Panasonic
INDUSTRY

RTEX EtherCAT

# Motion Controller

## GM1 SERIES

CE Marking conformity

## PLC + Motion + Communication
## All - in - one

# IN Better Solution

RTEX type

EtherCAT type

2024.10

# PLC + Motion + Communication

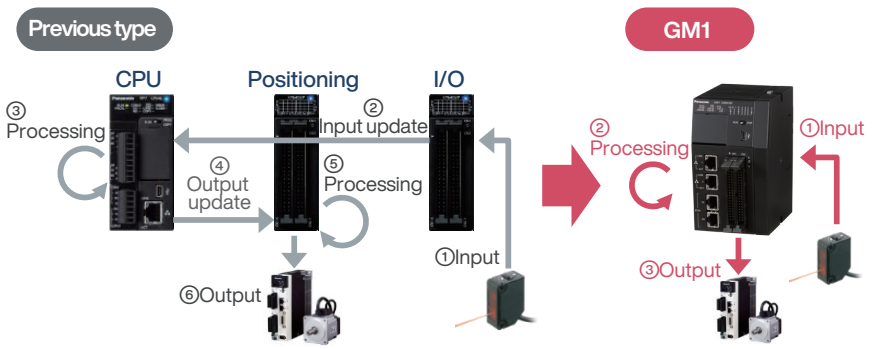
## Integrate PLC and motion

## Standardization of PLC programming

## Enhanced communication between the upper level and the device

## Integrate PLC and motion

**High speed motion control  Fastest cycle 500μs**
**Multitask control by function aggregation**




### Motion control

- Positioning / Speed control / Torque control
- Cam synchronization, Gear synchronization, CNC control

### Multitask control

- High speed motion control
- Display / Device / Upper communication
- Data processing

## Standardization of PLC programming

**Break away from manufacturer-dependent programming**

Programming:  IEC61131-3 standard compliant, PLCopen
Supports 6 languages: LD / ST / FBD / SFC / IL / CFC
Componentization by library function
Supports object orientation

### GM Programmer

*It can be downloaded free of charge from our website.

## Enhanced communication between the upper level and the device

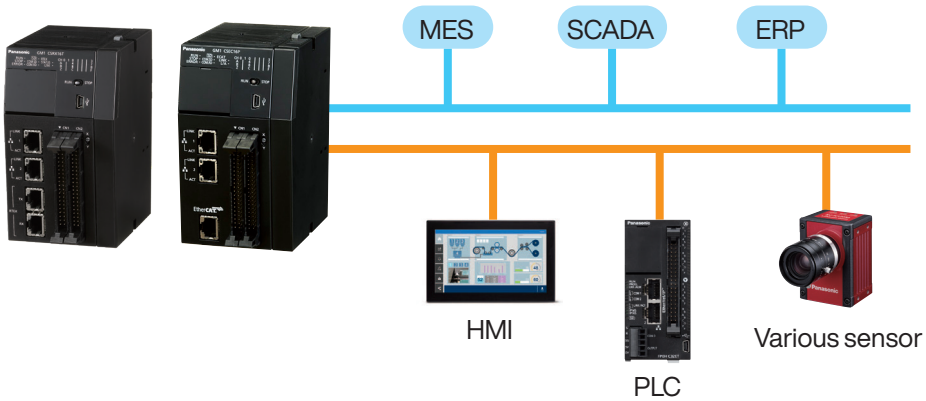
**Supports various network protocols**

### Communication with upper levels

OPC UA Server
FTP Server
MQTT Client
SNTP Client
DNS Client

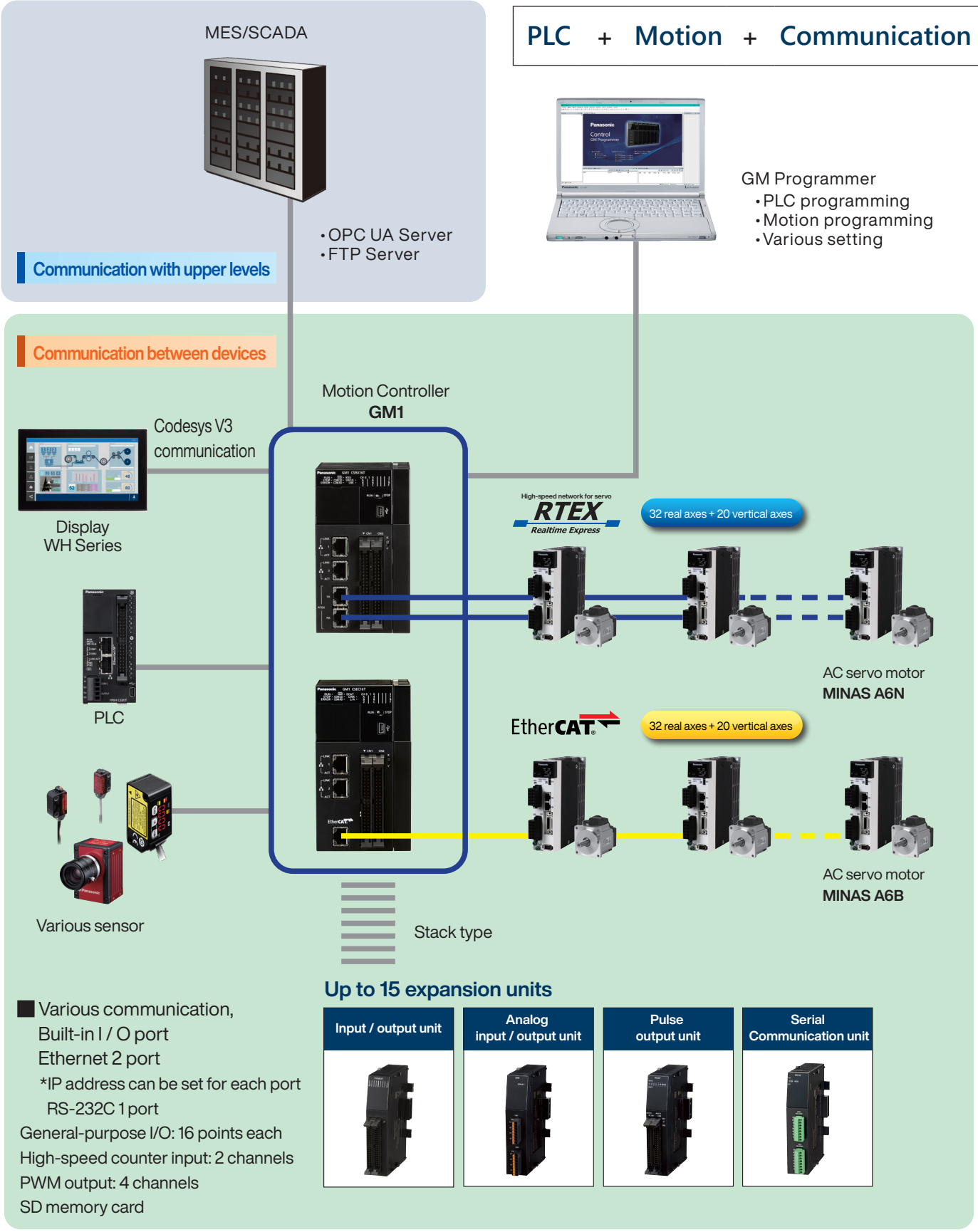
### Communication between devices

Ethernet/IP
Modbus
Codesys V3 communication



# System configuration

**PLC + Motion + Communication**




## Up to 15 expansion units

| Input / output unit | Analog input / output unit | Pulse output unit | Serial Communication unit |
|---|---|---|---|
|  |  |  |  |

■ Various communication,
Built-in I / O port
Ethernet 2 port
*IP address can be set for each port
RS-232C 1 port
General-purpose I/O: 16 points each
High-speed counter input: 2 channels
PWM output: 4 channels
SD memory card

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Realtime Express is a high-speed and synchronous motion network exclusively developed by our company.
* The EtherCAT is a registered trademark of patented technology licensed from Beckhoff Automation GmbH in Germany.

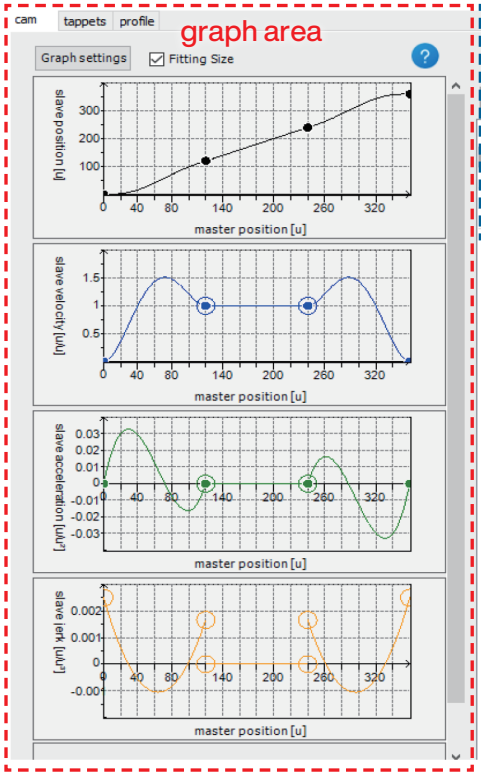
# Motion

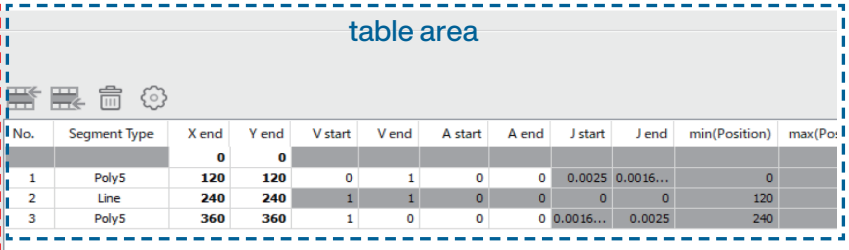
## Cam synchronous control expanded so that anyone can use it

### Extended cam editor

Ver.1.4 Additional Features

Create cam waveforms more easily by intuitively editing graphs and numerically editing sections.




| No. | Segment Type | X end | Y end | V start | V end | A start | A end | J start | J end | min(Position) | max(Po |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 0 | | | | | | | | |
| 1 | Poly5 | 120 | 120 | 0 | 1 | 0 | 0 | 0.0025 | 0.0016... | 0 | |
| 2 | Line | 240 | 240 | 1 | 1 | 0 | 0 | 0 | 0 | 120 | |
| 3 | Poly5 | 360 | 360 | 1 | 0 | 0 | 0 | 0.0016... | 0.0025 | 240 | |

It is possible to move, detach, and attach nodes.
Streamline trial and error in cam waveform editing.

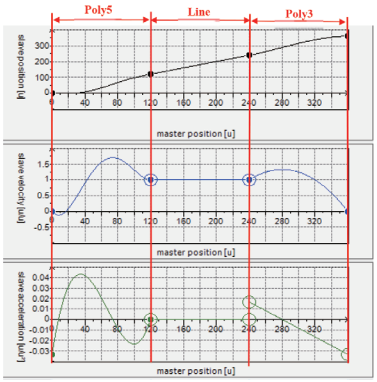
| Node | Characteristic | Operation Of Dragging Nodes | <Shift>key + Operation Of Dragging Nodes |
|---|---|---|---|
| Movable Node | The value of the slave axis can be changed | Drag Down / Drag Up | The value of the master axis can be changed. Only the slave axis position graph can be dragged left and right, but the result of the change is also reflected in the velocity, acceleration, and jerk of the slave axis. Drag Right / Drag Left |
| Fixed Node | The value of the axis cannot be changed | Can't move up or down | |
| Mixed Node | Has the Characteristic of an active node on one side and a fixed node on the other side | Drag Down(Separation) / Drag movable node up(sorption) | |

### Supports multiple types of cam waveforms

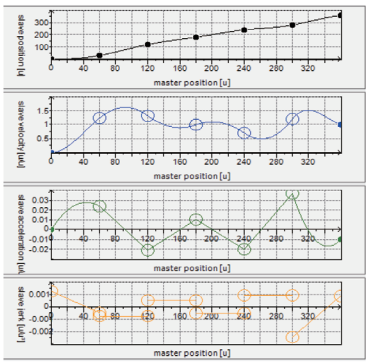
Ver.1.4 Additional Features

You can freely draw a cam waveform using a generic cam curve.

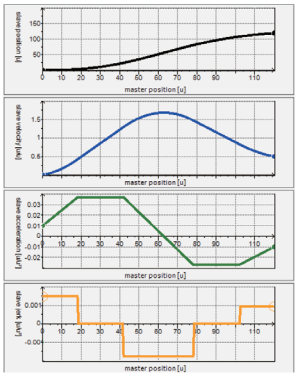
Applies to applications using dedicated cam curves.



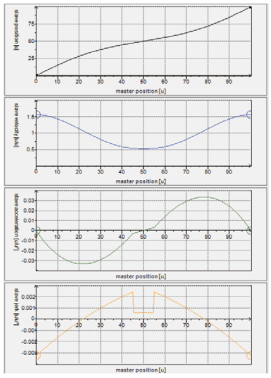

Line
Poly3,Poly5



Spline 4-3-4



Floating Trapezoid



Rotary knife A

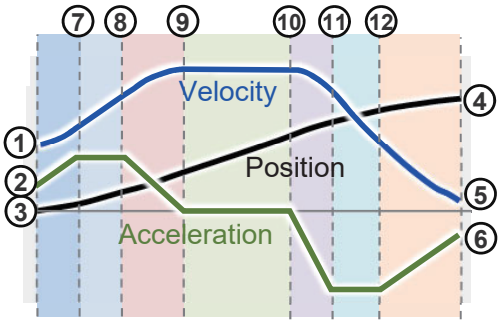
# Function blocks optimized for each application

## Floating Trapezoid

Patent pending

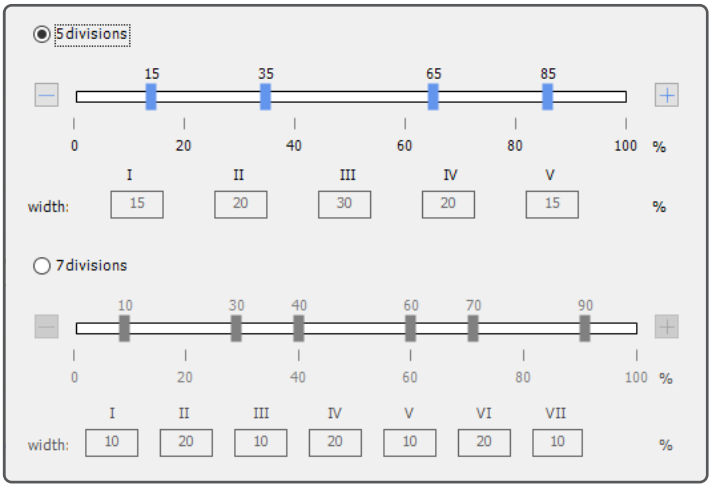
UP Ver.1.4 Additional Features

It combines the versatility of a trapezoid with the connectivity of a quintic curve. You can create cam waveforms that suppress rapid acceleration and deceleration.



Connection conditions ①+⑥ Time allocation ⑦～⑫

It has about twice the editing freedom of a conventional curve.



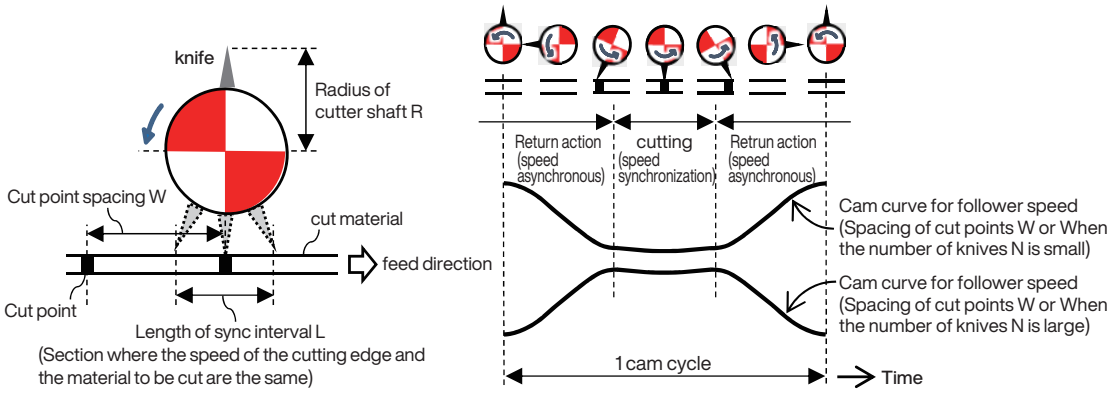

Check the waveform and use the sliders to adjust the time distribution for each section.

## Rotary cutter

In packaging machines and cutting machines, it is possible to perform cutting operations that synchronize the speed of the cutter blade with the feed direction of the product.The cut surface is cleaner than the cutting method with constant circumferential speed.

Configuration parameters

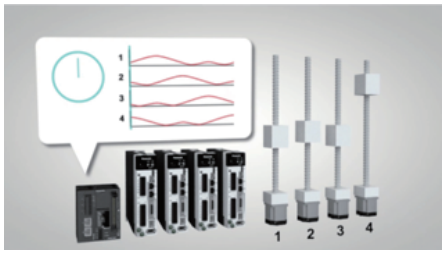
| Project | Value | Unit | SettingValue | Content |
|---|---|---|---|---|
| N: Number of Knives | 1 | - | 1 to 10 | Set the number of knives. The angle between each knife must be equal. |
| R: Radius of cutter axis | 30.0 | mm | 1 to 500 | Set the rotary cutter axis radius for from the view of its knife tips. |
| L: Length of synchronization | 10.0 | mm | (0.001*W < L < 0.8*W) && (L < 1.6... | Set the length of synchronous section. The knife and cut material have same velocity in the synchronous section. |
| W: Width between cut points | 100.0 | mm | 1 to 10000 | Set the width between cut points. |




# Application example

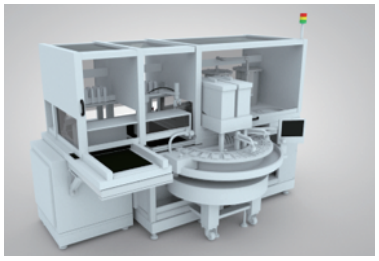
### Electronic cam

Even complex mechanical cams can be changed to electronic cams



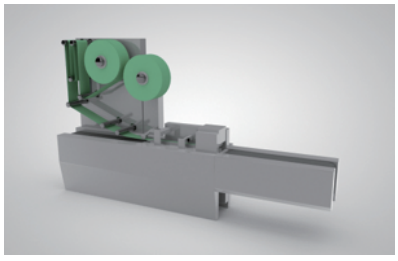
### Processing machine

Supports reciprocating motion of acceleration-constant velocity-deceleration



### Packaging machine, Cutting machine

Compatible with rotary cutter



We also have other application examples, so please feel free to contact us.

# Motion

## Expanding CNC synchronous control so that anyone can use it

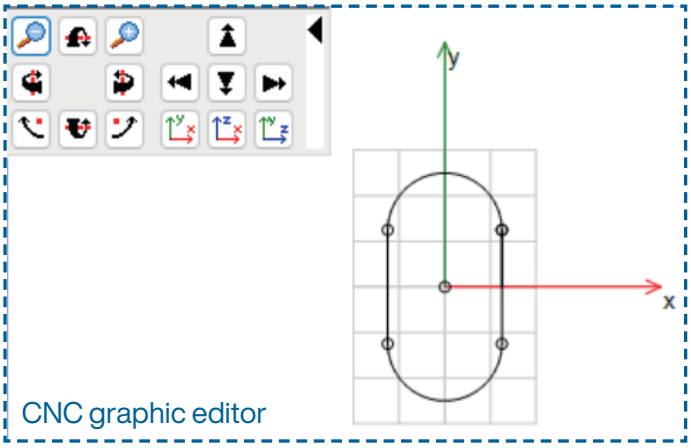
### CNC program editor

You can easily create a program for the first time because you can check the trajectory while writing the program.

```
1  N00 G92
2  N01 G99 X10 Y0
3  N02 G01 X10 Y10
4  N03 G03 R10 X-10 Y10
5  N04 G01 X-10 Y-10
6  N05 G03 R10 X10 Y-10
7  N06 G01 X10 Y10
```

CNC cord editor

100




**G-cord**

| | |
|---|---|
| G00/G01 | Linear interpolation |
| G02/G03 | Circular interpolation |
| G04 | Dwell time |
| G15□G19 | Plane specification |
| G20 | Repeated processing, Conditional branching |
| G36/G37 | Internal counter processing |
| G40/G42 | Tool radius correction |
| G43 | Tool Length Correction |
| G50/G52 | Path Smoothing |
| G53/G56 | Coordinate Conversion |
| G75 | Timing Synchronization |
| G90/G91 | Absolute/Relative coordinates specification |
| G92 | Start position specification |
| G98/G99 | Circular arc coordinate specification |

**M-cord**

Freely customizable
Can be freely written by programming

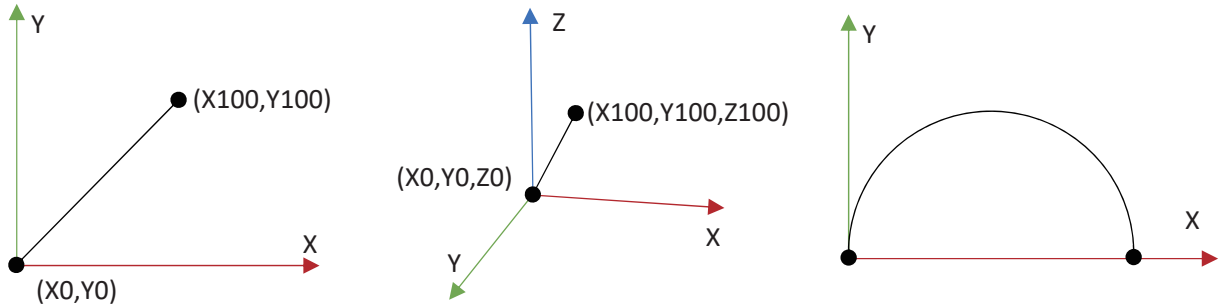
**Subprograms**

CNC program to another CNC programcan be started

### Supports various CNC programs

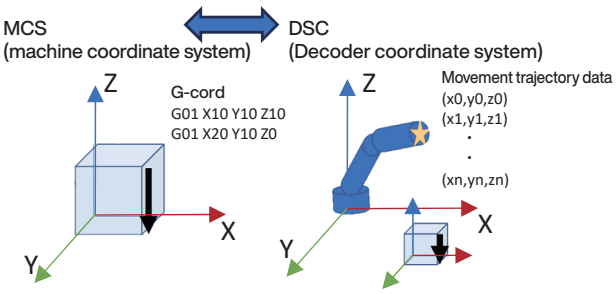
#### 2-axis, 3-axis linear (circular) interpolation

Move from current coordinates to target coordinates by linear (circular) interpolation



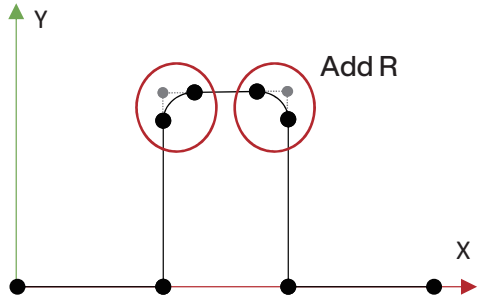

#### Coordinate transformation

Work and tool coordinates are also supported.



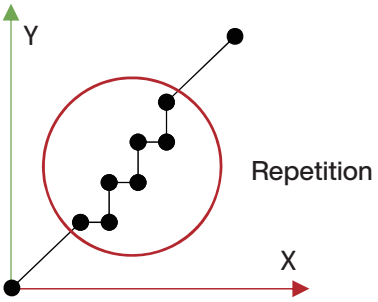

#### Smooth the path, add R to the path

Path connections can be changed to smooth trajectories



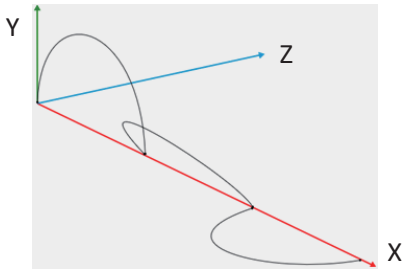
## Iterative processing

Possible to repeat by incrementing the counter or by conditional branching



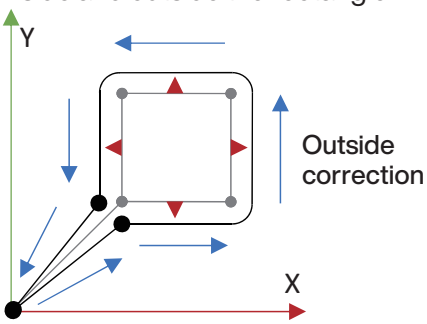

## Change of machining plane, coordinate transformation

Set the plane on which circular interpolation will be performed. 3D processing is also applicable



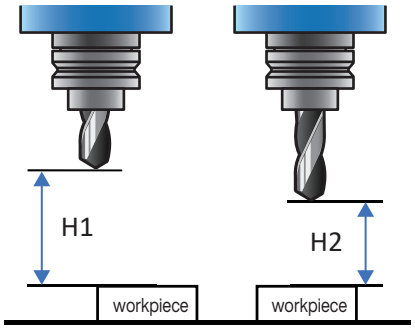

## Tool diameter compensation

Correction is performed at the specified distance inside and outside the rectangle.



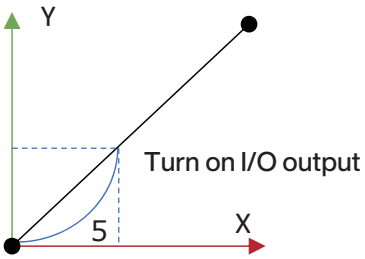

## Tool length compensation

Correct the path according to the tool length used




## H-switch function

This function allows you to turn the IO output ON/OFF when the interpolation movement distance reaches a predetermined amount.




## Subprograms

Programs can be modularized.

CNC1.cnc

```
N0 G01 X$g_x$ Y0 F50 E30 E-30
N10 G01 X0 Y$g_y$
N20 CNC2[25]
N30 G01 X0 Y-200
```

CNC2.cnc

```
SUBPROGRAM CNC2{#RADIUS : LREAL}
N010 G91
N020 G02 X#RADIUS*2 Y0 R#RADIUS Z2.5 F100 E-100 E100
N030 G02 X-#RADIUS*2 Y0 R#RADIUS Z7.5
END_SUBPROGRAM
```

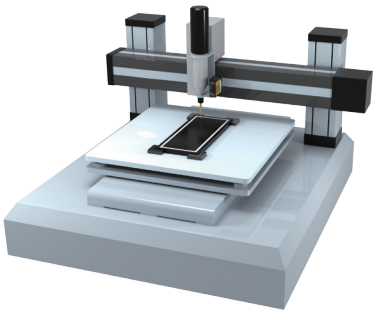
# Application example

### NC processing machine

Compatible with various G-codes

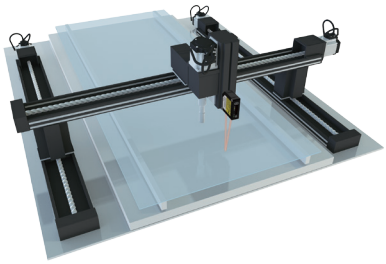
### Dispenser

Program-linked coating start timing



### Robotic control

XYZ axis mechanism, gantry control

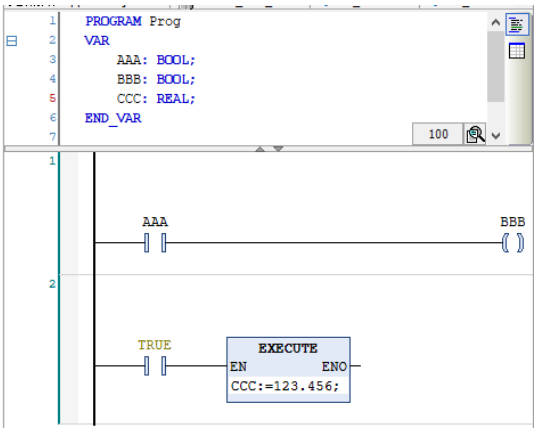


We also have other application examples, so please feel free to contact us.

# PLC

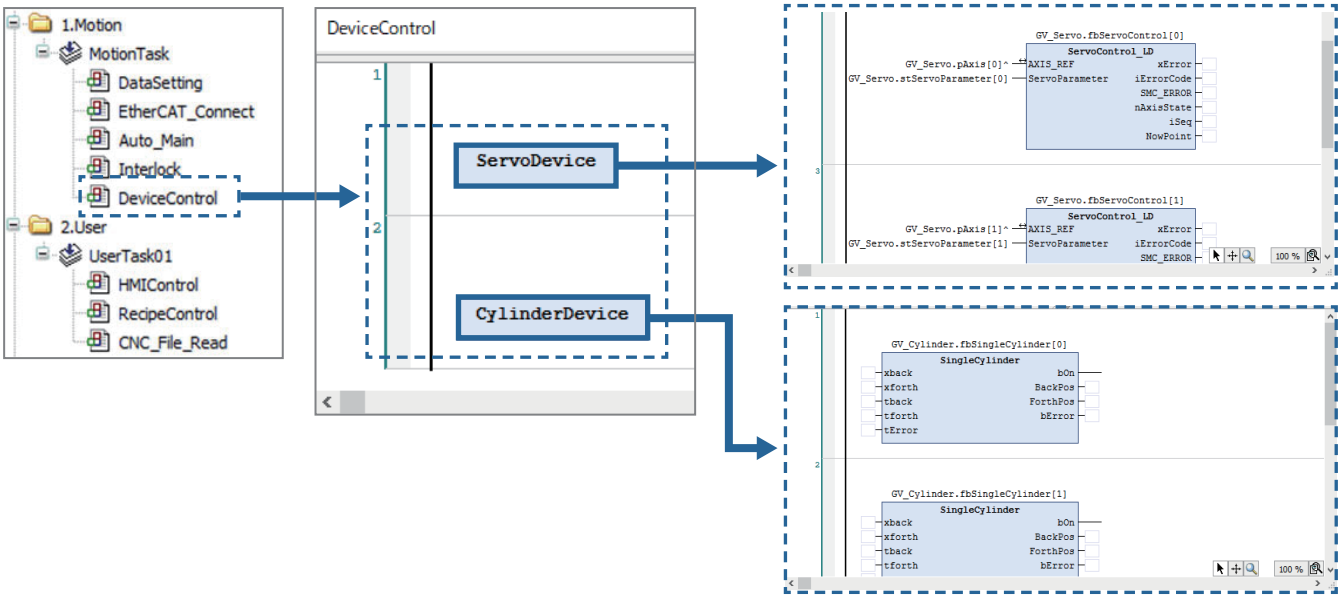
## Achieve object-oriented programming

- Divided implementation by POU (program configuration unit)
- Program part, function part (FB, FUN), variable definition part (structure, enumeration, union)
- FB methods and inheritance (equivalent to class concept), interfaces available
- Realization of componentization by library function




### Sample image of modularization and structuring

Realization of highly readable programs through modularization and structuring.
Contributes to reducing design man-hours as it is easy to reuse designs.




## Project data management is possible

### Recipe manager function

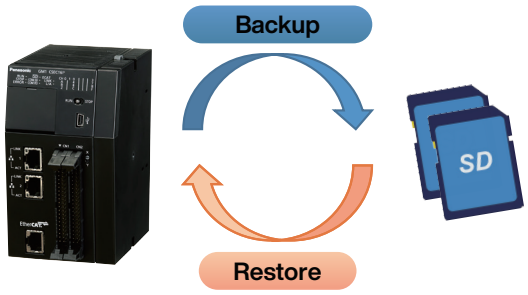
- Management of product type data
- Backup / restore of retained data

RecipeData

| Variable | Type | Name | Comment | Minimal Value | Maximal Value | Current Value | InitialRecipe | Rcp1 | Rcp2 |
|---|---|---|---|---|---|---|---|---|---|
| GVL.stRecipesData.int_val[0] | INT | Width | | 0 | 10 | | 0 | 0 | 0 |
| GVL.stRecipesData.int_val[1] | INT | Height | | 0 | 100 | | 1 | 1 | 1 |
| GVL.stRecipesData.int_val[2] | INT | Weight | | 0 | 99 | | 2 | 2 | 2 |
| GVL.stRecipesData.int_val[3] | INT | Length1 | | 0 | 10000 | | 3 | 3 | 3 |
| GVL.stRecipesData.int_val[4] | INT | Length2 | | 0 | 10000 | | 4 | 4 | 4 |
| GVL.stRecipesData.int_val[5] | INT | Length3 | | 0 | 10000 | | 5 | 5 | 5 |
| GVL.stRecipesData.int_val[6] | INT | | | | | | 6 | 6 | 6 |
| GVL.stRecipesData.int_val[7] | INT | | | | | | 7 | 7 | 7 |
| GVL.stRecipesData.int_val[8] | INT | | | | | | 8 | 8 | 8 |
| GVL.stRecipesData.int_val[9] | INT | | | | | | 9 | 9 | 9 |

### Project management function

- Operation of the main unit or program (FB)
- Project backup to SD
- Project restore from SD

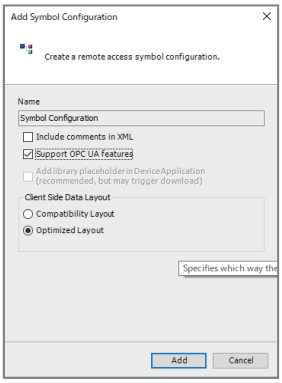


# Communication

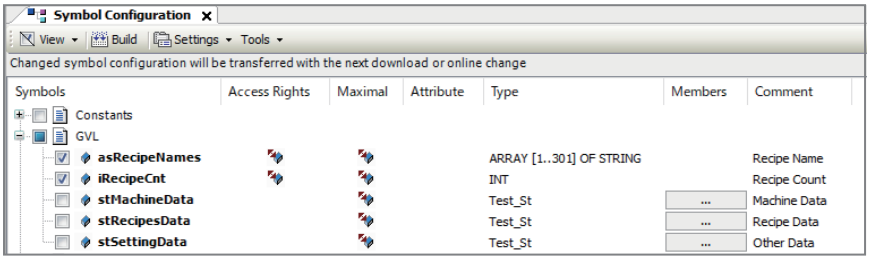
## Communication settings can be set easily

### Easy registration to OPC UA server

1. Enabling/disabling OPU UA server



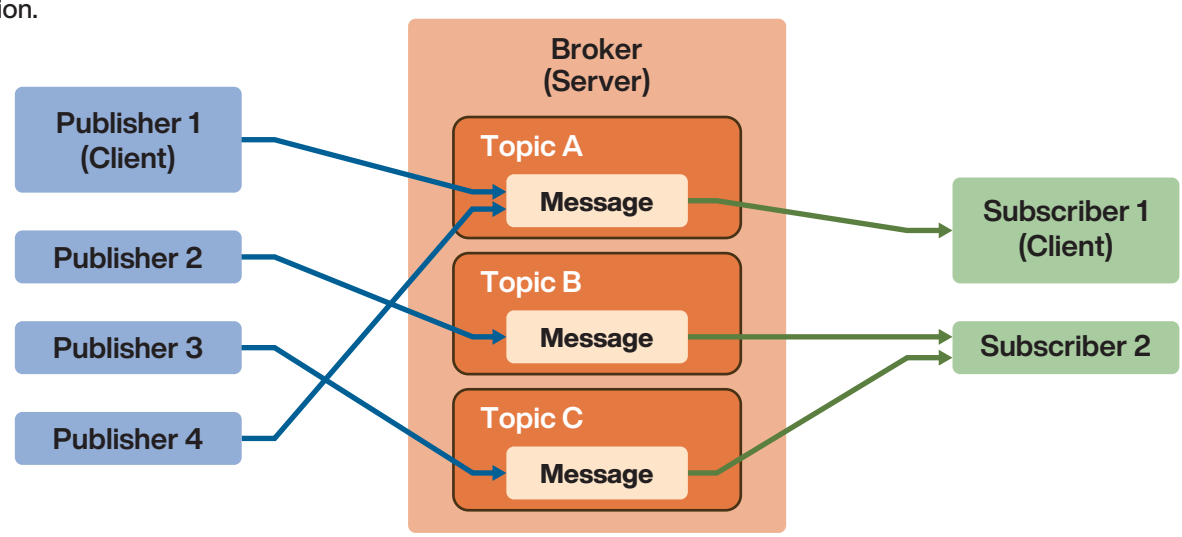

2. Check and register the variables to be published.It can support OPC UA, which is attracting attention in IoT, with only setting (no program required).




### Easily program MQTT clients compatible with PubSub model

Ver.1.4 Additional Features

By building an asynchronous communication system, it is possible to add or reduce equipment while the site is in operation.




Also supports FTP server, DNS, and SNTP connections.

## Also supports FTP server, DNS, and SNTP connections.

Ver.1.4 Additional Features

The number of connected devices has been doubled compared to the previous model, making it applicable to a variety of applications.

# Specifications

## GM1 Controller unit common specifications

RTEX type
AGM1CSRX16T

EtherCAT type
AGM1CSEC16T
AGM1CSEC16P

| Item | Specifications |
|---|---|
| Rated voltage | 24 V DC |
| Operating voltage range | 20.4 to 28.8 V DC |
| Allowable momentary power failure time | 24 V DC 10 ms or less (at Product shipment) |
| Operating ambient temperature | 0 to +55 °C |
| Storage ambient temperature | -40 to +70 °C |
| Operating ambient humidity | 10 to 95 %RH (at +25 °C, no condensation or icing) |
| Storage ambient humidity | 10 to 95 %RH (at +25 °C, no condensation or icing) |
| Vibration resistance (Leakage current 5 mA) | 500 V AC for one minute (Note 1) |
| Insulation resistance (Test voltage 500 V DC) | 100 MΩ or more (Note 1) |
| Vibration resistance | Compliant with JIS B 3502, IEC 61131-2<br>5 to 8.4 Hz, half amplitude 3.5 mm<br>8.4 to 150 Hz acceleration 9.8 $m/s^2$<br>10 sweeps each in X, Y and Z directions (1 octave/min) |
| Shock resistance | Compliant with JIS B 3502, IEC 61131-2<br>147 $m/s^2$, 3 times each in the X, Y, Z directions |
| Noise resistance | 1000 V [P-P]with pulse widths of 1 μs and 50 ns (using a noise simulator)<br>(Power supply terminal) |
| Atmosphere | Free of corrosive gases No excessive dust |
| European EU standards | EMC : EN 61131-2<br>RoHS : EN IEC 63000 |
| Overvoltage category | Category II or less |
| Pollution degree | 2 |

(Note 1): For details about the Dielectric strength or the Insulation resistance, check on the specifications of each product.

### Specifications of the USB Port

| Item | Specifications |
|---|---|
| Standard | USB2.0 Fullspeed |
| Connector shape | USB miniB type |

### Specifications of the COM Port (RS-232C)

| Item | | Specifications |
|---|---|---|
| No. of channels | | 1 |
| Physical layer | | RS-232C, three-wire system (non-isolated) |
| Transmission distance | | MAX. 15 m |
| Communication mode | | 1:1 communication |
| Communication method | | Half-duplex transmission |
| Transmission line | | Multicore shielded wire |
| Baud rate | | 9600 / 19200 / 38400 / 57600 / 115200 bps |
| Communication format | Data length | 7 bit / 8 bit |
| | Parity | None, odd, even |
| | Stop bit | 1 bit / 2 bit |
| | Start code | None |
| | End code | None |
| Connector shape | | Removable terminal block (5-pin) |

### Specifications of the LAN Port

| Item | | Specifications |
|---|---|---|
| Number of ports | | 2 |
| Communication interface | | Ethernet 100BASE-TX / 10BASE-T |
| Baud rate | | 100 Mbps / 10 Mbps, automatic negotiation |
| Max. segment length | | 100 m (Note 1) |
| Max. distance between nodes | | 100BASE-TX 2 segments |
| | | 10BASE-T 5 segments |
| Communication cable | | Shielded twisted pair (TIA/EIA-568B CAT5e or higher) |
| Communication protocol | | TCP/IP UDP |
| No. of simultaneous connections | LAN1 | Maximum 16 units (System connection: 1 unit, user connection: 15 units) |
| | LAN2 | Max. 32 units, general-purpose: 16 units<br>A cycle restriction is applied depending on the total number of connections. |
| Communication method | | Full-duplex / half-duplex communication |
| TCP/IP protocol | | TCP/IP compliant (IPV4) |
| Functions | | • Modifying or holding the network settings (IP, Subnet, Gateway)<br>• Possible to set the same or different networks between Ethernet ports.<br>• Routing between Ethernet ports is not performed. |
| LED display | LINK | Lit when connection is established with the device on the Ethernet network. |
| | ACT | Flashes when some communication is performed such as transmitting commands and responses with the devices with established connections. |

(Note 1): The standards cite 100m as the maximum, but noise resistance measures such as attaching a ferrite core may be necessary in some cases, depending on the usage environment. Also, it is recommended to position a hub near the control board, and limit the length within 10m.

## Specifications of the RTEX/EtherCAT

| Item | Specifications (RTEX type) | Specifications (EtherCAT type) |
|---|---|---|
| Baud rate | 100 Mbps | |
| Physical layer | 100BASE-TX full duplex (IEEE 802.3u) | |
| Cable | Shielded twisted pair (TIA/EIA-568B CAT5e or higher) | |
| Topology | Ring | Daisy chain (No branching) |
| Insulation method | Pulse transformer | |
| Connector | 8-pin RJ45 | |
| Maximum cable length | Between nodes: 100 m, total length: 200 m | |
| Transmission distance | | Between nodes: 100 m, total length: 200 m |
| Communication cycle | 500 µs to 2 ms | 500 µs or more |
| Command update period | 500 µs to 4 ms | |
| Operation command | Profile position, cyclic position / speed / torque | |
| Number of connectable axes | 32 real axes , 20 vertical axes (Total 52 axes) | |

## High-speed Counter Input Specifications

| Item | Specifications | | |
|---|---|---|---|
| | Input A, B, Z signals | | |
| | 24 V DC | 5 V DC | |
| | | Open collector connection | Line driver connection |
| Insulation method | Optical coupler | | |
| Rated input voltage | 12 V DC to 24 V DC | 5 V DC | Equivalent to AM26LS31 |
| Operating voltage range | 10.8 V DC to 26.4 V DC | 3.5 V DC to 5.5 V DC | |
| Input points per common | Independent common for each point | | |
| Min. ON voltage / Min. ON current | 10 V DC / 4 mA | 3 V DC / 4 mA | |
| Max. OFF voltage / Max. OFF current | 2 V DC / 2 mA | 1 V DC / 0.5 mA | |
| Input impedance | Approx. 3.9 kΩ | Approx. 560 Ω | |
| Operating mode indicator | 6-point LED display | | |

## Input Specifications

| Item | | Specifications |
|---|---|---|
| Insulation method | | Optical coupler |
| Rated input voltage | | 24 V DC |
| Rated input current | | Approx. 3 mA (at 24 V DC) |
| Input impedance | | Approx. 6.8 kΩ |
| Operating voltage range | | 21.6 to 26.4 V DC |
| Min. ON voltage / Min. ON current | | 19.2 V / 6 mA |
| Max. OFF voltage / Max. OFF current | | 2.4 V / 1 mA |
| Response time | OFF→ON | 135 µs max. (Possible to change by using the input time constant selection function) |
| | ON→OFF | 135 µs max. (Possible to change by using the input time constant selection function) |
| Input points per common | | 16 points/1 common |
| Operating mode indicator | | 16-point LED display (Lit when ON, SW selection) |
| External connection method | | Connector connection (Compliant with the MIL standard, 40P) |

## Output Specifications

| Item | | Specifications (sink type) | Specifications (source type) |
|---|---|---|---|
| Insulation method | | Optical coupler | Optical coupler |
| Output type | | NPN open collector | PNP open collector |
| Rated load voltage | | 5 to 24 V DC | 24 V DC |
| Allowable load voltage range | | 4.75 to 26.4 V DC | 21.6 to 26.4 V DC |
| Max. load current | | 0.1 A | |
| Common restrictions | | 1.6 A/common | |
| Max. inrush current | | 1.0 A | |
| OFF state leakage current | | 1 µA or less | 2 µA or less |
| ON state max. voltage drop | | 0.7 V or less | 0.7 V or less |
| Response time | OFF→ON | 6 µs or less (at an ambient temperature of 25°C) | |
| | ON→OFF | 15 µs or less (at an ambient temperature of 25°C) | |
| External connection method | Voltage | 4.75 to 26.4 V DC | 21.6 to 26.4 V DC |
| | Current | 35 mA/common (at 24 V) | 30 mA/common (at 24 V) |
| Surge absorber | | Zener diode | |
| Short-circuit protection | | Provided (to automatically protect every eight points) (Note 1) | |
| Input points per common | | 16 points/1 common | |
| Operating mode indicator | | 16-point LED display (Lit when ON, SW selection) | |
| External connection method | | Connector connection (Compliant with the MIL standard, 40P) | |

(Note 1): When the maximum inrush current is exceeded, eight output points in the same protection block are turned OFF simultaneously.

# Specifications

## Input Unit Specifications

AGM1X64D2

| Item | | Specifications |
|---|---|---|
| Insulation method | | Optical coupler |
| Rated input voltage | | 24 V DC |
| Rated input current | | Approx. 2.7 mA (at 24 V DC) |
| Input impedance | | Approx. 6.8 kΩ |
| Operating voltage range | | 20.4 to 26.4 V DC |
| Min. ON voltage / Min. ON current | | 19.2 V / 2.5 mA |
| Max. OFF voltage / Max. OFF current | | 5 V / 1.5 mA |
| Response time | OFF→ON | 0.2 ms max. (Possible to change by using the input time constant selection function) |
| | ON→OFF | 0.2 ms max. (Possible to change by using the input time constant selection function) |
| Input points per common | | 32 points/1 common |
| Operating mode indicator | | Operating mode indicator: 32-point LED display (Lit when ON, SW selection) |
| External connection method | | Connector connection (Compliant with the MIL standard, 40P, two pieces used) |

## Output Unit Specifications

AGM1Y64T
AGM1Y64P

| Item | | Specifications (sink type) | Specifications (source type) |
|---|---|---|---|
| Insulation method | | Optical coupler | |
| Output type | | NPN open collector | PNP open collector |
| Rated load voltage | | 5 to 24 V DC | |
| Allowable load voltage range | | 4.75 to 26.4 V DC | |
| Max. load current | | 0.3 A (20.4 to 26.4 V DC), 30 mA (4.75 V DC) | |
| Common restrictions | | 3.2 A/common | |
| Max. inrush current | | 0.6 A | |
| OFF state leakage current | | 1 μA or less | |
| ON state max. voltage drop | | 0.5 V or less | |
| Response time | OFF→ON | 0.1 ms or less (Load current: 2 mA or more) | |
| | ON→OFF | 0.3 ms or less (Load current: 2 mA or more) | 0.5 ms or less (Load current: 2 mA or more) |
| External power supply | Voltage | 4.75 to 26.4 V DC | |
| | Current | 70 mA/common (at 24 V) | 90 mA/common (at 24 V) |
| Surge absorber | | Zener diode | |
| Short-circuit protection | | None | |
| Input points per common | | 32 points/1 common | |
| Operating mode indicator | | 32-point LED display (Lit when ON, selection using the display selector switch) | |
| External connection method | | Connector connection (Compliant with the MIL standard, 40P, two pieces used) | |

## Input / Output unit Specifications

AGM1XY64D2T
AGM1XY64D2P

| Item | | | Specifications (sink type) | Specifications (source type) |
|---|---|---|---|---|
| Input specifications | Insulation method | | Optical coupler | |
| | Rated input voltage | | 24 V DC | |
| | Rated input current | | Approx. 2.7 mA (at 24 V DC) | |
| | Input impedance | | Approx. 6.8 kΩ | |
| | Operating voltage range | | 20.4 to 26.4 V DC | |
| | Min. ON voltage / Min. ON current | | 19.2 V / 2.5 mA | |
| | Max. OFF voltage / Max. OFF current | | 5 V / 1.5 mA | |
| | Response time | OFF→ON | 0.2 ms max. (Possible to change by using the input time constant selection function) | |
| | | ON→OFF | 0.2 ms max. (Possible to change by using the input time constant selection function) | |
| | Input points per common | | 32 points/1 common | |
| Output specifications | Insulation method | | Optical coupler | |
| | Output type | | NPN open collector | PNP open collector |
| | Rated load voltage | | 5 to 24 V DC | |
| | Allowable load voltage range | | 4.75 to 26.4 V DC | |
| | Max. load current | | 0.3 A (20.4 to 26.4 V DC), 30 mA (4.75 V DC) | |
| | Common restrictions | | 3.2 A/common | |
| | Max. inrush current | | 0.6 A | |
| | OFF state leakage current | | 1 μA or less | |
| | ON state max. voltage drop | | 0.5 V or less | |
| | Response time | OFF→ON | 0.1 ms or less (Load current: 2 mA or more) | |
| | | ON→OFF | 0.3 ms or less (Load current: 2 mA or more) | 0.5 ms or less (Load current: 2 mA or more) |
| | External power supply | Voltage | 4.75 to 26.4 V DC | |
| | | Current | 70 mA/common (at 24 V) | 90 mA/common (at 24 V) |
| | Surge absorber | | Zener diode | |
| | Short-circuit protection | | None | |
| | Input points per common | | 32 points/1 common | |
| Operating mode indicator | | | 32-point LED display (Lit when ON, selection using the display selector switch) | |
| External connection method | | | Connector connection (Compliant with the MIL standard, 40P, two pieces used) | |

## Analog input unit Specifications

AGM1AD8

| Item | | Specifications |
|---|---|---|
| No. of input points | | 8 ch |
| Input range (resolution) | Voltage | -10 to +10 V DC (Resolution: 1/64,000)<br>0 to +10 V DC (Resolution: 1/32,000)<br>-5 to +5 V DC (Resolution: 1/64,000)<br>0 to +5 V DC (Resolution: 1/32,000)<br>+1 to +5 V DC (Resolution: 1/25,600 ) (Note 1) |
| | Current | 0 to + 20 mA (Resolution: 1/32,000)<br>+4 to + 20 mA (Resolution: 1/25,600) (Note 1) |
| Conversion speed | | 50 μs/ch |
| Exceeding the rated range | | Possible to output up to the rated value ± 2%.<br>With the 0 to 20 mA range, the lower limit is not supported for exceeding the rated range. (Note 2) |
| Total accuracy | | ±0.2 %F.S. or less (at +25 ℃)<br>±0.4 %F.S. or less (at 0 to +55 ℃) |
| Input impedance | | Voltage input: Approximately 1 MΩ; current input: Approximately 250 Ω |
| Absolute max. input | | Voltage input: Approximately -15 V to +15 V; current input: Approximately -30 mA to +30 mA |
| Insulation method | | Between input terminals and internal circuit: Photocoupler and isolated DC/DC converter<br>Between channels: Non-insulated |
| Execution / Non-execution channel settings | | Possible to make non-converted channel settings. |
| Input range selection | | Possible to make settings on a channel-by-channel basis. |
| Average processing | Number of averaging times | Setting range of 2 to 60,000 times |
| | Time average | Time setting range of 1 to 1,500 ms |
| | Moving average | Setting range of 2 to 2,000 times |
| Offset / Gain settings | | A desired value within the digital output range can be set for the offset value.<br>Setting range: -3000 to +3000<br>A desired value within the digital output range can be set for the gain value.<br>Setting range: +9000 to +11000 (90 % to 110 %) |
| Scale conversion settings | | A desired value within the digital output range can be set for the scale conversion setting value.<br>Setting range: -32768 to +32767 |
| Upper limit / lower limit comparison | | Output if the value is outside the preset upper limit or lower limit.<br>Setting range: -32768 to +32767 |
| Max. / Min. hold | | Holding max. / min. values sampled |
| Disconnection detection | | Disconnection detection is possible for the following ranges. Possible to select auto or manual resetting.<br>• 1 to 5 V range (Detection level: 0.7 V or less)<br>• 4 to 20 m Arange (Detection level: 2.8 mA or less) |

(Note 1): The full scale (F.S.) on the accuracy of an analog voltage input range from +1 to +5 V and that of an analog current input range from +4 to +20 mA are 0 to +5 V and 0 to +20 mA, respectively.
(Note 2): When a value exceeding the rated value ±2% is set, the output is rounded to a value equivalent to the rated value ±2%.

## Analog output unit Specifications

AGM1DA4

| Item | | Specifications |
|---|---|---|
| No. of output points | | 4 ch |
| Output range (resolution) (Note 1) | Voltage | -10 to +10 V DC (Resolution: 1/64,000)<br>0 to +10 V DC (Resolution: 1/32,000)<br>-5 to +5 V DC (Resolution: 1/64,000)<br>0 to +5 V DC (Resolution: 1/32,000)<br>+1 to +5 V DC (Resolution: 1/25,600) |
| | Current | 0 to +20 mA(Resolution: 1/32,000)<br>+4 to +20 mA (Resolution: 1/25,600) |
| Conversion speed | | 50 μs/4 ch |
| Exceeding the rated range | | Possible to output up to the rated value ± 2%.<br>With the 0 to 20 mA range, the lower limit is not supported for exceeding the rated range. (Note 2) |
| Total accuracy | | ±0.2 %F.S. or less (at +25 ℃)<br>±0.4 %F.S. or less (at 0 to +55 ℃) |
| Output impedance (voltage output) | | 0.5 Ω or less |
| Maximum output current (voltage output) | | 10 mA |
| Output allowable load resistance (current output) | | 500 Ω or less |
| Insulation method | | Between output terminals and internal circuit: Photocoupler and isolated DC/DC converter<br>Between channels: Non-insulated |
| Execution / Non-execution channel settings | | Possible to make non-converted channel settings. |
| Clipping function | | Upper and lower output limits can be set for digital input values.<br>Setting range: -32,640 to +32,640 |
| Scale conversion settings | | A desired value within the digital input range can be set for the scale conversion setting value.<br>Setting range: -32768 to +32767 |
| Offset / Gain settings | | A desired value within the digital input range can be set for the offset value.<br>Setting range: -3,000 to + 3,000<br>A desired value within the digital input range can be set for the gain value.<br>Setting range: + 9000 to +11000 (90 % to 110 %) |
| Analog output hold (in STOP mode) | | A desired output value while in STOP mode can be set as a digital value.<br>Setting range: -32640 to +32640 |

(Note 1): The full scale (F.S.) on the accuracy of an analog voltage output range from +1 to +5 V and that of an analog current output range from +4 to +20 mA are 0 to +5 V and 0 to +20 mA, respectively.
(Note 2): When a value exceeding the rated value ±2% is set, the output is rounded to a value equivalent to the rated value ±2%.

# Specifications

## Performance Specifications of the Pulse Output Unit

AGM1PG04T
AGM1PG04L

| Item | | Specifications | |
|---|---|---|---|
| Product No. | | AGM1PG04T | AGM1PG04L |
| Output type | | Transistor | Line driver |
| Number of control axes | | 4 axis, independent | |
| Position command | Command unit | Pulse unit (for increment or absolute) | |
| | Max. pulse count | Signed 32 bits (-2,147,483,648 to +2,147,483,647 pulses) | |
| Speed command | Command range | 1 pps to 500 kpps | 1 pps to 4 Mpps |
| | | (can be set in 1 pps.) | (can be set in 1 pps.) |
| Acceleration / deceleration command | Acceleration / deceleration method | Linear acceleration / deceleration, S-shaped acceleration / deceleration control | |
| | S-shape pattern | Sine curve, Cubic curve (can be select) | |
| Home return | Home return speed | Speed setting possible (changes return speed and search speed) | |
| | Input signal | Home input, near home input, over limit input (+), over limit input (-) | |
| | Output signal | Deviation counter clear signal | |
| Operation mode | | •E-point control (Linear and S-shaped acceleration / deceleration)<br>•P-point control (Linear and S-shaped acceleration / deceleration)<br>•Home return (Home search) •JOG operation (Note 1) •JOG positioning<br>•Pulser input operation (Note 2) Transfer multiplication ratio (×1, ×2, ×5, ×10, ×50, ×100, ×500, ×1000)<br>•Real-time frequency change function | |
| Startup time | | 0.001 ms / 0.005 ms / 0.02 ms | |
| Output interface | Output mode | Pulse/Sign, CW/CCW | |
| Feedback counter function (Note 2) | Counting range | Signed 32 bits (-2,147,483,648 to +2,147,483,647 pulses) | |
| | Input mode | 2-phase input, direction identification input, individual input (transfer multiple available for each mode) | |
| | Max. counting speed | 4 MHz (2-phase input) | |
| | | 1 MHz (Direction distinction input and individual input) | |
| Other functions | | •Built-in over limit input (+) and over limit input (-) •Servo ON output incorporated | |

(Note 1): When Linear acceleration/deceleration operation is selected, the target speed can be changed during an operation.
(Note 2): "Pulser input operation" and "Feedback counter" use the same pulse input terminal. Either function of the two can only be used.

## Serial Communication Unit

AGM1NSCS2
AGM1NSCM2
AGM1NSCS1M1

| Item | | Specifications | | |
|---|---|---|---|---|
| Product No. | | AGM1NSCS2 | AGM1NSCM2 | AGM1NSCS1M1 |
| Interface | Connector 1 | RS-232C | RS-422A / 485 | RS-232C |
| | Connector 2 | RS-232C | RS-422A / 485 | RS-422A / 485 |
| Communication method | RS-232C | Full-duplex / half-duplex | - | Full-duplex / half-duplex |
| | RS-422A | - | Full-duplex / half-duplex | Full-duplex / half-duplex |
| | RS-485 | - | Half-duplex | Half-duplex |
| Transmission distance (Note 1) | RS-232C | Max. 15 m | - | Max. 15 m |
| | RS-422A | - | Max. 1,200 m (Note 1) (total extension distance) | Max. 1,200 m (Note 1) (total extension distance) |
| | RS-485 | | | |
| Transmission mode Number of destination units | RS-232C | 1:1 | - | 1:1 |
| | RS-422A | - | 1:1 | 1:1 |
| | RS-485 | - | 1:N (N = 32 max.) | 1:N (N = 32 max.) |
| Protocol | | General-purpose communication / Modbus-RTU (master / slave) | | |
| Baud rate | General-purpose communication | 1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200 / 230,400 bps | | |
| | Modbus-RTU | 1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200 bps | | |
| Maximum data length | General-purpose communication | 1,024 Byte | | |
| | Modbus-RTU | 252 Byte | | |
| Communication format | Data length | 7bit / 8bit | | |
| | Parity | None, odd, even | | |
| | Stop code | 1bit / 2bit | | |
| | Start code | None | | |
| | End code | None | | |

(Note 1): Check the transmission distance using the actual unit as it may depend on the destination device. The recommended transmission distance is 100 m or less.

## List of consumption current

| Unit type | | Consumption current |
|---|---|---|
| GM1 controller RTEX type | AGM1CSRX16T | 400 mA or less |
| GM1 controller EtherCAT type | AGM1CSEC16T | 400 mA or less |
| | AGM1CSEC16P | 400 mA or less |
| Input / output unit | AGM1X64D2 | 90 mA or less (*1) |
| | AGM1Y64T | 160 mA or less (*1) |
| | AGM1Y64P | 160 mA or less (*1) |
| | AGM1XY64D2T | 120 mA or less (*1) |
| | AGM1XY64D2P | 120 mA or less (*1) |
| Analog input / output unit | AGM1AD8 | 160 mA or less (*1) |
| | AGM1DA4 | 320 mA or less (*1) |
| Pulse output unit | AGM1PG04T | 120 mA or less (*1) |
| | AGM1PG04L | 120 mA or less (*1) |
| Serial Communication Unit | AGM1NSCS2 | 120 mA or less (*1) |
| | AGM1NSCM2 | 140 mA or less (*1) |
| | AGM1NSCS1M1 | 150 mA or less (*1) |

*1 This is the increase in the current consumption of the controller.
(Operating voltage range: 20.4 - 28.8 V)

# Product types

## Controller

| Product name | Number of axes | Network | Number of I/O | High-speed counter | Rated voltage | Output specifications | Part No. |
|---|---|---|---|---|---|---|---|
| GM1 controller | 32 axes | RTEX | Input: 16 points Output: 16 points | 2 ch | 24 V DC | Transistor output sink(NPN) | **AGM1CSRX16T** |
| | | EtherCAT | | | | | **AGM1CSEC16T** |
| | | | | | | Transistor output sauce(PNP) | **AGM1CSEC16P** *2 |

## Input / output unit

| Product name | Type | Number of I/O | Specifications | Part No. |
|---|---|---|---|---|
| Input / output unit | DC input | Input: 64 points | 24 V DC 32 points/1 common | **AGM1X64D2** |
| | Transistor output sink(NPN) | Output: 64 points | Maximum load current: 0.3 A (20.4 to 26.4 V DC), 30 mA (4.75 V DC) 3.2 A/common 32 points/1 common | **AGM1Y64T** |
| | Transistor output sauce(PNP) | | | **AGM1Y64P** *2 |
| | DC input Transistor output sink(NPN) | Input: 32 points Output: 32 points | Input: 24 V DC 32 points/1 common Output: Maximum load current: 0.3 A (20.4 to 26.4 V DC), 30 mA (4.75 V DC) 3.2 A/common 32 points/1 common | **AGM1XY64D2T** |
| | DC input Transistor output sauce(PNP) | | | **AGM1XY64D2P** *2 |

## Analog input / output unit

| Product name | Specifications | Number of channels | Part No. |
|---|---|---|---|
| Analog input unit | Conversion speed 50 µs/ch Resolution 16 bit (maximum) Accuracy ±0.2 %F.S. or less (at+25 °C) | 8 ch | **AGM1AD8** |
| Analog output unit | Conversion speed 50 µs/4 ch Resolution 16 bit (maximum Accuracy ±0.2 %F.S. or less (at+25 °C) | 4 ch | **AGM1DA4** |

## Pulse output unit

| Product name | Output type | Number of control axes | Speed command | Part No. |
|---|---|---|---|---|
| Pulse output unit | Transistor | 4 axes | 1 pps to 500 kpps | **AGM1PG04T** |
| | Line driver | | 1 pps to 4 Mpps | **AGM1PG04L** |

## Serial communication unit

| Product name | Specifications | Part No. |
|---|---|---|
| Serial Communication Unit | RS-232C × 2ch | **AGM1NSCS2** |
| | RS-422A/485 × 2ch | **AGM1NSCM2** |
| | RS-232C × 1ch RS-422A/485 × 1ch | **AGM1NSCS1M1** |

## Option

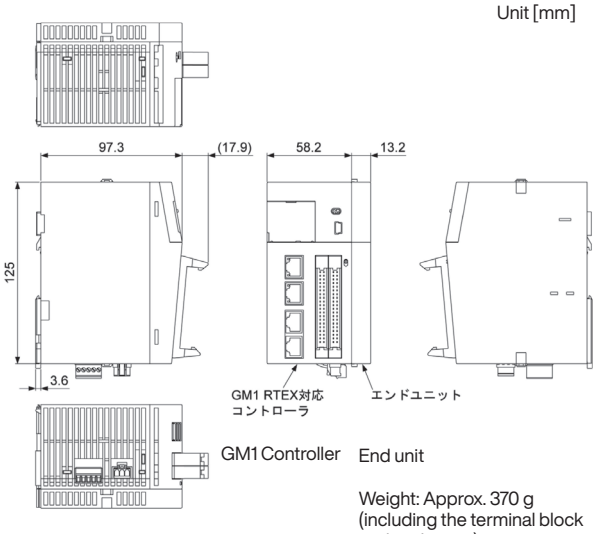
| Product name | Description | Part No. |
|---|---|---|
| Discrete-wire connector set (40-pin) | For GM1 Controller, for Expansion Unit (2 pieces) | **AFP2801** |
| Flat cable connector set (40-pin) | Use for batch wiring with flat cable For GM1 Controller, for Expansion Unit (2 pieces) | **AFP2802** |

*1 Connectors are not included with the controller or expansion unit. Please ensure you have the following connectors.
Discrete-wire connector set (Part No.: AFP2801) Flat cable connector set (Part No.: AFP2802)
Power cable (Part No.: AFPG805) is included with the controller.
*2 The PNP type complies with Korean KC from May 2024 production lot.

# Dimensions

## GM1 controller (RTEX type)

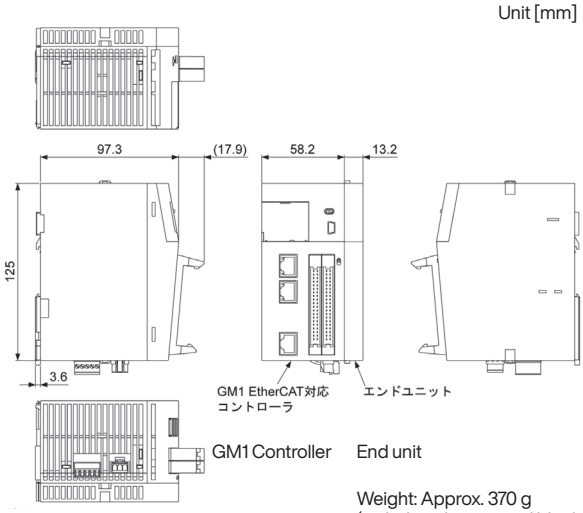
Unit [mm]




Weight: Approx. 370 g
(including the terminal block
and end cover)

## GM1 controller (EtherCAT type)

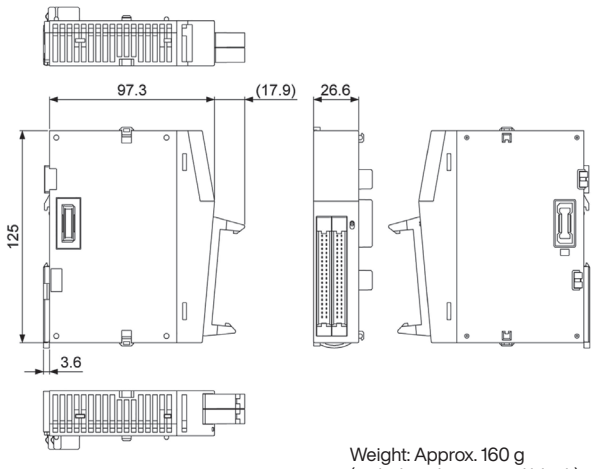
Unit [mm]




Weight: Approx. 370 g
(including the terminal block
and end cover)

## Input / output unit / Pulse output unit

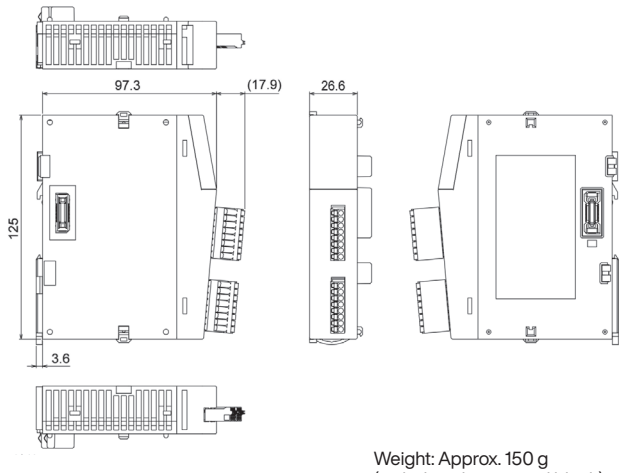
Unit [mm]




Weight: Approx. 160 g
(including the terminal block)

## Analog input / output unit

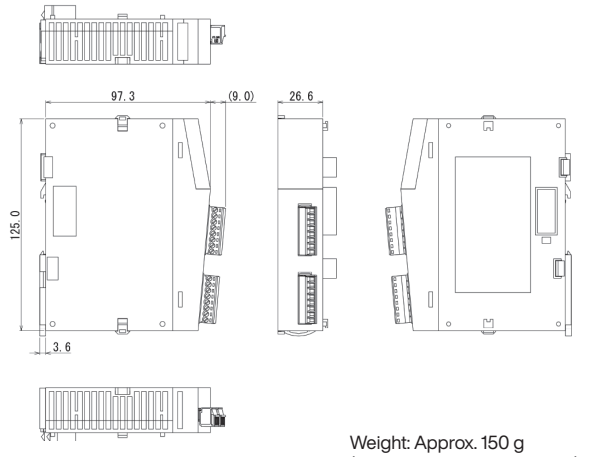
Unit [mm]




Weight: Approx. 150 g
(including the terminal block)

## Serial communication unit

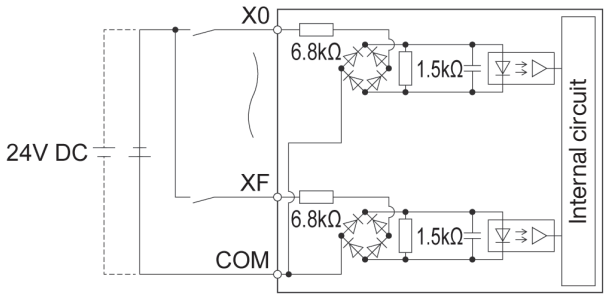
Unit [mm]



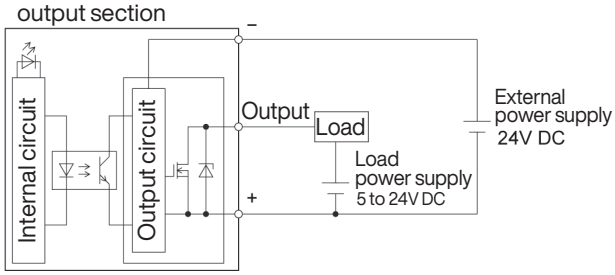

Weight: Approx. 150 g
(including the terminal block)

# Circuit Diagram

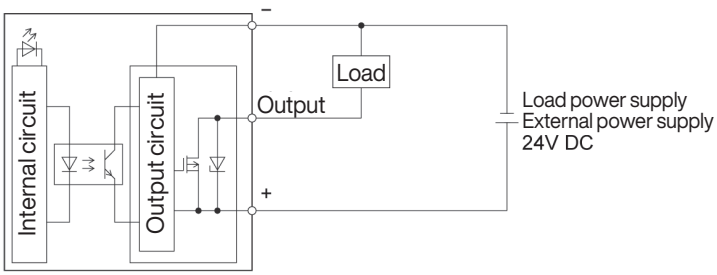
■ Internal circuit diagram of the GM1 Controller input section



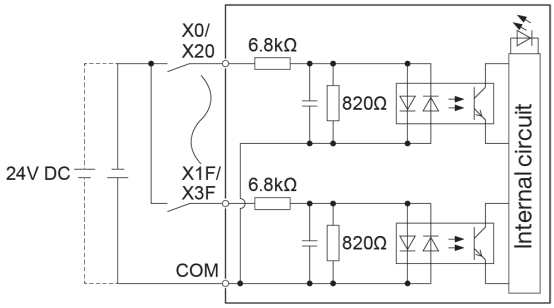

■ Internal circuit diagram of the GM1 Controller (sink type) output section



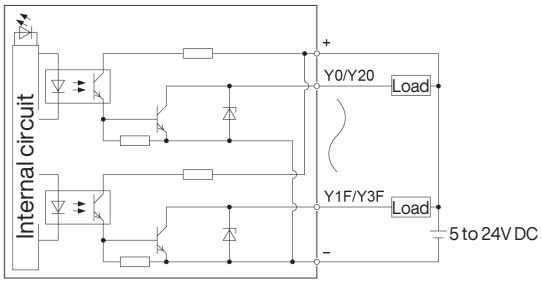

■ Internal circuit diagram of the GM1 Controller output section



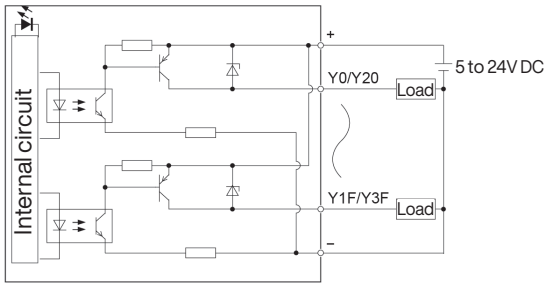

■ Internal circuit diagram of the 64-point digital input unit




■ Internal circuit diagram of the 64-point digital output unit (sink type)

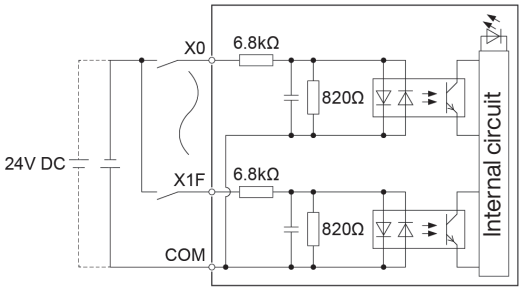



■ Internal circuit diagram of the 64-point digital output unit (source type)

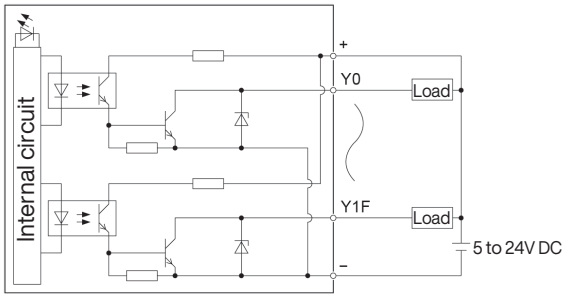



■ Internal circuit diagram of the 64-point digital input / output unit (sink type)

Input section (32 points)

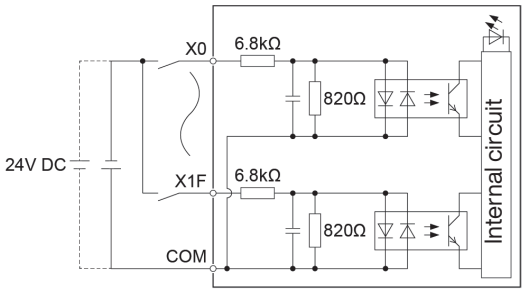



Output section (32 points)

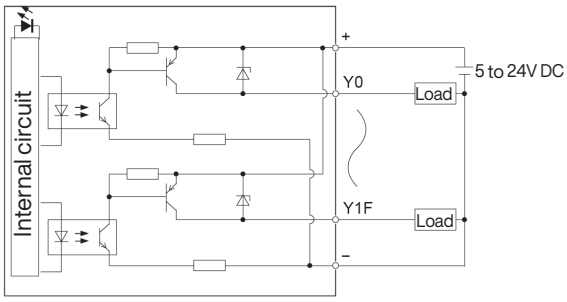



■ Internal circuit diagram of the 64-point digital input / output unit (source type)

Input section (32 points)




Output section (32 points)



# Motor and driver combinations

# MINAS A6 Family

Programmable Controller

Controller

RTEX Realtime Express

EtherCAT

Simple network
small axis
and distributed control

Open network
multi-axis and high-speed

Amplifier

Standard type
A6NE series

Multi function type
A6NF series

Standard type
A6NM series
A6NL series
Special Order Product

Rotary motor

Linear motor / DD motor

*The photograph represents A6NM series.

Standard type
A6BE series

Multi function type
A6BF series

Rotary motor

Standard type
A6BM series
A6BL series
Special Order Product

Linear motor / DD motor

*The photograph represents A6NM series.

AC Servo Motor

Motor

MSMF
Low inertia

MQMF
Middle inertia/
Flat type

MDMF
Middle inertia

MGMF
Middle inertia/
Low speed/High torque type

MHMF
High inertia

Special Order Product For more information, visit the website or please request to our distributors separately.

## Motor Line-up

| Motor | | | Rated output (kW) | Rated rotational speed (Max. speed) (r/min) | Rotary encoder 23 bit absolute | Enclosure | Motor lead-out configuration | Features | Applications |
|---|---|---|---|---|---|---|---|---|---|
| Low inertia | MSMF | 80 mm sq. or less | 0.05 0.1 0.2 0.4 0.75 1.0 | 3000 (6000) | ○ | IP65 | Leadwire | • Small capacity • Suitable for high speed application • Suitable for all applications | • Bonder • Semiconductor production equipment • Packing machines etc |
| | | 80 mm sq. or less | 0.05 0.1 0.2 0.4 0.75 1.0 | 3000 (6000) | ○ | IP67 | Connector | | |
| | | 100 mm sq. or more | 1.0 1.5 2.0 3.0 | 3000 (5000) | ○ | IP67 | Connector | • Middle capacity • Suitable for the machines directly coupled with ball screw and high stiffness and high repetitive application | • SMT machines • Food machines • LCD production equipment etc |
| | | | 4.0 5.0 | 3000 (4500) | | | | | |
| Middle inertia | MQMF (Flat type) | 80 mm sq. or less | 0.1 0.2 0.4 | 3000 (6500) | ○ | IP65 | Leadwire | • Small capacity • Flat type and suitable for low stiffness machines with belt driven • Motors with gear reducers are also available. | • SMT machines • Inserter machines • Belt drive machines • unloading robot |
| | | 80 mm sq. or less | 0.1 0.2 0.4 | 3000 (6500) | ○ | IP67 | Connector | | |
| | MDMF | 130 mm sq. or more | 1.0 1.5 2.0 3.0 4.0 5.0 | 2000 (3000) | ○ | IP67 (22.0 kW : IP44) | Connector (22.0 kW : Terminal) | • Middle capacity • Suitable for low stiffness machines with belt driven | • Conveyors • Robots • Machine tool etc |
| | | | 7.5 | 1500 (3000) | | | | | |
| | | | 11.0 15.0 22.0 | 1500 (2000) | | | | | |
| | MGMF (Low speed/ High torque type) | 130 mm sq. or more | 0.85 1.3 1.8 2.4 2.9 4.4 5.5 | 1500 (3000) | ○ | IP67 | Connector | • Middle capacity • Suitable for low speed and high torque application | • Conveyors • Robots • Textile machines etc |
| High inertia | MHMF | 80 mm sq. or less | 0.05 0.1 0.2 0.4 | 3000 (6500) | ○ | IP65 | Leadwire | • Small capacity • Suitable for low stiffness machines with belt driven • Motors with gear reducers are also available. | • Conveyors • Robots etc |
| | | | 0.75 1.0 | 3000 (6000) | | | | | |
| | | 80 mm sq. or less | 0.05 0.1 0.2 0.4 | 3000 (6500) | ○ | IP67 | Connector | | |
| | | | 0.75 1.0 | 3000 (6000) | | | | | |
| | | 130 mm sq. or more | 1.0 1.5 2.0 3.0 4.0 5.0 | 2000 (3000) | ○ | IP67 | Connector | • Middle capacity • Suitable for low stiffness machines with belt driven, and large load moment of inertia | • Conveyors • Robots • LCD manufacturing equipment etc |
| | | | 7.5 | 1500 (3000) | | | | | |

## NETWORK MOTION

| | GM1 | FP0H | FP-XH M8N |
|---|---|---|---|
| Controller | | | |
| Network | RTEX<br>EtherCAT | RTEX | RTEX |
| Corresponding AC servomotor | MINAS-A6N / A5N<br>MINAS-A6B / A5B | MINAS-A6N / A5N | MINAS-A6N / A5N |
| Maximum number of sync axes | RTEX 32 axes<br>EtherCAT 32 axes | 4/8 axes | 8 axes |
| Command update period (Max.) | 500 µs | 1 ms | 1 ms |
| Operation command | position / speed / torque | position | position |
| Interpolation control | Straight line / Arc / Spiral | Straight line / Arc / Spiral | Straight line / Arc / Spiral |
| Synchronization command | Cam synchronization, Gear synchronization, CNC control | Synchronization, Electronic cam, Electronic clutch, Electronic gear | Synchronization, Electronic cam, Electronic clutch, Electronic gear |
| Tool | GM Programmer | Control FPWIN GR7<br>Control FPWIN Pro7 | Control FPWIN GR7<br>Control FPWIN Pro7 |
| Ethernet Port | 2 port<br>*IP address can be set for each port | 2 port<br>*Only one IP address can be set | none |
| Communication protocol (Ethernet) | OPC UA, Ethernet / IP, Modbus-TCP, CodesysV3 | Ethernet / P, Modbus-TCP, MC protocol | |
| FTP server function | ○ | ○ | |
| System scale | Large ← | | Small |

## ⚠ Safety Precautions

- **Before you use the product, please carefully read through the instruction manual, the installation instructions and the manuals, and understand them in detail to use the product properly.**

Please contact .....

**Panasonic Industry Co., Ltd.**
**Industrial Device Business Division**
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Panasonic INDUSTRY

Panasonic Industrial Search

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