Pr7.40 are set as "Station alias".

Statio	n alias
Higher 8 bits	Lower 8 bits
Set value of 3740h	Set value of the rotary switch

When Pr7.41 is set to 1, the value of the SII area (0004h) is regarded as Station alias. The setting of the SII area (0004h) can be made using EtherCAT slave device object of the GM Programmer.

4. Click the [OK] button.

The "Setting Complete" dialog box will be displayed.

5. Click the [OK] button.

The main pane will be displayed. Start the servo amplifier.

15.6.2 Setting up the Servo Amplifier Connected to the GM1 Controller

This section explains how to set up MINAS series servo amplifiers connected to the GM1 Controller.

For other devices, refer to their instruction manuals when setting up them.

The PC communicates with the servo amplifier connected to the GM1 Controller.

Connect the PC and GM1 Controller with an Ethernet cable or USB cable. With the GM1 Controller and servo amplifier connected with a Cat5e shielded cable, set up the servo amplifier.

• Perform this setup work only after the connection between the GM1 Controller and the servo amplifier has been established.

If Connected with Ethernet Cables

If connected with Ethernet cables, use the following procedure.

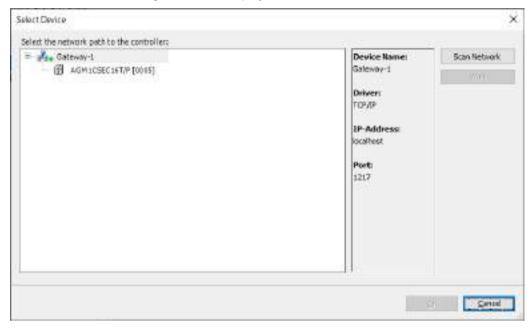


 Start PANATERM Lite for GM. The "Connect" dialog box will be displayed.

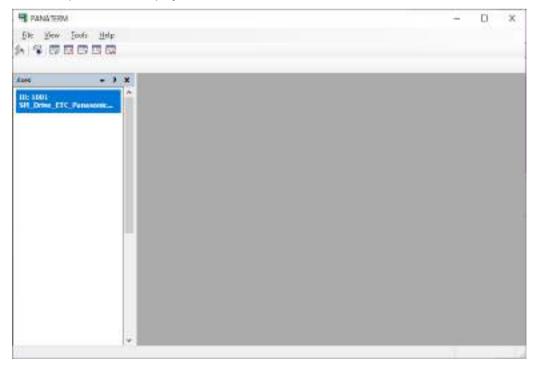
 Select "Connect to the GM series controller with LAN" and click the [OK] button. The "Communication timeout settings" dialog box will be displayed.

Communication timeout settings X				
Communication timeout settings				
Timeout period(s):				
	ОК	Cancel		

3. Change the timeout period and click the [OK] button. The "Select Device" dialog box will be displayed.



4. Click the [Search Network] button, select the GM1 Controller, and click the [OK] button. The main pane will be displayed.

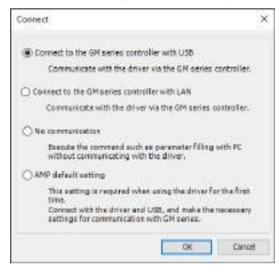


If Connected with USB Cables

If connected with USB cables, use the following procedure.

1₂ Procedure

 Start PANATERM Lite for GM. The "Connect" dialog box will be displayed.



2. Select "Connect to the GM series controller with USB" and click the [OK] button. The "Add USB Port" dialog box will be displayed.

Device:	Panasonic GM US8-COM
Port:	СОМЗ
Communication 1	timeout settings I(s): 10 🗳

Change the timeout period and click the [OK] button.
 A message window will be displayed, asking whether to add a USB port and restart the Gateway.



4. Click the [OK] button.

The "Select Device" dialog box will be displayed.

Select Device		1
Select the network path to the controllers	10.0	
■ AGM1CSEC16T/P [0016]	Device Name:	Scan Network
	Galeway-1	(
	Driveri TOP/IP	
	8P-Address	
	localhest.	
	Port	
	1217	
	1.0	
		Quice
		Long and the second

5. Click the [Search Network] button, select the GM1 Controller, and click the [OK] button. The main pane will be displayed.

PANATERNI	1	-	D	х
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III: 1001 SH Drive ETC	2000000 C			
an unse pro				
	v .			

15.6.3 Editing Settings without Connecting to the GM1 Controller

You can freely edit parameters and other data saved in files without connecting to the GM1 controller. The edited contents are not written to the servo amplifier.

¹² Procedure

1. Start PANATERM Lite for GM.

The "Connect" dialog box will be displayed.

Connect	×
Connect to the GM series controller with USB	
Communicate with the driver via the GM series controller.	
Connect to the GM series controller with LAN	
Communicate with the driver via the GM series controller.	
No communication	
Execute the command such as parameter filling with PC without communicating with the driver.	
O AMP default setting	
This setting is required when using the driver for the first time. Connect with the driver and USB, and make the necessary settings for communication with GM series.	
OK Cancel	

2. Select "No communication" and click the [OK] button. The "Select Series " dialog box will be displayed.

AS-ASE AS-ASN	
AS-A68	
as-a6N	
	OK Cancel

3. Select a servo amplifier to be connected and click the [OK] button. The main pane will be displayed.



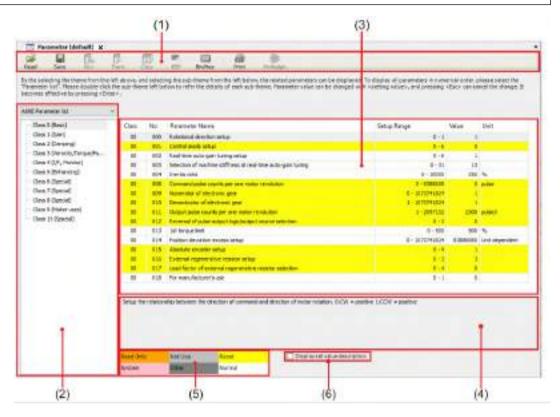
When the "Select Model" dialog box is displayed, select a model and click the "OK" button.

MINAS-A6NSelection of Aircraft Types	52		×
MDNA6-AGNE standard MDNA5-AGNE standard			
	0K	Can	cel

15.7 Parameter Window

The Parameter window allows the user to check and rewrite the values of servo amplifier parameters, save them to parameter files, and perform other parameter-related operations.

15.7.1 Configuration of Parameters Window



No.	Name	Function			
		The toolbar consists of basic operation commands related to parameters, such as save and read.			
		Icon	Name	Function	
(1)		Read	Read	Reads parameters from file ".prm5". When this button is enabled, you can specify a parameter file also by drag-and- drop operation.	
			Save	Writes parameters to file ".prm5".	
		Rcv	Rcv	Receives parameters from the servo amplifier.	

No.	Name	Function				
		lcon	Name		Function	
		Trans	Trans		Transmits parameters to the servo amplifier.	
		Сору	Сору		Copies the parameters of a servo amplifier to servo amplifiers for other axes.	
		EEP	EEP		Writes parameters to EEPROM of the servo amplifier.	
		Bin/Hex	Bin / Hex		Inputs the selected settings in binary or hexadecimal format.	
		Print	Print		Prints parameters.	
		Pinèssign	Pin assignr setting	nent	Sets I/O pin assignment.	
(2)	Theme selection pane	After a theme is selected, if a parameter category is selected from a sub- theme, related parameters will be displayed in the parameter setting area. Position control Theme Theme Totally(Position) Position mode adection Position command input Electronic gear rat Electronic gear rat Cain turing (Position) Real Time Auto Turi Adeptive filter Posit For details on each parameter, refer to the instruction manual and other technical references for the servo amplifier.				
		Name	user to set o	Function		
	Parameter setting area	Class			parameter categories	
		No.		1 7 1	parameter numbers	
		Paramete				
(3)		Setup Rai			he maximum and minimum allowable parameter settings	
		Value		Displays parameter values. Values can be changed. For parameters provided with a ▼ button beside the set value, a desired value can be selected from the combo box. After selecting a value from the combo box, press the <enter> key. For parameters without a ▼ button beside the set value, either directly enter a value using <numerical> keys or click "▲""▼" to edit the value by increasing or decreasing it. To set a</numerical></enter>		

No.	Name	Function		
		Name	Function	
			value, press the <enter> key. To return a value to its original value, press the <esc> key.</esc></enter>	
		Unit	Displays the unit of parameter settings.	
(4)	Text display area	Displays a description related to the selected parameter.		
(5)	Parameter attribute description area	Displays a description of parameter attributes. The background color of each parameter in the parameter setting area represents an attribute.		
(6)	"Display-set value description" check box	Selecting the check box displays combo boxes and decimal points in the "Value" column of the parameter setting area. To display parameter set values in an easy-to-understand manner, select the check box.		

15.7.2 Setting Parameters

¹² Procedure

1. From the menu bar on the main pane, select **View>Parameter**. Alternatively, on the toolbar, click the "Open the Parameter view" icon.

RANATERM		-	×
Die Jee Jush Beit			
Area Door the Personal (U(r.1)			
HURAS ASU			

The "Selection of parameter to be read" dialog box will be displayed.

Selection of parameter to be read	×
 Read-out from the driver Read from file Read default 	
OK Cance	el

□Read-out from the driver

Communicates with the connected servo amplifier and reads the parameter settings from the servo amplifier. If this mode is selected, parameter values will be reflected in the servo amplifier as soon as they are changed.

□Read from file

Reads the parameter file (".prm5") that was edited previously. If communication is performed with the servo amplifier, parameter values will be reflected in the servo amplifier as soon as they are changed.

□Read default

Reads the factory default settings of the servo amplifier that were saved during installation. If communication is performed with the servo amplifier, parameter values will be reflected in the servo amplifier as soon as they are changed.

2. Select one of the three options above and click the [OK] button.

The Parameter window will be displayed.

Factor (default) x	E.	<u> </u>	01 Sets	a Ant	and a second						
o the indication the therma from the li leases and the "Determination for". An East- concerned the sharings & torco Neuroscientist	ana double men effectio	-click the	sub-theme laft bei	from the left build on to refler the d	os, the related parameters of date of each sub-disers. For	n be displayed. To display all anotar value can be charged a	paranabara in kum ithi k pathing raise	enal erde s, erd pres	ia inte		
manufactor lot	Cher	Ne	Facester Net			Setuc Range	10.4	Uer-			
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- Date 3 Sylerocty/Targue Fig.	.01	101	Central mole set	and the second se			0.1				
- Gets 4 (DG, Newtor)	08	902	Rasi-trie Auto 1.	and the second sec	13222		0.1 4				
- time v (ivelance)	08	603		nic real-time auto	toreg -		(-3) D				
Case 6 Special	02	804	tierta (ato					0.96			
Date 7 (Special)	08	808	For neversetary			1-10					
- tissa # (towite)	08	808	For menufacture				0 - 3075NGE24				
trans a fight red	- 68	818	PER REPORTE Y			1 - 10/15	Contraction of the second s				
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		613	and support that					1.94			
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		81.8	Aboolute pricede	SPEAK		9-1 1	_				
	1 Phase	-72	licture	Paret	Thisperior	valueSelongst av					
	and the second se				C. C						
	Sustan		DAME: NO	Normal .							

- **3.** After changing the parameter settings, click the [EEP] button to write the parameter settings to the EEPROM of the servo amplifier.
- 4. Click the [x] button on the Parameter window to close the Parameter window.

15.7.3 Copying Parameters

The parameters of a servo amplifier can be copied to servo amplifiers for other axes. It is not possible to copy from A6B type to A5B type or from A5B type to A6B type.

¹₂ Procedure

 Click the "Copy" icon on the toolbar. The Copy Parameter window will be displayed.

Copy Planamatan		×
Source Avia	Darthation Awai	
Dit 1000, SM Drive ETC Parksons, MPAR,	Ct. 1001, SP. DHIE, STC. Panaeose, MDHES	
	Create	11

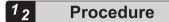
- 2. In the "Copy source" area, select an axis from which parameters are to be copied.
- 3. In the "Copy destination" area, select an axis to which parameters are to be copied.

Copy Platestation		×
Bource Avia	Dartinition Awai	
ID: 1001, SM_Drive_ETC, Parksone, MPARS ID: 1000, SM_Drive_ETC, Parksone, MPARS	China and an and a star star star star star star star st	3
	OE Cred	i i i

- 4. Click the [OK] button.
- 5. The Parameter window for the copy destination axis will be displayed.
- Click the "Trans" icon on the toolbar. The parameters will be written to the servo amplifier.
- Click the [EEP] icon on the toolbar. The parameters will be written to the EEPROM of the servo amplifier.

15.7.4 Switching the Input Format of Parameter Values

Selected parameter values can be entered in binary or hexadecimal format.



 Click the "Bin / Hex" icon on the toolbar. The Binary / Hexadecimal Input window will be displayed.

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To enter parameter values in hexadecimal format, enter a value and then press the <Enter> key. To enter parameter values in binary format, click the button corresponding to each bit to switch between "0" and "1".

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Note: If the entered value is outside the setting range of the parameter, the allowable range will be displayed below the decimal display section.

3. After the above input operation is complete, click the [OK] button.

15.7.5 Setting I/O Pin Assignment

I/O pin assignment can be set.

The assignment can be set for the input and output related parameter "Class 4 (I/F, monitor)".

¹² Procedure

 Click the "Pin assignment " icon on the toolbar. The pin assignment setting input window will be displayed.

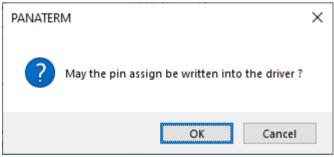
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2. Double-click the row of the pin number to be set. The function selection window will be displayed.

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Velocity control		A-Connect		O B-Connect		
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+1)	+		-			
43 	32		+		~	
			1	OK Ca	tcal	

- **3.** Select a function to be assigned to the pin for each control mode and a contact method (only when an input function is selected).
- In the function selection window, click the [OK] button.
 The display will be returned to the pin assignment setting input window.
- 5. Click the [OK] button.

A confirmation window will be displayed, asking whether to write to the servo amplifier.



Click the [OK] button to write the parameter settings to the EEPROM of the servo amplifier. Click the [Cancel] button to close the window without writing the parameter settings to the EEPROM of the servo amplifier.

Note: Pin assignment settings do not take effect until the servo amplifier is restarted.

15.8 Object Window

Troubleshooting can be performed more easily by displaying and editing the list of objects on the amplifier side without using a host device.

i Info.

• Some objects affect the behaviors of servo amplifiers or motors. Therefore, before changing the objects, carefully read the instruction manual and other technical references for the servo amplifier and pay careful attention when changing them.

15.8.1 Configuration of Object Window

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No.	Name	Function	Function					
		The toolbar consists of basic operation commands related to objects, such as save and read.						
		lcon	Name	Function				
(1)	Toolbar	Read	Read	Reads objects from the file (.obj5). When this button is enabled, you can specify a file by drag-and-drop operation.				
(1)		I Save	Save	Writes objects to the file (.obj5).				
		Rcv	Rcv	Receives objects from the servo amplifier.				

No.	Name	Function			
		Trans	Trans	Transmits objects to the servo amplifier. If you turn OFF the power supply to the servo an without writing to EEPROM, the object will be rev back to the value before the change was made.	
		Сору	Сору	Copies the objects of a servo amplifier to servo a for other axes.	amplifiers
				Writes objects to EEPROM of the servo amplifier	
		-	EEP	Do not turn OFF the power supply to the servo a and the PC while data is being written to EEPRC	
		EEP		If the power supply is cut off while data is being with the data content is not warranted.	vritten,
		Print	Print	Prints objects.	
				Changes the numerical display of the object bein displayed.	ıg
			Display	Hex: Displayed in hexadecimal number and "h" is at the end of the number.	s placed
		Hex •	mode	Dec: Displayed in decimal number and a sign is a Bin: Displayed in binary number and "b" is placed end of the number.	
				The values in the Min-Max column are displayed hexadecimal number.	in
		PDS Condi	tion	1	
		Displays the	e PDS conditio	n on the servo amplifier side.	
	Condition	It varies de	pending on the	object value of 6041h-00h.	
(2)	monitor	ESM Cond	ition		
			e condition that mplifier side.	t indicates whether the object can be rewritten on	Full display
		Rewriting is	possible wher	n "Operational" is displayed.	
		When a not object settir		rom the object tree, related objects are displayed i	n the
		Operate Cle	ose TreeView	or Open TreeView to hide or display the object tre	e.
		Select "All o	bject" to displa	ay all objects.	
(3)	Object tree	When a par displayed.	ent node is sel	lected, all child node objects under the selected no	ode are
		When a chi	d node is sele	cted, objects of the selected node are displayed.	
			of each object, for the servo a	refer to the instruction manual and other technical mplifier.	1

Al aspect BLOD SSUR SARR SARR SARR STOP	Parent node Child node		
 3005 2005 71036 7026 7026 7026 7026 7026 7026 7026 7026 8026 7026 8026 8026 			
	ser to edit and set an object.		
me	Function		
ain ex"	Displays the Main Index of an object.		
b Index	Displays the Sub Index of an object.		
ject me	Displays the name of an object.		
ta Type	Displays the data type of an object. 18: Integer 8 type 116: Integer 16 type 132: Integer 32 type U8: Unsigned 8 type U16: Unsigned 16 type U32: Unsigned 32 type Bool: Boolean type OS: Octet String type VS: Visible String type		
ributes	Displays the attributes of an object. RO: Read-only attribute, exclusively for reading. RW: Read/write attribute, possible to read or write.		
ו	Displays the setting range of an object.		
x	The setting range is not displayed for an object whose Data Type is "OS" or "VS".		
ue	Displays the value of an object. The value can be changed if the object attribute is "RW" and the set value is a numerical value. Note that there are input restrictions for each Display mode setting. The following values can be input. Hex: 0 to 9, A to F (After editing, ""h"" is automatically placed at the end of the number.) Dec: 0 to 9 and minus sign "-" Bin: 0 and 1 (""b"" is automatically placed at the end of the number.) After changing the value, press the <enter> key or click the [Trans] button. To return a value to its original value press the <esc> key.</esc></enter>		
	ne iin ex" o Index ect ne a Type ributes		

15.8.2 Setting Objects



1. From the menu bar on the main pane, select **View>Object**. Alternatively, on the toolbar, click the "Open the Object view" icon.

PANATERM				
	Tools Help			
84 📽 🖾 I				
	Open th	e Object view (Al	(+2)	
Axes		* 4 ×		
ID: -		<u>^</u>		
MINAS-A6BE				
18-14 H				

The "Selection of objects to be read" dialog box will be displayed.

o be read X
he driver
OK Cancel

□Read-out from the amplifier.

Communicates with the connected servo amplifier and reads objects set in the servo amplifier.

If this mode is selected, object values will be reflected in the servo amplifier as soon as they are changed.

□Read from file

Reads the parameter file ("obj5") that was edited previously. If communication is performed with the servo amplifier, object values will be reflected in the servo amplifier as soon as they are changed.

□Read default

Reads the standard default settings of the servo amplifier that were saved during installation.

If communication is performed with the servo amplifier, object values will be reflected in the servo amplifier as soon as they are changed.

2. Select one of the three options above for reading the object settings and click the [OK] button.

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The Object window will be displayed.

- **3.** After changing the object settings, click the [EEP] button to write the object settings to the EEPROM of the servo amplifier.
- 4. Click the [×] button on the Object window to close the Object window.

15.9 MINAS Parameters for the GM1 Controller

Some parameters for servo amplifiers on the A5B / A6B side affect the behaviors of the EtherCAT-compatible GM1 controller. Use the following parameters.

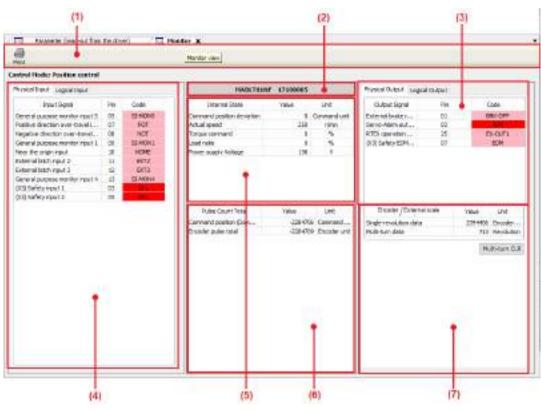
No.	Name	Settings	Standard factory default setting
Pr5.04	Over-travel inhibit input setup	Use setting value 1. (Recommended)	1 ^(Note 1)

(Note 1) We recommend that the set value should not be changed judging from the characteristics of the GM1 and MINAS.

15.10 Monitor Window

The Monitor window displays the operating states of servo amplifiers and motors, I/O signals, internal statuses, and other information and also allows the user to check them.

15.10.1 Configuration of Monitor Window



NO.	Name	Description					
		The toolbar consists of basic operation commands related to parameters.					
(1)	Toolbar	lcon	Name	Function			
(1)	TOUDAI	Print	Print	Prints the contents of the Monitor window.			
(2)	Amplifier model name and serial number	Displays the model	name and serial n	umber of the servo amplifier.			
		Displays the status "Physical Output" a		nal. The tab can be switched between ".			
(3)	Output signal status monitor	Physical Output – Displays the status of output signals from the servo amplifier.					
		Red: Indicates that	output transistor is	ON			
		Pink: Indicates that	output transistor is	OFF			

NO.	Name	Description					
		Logical Output – Displays the status of signals within the servo amplifier.					
		Red: Indicates that signal status is active					
		Pink: Indicates that signal status is inactive					
(4)	Input signal status monitor	Displays the status of input signals. The tab can be switched between "Physical Input" and "Logical Input". Physical Input – Displays the status of input signals to the servo amplif Red: Indicates that COM- is connected Pink: Indicates that signal status is open Logical Input – Displays the status of signals within the servo amplifier. Red: Indicates that signal status is active Pink: Indicates that signal status is inactive					
		PINK: INDICATES THAT SI	gnai status is inactive				
		Displays the internal s	status of the servo amplifier.				
		Name	Function				
	(5) Internal status monitor	Commanded position deviation	Displays the position deviation of a command unit.				
(5)		Actual speed	Displays the monitor speed				
		Torque command	Displays the torque command.				
		Load factor	Displays the ratio relative to the rated load. Adjust the operation pattern so that 100% is not exceeded.				
		Power supply voltage value	Displays the voltage (voltage between the P and N terminals) of power supply to the servo amplifier.				
(6)	Pulse sum monitor	Displays the sum of command and encoder pulses received by the servo amplifier.					
		Displays encoder information.					
		Single-turn data	Displays an absolute position when the motor makes no more than a single turn.				
(7)	Encoder information monitor	Multi-turn data	Displays how many turns the motor made after "Clear" operation.				
		Clicking "Clear Multi-turn" resets the multi-turn data stored in the encoder to "0" and clears all encoder errors. Note: Before using "Clear Multi-turn", check the precautions on use. To clear encoder errors, you may need to restart the servo amplifier.					

(Note 1) Because Ethernet communication is used to transfer data between the servo amplifier and PC, there is a difference or delay between the value displayed on the screen and the actual value of the servo amplifier.

- (Note 2) When the polarity is "+", symbol "+" is not displayed.
- (Note 3) The monitor function is not a measuring instrument. Use the values displayed in the Monitor window as a guide.
- (Note 4) If the servo amplifier outputs "Error 40.0 Error protection from absolute system failure" or "Error 42.0 Error protection from absolute overspeed", execute "Clear Multi-turn". Unless the absolute encoder is reset, the alarm cannot be cleared.

15.10.2 Checking the Monitor Window

1₂ Procedure

1. From the menu bar on the main pane, select **View>Monitor**. Alternatively, on the toolbar, click the "Open the Monitor view" icon.

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SM_Drive_ETC	Panasonic				

The Monitor window will be displayed.

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2. Check each item.

Check the input signal state, output signal state, and the internal status of the servo amplifier.

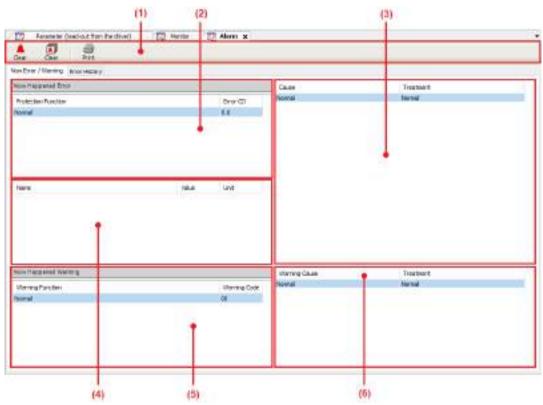
 Click the [x] button on the Monitor window. The Monitor window will be closed.

15.11 Alarm Window

The Alarm window allows the user to check error status when the front panel of the servo amplifier is blinking due to motor operation failure or for some other reason.

15.11.1 Configuration of Alarm Window

Display of the current errors and warnings (only during communication with servo amplifier)



Display of error histories

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7 Canadated ever an alter box		27.4			serva-an, check whe ther the postion convertent was initiated by the actual position
E/Ex consumation toneout arror protoction		94.0			With beive_active to a.
ETEX communication times it an or protection		94.0			check whether parameter on targe related to
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No.	Name	Description				
		Icon	Name	Function		
(1)	Toolbar	Clear	Clear	Allows the user to clear the current alarm history. If you click this button after eliminating the cause of the alarm, the current alarm will be cleared and normal operation will be performed. However, you cannot clear any alarms that cannot be cleared by alarm clear input signals of servo amplifiers. In such a case, turn off the servo amplifier, eliminate the cause of the alarm, and then turn the power on again.		
		Clear	Clear	Allows the user to clear error histories.		
		Print	Print	Prints error-related information.		
(2)	Current error display area	Displays the alarm occurring.	numbers and name	es of all errors that are currently		

No.	Name	Description
		The alarm displayed on the top of the list is the alarm displayed on the front panel of the servo amplifier.
(3)	Error cause / treatment display area	Displays the cause and treatment of the selected error.
(4)	Motor internal status display area	Displays the motor internal status in the event of an alarm.
(5)	Current warning display area	Displays the warning numbers and names of all warnings that are currently occurring.
(6)	Warning cause / treatment display area	Displays the cause and treatment of the selected warning.
(7)	Error history display area	Displays the order of error histories, alarm numbers, and error names.
(8)	Error cause / treatment display area	Displays the cause and treatment of the selected error.
(9)	Motor internal status display area	Displays the motor internal status in the event of an alarm.

(Note 1) Some alarms cause tripping as errors but are not recorded in error histories. For alarms that are not recorded in error histories, refer to the instruction manual of the servo amplifier.

(Note 2) Up to 14 error histories are stored. When more than 14 errors occur, error histories are erased in chronological order (the oldest error history is erased first).

(Note 3) Up to three histories of motor internal status in the event of an alarm are stored. If an alarm occurs immediately after the power is turned on, motor internal status may not be captured normally.

15.11.2 Checking Alarms

1₂ Procedure

1. From the menu bar on the main pane, select **View>Alarm**. Alternatively, on the toolbar, click the "Open the Alarm view" icon.

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ID: 1001		
ID: 1001	+4)	

The Alarm window will be displayed.

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- Check for any errors that are currently occurring. Click the "Now Error / Warning" tab and check for any errors that are currently occurring.
- Check for any errors that occurred in the past. Click the "Error History" tab and check for any errors that occurred in the past.
- **4.** Click the [×] button on the Alarm window. The Alarm window will be closed.

15.12 Other Functions

15.12.1 Language Setting Function

This function allows the user to set the display language of PANATERM Lite for GM. The default setting is the same language as the one set in GM Programmer.



 Select a language from the menu bar tool. The language set in PANATERM Lite for GM will be switched.



• The display language setting of PANATERM Lite for GM is linked with that of the GM Programmer.

15.12.2 Help Function

While performing operation in PANATERM Lite for GM, you can start the Help function to check information such as operating methods.



From the menu bar, select Help>PANATERM Lite for GM Help.
 "PANATERM Lite for GM Operation Guide" will be started.

15.12.3 Version Display Function

This function allows the user to check the version, license, and other information for PANATERM Lite for GM.

2 Procedure

1. From the menu bar, select **Help>About**.



2. Click a desired button at the bottom of the window.

Button	Description
Version Info	Displays information about the plug-ins that have been applied and the operating system of the PC that is used.
License Info	Displays license information for the software used by PANATERM Lite for GM.

15.13 Troubleshooting for Servo Amplifiers and Motors

This section explains how to resolve problems.

15.13.1 I Cannot Set up

Symptom	Action method
l cannot set up	• Refer to the chapter related to the system configuration that you need, and check that the PC in which you install the software satisfies the necessary conditions. In particular, note that all the necessary service packs for the operating system must have been applied.
	• The installer may have been damaged due to download failure. Clear the browser cache and then download again.

15.13.2 I Cannot Communicate

Symptom	Solution
	• Check that the power to the control circuit of the servo amplifier is turned on.
After PANATERM Lite for GM is started, the servo amplifier is not recognized in the window for connecting to the servo	 Check the USB communication cable for loose connections or breakage or check whether a correct cable is used.
amplifier.	• Check whether the USB port on the PC is functioning normally. (Refer to the instruction manual of the PC.)
	Check whether the USB driver is installed correctly.
	Check that the power to the GM1 controller is turned on.
After PANATERM Lite for GM is started.	 Check the USB communication cable or Ethernet cable for loose connections or breakage or check whether a correct cable is used.
the GM1 controller is not recognized in the window for connecting to the GM1	 Check whether the USB port on the PC is functioning normally. (Refer to the instruction manual of the PC.)
controller.	 Check whether the LAN adapter on the PC is functioning normally. (Refer to the instruction manual of the PC.)
	Check whether the USB driver is installed correctly.
	Check whether Gateway is running.

15.13.3 I Cannot Print

Symptom	Action method
	 Check whether the printer is connected correctly. Check that the printer driver is operating normally, by printing a test page, for example.
I cannot print	• You may be unable to print any comment that consists of too many characters in a single line. Split such a comment into multiple lines so that the number of characters per line falls within the printable range.

15.13.4 I Cannot Set up Axes

Symptom	Solution	
The number of servo amplifiers connected does not match the number of servo amplifiers checked by performing a search.	• Check whether the axis name (ID) of the servo amplifier connected to the PC is 0, the respective axis names (IDs) of other servo amplifiers are 1 to 15, and there are any duplicate axis names (IDs).	
	 Check the communication cable for loose connections or breakage or check whether a correct cable is used. 	

15.13.5 PANATERM Lite for GM Does Not Behave Normally

Symptom	Solution	
PANATERM Lite for GM responds or acts slowly	 Close any windows that are not used. All windows communicate with the servo amplifier in certain cycles even if they are hidden under other windows. 	
	• If USB devices other than servo amplifiers are connected, reduce USB communication load by pausing their operations or taking some other action.	
The window does not open or icons appear garbled	• The PC is running out of memory. Temporarily close PANATERM Lite for GM and other applications that are not used. Alternatively, turn the PC off and then on, and start PANATERM Lite for GM again.	
PANATERM Lite for GM does not respond	• Press the <ctrl> key + <alt> key + <delete> key simultaneously to invoke the window for forcibly terminating programs, and terminate PANATERM Lite for GM.</delete></alt></ctrl>	
PANATERM Lite for GM suddenly terminates	Start PANATERM Lite for GM again.	
PANATERM Lite for GM does not start	• Microsoft .NET Framework Ver. 4.6.1 may have failed to be installed. Refer to the website of Microsoft and install Microsoft .NET Framework Ver. 4.6.1 directly on the PC that you use. After installing Microsoft .NET Framework Ver. 4.6.1, run the PANATERM Lite for GM installer again.	

15.13.6 The Parameter Window Does Not Behave Normally

Symptom	Solution	
The changed parameter value returns to its original value	 After changing the parameter value, press the <enter> key or click the [Trans] button. If you move to another parameter or make changes in the window without performing either of these operations, any change to the parameter value will be canceled.</enter> When the values read from a file are displayed in the window, changed parameter values are not sent to the servo amplifier. To send changed parameter values to the servo amplifier, click the [Trans] button. 	

Symptom	Solution	
The object window does not open.	 The object editor window can be displayed only when a series that uses the EtherCAT communication is selected. (Example: MINAS-A5B, MINAS-A6B) 	
The object set value cannot be changed or transmitted.	• Check if the ESM Condition is set to "Operational".	
The object set value returns to its original value.	 After changing the object value, press the <enter> key or click the [Trans] button. If you move to another object or make changes in the window without performing either of these operations, any change to the object value will be canceled.</enter> 	
	 When the values read from a file are displayed in the window, changed object values are not sent to the servo amplifier. To send changed object values to the servo amplifier, click the [Trans] button. 	

15.13.8 The Monitor Window Does Not Behave Normally

Symptom	Solution	
Monitor display does not change	• There is a possibility that communication with the servo amplifier has been disrupted and the PC is in an offline state. Check the connection status of the servo amplifier.	

15.13.9 The Alarm Window Does Not Behave Normally

Symptom	Action method	
Error histories are not displayed	 If no error has occurred before or error histories have been cleared, error histories are not displayed. 	
	• Supplementary information about errors is displayed only when the most recent, the second most recent, or the third most recent error history is selected. Select an error history number again.	
	• Errors that are not recorded in error histories are not displayed in error histories even if they occur.	

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Appendix Warranty / Cautions for Proper Use

Warranty	Арр-2
Cautions for Proper Use	Арр-3

Warranty

Warranty Period

Warranty period shall be 12 months from the ex-factory date or 18 months from the date of manufacturing.

This Warranty shall be exempted in the following cases,

- 1. Defects resulting from misuse and/or repair or modification by the customer.
- 2. Defects resulting from drop of the Product or damage during transportation.
- 3. Defects resulting from improper usage of the Product beyond the Specifications.
- 4. Defects resulting from fire, earthquake, lightening, flood, damage from salt, abnormal voltage or other Act of God, or other disaster.
- 5. Defects resulting from the intrusion of foreign material to the Product, such as water, oil or metallic particles.

Parts exceeding their standard lifetime specified in this document are excluded.

Warranty Scope

Panasonic warrants the replacement of the defected parts of the Product or repair of them when the defects of the Product occur during the Warranty Period, and when the defects are under Panasonic responsibility. This Warranty only covers the Product itself and does not cover any damage incurred by such defects.

Panasonic in accordance with 'Warranty Period' records, in any case, the machine state is poor, and cause damage to your company and the third party, all liability, Panasonic is not responsible.

- 1. The machines are not assembled in accordance with the instructions or precautions noted in this specification.
- 2. When the machine does not match the product assembled in the machine.
- 3. This specification does not depend on your company.
- 4. When the machine condition is not caused by Panasonic reasons.

Cautions for Proper Use

- Practical considerations for exporting the product or assembly containing the product When the end user of the product or end use of the product is associated with military affair or weapon, its export may be controlled by the Foreign Exchange and Foreign rade Control Law. Complete review of the product to be exported and export formalities should be practiced.
- This product is intended to be used with a general industrial product, but not designed or manufactured to be used in a machine or system that may cause personal death when it is failed.
- Installation, wiring, operation, maintenance, etc., of the equipment should be done by qualified and experienced personnel.
- Install a safety equipments or apparatus in your application, when a serious accident or loss of property is expected due to the failure of this product.
- This product is designed for general industrial equipments.Don't use this product under special conditions such as nuclear energy control, aerospace equipments, transportation, medical equipment, various safety equipments or special equipments.
- The wiring condition(earth wire method and cables length and shield cable condition of signal lines) may affect the noise resistance, please confirm the noise resistance of the machine.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- Product overload can cause the goods to fall, please follow the marking.
- Do not use benzine, thinner, alcohol, acidic cleaner and alkaline cleaner because theycan discolor or damage the exterior case.
- This product shall be treated as industrial waste when you dispose.
- This product related standards, laws and the user is responsible for matching between machine and components in terms of configuration, dimensions, life expectancy, characteristics, when installing the machine or changing specification of the machine. The user is also responsible for complying with applicable laws and regulations.
- The product will not be guaranteed when it is used outside its specification limits.
- Parts are subject to minor change to improve performance.

(MEMO)

Revision History

Date of issue	Manual code	Revision details
August 2021	WUME-GM1ETCOP-01	First edition
February 2022	WUME-GM1ETCOP-02	 2nd edition Updated the CNC control (G codes, instructions). Newly added the Recipe Manager.
April 2022	WUME-GM1ETCOP-03	3rd editionChanged the Company name

The manual code is shown at the bottom of the cover page.

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