



Motion Control Solutions
Minas A4/A4N Servo Drives / FP-Series PLCs



Panasonic Motion Control Solutions

Overview



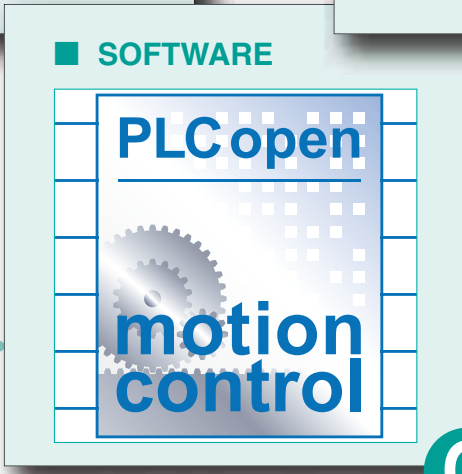
■ FP-SERIES PLCs

A



■ MINAS A4/A4N SERIES SERVO DRIVES

B



■ SOFTWARE

C

A

■ FP-SERIES

The compact FPM(Sigma) is suitable for most applications. The FPM(Sigma) PLC itself has powerful features for up to two axes. Add FPM(Sigma) positioning units to control up to 10 independent axes. The new FP-X PLC with transistor outputs offers functionality similar to the FPM (Sigma). The FP2/FP2SH is also suitable for complex positioning applications, while the compact FP0 and FP-e can handle simple positioning tasks. RTEX units for FPM(Sigma) and FP2 offer real-time access to multiple Minas A4N drivers.

B

■ MINAS A4/A4N SERIES SERVO MOTORS AND DRIVERS

Powerful servo drives with cutting edge technology, high power density and a power range of 50W to 5kW.

C

■ SOFTWARE

Use any of the built-in functions for FPM(Sigma) or FP-X for up to two axes or the certified Motion Control Library for more complex tasks that require positioning units.



A FP-Series PLCs

Overview

■ FPM (SIGMA)



Programme capacity:	32k steps
Memory capacity:	32k words
Expansion capacity:	4 modules (left side) 3 modules (right side) up to 384 I/Os
Processing speed:	0.32µs/basic instruction
Number of independent axes:	2 axes with CPU + 8 axes with positioning units 16 axes with RTEX units

■ FP-X TRANSISTOR OUTPUT TYPES



Programme capacity:	FPXC30, FPXC60 32k steps FPXC14 16k steps
Memory capacity:	32k words
Expansion capacity:	Up to 8 units + up to 2 cassettes for FPXC14 or + up to 3 cassettes for FPXC30/C60 Up to 300 I/Os possible
Processing speed:	0.32µs/basic instructions
Number of independent axes:	FPXC14 3 axes, FPXC30/C60 4 axes 2-axes linear interpolation simultaneously in 2 pairs!

■ FP2 / FP2SH



Programme capacity:	FP2 16 or 32k steps FP2SH 60 or 120k steps
Memory capacity:	FP2 6000 words FP2SH 10,240 words
Expansion capacity:	Up to 28 modules or 2048 I/Os
Processing speed:	FP2 0.35µs/basic instruction FP2SH 0.03µs/basic instruction
Number of independent axes:	FP2 64 axes FP2SH 88 axes FP2RTEX units 112 axes



A FP-Series PLCs

Positioning with FP⁻ (Sigma)

The FPM(Sigma) positioning unit supports ultra-high speed linear servo motors. All-purpose device capable of linear interpolation and circular interpolation.

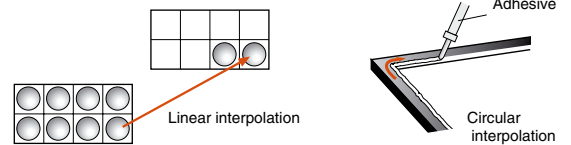


FPM(Sigma) positioning unit

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

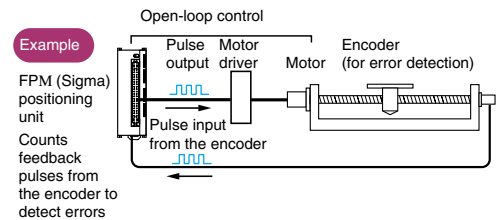
The linear and circular interpolation functions support a wide variety of applications.

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.



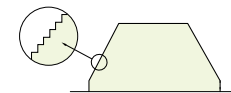
Error detection is available by using the high-speed counter in combination.

Unexpected accidents, such as errors in the driving system, can be detected by setting the counter so that it counts the feedback pulses from the encoder during positioning.



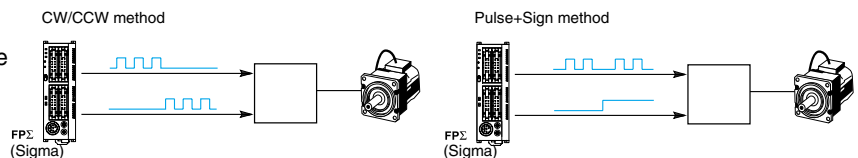
Smooth acceleration/deceleration enables smooth startup.

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 FPM(Sigma) with small stepping motors or servo motors that do not support the pulse-and-sign method.

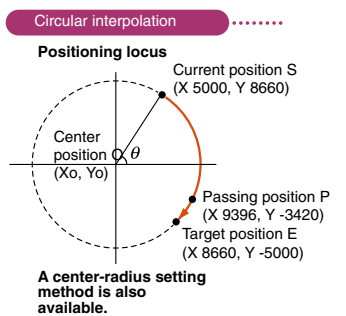


The control unit on its own can provide two-axis control.

The control unit has a pulse output of 100kpps and startup speed of 0.02ms, 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, e.g. when only a single sensor is being used.
- Output of the deviation counter reset signal upon completion of return to home position is also available.



Unit type and product number

Type	Output type	Product number
1-axis type	Transistor output type	FPG-PP11
2-axis type	Transistor output type	FPG-PP21
1-axis type	Line driver output type	FPG-PP12
2-axis type	Line driver output type	FPG-PP22

Type	Output type	Product number
FP ⁻ (Sigma) CPU	Transistor output type NPN	FPG-C32T2H-A
FP ⁻ (Sigma) CPU	Transistor output type PNP	FPG-C28P2H-A



A FP-Series PLCs

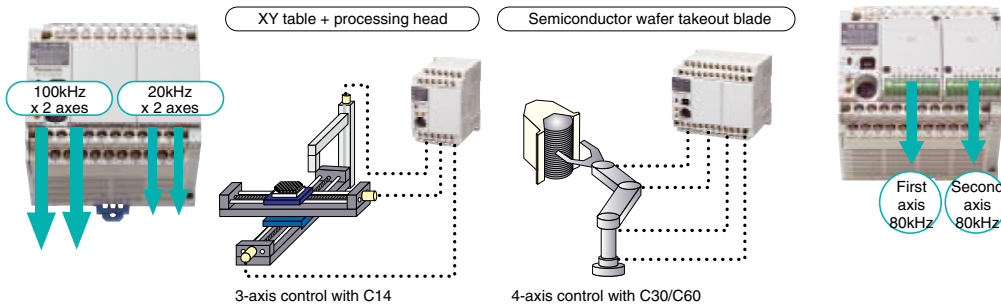
Positioning with FP-X

FP-X perfectly fits the need for low cost “multi-axis positioning control in small-scale equipment”.

Built-in 4-axis pulse output (transistor output type).

The transistor output type C14 comes with 3-axis pulse output while C30/40 comes with 4-axis pulse output inside the control unit. Multi-axis control, which previously required a higher-level PLC, additional positioning unit, or two or more PLC units, can now be achieved with only one FP-X transistor output type unit in a small space at a low cost. In addition, as this type does not require a pulse I/O cassette as needed for a relay output type, other function expansion cassettes such as communication or analogue input can be attached for more diversified applications.

Item	Specification
Pulse output Max. frequency	C14: 100kHz (CH0,1), 20kHz (CH2) C30, C60: 100kHz (CH0,1), 20kHz (CH2,3)
Output type	Transistor output type PNP
Function	Trapezoidal control, multi-stage operation, jog operation, origin return, 2-axis linear interpolation

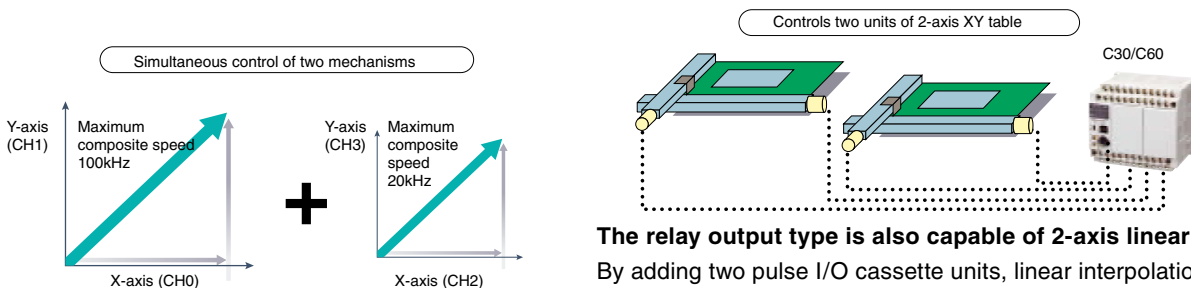


The relay output type can control two axes by using expansion cassettes.

2-axis 80kHz pulse output is possible by attaching two pulse I/O cassettes (AFPX-PLS). This type is also capable of performing 2-axis linear interpolation. The pulse I/O cassette does not work with the control unit transistor output type.

2-axis linear interpolation simultaneously in two sets (transistor output type).

2-axis linear interpolation simultaneously controls two motor shafts, allowing you, for example, to move a robot arm diagonally. It is used for palletising, component pick and place, XY table control, contour cutting of a PC board, etc. The FP-X transistor output type is capable of simultaneously controlling 2-axis linear interpolation, for the first time in the industry with a compact pulse-output PLC. This unit greatly expands the range of applications as well as providing the added convenience of programming by using the linear interpolation command F175 (SPSH).



The relay output type is also capable of 2-axis linear interpolation.

By adding two pulse I/O cassette units, linear interpolation is possible at a maximum composite speed of 80kHz. The command used for this unit is F175 (SPSH) as for the transistor output types.

FP-X type overview		Power supply	Output type	In-puts	Out-puts
	AFPX-C14TD	24VDC	Transistor NPN	8	6
	AFPX-C14T	100 to 240VAC	Transistor NPN	8	6
	AFPX-C14PD	24VDC	Transistor PNP	8	6
	AFPX-C14P	100 to 240VAC	Transistor PNP	8	6
	AFPX-C30TD	24VDC	Transistor NPN	16	14
	AFPX-C30T	100 to 240VAC	Transistor NPN	16	14
	AFPX-C30PD	24VDC	Transistor PNP	16	14
	AFPX-C30P	100 to 240VAC	Transistor PNP	16	14

FP-X type overview		Power supply	Output type	In-puts	Out-puts
	AFPX-C60TD	24VDC	Transistor NPN	32	28
	AFPX-C60T	100 to 240VAC	Transistor NPN	32	28
	AFPX-C60PD	24VDC	Transistor PNP	32	28
	AFPX-C60P	100 to 240VAC	Transistor PNP	32	28



A FP-Series PLCs

FP2 and FP2SH Positioning Units

FEATURES

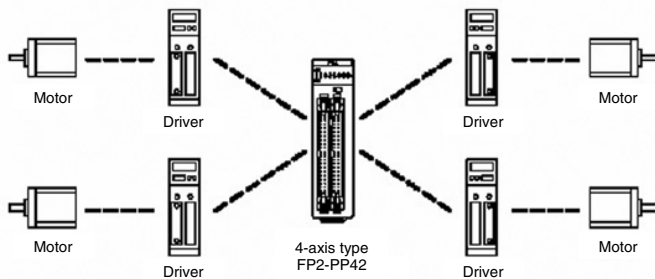
- Maximum 4Mpps command gives high-speed, high-precision positioning.
- 0.005ms high-speed drive reduces tact-time (start-up time is the time from reception of the CPU unit start-up command to release of the pulse output by the positioning unit).
- 4 axes per unit means versatility and saves space.
- S (sight-shaped) acceleration/deceleration function provides smooth starting and stopping.
- Feedback pulse count function makes output pulse counting possible for encoders, etc.
- The pulse input function allows users to generate pulses manually to adjust machines, for example.

Operation modes:

- E-point control
- P-point control
- Homing function
- Jog operation function
- Pulser input function
- Interpolation
- Single speed acceleration/deceleration
- Multistage acceleration/deceleration
- Fast startup of 0.02 or 0.005ms makes cycle time reduction possible
- Acceleration/deceleration control: Linear or 4 types of S-curve: Sine, quadratic, cycloid and cubic curves (for smooth startup and stopping)



UP TO 4 AXES PER POSITIONING MODULE:



FP2 CPU types

Type	Programme capacity	Product number
FP2 Standard CPU	16k steps	FP2C1
FP2SH CPU	60k steps	FP2C2
FP2SH CPU	120k steps	FP2C3

FP2 positioning units

Number of axes	Output type	Product number
2	Transistor	FP2PP21
2	Line driver	FP2PP22
4	Transistor	FP2PP41
4	Line driver	FP2PP42

FP2 power supplies

Supply voltage	Power	Product number
200–240VAC	2.5A	FP2PSA2
100–240VAC	5A	FP2PSA3

FP2 backplanes

Description	Product number
FP2 backplane 5 modules	FP2BP05
FP2 backplane 7 modules	FP2BP07
FP2 backplane 9 modules	FP2BP09
FP2 backplane 12 modules	FP2BP12
FP2 backplane 14 modules	FP2BP14



A FP-Series PLCs

FP (Sigma) Positioning Unit RTEX / FP2 Positioning Unit RTEX

NEW REAL-TIME ETHERNET SERVO SYSTEM FOR MINAS A4N SERVO DRIVES

New positioning units for FPM(Sigma) and FP2 PLCs support Minas A4N network servo drives. A mutually optimised system consisting of PLC and servo drive greatly simplifies installation.



THE MOST IMPORTANT ADVANTAGES ARE:

- World's first: Allows easy control of network servos with an ultracompact PLC.
- Allows highly accurate control of multi-axis positioning using high-speed 100Mbps communication.
- Commercial LAN cables greatly reduce wiring costs.
- New product lineup includes a new 2-axis unit in addition to the 4-axis and 8-axis units.
- Dedicated software tool ConfiguratorPM provides total support, from configuration and startup to monitoring.
- Includes manual pulser input allowing support for precision teaching.

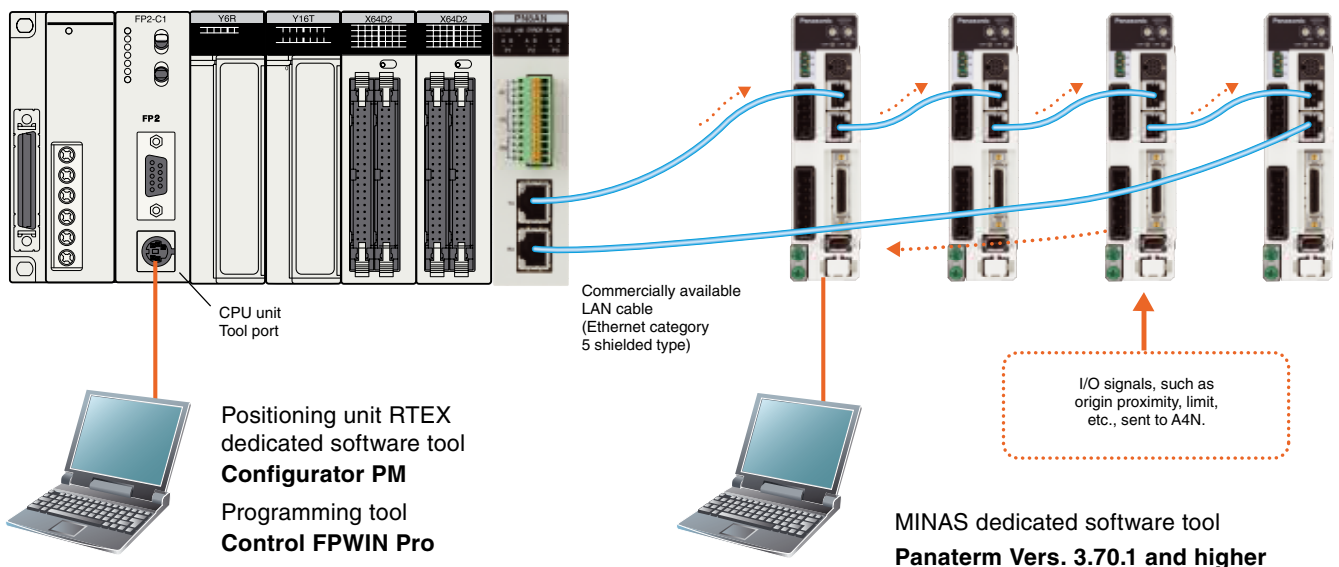
SYSTEM CONFIGURATION

No. of positioning units per RTEX unit

FPM 2 units

FP2: 14 units (limited by consumption current)

Control of 2 to 8 axes in one positioning unit





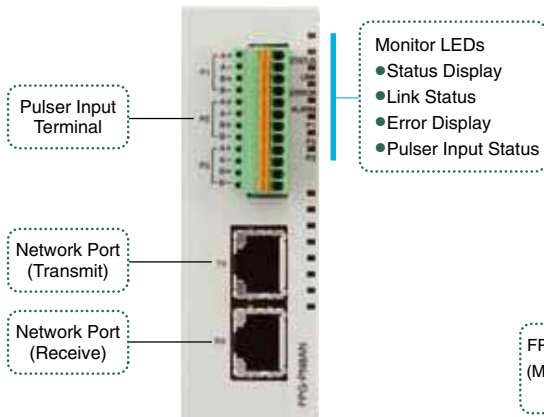
A FP-Series PLCs

RTEX Multi-Axis Network Servo System

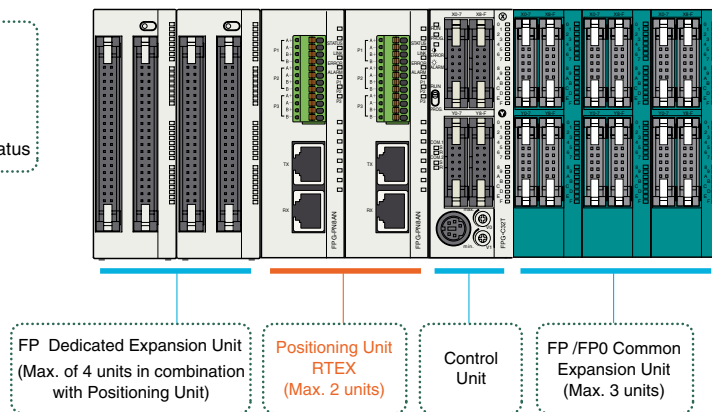
■ FP (SIGMA) POSITIONING UNIT RTEX – THE WORLD’S FIRST SERVO SYSTEM WITH ULTRACOMPACT PLC!

- Maximum number of control axes: 16 axes. Realisation of highly accurate 2-axis circular interpolation, 3-axis linear interpolation and 3-axis spiral interpolation with high-speed 100Mbps communication.
- With 3 types in the product range, for 2 axes, 4 axes and 8 axes, provides flexible support even for control of small numbers of axes.
- Provides a rich environment for total control of equipment including I/O control, with a powerful control unit with 32k step programme capacity/max. 320 I/O points/serial communication on 3 ports.

FP Positioning Unit RTEX



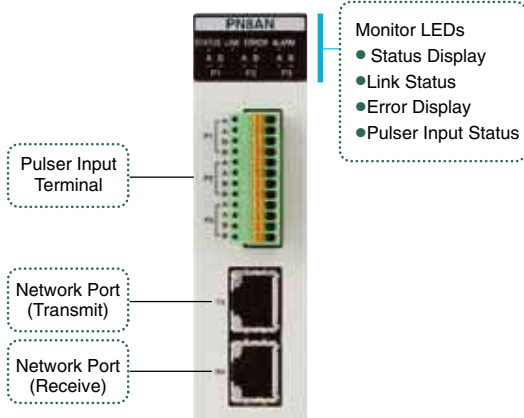
Configuration Example: 16 axes + I/O (256 points)



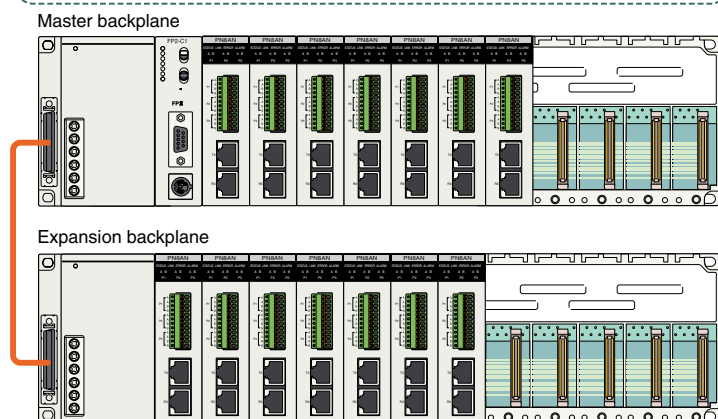
■ ULTRA-HIGHSPEED PROCESSING WITH FP2/FP2SH

- Installation of up to 14 units with 8 axes is possible bringing the number of control axes up to 112.
- With the addition of 2 axis, 4 axis and 8 axis units to the product lineup, flexible system configurations from small to large numbers of axes are possible.
- RTEX in combination with the ultra-highspeed and large capacity FP2SH CPU unit [20k steps/1ms (as measured in in-house experiments) and 120k step programme capacity] provides sufficient support also for large-scale equipment.

FP2 Positioning Unit RTEX



Example Configuration: 8 axes x 14 units = 112 axes (max. no. of control axes)





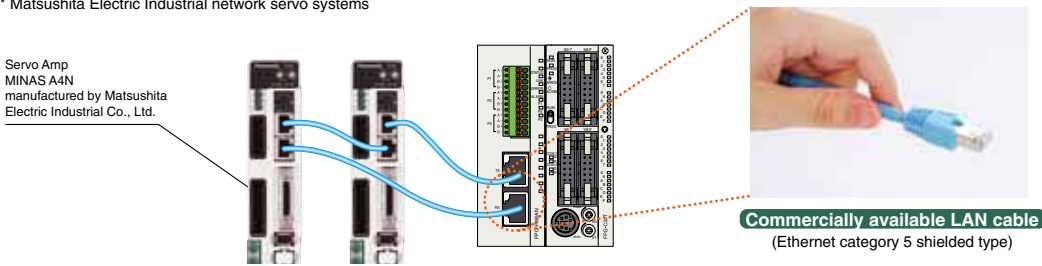
A FP-Series PLCs

RTEX Multi-Axis Network Servo System

BROAD REDUCTION IN WIRING COSTS

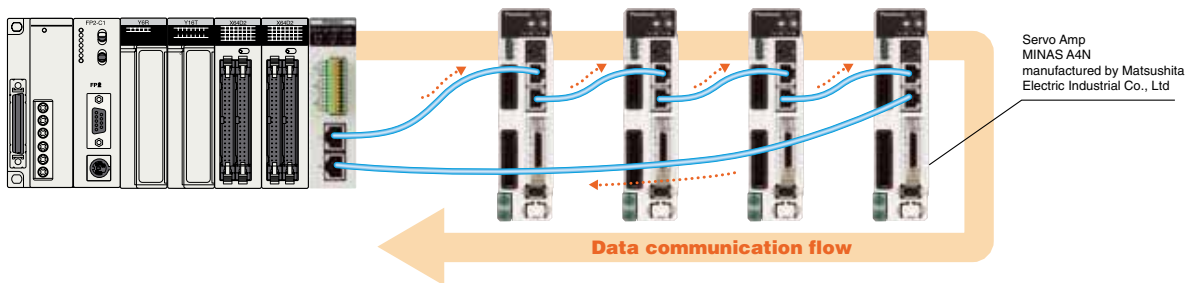
Realtime Express* uses commercially available LAN cables as wiring for its network. In terms of cost efficiency, availability and workability, this is a great benefit.

* Matsushita Electric Industrial network servo systems



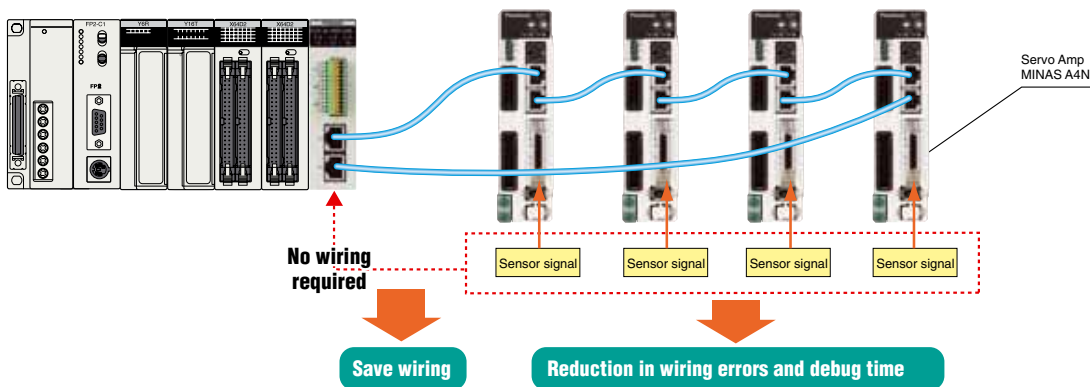
HIGH RELIABILITY WITH LOOP WIRING

Transmitted and received data in serial communication is normally sent and received at frequent intervals in the same cable making the communication state extremely sensitive to environmental conditions such as noise. However, by using loop wiring as shown in the figure below, Realtime Express provides high reliability by creating smooth communication conditions with the data flow always in the same direction. In addition, by utilising the 100Mbps high communication speed, Realtime Express reads the data transmissions which occur every 0.5ms twice and carries out data transfer in the extremely short period of 1ms, further improving reliability.



ADVANCED WIRING METHOD

Sensor input (origin proximity, limit) is wired directly to the servo amp of each axis and the signal is transferred through the network to the positioning unit. This enables you to check at a glance which sensor input is connected to which axis. Wiring errors are reduced and the time required for debugging shortened, especially when the system deals with large numbers of axes. In addition, even if the positioning unit and servo amp are far apart, it is not necessary to wire the signal from a sensor which is close to the servo amp to the distant positioning unit, further reducing the amount of wiring.



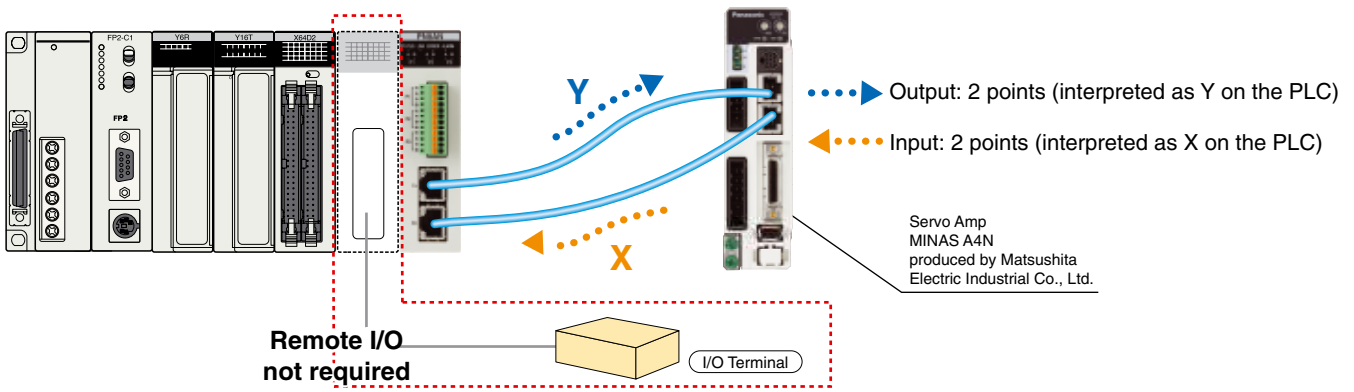


A FP-Series PLCs

RTEX Multi-Axis Network Servo System

4-POINT GENERAL-PURPOSE INPUT/OUTPUTS INSTALLED IN SERVO DRIVER

- The servo amp is equipped with 2 points DC input and 2 points DC output. These are sent via the network and interpreted by the PLC as X and Y values respectively.
- The various sensor signal inputs and lamp illumination outputs, etc. for the control axis can be controlled from the PLC thereby reducing costs for the addition of remote I/O systems.



FUNCTIONS

<p>Operating patterns</p> <ul style="list-style-type: none"> • E-point trapezoidal control (PTP control) • P-point change speed control (CP control) • C-point repeated trapezoidal control (PTP c onrol) 	<p>Low speed test operation mode (speed setting)</p> <ul style="list-style-type: none"> • The acceleration/deceleration time and target speed for each point indicated in the data table can be set to a low speed in the range of 1 to 100% without actually changing the data itself. Test operations can be carried out safely by checking the operation of the device at low speed.
<p>Control methods</p> <ul style="list-style-type: none"> • Absolute method, increment method 	<p>Interpolation operation modes</p> <ul style="list-style-type: none"> • 2-axis circular, 2-axis linear • 3-axis spiral, 3-axis linear
<p>Movement unit settings</p> <ul style="list-style-type: none"> • Pulse (pulse), scale (μm, inch), angle (degree) 	<p>Auxiliary output</p> <ul style="list-style-type: none"> • Codes can be output during operation according to the data table number.
<p>Acceleration/deceleration method</p> <ul style="list-style-type: none"> • Linear, S-curve 	<p>JOG operation</p> <ul style="list-style-type: none"> • Speed and acceleration/deceleration time can be changed during operation.
<p>Origin return</p> <ul style="list-style-type: none"> • Origin proximity (DOG) search method 	<p>Pulser input</p> <ul style="list-style-type: none"> • 2-phase quad edge – max. 1Mpps • Division ratio setting possible by specification of numerator/denominator.



A FP-Series PLCs

Software Tool Configurator PM for RTEX

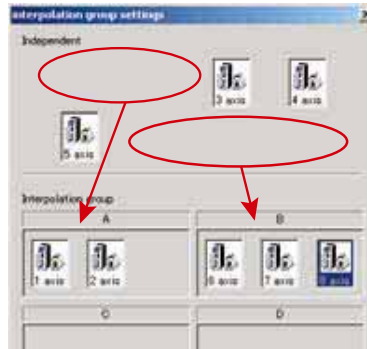
The Configurator PM provides powerful yet simple full support ranging from configuration settings (axis settings, parameter settings, data table creation, JOG operations, origin return, data monitor settings, etc.) and startup to operation monitoring. This reduces the time and man hours required for system setup.

Axis settings

Check the axis to be used. Select axis no. used.

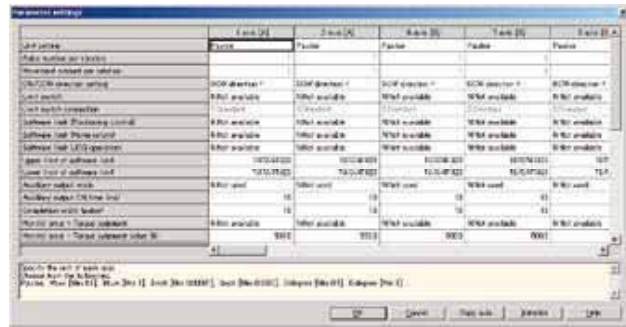


Grouping of axes for interpolation operations is carried out simply by dragging and dropping the relevant axes.

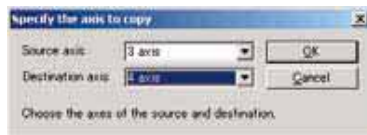


Parameter settings

The details of the settings can be displayed in a table. Details on how to create settings for each category are explained in the box below.



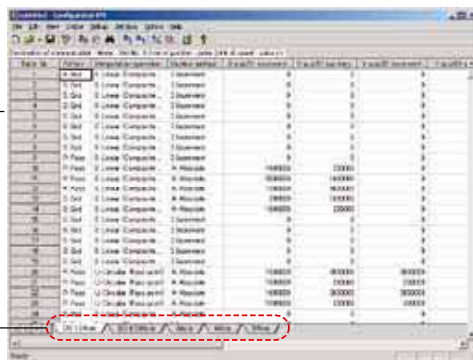
Parameters can be copied between axes. In instances where many settings are shared among the axes, this can reduce the number of repeat inputs.



Data table creation

Simple input as in Excel.

Each axis (or each interpolation axis group) has a separate sheet, and data tables for each axis are displayed in an easy-to-understand manner.



Data tables can be exported as text files in CSV format. This is effective when making printouts for document management.

You can copy parts of a CSV file to a data table using Cut & Paste.

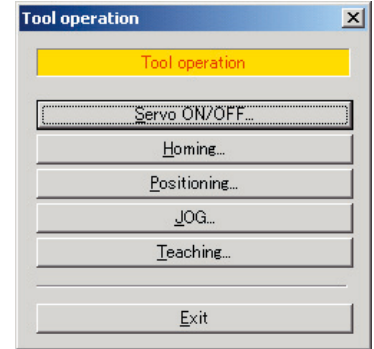


A FP-Series PLCs

Software Tool Configurator PM for RTEX/RTEX Unit Specifications

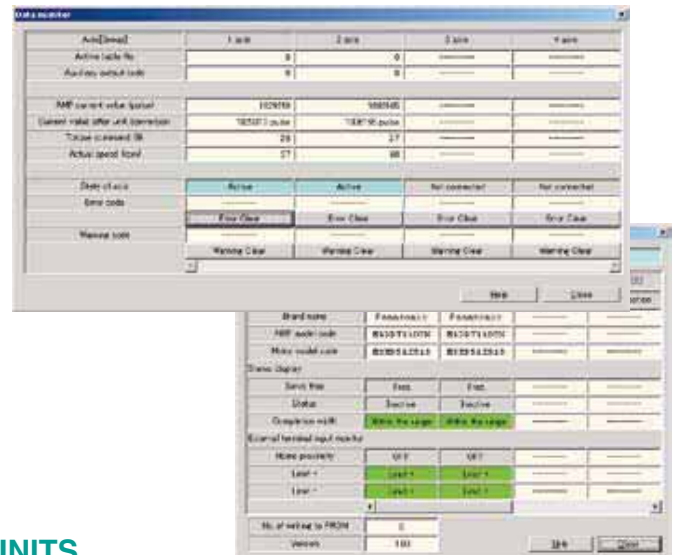
TOOL OPERATIONS

- Each axis can be operated by tool operation independently from the operation modes (PROG and RUN) of the FP control unit (or the FP2CPU unit).
- JOG operation and teaching can be carried out easily to index positioning points. Test operation is possible without having to create a rudder programme.



DATA MONITOR

- Data table no. during operation
- Auxiliary output
- Current position, speed and vector
- Error code, warning code (Errors and warnings can also be cleared)



STATUS MONITOR

- Connection status of each axis
- Model code of each motor amp and motor connected
- Servo lock status
- Origin proximity input, limit input

SPECIFICATIONS OF RTEX POSITIONING UNITS

		2-axis type		4-axis type		8-axis type		
Unit specifications	Product number FPM/FP2		FPGPN2AN	FP2PN2AN	FPGPN4AN	FP2PN4AN	FPGPN8AN	FP2PN8AN
	Positioning control functions	Control method	PTP Control, Cursor Path (CP) Control					
		Interpolation control	2-axis/3-axis linear interpolation • 2-axis circular interpolation • 3-axis spiral interpolation					
		Control units	Pulse/μm/inch/degree					
		Position data	600 points for each axis					
		Backup	Parameters and data file can be saved to FROM					
		Acceleration/deceleration method	Linear acceleration/deceleration/S-curve acceleration/deceleration					
		Acceleration/deceleration time	0 to 10,000ms (1ms units) different settings for acceleration and deceleration are possible					
	Positioning area	(-1,073,741,823 to 1,073,741,823 pulse) increment and absolute specification						
	Speed control functions		Supported with JOG operation (free rind operation)					
Origin functions	Search method	Origin proximity (DOG) search						
	Creep speed	Free settings possible						
Other functions		Pulser input operation support						
		Auxiliary output code, auxiliary output contact support						
		Dwell time support						
		100Mbps						
Communication specifications	Communication speed	100Mbps						
	Cable	Commercially available LAN straight cable (shielded category 5e)						
	Connection method	Ring method						
	Communication cycle/no. of terminals	0.5ms: Max. 8 axes/system (command cycle: 1ms)						
Transmission distance		Between terminals: 60m; total length: 200m						