# Panasonic
## ideas for life
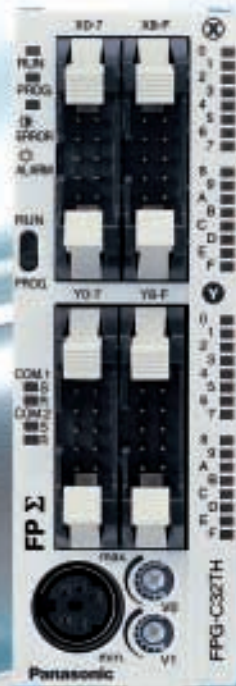
## Ultra-compact high performance PLC

**High speed, High capacity, and New functions -** *V3* **launched for new performance stage**

FPG-C32TH

**Actual size:**
W30 × H90 × D60 (mm)
W1.181 × H3.543 × D2.362 (inch)

Panasonic

**FPG-C32T2H**
**FPG-C28P2H**

**FPG-C24R2H**

**FPG-C32T2HTM**
**FPG-C28P2HTM**

**FPG-C24R2HTM**

**Programmable Controllers FPΣ**
ARCT1B208E-2 '05.12

**New**
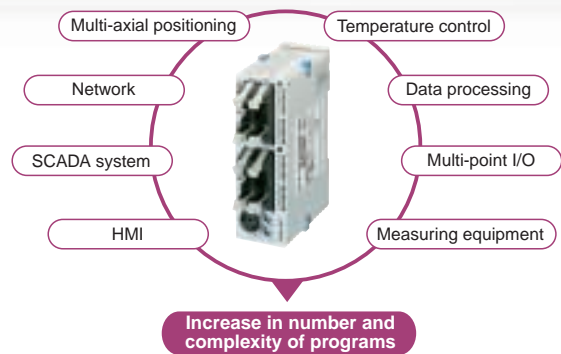
## Matsushita Electric Works, Ltd.

# V3 is added to the FP$\Sigma$ ultra-compact PLC serie
## of your equipment performance.

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## Sufficient programming capacity

### 32 k steps: Approx. 2.7 times bigger than our conventional model

More advanced and complex control is required for PLCs in accordance with equipment functionality enhancements, such as the support of multi-axial positioning, multi-point temperature control, serial communications, or networking. A greater programming memory capacity is thus being increasingly required, even for compact models.

FP$\Sigma$ V3 has a programming capacity of 32 k steps, which is approx. 2.7 times bigger than our conventional model and can accommodate an increase in the number and complexity of programs without difficulty.
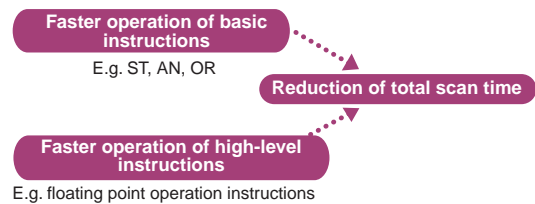
- Multi-axial positioning
- Network
- SCADA system
- HMI
- Temperature control
- Data processing
- Multi-point I/O
- Measuring equipment

**Increase in number and complexity of programs**

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## High-speed operation

### 0.32 $\mu$sec/step for basic instructions: Approx. 1.2 times faster than our conventional model

Upgraded equipment also requires an increase in the operation speed of PLCs to process increased programs in addition to the expansion of the program memory.

FP$\Sigma$ V3 is compact in size but equipped with a RISC processor. The basic instruction operation speed is 0.32 $\mu$s/step, which is 1.2 times faster than our conventional model. The speed of high-level instruction operations, including floating point operations, is also high, reducing the total scan time.

**Faster operation of basic instructions**
E.g. ST, AN, OR

**Reduction of total scan time**

**Faster operation of high-level instructions**
E.g. floating point operation instructions

---

## Simple temperature control

### New PID instruction (F356 EZPID) has been added.

- Temperature control applications operated by PLCs are being expanded, for example, to multistage control, timer control, control according to variables based on data processing results, or multi-point control. FP$\Sigma$ V3 has a new PID instruction (F356 EZPID), which makes PID control programming much easier than with our conventional model, facilitating temperature control by a PLC, which had previously been considered difficult.
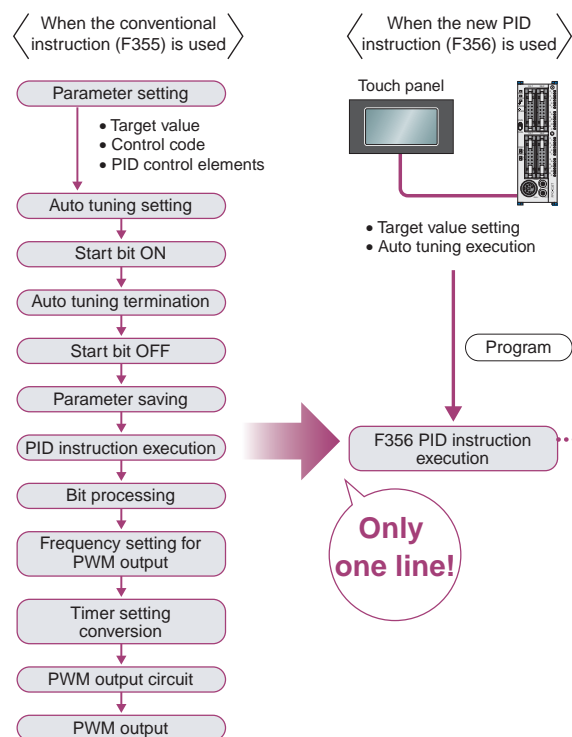
  The right-hand example shows simple temperature control. A combination of touch panel operations and the F356 instruction allows you to write the program in only one line, significantly facilitating PID control.
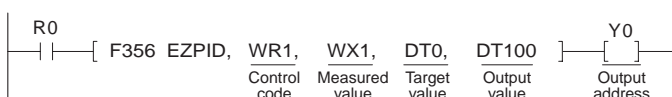
  Thermocouple *1
  SSR
  Heater
  PWM output
  °C
  Constant temperature
  t
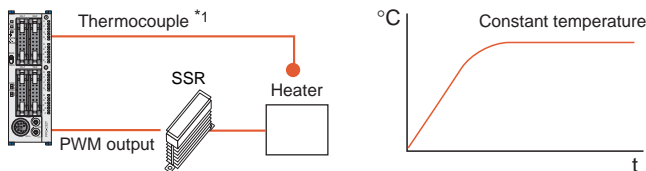
  *1: FP0 thermocouple unit is required to connect a thermocouple.

- **Control data can be seen at a glance.**

  Since key parameters are written in each instruction line, you can see details of the PID control at a glance by monitoring instructions on the ladder program.

### When the conventional instruction (F355) is used

- Parameter setting
  - Target value
  - Control code
  - PID control elements
- Auto tuning setting
- Start bit ON
- Auto tuning termination
- Start bit OFF
- Parameter saving
- PID instruction execution
- Bit processing
- Frequency setting for PWM output
- Timer setting conversion
- PWM output circuit
- PWM output

### When the new PID instruction (F356) is used

Touch panel

- Target value setting
- Auto tuning execution

Program

F356 PID instruction execution

**Only one line!**

```
 R0
 ─┤├─── F356  EZPID,  WR1,    WX1,      DT0,    DT100            Y0
                      Control  Measured  Target  Output        Output
                      code     value     value   value         address
```
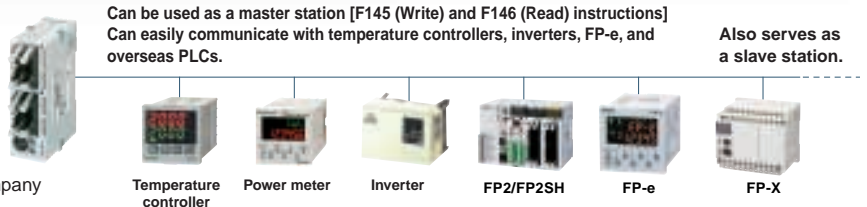
2

## Network enhancement

### Modbus Master/MEWTOCOL Master/3-port general-purpose serial communications
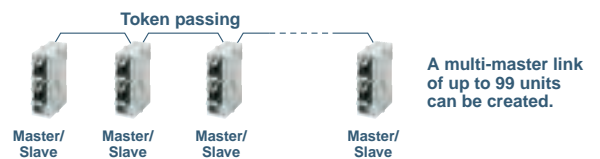
#### ■ Modbus-compatible

FPΣ V3 is compatible with the world's Modbus* de facto standard and can serve as both Modbus master and slave RTUs, which are ideal for air conditioning or temperature control etc.

*\* Protocol developed by Modicon Inc., an American company*

Can be used as a master station [F145 (Write) and F146 (Read) instructions]
Can easily communicate with temperature controllers, inverters, FP-e, and overseas PLCs.

Also serves as a slave station.

Temperature controller    Power meter    Inverter    FP2/FP2SH    FP-e    FP-X

**These applications are also available.**

When 17 or more FPΣ units need to be linked, you can use the Modbus function instead of MEWNET-W0 to link up to 99 units. Since each FPΣ unit can be either a master or a slave, a multi-master link can be created by passing a token from a user program.

Token passing

Master/Slave    Master/Slave    Master/Slave    Master/Slave

A multi-master link of up to 99 units can be created.

#### ■ The new "MEWTOCOL Master" function is available.

The MEWTOCOL master function automatically creates and transmits commands using the Matsushita open protocol MEWTOCOL. This function significantly facilitates serial communications with MEWTOCOL-compatible equipment, such as PD50, KT4H, and KW4H.

RS232C — 2D Code Reader PD50

RS485 — Temperature Controller KT4H — Eco Power Meter KW4M
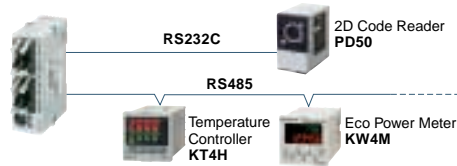
#### ■ Up to 3 general-purpose serial communication ports can be used at once.

In addition to COM1 and COM2 of a communication cassette, the tool port also became usable as a general-purpose serial port in the RUN mode. This new feature increases the number of devices that can be connected simultaneously, such as barcode readers, printers, meters, RF-ID, and wireless equipment.

## Security enhancement

### Programs are copy-protected by the upload restriction setting and an eight-character password.

● The setting to inhibit the uploading of PLC programs to PCs protects your programs from unauthorized copying. (If this setting is released, programs in the PLC are forcibly cleared.)

● An **eight-character** password has been adopted. (Tne conventional four-character password is also available.)
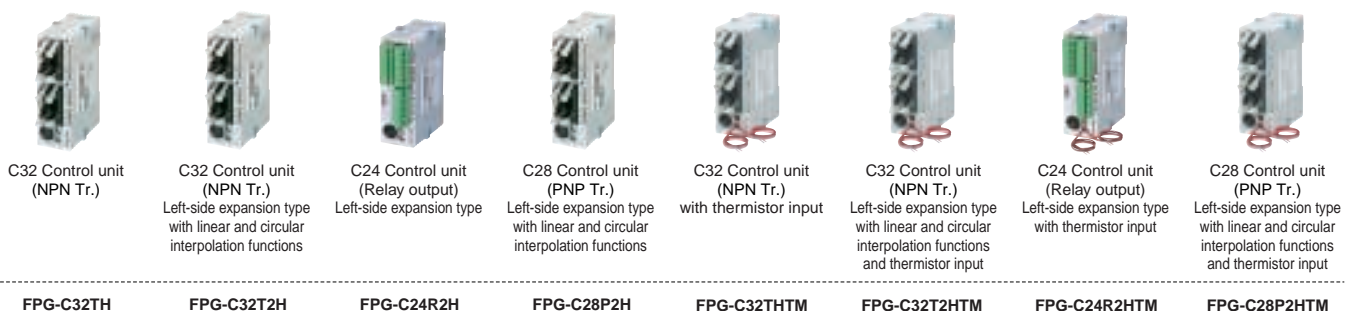**Approx. 218 trillion passwords** can be set by combining eight alphanumeric characters, making it nearly impossible to crack the set password.

## Debugging performance enhancement

### 512 steps rewritable in RUN mode

Up to 512 steps can be rewritten simultaneously in RUN mode. The number of steps is four times larger than with the conventional model. This improvement allows efficient program debugging without stopping the equipment operation.

## V3 controller lineup

| C32 Control unit (NPN Tr.) | C32 Control unit (NPN Tr.) Left-side expansion type with linear and circular interpolation functions | C24 Control unit (Relay output) Left-side expansion type | C28 Control unit (PNP Tr.) Left-side expansion type with linear and circular interpolation functions | C32 Control unit (NPN Tr.) with thermistor input | C32 Control unit (NPN Tr.) Left-side expansion type with linear and circular interpolation functions and thermistor input | C24 Control unit (Relay output) Left-side expansion type with thermistor input | C28 Control unit (PNP Tr.) Left-side expansion type with linear and circular interpolation functions and thermistor input |
|---|---|---|---|---|---|---|---|
| **FPG-C32TH** | **FPG-C32T2H** | **FPG-C24R2H** | **FPG-C28P2H** | **FPG-C32THTM** | **FPG-C32T2HTM** | **FPG-C24R2HTM** | **FPG-C28P2HTM** |

3

# Positioning

# Precise positioning
## Compact type achieves high-speed and high-precision positioning.

**FPΣ**

## P ositioning
### The FPΣ positioning unit supports ultra-high speed linear servomotors.
### All-purpose device capable of linear interpolation and circular interpolation

**FPΣ positioning unit**

### Pulse output of up to 4 Mpps and high-speed startup at 0.005 ms enable linear servomotor control.

### The linear and circular interpolation functions support a wide variety of applications.
These interpolation functions enable simultaneous two-axis control, which can support applications that up to now have been difficult to handle using conventional compact PLCs.

- Linear interpolation
- Circular interpolation

Adhesive
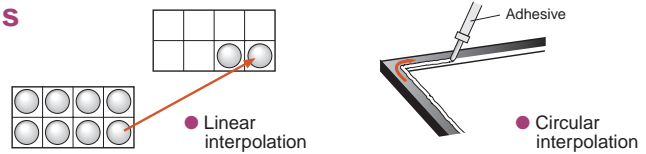
### Error detection can be available by using the high-speed counter in combination.
Unexpected accidents, such as errors in the driving system, can be detected by setting the counter so that it counts the feedback pulses from an encoder during positioning.

**Example**

Open-loop control

FPΣ positioning unit — Pulse output — Motor driver — Motor — Encoder (for error detection)

Pulse input from the encoder

- Counts feedback pulses from the encoder to detect errors
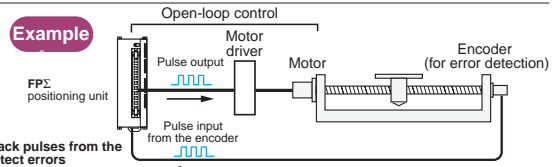
### Smooth acceleration/deceleration enables smooth startup.
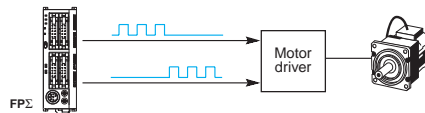
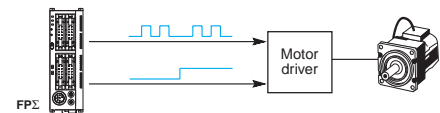Accelerates/decelerates in a maximum of 60 steps depending on preset parameters
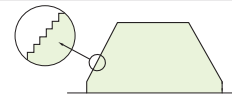
### CW/CCW is also supported.
Pulse+Sign method. Cost reduction of the whole system can be achieved by using FPΣ with small stepping motors or servomotors that do not support the Pulse-and-Sign method.

- **CW/CCW method**

FPΣ — Motor driver

- **Pulse+Sign method**

FPΣ — Motor driver

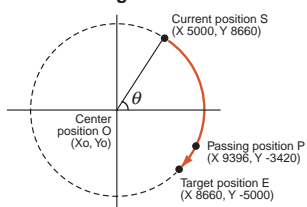### Even the control unit on its own can provide two-axis control.
Even the control unit on its own has a pulse output of 100 kpps and startup speed of 0.02 ms, which provide sufficient performance for normal positioning.

### Convenient and easy programming and selectable home return mode
- Uses a data table for setting parameters, such as startup speed, target speed, acceleration/deceleration time.
- Comes with dedicated instructions for each mode: trapezoidal control, home return, JOG operation, free table operation, linear interpolation, and circular interpolation.
- The home return method is selectable depending on the design, such as in the case where only a single sensor is being used.
- Output of the deviation counter reset signal upon completion of return to home position is also available.

**Circular interpolation**
- **Positioning locus**

Current position S (X 5000, Y 8660)

Center position O (Xo, Yo)

$\theta$

Passing position P (X 9396, Y -3420)

Target position E (X 8660, Y -5000)

- **A center-radius setting method is also available.**

**Program**

R12
```
[ F1  DMV,  H10,    DT600 ]
[ F1  DMV,  K500,   DT602 ]
[ F1  DMV,  K8660,  DT604 ]
[ F1  DMV,  K-5000, DT606 ]
[ F1  DMV,  K9396,  DT608 ]
[ F1  DMV,  K-3420, DT610 ]
[ F176 SPCH, DT600, K0 ]
```

**Positioning data table**

<Passing position designation>

| | | |
|---|---|---|
| DT600 | DT601 | Control code: H10 |
| DT602 | DT603 | Combined speed: 500 Hz |
| DT604 | DT605 | Target value (X-axis CH0): 8,660 pulses |
| DT606 | DT607 | Target value (Y-axis CH2): -5,000 pulses |
| DT608 | DT609 | Passing value (X-axis CH0): 9,396 pulses |
| DT610 | DT611 | Passing value (Y-axis CH2): -3,420 pulses |

### B est match
### AC servomotors in the best match to FPΣ

### MINAS A IV Series

- Features an upgraded real-time auto tuning function.
- The enhanced vibration damping function has improved the operability and enabled use in both low and high rigidity mechanisms.
- Usable for a wide range from position to speed and torque instructions.
- The slim design has enabled a size reduction to 75% of the conventional model (200 W, A series).

**Matsushita Electric Industrial Co., Ltd. Motor Company**

# Optimized communications
## Flexible selection of communication cassettes
**FP$\Sigma$**

- 1-channel RS232C type
- 2-channel RS232C type
- 1-channel RS485 type
- 1-channel RS232C + 1-channel RS485 type
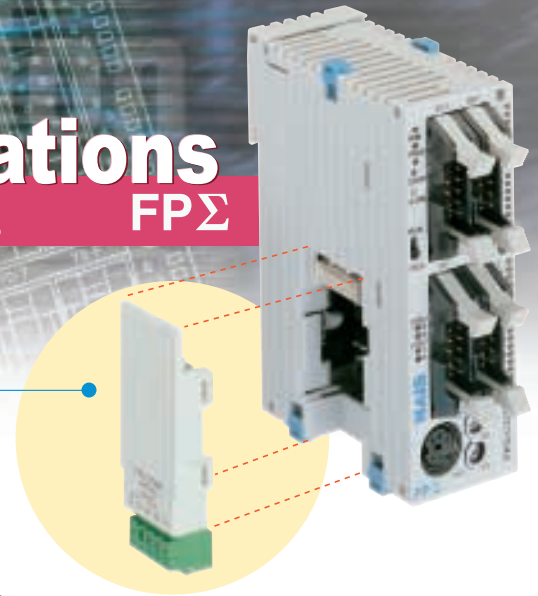
## C ommunication
# RS485 communication cassette
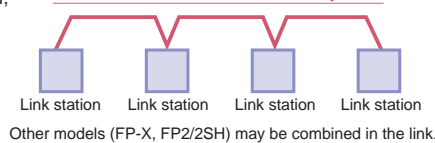## Enables compact but full-scale PLC links (MEWNET-W0)!

### Links up to 16 PLC units-as many as a medium-sized PLC. (2,048 link relays/256-word link data register: V3 type)

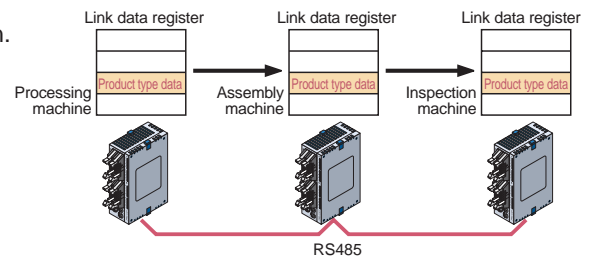Enables sharing of product type information and interlocking among 16 PLC stations.
Even when the power is turned off, the Multi-master communication system automatically switches the master station to continue operation. This provides smoother startup and faster recovery from errors.

- Even when a station is turned off, the other stations maintain communications.

Multi-master communications by FP$\Sigma$

Link station | Link station | Link station | Link station

Other models (FP-X, FP2/2SH) may be combined in the link.

- Sharing product type information among machines
- Interlocking among machines
- Easy wiring between PLC units by means of twin-core cables

Link data register — Link data register — Link data register

Processing machine — Product type data — Assembly machine — Product type data — Inspection machine — Product type data

RS485

### Enables computer linkage with up to 99 stations, contributing to higher design flexibility
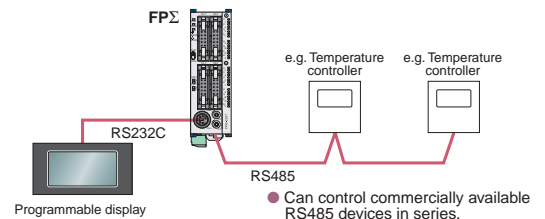
With the C-NET adapter, up to 32 stations can be linked, and with a commercially available adapter, up to 99 stations can be linked.
This enables information collection from other stations, maximizing design flexibility.

Computer linkage with up to 99 stations

Computer
RS232C
Commercially available adapter
FP$\Sigma$ FP$\Sigma$ FP$\Sigma$
RS485
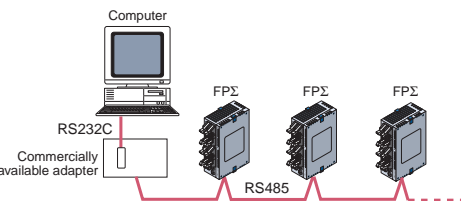
### Connection to external devices with an RS485 interface is also available.
- Can be connected with external devices having an RS485 interface, such as a temperature controller.
- Our temperature controller KT4H is compatible with MEWTOCOL and easy to connect. (FP$\Sigma$ uses the new "MEWTOCOL Master" function.)
- Can be applied to data collection and setting.

FP$\Sigma$
e.g. Temperature controller e.g. Temperature controller
RS232C
RS485
Programmable display
- Can control commercially available RS485 devices in series.

## C ommunication
# RS232C communications cassette
## Enables efficient connection to other control devices, contributing to major space savings!

### Communications using up to 3 ports
- Enables connection to devices with an RS232C interface, such as programmable displays and image processing devices
- Use of the tool port enables connection to up to three external devices.
- V3 allows the use of up to three general-purpose serial ports, broadening the choices of equipment to be connected.

- With the 2-channel type communication cassette

FP$\Sigma$ Computer
Image processing device
RS232C RS232C
Programmable display
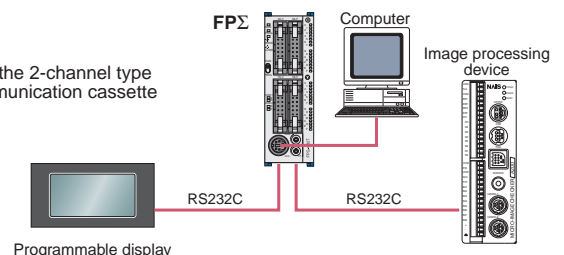
# Optimized temperature control
## Top-class easy and highly accurate temperature control
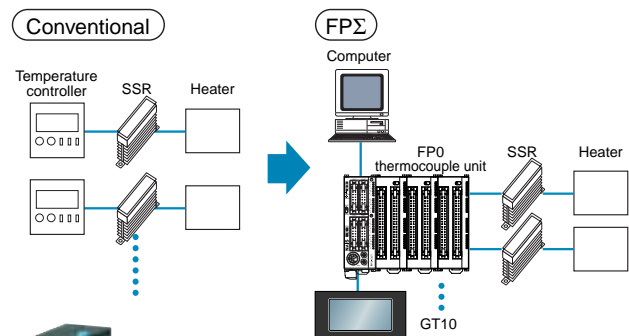
## T
### Highly accurate temperature control using the thermocouple unit
Temperature Control

### Temperature control of up to 24 channels enables multi-channel control at low cost.

Up to three units can be added to each control unit, enabling temperature control of up to 24 channels. Many advantages over multiple temperature controllers:

- Information collection and computer-based data storage
- On-site errors monitoring using a programmable display
- Significant reduction of total costs
- Power supply stabilization by protecting synchronization between heater ON and OFF states
- Approx. 80% reduction in footprint
- Easy tool changing by batch changing of temperature settings
- Multi-channel but uniform temperature control

Conventional | FPΣ

Temperature controller / SSR / Heater

Computer / FP0 thermocouple unit / SSR / Heater / GT10

### Temperature control at a high total accuracy of ±0.8°C

High total accuracy of ±0.8°C (K.J.T range) allows use for applications with stringent accuracy requirements

FP0 thermocouple unit

### The control unit with thermistor inputs enables temperature control at low cost.

Two thermistors, which cost less than thermocouples, can be connected to the FPΣ control unit with the thermistor inputs. Even the FPΣ control unit on its own with thermistor inputs can control temperature via a small number of control points at low cost.
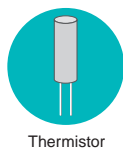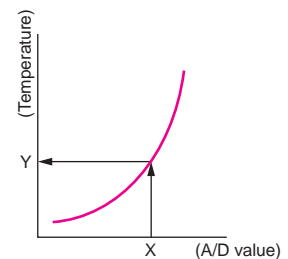
Thermistor

FPΣ control unit with thermistor inputs

- Using the SCAL command, temperature measuring by the thermistor can be programmed by issuing only one instruction.

- Program

| | Input data | Data table | Operation result |
|---|---|---|---|
| F282 | DT90040 | DT0 | DT100 |

- Data table

| Input data (X) | | Output data (Y) | |
|---|---|---|---|
| DT0 | 10 | | |
| DT1 | 110 | DT11 | 80 |
| DT2 | 120 | DT12 | 95 |
| DT3 | 130 | DT13 | 123 |
| | • | | • |
| | • | | • |
| DT10 | 200 | DT20 | 222 |

(Temperature)

Y

X (A/D value)

### Features useful instructions for temperature control.

#### Optimized temperature control with PID instruction and PWM instruction

Easy multi-stage temperature control and time control. Easy setting of multi-stage temperature control and time control, normally limited to only high performance-type temperature controllers.
The new PID instruction (F356 EZPID) of FPΣ V3 amazingly facilitates programming. The combination of this instruction and touch panel operations allows you to write a simple temperature control program, for example, in only one line.

Example of temperature control with the auto-tuning function only

Temperature

— Setting
— Progress

Time
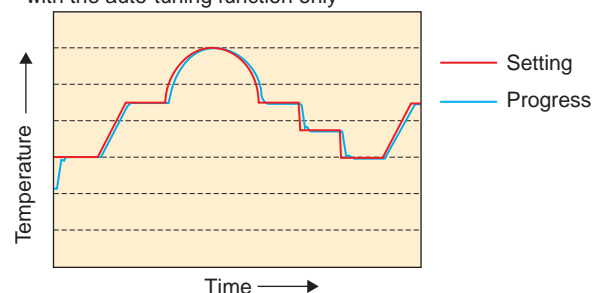
# Optimized analog control

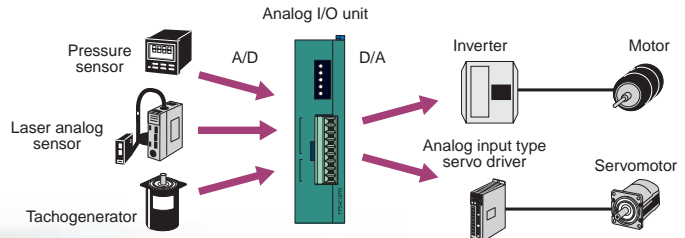## Features instruction and functions convenient for temperature control

FPΣ

## A nalog

### Analog I/O unit available

The analog I/O unit has a two-channel analog input and a one-channel analog output. With just a single unit it is easy to achieve analog control. Resolution of 1/4000 enables switching between a range of applications, as well.

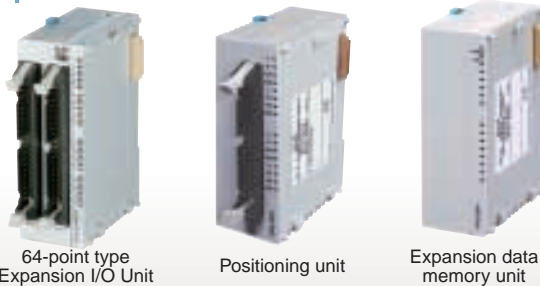An 8-ch analog input type is also included in the lineup.

Analog I/O unit

Pressure sensor — A/D — D/A — Inverter — Motor

Laser analog sensor — Analog input type servo driver — Servomotor

Tachogenerator

# Expandability

## Up to 384 control I/O ports* is achieved with a wide variety of combinations of FP0/FPΣ units.

FPΣ

* When four FPΣ expansions units (64 I/O ports × 4) and three FP0 expansion units (32 I/O ports × 3) are added

FPΣ expansions unit should be added to the left side of the FPΣ control unit.

FP0 expansions unit should be added to the right side of the FPΣ control unit.
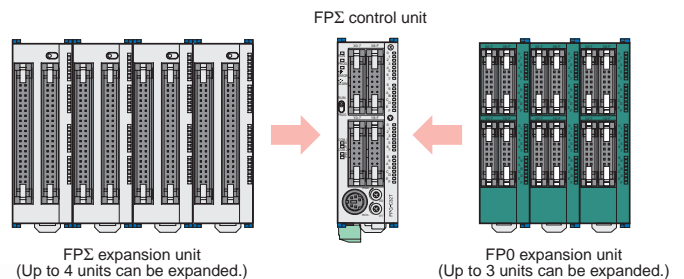
## E xpansion

64-point type Expansion I/O Unit

Positioning unit

Expansion data memory unit

Note: To use the expansion I/O unit with 64 ports, the control unit should be the left-addition-ready type (FPG-C32T2/FPG-C24R2).

FPΣ control unit

FPΣ expansion unit
(Up to 4 units can be expanded.)

FP0 expansion unit
(Up to 3 units can be expanded.)

# Ease of maintenance

## Incorporates many features that assist maintainability.

FPΣ

## M aintenance

### Built-in flash ROM

Flash ROM is embedded to assist maintenance after incorporation.

Battery replacement for program backup is not necessary.

### Backup battery (option)

Batteries for data backup are optionally available.
The batteries enable full backup of data register area and other items.

### Short-circuit protection transistor

12 out of 16 output points have a short-circuit protection transistor, which prevents the circuits from being damaged in the event of accidental short-circuiting.

### Comment memory

Comments can be checked using tool software during maintenance.

### Password function

Passwords can be set to prevent erroneous rewriting after delivery or to protect the original program.

### Two analog potentiometers

Features two potentiometers with 1,000-step resolution, which can be used as analog timers or for externally changing set values.

# FP$\Sigma$ Lineup
## V3, the 32-k-step type PLC, widens the applications!
(No price changes, completely upward compatible)

## Control Units

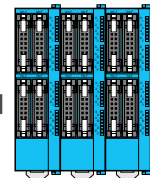| | C32 Control unit (NPN Tr.) | C32 Control unit (NPN Tr.) Left-side expansion type with linear and circular interpolation functions | C24 Control unit (Relay output) Left-side expansion type with linear and circular interpolation functions | C28 Control unit (PNP Tr.) Left-side expansion type with linear and circular interpolation functions |
|---|---|---|---|---|
| **V3** | **FPG-C32TH** | **FPG-C32T2H** | **FPG-C24R2H** | **FPG-C28P2H** |
| **Existing model** | FPG-C32T | FPG-C32T2 | FPG-C24R2 | FPG-C28P2 |

## Positioning

FP$\Sigma$ Expansion Units (Up to 4 units can be added.)

FP$\Sigma$ Control Unit

FP0 Expansion Units (Up to 3 units can be added.)
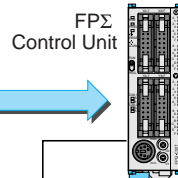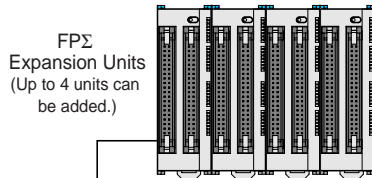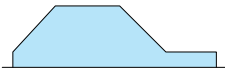
## FP$\Sigma$ Expansion Units

Expansion I/O unit 64 points
FPG-XY64D2T

Positioning units 1-axis transistor output
FPG-PP11

Positioning units 1-axis line driver output
FPG-PP12

Positioning units 2-axis transistor output
FPG-PP21

Positioning units 2-axis line driver output
FPG-PP22

Data memory expansion unit
FPG-EM1

CC-Link slave unit
FPG-CCLS

S-LINK unit
FPG-SL

Matsushita Electric Industrial Co., Ltd. MINAS Series

Motor driver I/F terminal II

AFP8503
1-axis

AFP8504
2-axis

## Communication Cassettes

1-channel RS232C type
FPG-COM1

2-channel RS232C type
FPG-COM2

1-channel RS485 (isolated) type
FPG-COM3

1-channel RS232C/ 1-channel RS485 (isolated) type
FPG-COM4

## Communication

## FP Memory Loader

Data clear type/Data hold type
AFP8670/AFP8671

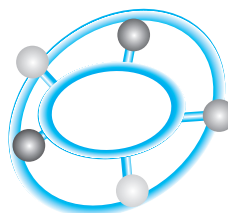| C32 Control unit (NPN Tr.) with thermistor input | C32 Control unit (NPN Tr.) Left-side expansion type with linear and circular interpolation functions and thermistor input | C24 Control unit (Relay output) Left-side expansion type with thermistor input | C28 Control unit (PNP Tr.) Left-side expansion type with linear and circular interpolation functions and thermistor input |
|---|---|---|---|
| **FPG-C32THTM** | **FPG-C32T2HTM** | **FPG-C24R2HTM** | **FPG-C28P2HTM** |
| FPG-C32TTM | FPG-C32T2TM | FPG-C24R2TM | FPG-C28P2TM |

## Power Supply Unit

Input: 100 to 240 V AC/ Output: 24 V DC, 0.7 A FP0-PSA4

## FP0 Expansion Units

### Input/Output Units

8 points: Input 4/Relay output 4

Terminal block FP0-E8RS

Connector FP0-E8RM

16 points: Input 8/Relay output 8

Terminal block FP0-E16RS

Connector FP0-E16RM

16 points: Input 8/ Transistor output 8

MIL connector FP0-E16T (NPN) FP0-E16P (PNP)

32 points: Input 16/ Transistor output 16

MIL connector FP0-E32T (NPN) FP0-E32P (PNP)

8 points: Input 8

MIL connector FP0-E8X

16 points: Input 16

MIL connector FP0-E16X

8 points: Relay output 8

Terminal block FP0-E8YRS

8 points: Transistor output 8

MIL connector FP0-E8YT (NPN) FP0-E8YP (PNP)

16 points: Transistor output 16

MIL connector FP0-E16YT (NPN) FP0-E16YP (PNP)

## Intelligent Units

FP Web-Server unit FP-WEB

Thermocouple units 4-channel FP0-TC4   8-channel FP0-TC8

Analog I/O unit (Input: 2 channels/ Output: 1 channel) FP0-A21
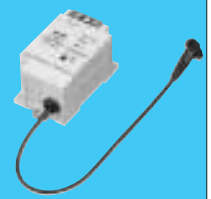
A/D converter unit (Input: 8 channels) FP0-A80

I/O link unit FP0-IOL

FP0 CC-Link slave unit FP0-CCLS

D/A converter unit (Output: 4 channels) FP0-A04V   FP0-A04I

C-NET Adapter S2 type AFP15402

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# FPΣ <SIGMA>
## A new, next-generation compact PLC



### New functions

1. Programming capacity of 32 k steps
2. Operation speed of 0.32 μsec/step for basic instructions
3. New PID instruction (F356 EZPID)
4. Program upload inhibition function
5. Eight-character password protection
6. Modbus master/slave RTU
7. MEWTOCOL Master
8. Tool port: Supports general-purpose serial communications.
9. 512 steps can be rewritten simultaneously in RUN mode.
10. Internal relays: 4,096 points Link relays: 2,048 points

### ■ Features

**1. Programming capacity of 32 k steps, which is approx. 2.7 times bigger than our conventional model**

Accommodates an increase in the number and complexity of programs accompanying equipment functionality enhancements.

**2. High speed operation**

(Operation speed of 0.32 μsec/step for basic instructions)
The embedded RISC processor executes basic instructions 1.2 times faster than our conventional model. The speed for high-level instruction operations, including floating point operations, is also high, reducing the total scan time.

**3. Easy temperature control (New PID instruction F356 EZPID)**

F356 significantly facilitates PID control programming, which was previously complicated, and thus makes temperature control easier.

## ■ Performance Specifications

| Item | | Descriptions | | | |
|---|---|---|---|---|---|
| Item | V3 | FPG-C32TH/FPG-C32THTM | FPG-C32T2H/FPG-C32T2HTM | FPG-C24R2H/FPG-C24R2HTM | FPG-C28P2H/FPG-C28P2HTM |
| | Existing model | FPG-C32T/FPG-C32TTM | FPG-C32T2/FPG-C32T2TM | FPG-C24R2/FPG-C24R2TM | FPG-C28P2/FPG-C28P2TM |
| Number of controllable I/O points | Control unit | 32 points (DC input: 16, NPN output: 16) | 32 points (DC input: 16, NPN output: 16) | 24 points (DC input: 16, relay output: 8) | 28 points (DC input: 16, relay output: 12) |
| | With FP0 expansion units | Max. 128 points (up to 3 units) * When using transistor output type expansion units | Max. 128 points (up to 3 units) * When using transistor output type expansion units | Max. 120 points (up to 3 units) * When using transistor output type expansion units | Max. 124 points (up to 3 units) * When using transistor output type expansion units |
| | With FPΣ expansion units | Not possible | Max. 288 points (up to 4 units) * When using transistor output type expansion units | Max. 280 points (up to 4 units) * When using transistor output type expansion units | Max. 284 points (up to 4 units) * When using NPN output type expansion units |
| | With FP0 and FPΣ expansion units | Max. 128 points * When using transistor output type expansion units | Max. 384 points * When using transistor output type expansion units | Max. 376 points * When using transistor output type expansion units | Max. 380 points * When using NPN output type expansion units |
| Programming method/Control method | | Relay symbol/Cyclic operation | | | |
| Program memory | | Built-in flash ROM (without backup battery) | | | |
| Program capacity | | 32 k steps (V3), 12 k steps (Existing model) | | | |
| Number of instructions | Basic | 93 | | | |
| | High-level | 216 | 218 | 216 | 218 |
| Operation speed | | Basic instruction: 0.32 μs/step (V3), 0.4 μs/step (Existing model) | | | |
| Operation memory points — Relay | Internal relay (R) | 4,096 points (V3): R0 to R255F, 1,568 points (Existing model): R0 to R97F (see note 1) | | | |
| | Timer/Counter (T/C) | 1,024 points (see note 1 and 2) (for initial setting, timer: 1,008 points (T0 to T1007), counter: 16 points (C1008 to C1023) Timer: Counts each unit up to 32767 times (units: 1 ms, 10 ms, 100 ms, or 1 s). Counter: Counts 1 to 32767. | | | |
| Operation memory points — Memory area | Link relays (L) | 2,048 points (V3), 1,024 points (Existing model) (see note 1) | | | |
| | Data register (DT) | 32,765 words (DT0 to DT32764) (see note 1) | | | |
| | Link data register (LD) | 256 words (V3), 128 words (Existing model) (see note 1) | | | |
| | Index register (I) | 14 words (I0 to ID) | | | |
| Differential points | | Unlimited | | | |
| Master control relay points (MCR) | | 256 | | | |
| Number of labels (JP and LOOP) | | 256 | | | |
| Number of step ladders | | 1,000 stages | | | |
| Number of subroutines | | 100 subroutines | | | |
| Pulse catch input | | 8 points (X0 to X7) | | | |
| Number of interrupt programs | | 9 programs (8 external input points (X0 to X7), 1 periodical interrupt point '0.5 ms to 30 s') | | | |
| Self-diagnosis function | | E. g. watchdog timer, program syntax check | | | |
| Real time clock function | | Available (year, month, day, hour, minute, second and day of week); however, this function can only be used when a battery has been installed (see note 3) | | | |
| Potentiometer (Volume) input | | 2 points, resolution: 10 bits (K0 to K1000) | | | |
| Battery life | | 220 days or more* (actual usage value: approx. 840 days (25°C). Suggested replacement interval: 1 year. * Value applies when no power is supplied at all. | | | |
| Comment storage | | All kinds of comments, including I/O comments, remarks, and block comments, can be stored (without backup battery). | | | |
| Link function | | Computer link (1:1, 1:N) (see note 4) General-purpose communication (1:1, 1:N) (see note 4) (see note 5) PLC link (see note 6) | | | |
| Other functions | | Program edition during RUN, constant scan, forced on/off, password, floating-point operation, and PID processing | | | |
| Linear/Circular interpolation for positioning | | Not available | Available | Not available | Available |

Notes: 1) If no battery is used, only the fixed area is backed up (counters 16 points: C1008 to C1023, R2480 to R255F (V3)/R900 to R970F (existing model), data registers 55 words: DT32710 to DT32764).
When the optional battery is used, data can be backed up. Areas to be held and not held can be specified using the system registers.
2) The number of points can be increased by using an auxiliary timer.
3) Precision of calendar timer:  - At 0°C 32°F, less than 119 seconds error per month.
- At 25°C 77°F, less than 51 seconds error per month.
- At 55°C 131°F, less than 148 seconds error per month.
4) An optional communication cassette (RS232C type) is required in order to use 1:1 communication. (Re-send processing is recommended.)
5) An optional communication cassette (RS485 type) is required in order to use 1:N communication. (Re-send processing is recommended.)
6) An optional communication cassette (RS485 type) is required.
7) The number of points actually available for use is determined by the hardware configuration.

## ■ General Specifications

| Item | | Description | |
|---|---|---|---|
| Rated operating voltage | | 24 V DC | |
| Operating voltage range | | 21.6 to 26.4 V DC | |
| Allowed momentary power off time | C32 C28 | 4 ms at 21.6 V, 7 ms at 24 V, 10 ms at 26.4 V | |
| | C24 | 3 ms at 21.6 V, 5 ms at 24 V, 8 ms at 26.4 V | |
| Ambient temperature | | 0 to +55°C 32 to +131 °F | |
| Storage temperature | | −20 to +70°C −4 to +158 °F | |
| Ambient humidity | | 30 to 85 % RH (at 25°C, non-condensing) | |
| Storage humidity | | 30 to 85 % RH (at 25°C, non-condensing) | |
| Breakdown voltage | C32 C28 | Between input/output terminals and power supply terminal/function earth | 500 VAC for 1 minute |
| | | Between input terminal and output terminal | |
| | C24 | Between input terminals (X0 to X7)/input terminals (X8 to XF) and power supply terminal/function earth | 500 VAC for 1 minute |
| | | Between output terminals and power supply terminal/function earth | 1,500 VAC for 1 minute |
| | | Between input terminals (X0 to X7) and input terminals (X8 to XF) | 500 VAC for 1 minute |
| | | Between input terminals (X0 to X7)/input terminals (X8 to XF) and output terminals | 1,500 VAC for 1 minute |
| Insulation resistance | C32 C28 | Between input/output terminals and power supply terminal/function earth | Min. 100 MΩ (measured with a 500 V DC megger) |
| | | Between input terminal and output terminal | |
| | C24 | Between input terminals (X0 to X7)/input terminals (X8 to XF) and power supply terminal/function earth | |
| | | Between output terminals and power supply terminal/function earth | |
| | | Between input terminals (X0 to X7) and input terminals (X8 to XF) | |
| | | Between input terminals (X0 to X7)/input terminals (X8 to XF) and output terminals | |
| Vibration resistance | | 10 to 55 Hz, 1 cycle/min: double amplitude of 0.75 mm/0.030 in., 10 min on 3 axes | |
| Shock resistance | | Shock of 98 m/s² or more, 4 times on 3 axes | |
| Noise immunity | | 1,000 Vp-p with pulse widths 50 ns and 1 μs (based on in-house measurements) | |
| Operating condition | | Free from corrosive gases and excessive dust | |

## ■ Input Specifications

| Item | | Description |
|---|---|---|
| Insulation method | | Optical coupler |
| Rated input voltage | | 24 V DC |
| Operating voltage range | | 21.6 to 26.4 V DC |
| Rated input current | | For X0, X1, X3, X4: approx. 8 mA<br>For X2, X5 to X7: approx. 4.3 mA<br>For X8 to XF: approx. 3.5 mA |
| Input points per common | | C32, C28: 16 points/common<br>C24: 8 points/common<br>(Either the positive or negative of the input power supply can be connected to the common terminal.) |
| Min. ON voltage/ Min. ON current | | For X0, X1, X3, X4: 19.2 V DC/6 mA<br>For X2, X5 to XF: 19.2 V DC/3 mA |
| Max. OFF voltage/ Max. OFF current | | 2.4 V DC/1.3 mA |
| Input impedance | | For X0, X1, X3, X4: 3 kΩ<br>For X2, X5 to X7: 5.6 kΩ<br>For X8 to XF: 6.8 kΩ |
| Response time | OFF→ON | For input X0, X1, X3, X4:<br>  1 ms or less: normal input<br>  5 μs or less: high-speed counter, pulse catch, interrupt input settings<br>For input X2, X5 to X7:<br>  1 ms or less: normal input<br>  100 μs or less: high-speed counter, pulse catch, interrupt input settings<br>For input X8 to XF:<br>  1 ms or less: normal input only |
| | ON→OFF | Same as above |
| Operating mode indicator | | LED display |

Note: X0 through X7 are inputs for the high-speed counter and have a fast response time.
If used as normal inputs, we recommend inserting a timer in the ladder program as chattering and noise may be interpreted as an input signal. The above specifications apply when the rated input voltage is 24 VDC and the temperature is 25°C 70°F.

## ■ Output Specifications

### 1. Relay Output Specifications (C24)

| Item | | Description |
|---|---|---|
| Output type | | 1a (1 Form A, Normally open) |
| Rated control capacity | | 2 A 250 V AC, 2 A 30 V DC (4.5 A or less per common) |
| Output points per common | | 8 points/common |
| Response time | OFF→ON | Approx. 10 ms |
| | ON→OFF | Approx. 8 ms |
| Lifetime | Mechanical | Min. 20,000,000 operations |
| | Electrical | Min. 100,000 operations |
| Surge absorber | | – |
| Operating mode indicator | | LED display |

### 2. Transistor Output Specifications (C32 and C28)

| Item | | Description | |
|---|---|---|---|
| | | C32 (NPN) | C28 (PNP) |
| Insulation method | | Optical coupler | |
| Output type | | Open collector (NPN) | Open collector (PNP) |
| Rated load voltage | | 5 to 24 V DC | 24 V DC |
| Operating load voltage range | | 4.75 to 26.4 V DC | 21.6 to 26.4 V DC |
| Max. load current | | For Y0, Y1, Y3, Y4: 0.3 A<br>For Y2, Y5 to YF: 0.1 A | For Y0, Y1, Y3, Y4: 0.5 A<br>For Y2, Y5 to YF: 0.3 A |
| Max. surge current | | For Y0, Y1, Y3, Y4: 0.9 A<br>For Y2, Y5 to YF: 0.5 A | For Y0, Y1, Y3, Y4: 1.5 A<br>For Y2, Y5 to YF: 0.7 A |
| Output points per common | | 16 points/common | 12 points/common |
| OFF state leakage current | | 100 μA or less | |
| ON state voltage drop | | 0.5 V or less | |
| Response time | OFF→ON | For Y0, Y1, Y3, Y4 (When the load current is 15 mA or more.): 2 μs or less<br>For Y2, Y5 to YF: 0.2 ms or less | |
| | ON→OFF | For Y0, Y1, Y3, Y4 (When the load current is 15 mA or more.): 8 μs or less<br>For Y2, Y5 to YF: 0.5 ms or less | |
| External power supply for driving internal circuit | Voltage | 21.6 to 26.4 V DC | |
| | Current | 70 mA or less | |
| Response time | | Zener diode | |
| Operating mode indicator | | LED display | |
| Phase fault protection | | Thermal protection for Y2, Y5 to YF | |

## ■ High-speed counter, Pulse output and PWM output Specifications

| | Item | Description | |
|---|---|---|---|
| High-speed counter | Input point number | Single-phase: max. 4 channels | Two-phase: max. 2 channels |
| | Maximum counting speed | Single-phase:<br>for 1 channel: max. 50 kHz (x 1)<br>for 2 channels: max. 30 kHz (x 2)<br>for 3 or 4 channels: max. 20 kHz (x 3 or 4) | Two-phase:<br>for 1 channel: max. 20 kHz (x 1)<br>for 2 channels: max. 15 kHz (x 2) |
| | Input mode | Single-phase:<br>incremental, decremental | Two-phase:<br>two-phase, incremental/decremental,<br>incremental/decremental control |
| | Input contact used (see note 1) | Single-phase:<br>X0: count input (CH0)<br>X1: count input (CH1)<br>X2: reset input (CH0, CH1)<br>X3: count input (CH2)<br>X4: count input (CH3)<br>X5: reset input (CH2, CH3) | Two-phase:<br>X0, X1: count input (CH0)<br>X2: reset input (CH0)<br>X3, X4: count input (CH2)<br>X5: reset input (CH2) |
| Pulse output | Output point number | Two independent points (simultaneous output possible) | |
| | Output mode | CW and CCW mode, pulse and direction mode | |
| | Maximum output frequency | 1 channel: max. 100 kHz (x 1)<br>2 channels: max. 60 kHz (x 2) | (linear interpolation function: max. 100 kHz<br>circular interpolation function: max. 20 kHz) |
| | High-speed counter used (see note 2) | Two-phase CH0 or CH2 | |
| | Input/Output contact used (see note 1) | X2 or X5: home input<br>Y0 or Y3: CW output or pulse output<br>Y1 or Y4: CCW output or direction output<br>Y2 or Y5: deviation counter reset output | |
| PWM output | Output point number | Two points (Y0, Y3) | |
| | Output frequency | 1.5 to 12.5 k Hz (at resolution of 1,000), 15.6 k to 41.7 k Hz (at resolution of 100) | |
| | Output duty | 0.0 to 99.9% (at resolution of 1,000), 1 to 99% (at resolution of 100) | |
| | High-speed counter used (see note 2) | Two-phase CH0 or CH2 | |
| | Output contact used (see note 1) | Y0 or Y3 | |

Notes: 1) The contacts noted above cannot be allocated for more than one fuction. Also, contacts that are not assigned to the various functions can be used as general inputs/outputs. Inputs X0 to X5 are pulse catch inputs, and can also be used for interrupt inputs.
2) If using pulse output or PWM output, one channel of the two-phase high-speed counter is used for each output point, in each case. If only one pulse output point is being used, either one point of the two-phase high-speed counter or three points of the single-phase high-speed counter may be used.

## ■ Serial communication Specifications (1:1 communication) (see note 1)

| Item | Description |
|---|---|
| Communication method | Half duplex transmission |
| Synchronous method | Start stop synchronous system |
| Transmission line | RS232C |
| Transmission distance | 15 m 49.21 ft. |
| Transmission speed (Baud rate) | 2,400 bits/s to 115.2 k bits/s (see note 2) |
| Interface | Conforming to RS232C<br>(connected via the terminal block) |

Notes: 1) In order to use the serial communication function (1:1 communication), a RS232C type communication cassette is required.
2) The transmission speed (baud rate) and transmission format are specified using the system registers.

## ■ PLC link function Specifications (see note 1)

| Item | Description |
|---|---|
| Communication method | Token bus |
| Transmission method | Floating master method |
| Transmission line | Twisted-pair cable or VCTF |
| Transmission distance (Total distance) | 1,200 m 3,937 ft. |
| Transmission speed (Baud rate) | 115.2 k bits/s |
| Number of units (stations) | Maximum 16 units (see note 2) |
| PLC link capacity | Link relay: 1,024 points, link register: 128 words |
| Interface | Conforming to RS485<br>(connected via the terminal block) |

Notes: 1) A RS485 type communication cassette is required in order to use the PLC link function.
2) Unit (station) numbers are specified using the switches on the control unit or the system registers.

## ■ Serial communication Specifications (1:N communication) (see note 1)

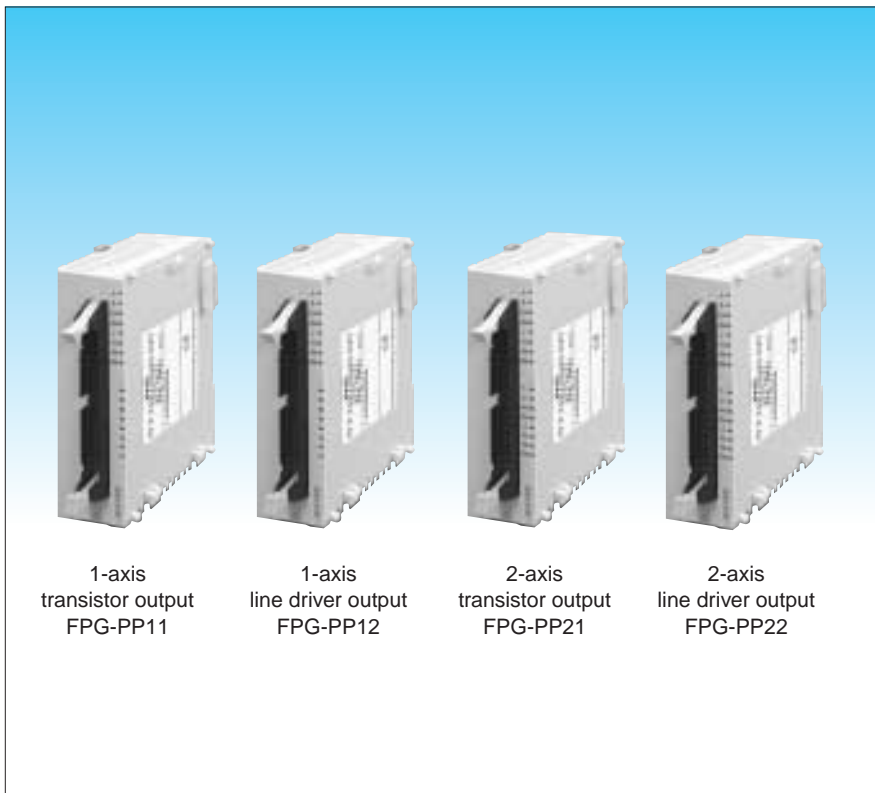| Item | Description |
|---|---|
| Communication method | Two-wire, half duplex transmission |
| Synchronous method | Start stop synchronous system |
| Transmission line | Twisted-pair cable or VCTF |
| Transmission distance (Total distance) | Maximum 1,200 m 3,937 ft.<br>(see notes 4 and 5) |
| Transmission speed (Baud rate) | 2,400 bits/s to 115.2 k bits/s<br>19,200 bits/s when a C-NET adapter is connected<br>(see notes 2, 4 and 5) |
| Number of units (stations) | Maximum 99 units (stations)<br>32 units (stations) max. when a C-NET adapter is connected (see notes 3, 4 and 5) |
| Interface | Conforming to RS485<br>(connected via the terminal block) |

Notes: 1) In order to use the serial communication function (1:N communication), a RS485 type communication cassette is required.
2) The transmission speed (baud rate) and transmission format are specified using the system registers.
3) Unit (station) numbers are specified using the system registers. Up to 31 units (stations) can be set, using the switches on the control unit.

4) When connecting a commercially available device that has an RS485 interface, please confirm operation using the actual device. In some cases, the number of units (stations), transmission distance, and transmission speed (baud rate) vary depending on the connected device.
5) The values for the transmission distance, transmission speed (baud rate), and number of units (stations) should be within the values noted in the graph below.
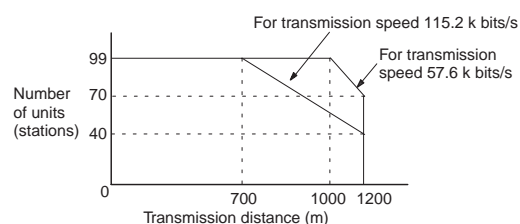


For a transmission speed of 2,400 bits/s to 38.4 k bits/s, you can set up a maximum of 99 units (stations) and a maximum transmission distance of 1,200 m.

# FPΣ Positioning Unit



1-axis
transistor output
FPG-PP11

1-axis
line driver output
FPG-PP12

2-axis
transistor output
FPG-PP21

2-axis
line driver output
FPG-PP22

## ■ Features

### 1. High-speed pulse and startup for great performance in compact package and even supports linear servos
Max. output frequency: 4 Mpps,
Startup speed: 0.005 ms

### 2. Supports indexed feeding with JOG positioning function
Able to support indexed feed processing applications with high-speed startup and repeated control.

### 3. Count of feedback pulse possible
Since feedback pulses from encoders, etc., can be counted, control is possible while detecting the out of step and verifying the current position in step motors.

## ■ Performance Specifications

| Part number | | FPG-PP11 | FPG-PP12 | FPG-PP21 | FPG-PP22 |
|---|---|---|---|---|---|
| Output type | | Transistor | Line driver | Transistor | Line driver |
| Occupied I/O points | | Input: 16 points, Output: 16 points | | Input: 32 points, Output: 32 points | |
| Number of axes controlled | | 1 axis | | 2 axes, independent | |
| Position command | Command units | Pulse unit (The program specifies whether Increment or Absolute is used.) | | | |
| | 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 (can set in 1 pps.) | 1 pps to 4 Mpps (can set in 1 pps.) | 1 pps to 500 kpps (can set in 1 pps.) | 1 pps to 4 Mpps (can set in 1 pps.) |
| Acceleration/ deceleration command | Acceleration/ deceleration method | Linear acceleration/deceleration, S acceleration/deceleration (this takes the form of an 'S') | | | |
| | 'S' Acceleration/ deceleration | Can select from Sin curve, Secondary curve, Cycloid curve and Third curve. | | | |
| | Acceleration/ deceleration time | 0 to 32,767 ms (can set in 1 ms) | | | |
| Home return | Home return speed | Speed setting possible (changes return speed and search speed) | | | |
| | Input terminals | Home input, Near home input, Over limit input (+), Over limit input (−) | | | |
| | Output terminals | Deviation counter clear output signal | | | |
| Operation mode | | • E point control (Linear and S accelerations/decelerations selecting possible)<br>• P point control (Linear and S accelerations/decelerations selecting possible)<br>• Home return function (Home search)<br>• JOG operation function [1]<br>• JOG positioning function<br>• Pulser input function [3]<br>  Transfer multiplication ratio<br>  (× 1, × 2, × 5, × 10, × 50, × 100, × 500, × 1000 selecting possible)<br>• Real-time frequency change function<br>• Infinity output function | | | |
| Startup time | | 0.02 ms or 0.005 ms possible [2] | | | |
| Output interface | Output mode | 1-pulse output (Pulse/Sign), 2-pulse output (CW/CCW) | | | |
| Feedback counter function [3] | Countable range | Signed 32 bits (−2,147,483,648 to +2,147,483,647 pulses) | | | |
| | Input mode | 2-phase input, Direction distinction input, Individual input (transfer multiple available for each.) | | | |
| Other functions | | • The flag to compare the elapsed value is built in.<br>  (The timing signal outputs at the optional position during an operation.) | | | |
| Internal current consumption (at 5 V DC) | | 150 mA max. | | 220 mA max. | |
| External power supply | Voltage | 21.6 V DC to 26.4 V DC | | | |
| | Current consumption | 20 mA | | 35 mA | |
| Mass | | Approx. 75 g max. | | Approx. 80 g max. | |

*1: When selected Linear acceleration/ deceleration operation, the target speed can be changed during an operation.

*2: The startup time can be changed by the control code setting in the shared memory.
The factory setting (default setting) is 0.02 ms.
The startup time is the time from the start request to the first pulse output.

*3: Pulser input function and feedback counter function use the same pulse input terminal, so the both cannot function simultaneously.

# FPΣ/FP0 CC-Link Slave Unit

## Available for Open Network CC-Link



FPΣ CC-Link Slave Unit
FPG-CCLS

FP0 CC-Link Slave Unit
FP0-CCLS

### ■ Features

**1. Fit into Open Network System**
Even when PLCs from other manufacturers are used, a system with high-speed positioning, temperature control and S-LINK connection can be established.

**2. Advanced I/O Points and Data Read/Write**
FPΣ CC-Link slave unit: Max. 112 I/O points each, 16-word data read/write
FP0 CC-Link slave unit: Max.16 I/O points each, 4-word data read/write

### ■ Specification

#### 1. General Specifications

| | |
|---|---|
| Rated operating voltage | 24 V DC |
| Operating voltage range | 21.6 to 26.4 V DC |
| Rated current consumption | CC-Link Unit: 40 mA or less/24 V DC |
| | Increase amount in the control unit when expansion units are added: 40 mA or less/24 V DC |
| Allowed momentary power off time | 10 ms |
| Ambient temperature | 0 to +55°C/+32 to +131°F |
| Storage temperature | -20 to +70°C/-4 to +158°F |
| Ambient humidity | 30 to 85% RH (non-condensing) |
| Storage humidity | 30 to 85% RH (non-condensing) |
| Breakdown voltage | Between RS485 terminal and power supply terminal/function earth: 500 V AC for 1minute |
| Insulation resistance | Between RS485 terminal and power supply terminal/function earth: Min. 100 (measured with a 500 V DC megger) |
| Vibration resistance | 10 to 55 Hz, 1 cycle/min. Double amplitude: 0.75 mm/0.030 in., 10 min. on 3 axes |
| Shock resistance | 98 m/s$^2$ or more, 4 times on 3 axes |
| Noise immunity | 1,000 V p-p with pulse width 50 ns and 1 μs (based on in-house measurements) |
| Operating condition | Free from corrosive gases and excessive dust |
| Weight | FPΣ CC-Link slave unit: Approx. 90 g, FP0 CC-Link slave unit: Approx. 80 g |

#### 2. CC-Link Communication Specifications

| | | | |
|---|---|---|---|
| Version | CC-Link Ver.1.10 | | |
| Communication method | Broadcast polling method | | |
| Transmission speed | 10 M bit/s, 5 M bit/s, 2.5 M bit/s, 625 k bit/s, 156 k bit/s | | |
| Max. transmission distance Note 1) | | Ver.1.10 CC-Link cable CC-Link high-performace cable | CC-Link cable |
| | 10 M bit/s | 100 m | 100 m |
| | 5 M bit/s | 160 m | 150 m |
| | 2.5 M bit/s | 400 m | 200 m |
| | 625 k bit/s | 900 m | 600 m |
| | 156 k bit/s | 1200 m | 1200 m |
| Interface | RS485 | | |
| Station type | Remote device station | | |
| Number of occupied stations | FPΣ: 1 to 4 stations (switch changeover), FP0: 1 station | | |

### ■ Unit Differences

| | FPΣ CC-Link slave unit | FP0 CC-Link slave unit |
|---|---|---|
| PLC to be connected | FPΣ | FPΣ/FP0 |
| Max. I/O points | Input: 112, Output: 112 | Input: 16, Output: 16 |
| Max. data | Read: 16-word data, Write: 16-word data | Read: 4-word data, Write: 4-word data |
| Limitations | — | • One FP0 CC-Link slave unit can be installed on the extremely right in the expansion position.<br>• When an FP0 CC-Link slave unit is used together with an FP0 thermocouple unit in a system, the measurement accuracy of the thermocouple unit is as shown in note 2) below. |
| Recommendation | When CC-Link is mainly used | When S-LINK and CC-Link are used together |

Note 1) Length of the multi-drop connected cables at both ends

The cable length has restrictions in communication speed, CC-Link version, and dedicated cables to be used.

For details concerning the CC-Link, refer to the CC-Link Partner Association.

Note 2) When an FP0 thermocouple unit is used with an FP0 CC-Link slave unit, the measurement accuracy of the thermocouple unit which is installed on the left of the CC-Link slave unit is as shown in the table below.

| Thermocouple | | Standard specifications | When CC-Link slave unit with a thermocouple unit |
|---|---|---|---|
| K.J.T | | 0.8°C | 2°C |
| R | 0 to 99.9°C | 3°C | 6°C |
| | 100 to 299.9°C | 2.5°C | 5°C |
| | 300 to 1500°C | 2°C | 4°C |

# FPΣ S-LINK unit

## Comprises the S-LINK wire-saving system (SUNX Ltd.) and controls up to 128 I/O points at a transmission distance of up to 400 m.
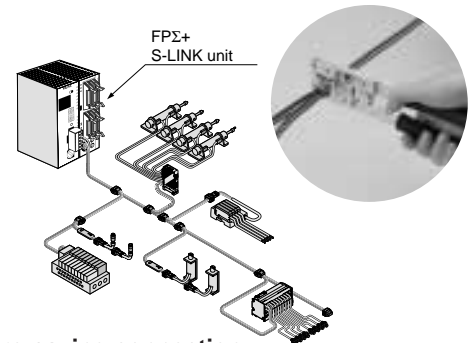
FPG-SL

### ■ Features

**1. T-branches allow you to freely determine the wiring layout.**

A wire-saving layout is available with a four-wire cable (two signal wires and two power wires), and a flexible layout is available with T-branches. You can easily make T-branches with one operation of the dedicated wire-crimping tool.

FPΣ+
S-LINK unit

**2. Up to four units can be connected. Each unit can control up to 128 I/O points.**

One unit controls up to 128 I/O points. Up to four S-LINK units can be connected to one FPΣ control unit.
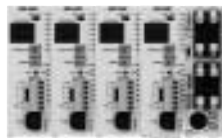
**3. Highly reliable wire-saving connection is available.**

Approx. 60 different types of S-LINK I/O devices can be connected, meeting the diverse needs for I/O. The high transmission voltage (24 V DC) and wide clock pulse width (35 μs) provide high noise immunity. Flexible and reliable wire-saving connection is available.
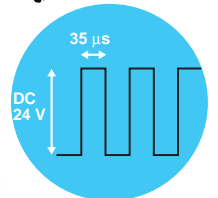
● Refer to SUNX Limited's S-LINK catalogs and manuals for details and I/O devices of the S-LINK system.

### ■ No time-consuming programming for communications is required

The control unit automatically recognizes I/O allocations by the S-LINK unit installation position. It can be used as though it were an ordinary expansion I/O unit.
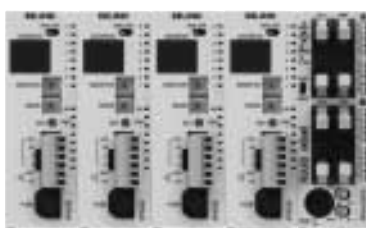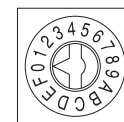
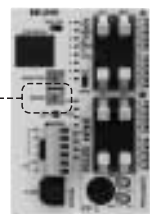When 64 input points and 64 output points are set to each unit

X100 - X13F, Y100 - Y13F
X180 - X21F, Y180 - Y21F
X260 - X29F, Y260 - Y29F
X340 - X37F, Y340 - Y37F

### ■ Setting of the number of I/O points

The balance between the number of input and output points within 128 can be selected in increments of 32 points by a rotary switch.

Example:
Setting 8 → 64 input points
64 output points

### ■ Indication of the address of I/O devices in error state

Even if the main line is broken, making it impossible to recognize an I/O device, the device address will be indicated on the display of the S-LINK unit. This function significantly reduces the time required for solving problems found during equipment start-up checks and for recovery work at the operation site.
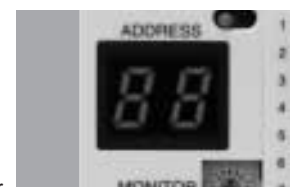
### ■ Performance specifications

| | |
|---|---|
| Transmission method | Bi-directional time division multiplex transmission |
| Synchronization | Bit/Frame synchronization |
| Transmission protocol | S-LINK protocol |
| Transmission line | Exclusive flat cable or cabtyre cable |
| Transmission speed | 28.5 k bits/s |
| Transmission distance *1 | Main signal line: Extensible to 200 m (400 m when a booster is used) |
| Connection | T-branch multi-drop wiring or multi-drop wiring |
| Number of I/O points | 128 points max. (The number of I/O points can be selected in increments of 32 points.) |

*1: Refer to SUNX Limited's S-LINK catalogs and manuals for the booster.

# FPΣ Data Memory Expansion Unit
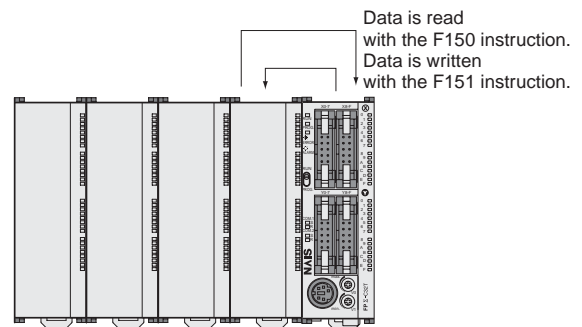## Data capacity expandable up to 256 k words



FPG-EM1
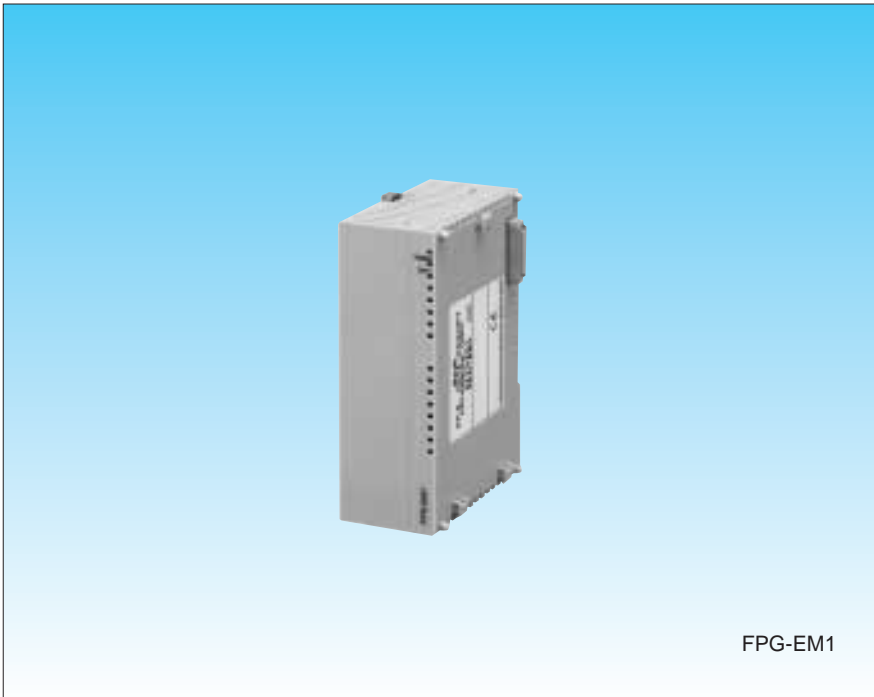
■ **Features**

**1. Ability to store large amounts of data suited for remote monitoring**
With a large storage of 256 k words, this memory unit is best suited to store remote monitoring logs.

**2. Harness its power for multi-model manufacturing equipment**
Ability to store large amounts of data allows the unit to store production data for multiple models. There is no need to download new production data every time there is a product switch-out.

**3.** A FPΣ unit can connect up to 4 units, allowing to store up to 1024 k words.

## ■ General Specifications

| Item | Description |
|---|---|
| Ambient temperature/ humidity | 0 to 55°C, 30 to 85 % RH (No condensation) |
| Storage temperature/ humidity | -20 to +70°C, 30 to 85 % RH (No condensation) |
| Vibration resistance | 10 to 55 Hz, 1 sweep/min., Double amplitude of 0.75mm, 10 min. on 3 axes (Towards X, Y & Z directions) |
| Shock resistance | 98 m/s$^2$ or more, 4 times on 3 axes (Towards X, Y & Z directions) |
| Noise immunity | 1,000 V (P-P) with pulse width 50 ns, 1 μs (using a noise simulator) |
| Operating condition | Must be free from corrosive gases and excessive dust |
| Basic unit mass | Approx. 80 g |
| The amount of increases in control unit consumption current | 35 mA or less (24 V DC) (100 mA or less (internal 5 V DC)) |

## ■ Performance Specifications

| Item | Description |
|---|---|
| Memory capacity | 256 k words (1 k words × 256 banks) |
| Battery life | 5 years or more |
| 5 V Power consumption | 100 mA or less |
| Number of I/O points | Input 16 points |



Data is read with the F150 instruction.
Data is written with the F151 instruction.

## ■ Programming tool FPWIN GR

Instructions F150 and F151, necessary to use data memory expansion units, are converted in versions 2.13 or later. Difference files are available at http://www.nais-e.com/plc/
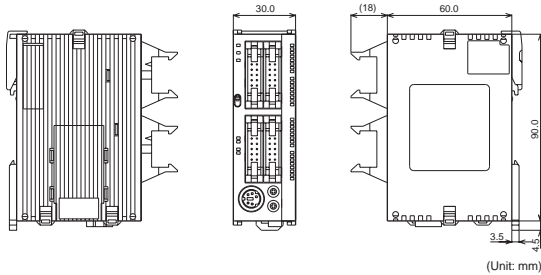
# FPΣ Dimensions and Restrictions when combining unit and using programming tools

## ■ FPΣ Control units

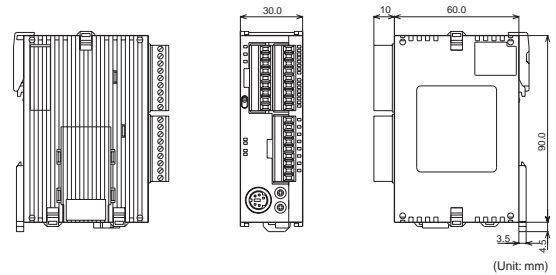**V3** FPG-C32TH/FPG-C32T2H/FPG-C28P2H
FPG-C32THTM/FPG-C32T2HTM/FPG-C28P2HTM

FPG-C32T/FPG-C32T2/FPG-C28P2
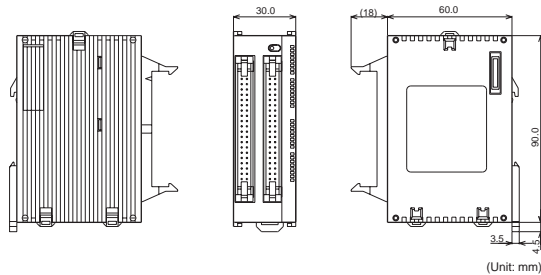FPG-C32TTM/FPG-C32T2TM/FPG-C28P2TM



(Unit: mm)
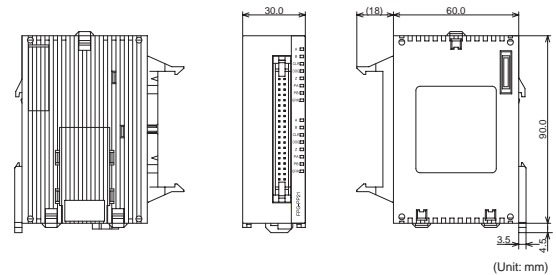
**V3** FPG-C24R2H/FPG-C24R2HTM

FPG-C24R2/FPG-C24R2TM



(Unit: mm)

## ■ FPΣ Expansion units/FP0 Expansion units

FPG-XY64D2T



(Unit: mm)

FPG-PP11/FPG-PP12/FPG-PP21/FPG-PP22



(Unit: mm)

FPG-EM1



(Unit: mm)

FP0-TC4/FP0-TC8



(Unit: mm)
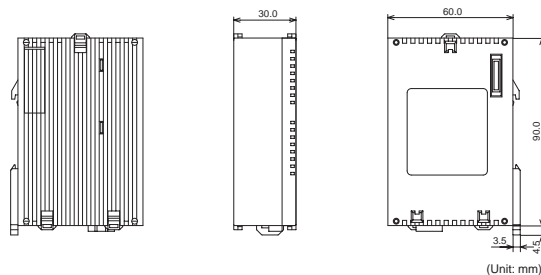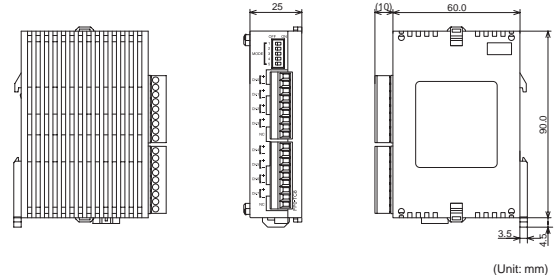
## ■ Restrictions when combining unit and using programming tools

### 1. Expansion I/O units for the FPΣ
1) The left-side expansion type FPΣ control unit is necessary for use with the FPΣ expansion I/O unit.
The previously available control units (Part No.: FPG-C32T/FPG-C32TTM, Product No.: AFPG2543/AFPG2543TM) cannot be used for expansion.
2) A maximum of four units can be used for expansion.

### 2. FPΣ and FP0 shared expansion I/O units and intelligence units
When combining expansion I/O units and intelligence units a maximum of up to three units can be added to the right side of control unit.

### 3. Programming tools
1) Either FPWIN GR Ver. 2 or FPWIN Pro Ver. 4 are necessary for use with the FPΣ control unit.
Users of FPWIN GR Ver. 1 will have to upgrade.
However, the upgrade only applies to Version 1.1 or higher. Those users with versions below Version 1.1 are asked to send us your user registration card. Upon receipt we will send you Version 1.1.
2) Either FPWIN GR Ver. 2.1 or FPWIN Pro Ver. 4.1 are necessary for use the left-side expansion type FPΣ control unit. An upgrade service is available from our programmable controller home page at http://www.nais-e.com/plc/
3) Handy-type programmers cannot be used with the FPΣ series PLC.

# FPΣ Product types

**❶ Control units**

| Product name | Specifications | | Part No. | Product No. |
|---|---|---|---|---|
| FPΣ C32<br>Control unit | Input 16 points DC, Transistor output (NPN) 16 points<br>I/O control points when expanded: Max. 128 points | V3 32 k steps | FPG-C32TH | AFPG2543H |
| | | 12 k steps | FPG-C32T | AFPG2543 |
| FPΣ C32<br>Left-side expansion type<br>Control unit | Input 16 points DC, Transistor output (NPN) 16 points<br>I/O control points when expanded: Max. 384 points<br>Built-in linear interpolation and circular interpolation functions | V3 32 k steps | FPG-C32T2H | AFPG2643H |
| | | 12 k steps | FPG-C32T2 | AFPG2643 |
| FPΣ C32<br>Left-side expansion type<br>Control unit | Input 16 points DC, Relay output 8 points<br>I/O control points when expanded:<br>Max. 376 points (transistor output) | V3 32 k steps | FPG-C24R2H | AFPG2423H |
| | | 12 k steps | FPG-C24R2 | AFPG2423 |
| FPΣ C28<br>Left-side expansion type<br>Control unit | Input 16 points DC, Transistor output (PNP) 12 points<br>I/O control points when expanded: Max. 380 points<br>Built-in linear interpolation and circular interpolation functions | V3 32 k steps | FPG-C28P2H | AFPG2653H |
| | | 12 k steps | FPG-C28P2 | AFPG2653 |
| FPΣ C32<br>Control unit with thermistor input | Input 16 points DC, Transistor output (NPN) 16 points<br>I/O control points when expanded: Max. 384 points | V3 32 k steps | FPG-C32THTM | AFPG2543HTM |
| | | 12 k steps | FPG-C32TTM | AFPG2543TM |
| FPΣ C32<br>Left-side expansion type<br>Control unit with thermistor input | Input 16 points DC, Transistor output (NPN) 16 points<br>I/O control points when expanded: Max. 384 points<br>Built-in linear interpolation and circular interpolation functions | V3 32 k steps | FPG-C32T2HTM | AFPG2643HTM |
| | | 12 k steps | FPG-C32T2TM | AFPG2643TM |
| FPΣ C24<br>Left-side expansion type<br>Control unit with thermistor input | Input 16 points DC, Relay output 8 points<br>I/O control points when expanded: Max. 376 points<br>(transistor output) | V3 32 k steps | FPG-C24R2HTM | AFPG2423HTM |
| | | 12 k steps | FPG-C24R2TM | AFPG2423TM |
| FPΣ C28<br>Left-side expansion type<br>Control unit with thermistor input | Input 16 points DC, Transistor output (PNP) 12 points<br>I/O control points when expanded: Max. 380 points<br>Built-in linear interpolation and circular interpolation functions | V3 32 k steps | FPG-C28P2HTM | AFPG2653HTM |
| | | 12 k steps | FPG-C28P2TM | AFPG2653TM |

* Thermistors with a resistance from 200 Ω to 75 kΩ can be used.

**❷ Communication cassettes**

| Product name | Specifications | Part No. | Product No. |
|---|---|---|---|
| FPΣ 1-channel, RS232C type<br>Communication cassette | Cassette for control unit installation.<br>Enables communications with devices with RS232C interface. | FPG-COM1 | AFPG801 |
| FPΣ 2-channel, RS232C type<br>Communication cassette | Cassette for control unit installation.<br>Enables communications with devices with RS232C interface. | FPG-COM2 | AFPG802 |
| FPΣ 1-channel, RS485 type<br>Communication cassette | Cassette for control unit installation.<br>PLC linking between FPΣs or communication with devices<br>with RS485 interface possible. | FPG-COM3 | AFPG803 |
| FPΣ 1-channel, RS232C/<br>1-channel, RS485 type<br>Communication cassette | Cassette for control unit installation.<br>Enables communications with devices with RS232C, RS485 interface. | FPG-COM4 | AFPG806 |

**❸ Expansion I/O units for FPΣ**

| Product name | Specifications | Part No. | Product No. |
|---|---|---|---|
| FPΣ 64-points<br>expansion I/O unit | Input 32 points DC, Transistor output 32 points<br>Max. possible expansion is with a total of 4 units to the left side of the FPΣ<br>control units | FPG-XY64D2T | AFPG3467 * |

* Replace "4" in the third last digit of Product No. with "5" to order the PNP output type.

**❹ Expansion I/O units for FPΣ and FP0**

| Product name | Specifications | Part No. | Product No. |
|---|---|---|---|
| FP0-E8 expansion unit | Input 8 points DC | FP0-E8X | AFP03003 |
| FP0-E8 expansion unit | Input 4 points DC, Relay output 4 points | FP0-E8RS | AFP03023 |
| FP0-E8 expansion unit | Relay output 8 points | FP0-E8YRS | AFP03020 |
| FP0-E8 expansion unit | Transistor output (NPN) 8 points | FP0-E8YT | AFP03040 * |
| FP0-E16 expansion unit | Input 16 points DC | FP0-E16X | AFP03303 |
| FP0-E16 expansion unit | Input 8 points DC, Relay output 8 points | FP0-E16RS | AFP03323 |
| FP0-E16 expansion unit | Input 8 points DC, Transistor output (NPN) 8 points | FP0-E16T | AFP03343 * |
| FP0-E16 expansion unit | Transistor output (NPN) 16 points | FP0-E16YT | AFP03340 * |
| FP0-E32 expansion unit | Input 16 points DC, Transistor output (NPN) 16 points | FP0-E32T | AFP03543 * |

* Replace "4" in the second last digit of Product No. with "5" to order the PNP output type.

**❺ Intelligent units for FPΣ**

| Product name | Specifications | Part No. | Product No. |
|---|---|---|---|
| FPΣ Positioning unit | 1 axis, Transistor output | FPG-PP11 | AFPG430 |
| FPΣ Positioning unit | 1 axis, Line driver output | FPG-PP12 | AFPG432 |
| FPΣ Positioning unit | 2 axes, Transistor output | FPG-PP21 | AFPG431 |
| FPΣ Positioning unit | 2 axes, Line driver output | FPG-PP22 | AFPG433 |
| FPΣ Data memory expansion unit | 256 k words | FPG-EM1 | AFPG201 |
| FPΣ CC-LINK slave unit | Unit to connect to CC-Link | FPG-CCLS | AFPG7943 |
| FPΣ S-LINK unit | Unit to connect to SUNX S-LINK I/O devices | FPG-SL | AFPG780 |

❻ Intelligent units for FPΣ and FP0

| Product name | Specifications | | Part No. | Product No. |
|---|---|---|---|---|
| FP0 Thermocouple unit | K, J, T, R thermocouple, Resolution: 0.1°C | | FP0-TC4 | AFP0420 |
| | K, J, T, R thermocouple, Resolution: 0.1°C | | FP0-TC8 | AFP0421 |
| FP Web-Server unit | Unit for connecting FP series/RS232C interface and Ethernet Web-Server function and E-mail sending function | | FP-WEB | AFP0610 |
| FP0 I/O Link unit | This is a link unit designed to connect FP0 as a station to MEWNET-F (our remote I/O system). | | FP0-IOL | AFP0732 |
| FP0 CC-Link Slave unit | Unit to connect to FP0 CC-Link | | FP0-CCLS | AFP07943 |
| FP0 A/D Converter Unit | Analog input 8 points: 0 to 5 V, −10 to +10 V, −100 to +100 mV, 0 to 20 mA Resolution: 1/4000 (12 bits) | | FP0-A80 | AFP0401 |
| FP0 D/A Converter Unit | Analog output 4 points: FP0-A04V: −10 to +10 V (Resolution: 1/4000) FP0-A04I : 4 to 20 mA (Resolution: 1/4000) | | FP0-A04V | AFP04121 |
| | | | FP0-A04I | AFP04123 |
| FP0 Analog I/O unit | Analog input 2 points: 0 to 5 V, −10 to +10 V Analog output 1 points: −10 to +10 V, 0 to 20 mA Resolution: 1/4000 (12 bits) | | FP0-A21 | AFP0480 |

*1: Refer to the FAQ section on our website for thermocouple units.

❼ Power supply unit

| Product name | Specifications | Part No. | Product No. |
|---|---|---|---|
| FP0 Power supply unit | Input: 100 to 240 V AC, Output: 24 V DC 0.7 A | FP0-PSA4 | AFP0634 |

❽ Options

| Product name | Specifications | Product No. |
|---|---|---|
| Backup battery for FPΣ | Battery for full-time back up of operation memory and clock/calendar function | AFPG804 |
| FP0 Slim 30 type mounting plate | Plastic plate to mount FPΣ units and FPΣ expansion units on a panel (including 10 pieces) | AFP0811 |
| Slim type FP0 mounting plate | Plastic plate to mount FP0 expansion units on a wall (including 10 pieces) | AFP0803 |
| Power cable for FPΣ | Included with control unit. Maintenance part. 1 m length | AFPG805 |
| FP Memory loader | Data clear type | AFP8670 |
| | Data hold type | AFP8671 |

❾ Programming tools

| Product name | Specifications | | | Product No. |
|---|---|---|---|---|
| Standard programming tool software Control FPWIN GR Ver.2 | English-language menu | Full type (for all type FP series PLC) | | AFPS10520 |
| | | Small type (for FP0, FPΣ) | | AFPS11520 |
| | | Upgrade (to upgrade from Ver.1.1) | | AFPS10520R |
| | Chinese-language menu | Standard | | AFPS10820 |
| | | Upgrade (to upgrade from Ver.1.1) | | AFPS10820R |
| | Korean-language menu | Standard | | AFPS10920 |
| Conforms to IEC61131-3 programming tool software Control FPWIN Pro Ver.5 | English-language menu | Full type (for all type FP series PLC) | | AFPS50550 |
| | | Small type (for FP0, FPΣ) | | AFPS51550 |
| PC connection cable | Between D-sub 9 pins and DIN 5 pins, 3 m length | | | AFC8503 |

❿ Motor Driver I/F Terminal Ⅱ

| Product name | Specifications | Product No. |
|---|---|---|
| Motor Driver I/F Terminal Ⅱ 1-axis type | I/F terminal for connecting the MINAS series and FPΣ Positioning unit/FP2 Multi function type Positioning unit. | AFP8503 |
| Motor Driver I/F Terminal Ⅱ 2-axis type | | AFP8504 |
| Exclusive cable for MINAS AⅢ Series, 1 m 3.281 ft | Cable for connecting the MINAS A IV/A/AⅢ series and motor driver I/F terminal Ⅱ. The transmission speed becomes 500 kbps at a maximum when connected to the MINAS A IV Series. | AFP85131 |
| Exclusive cable for MINAS AⅢ Series, 2 m 6.562 ft | | AFP85132 |
| Exclusive cable for MINAS S Series, 1 m 3.281 ft | Cable for connecting the MINAS E/S series and motor driver I/F terminal Ⅱ. | AFP85141 |
| Exclusive cable for MINAS S Series, 2 m 6.562 ft | | AFP85142 |
| Connection cable for FP2 Posiotioning unit, 0.5 m 1.640 ft | Cable for connecting the FPΣ Positioning unit/FP2 Multi function type Positioning unit and motor driver I/F terminale Ⅱ. | AFP85100 |
| Connection cable for FP2 Posiotioning unit, 1 m 3.281 ft | | AFP85101 |

Please contact ..........

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