



## **The IT M@chine Controller**

[www.yokogawa.com/itc/](http://www.yokogawa.com/itc/)

Information in this document is current as of Feb. 2009.  
For the latest product information, contact Yokogawa  
sales office.

This document does not include detailed description of the latest  
F3SP66-4S and F3SP67-6S Sequence CPU Modules (with network  
functions).

See "Sequence CPU Module (with network functions): New Product  
Introduction" (TI34M6A08-01E) instead.









## From **EVOLUTION** to **REVOLUTION**

The FA-M3 has reborn as the FA-M3R,  
to revolutionize users' equipment.

**R** for **Revolution!** **R**

- FA-M3R is the new generic name for FA-M3 controllers installed with one or more of the ultra-fast CPU modules.
- FA-M3R can simply be called the "M3R".
- FA-M3R and FA-M3 are upward compatible.



## The IT M@chine Controller

Transforms Equipment Using IT



Range-free Controller FA-M3R  
Transforms user "Machine" into "M@chine".



## FA-M3R Features

The IT M@chine Controller

- › Ultra-fast Processing Speed
  - 20K steps of ladder program scanned per millisecond\*
  - Minimum scan time of 200  $\mu$ s
  - Sensor control function with constant scan from 200  $\mu$ s
  - Quick response from input to output of 10  $\mu$ s
  - Quick response of 100  $\mu$ s to an interrupt signal
- › Postcard-size Controller
  - Compact, 147 (W) x 100 (H) x 88 (D) mm size handles 192 points.
- › Universal I/O Range Achievable with One PLC
  - Controls up to 8,192 points and contain devices of up to 344K words per system.
  - Capabilities of a high-end PLC at the cost of a low- or mid-range PLC
  - One third to one half the price of competitors' PLC for 1000- to 2000-point range
- › Mixed Installation of Different CPUs within 1 Unit
  - Tasks can be divided among multiple ladder CPUs
  - Data processing using BASIC CPU
- › FA-M3R Programming Tool WideField2
  - Object ladder, a new programming paradigm after structured programming
  - Structure facilitates data reuse.
  - Program componentization using Indirect specification and input macro instructions
  - Circuit comments/subcomments and tag name definitions can be stored in CPU to speed up maintenance.
  - Partial download increases debugging efficiency
  - Blocks and macros can be coded independently, thus dramatically increasing reusability.
  - Improved visibility increases efficiency of reuse
  - Easy data exchange with Windows-based applications
  - System logs and user logs for troubleshooting
  - Sampling trace for troubleshooting
- › Remote OME\*\* in Your Preferred Way
  - Remote OME by E-mail via Internet
  - Remote OME via Ethernet network
  - Remote OME via public telephone line and analog modem

\* These figures indicate the performance when running a program with typical ratio of basic instructions to application instructions. Not all user programs are guaranteed to run at this speed.

\*\* Acronym of remote **O**peration **M**aintenance and **E**ngineering proposed by Yokogawa Electric Corporation.

The FA-M3R outclasses the capabilities of today's PLCs and offers the functionality, performance, choice of languages and expandability provided by a microcomputer board.

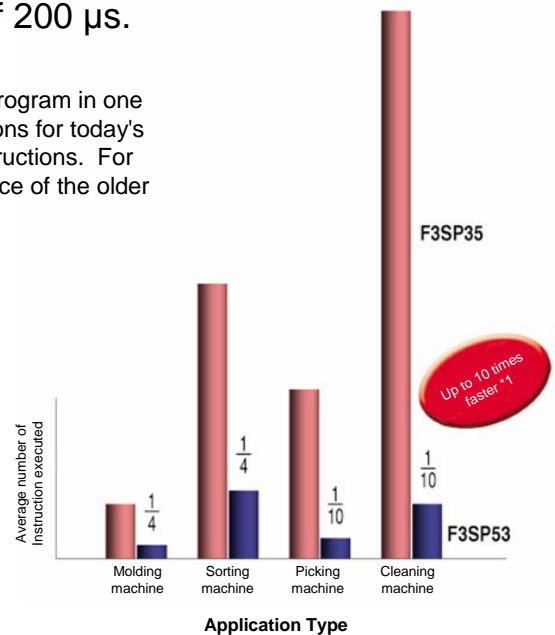
No more tedious quality control of huge variety of boards or discontinuation of parts - Users can now concentrate on adding value to equipment.



World's fastest processing speed realized by triple processors.  
 20K steps of ladder program scanned per millisecond.  
 Minimum scan time of 200  $\mu$ s.

The FA-M3R delivers high-speed in all aspects, running a 20K steps of program in one millisecond (ratio of application instructions used: 50%). Actual applications for today's functionally-enhanced equipment contain a larger ratio of application instructions. For such applications, the FA-M3R achieves at least ten times the performance of the older CPU modules for the FA-M3.

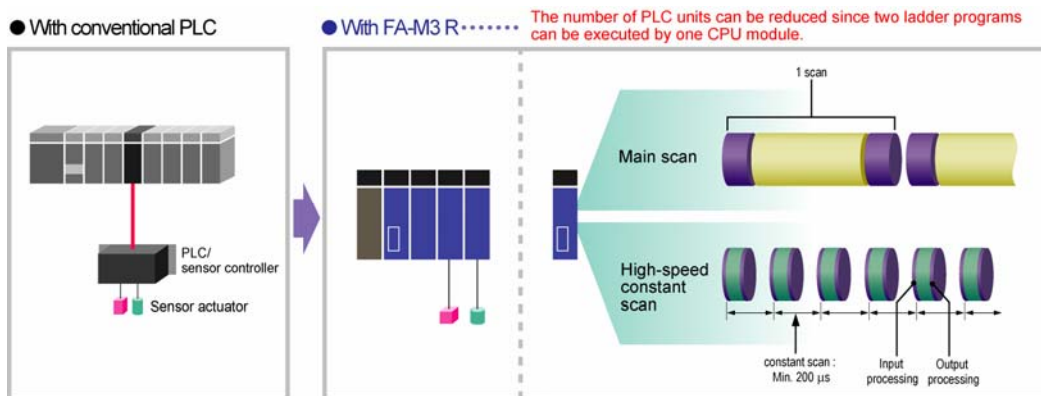
The graph on the right shows examples of performance improvements.



\*1: In comparison with Yokogawa's older CPU modules using actual applications

## Sensor Control Function

- One CPU can carry out a high-speed constant scan (from 200  $\mu$ s) independently besides the normal scan.
- The same CPU can also be used to achieve quick response.



## Quick 10 $\mu$ s response from input to output

- Ultra-quick response  
 ON->OFF: 100  $\mu$ s, OFF->ON: 300  $\mu$ s  
 F3XD08-6F, F3XD16-3F/4F, F3XD32-3F/4F,  
 F3XD64-3F/4F, F3WD64-3F/4F (with 32 inputs)
- Ultra-quick response to input: 10  $\mu$ s  
 F3XD16-3H
- Option to HOLD/RESET outputs when CPU fails  
 F3YD64-1P, F3WD64-3F/4F (with 32 outputs)

## Faster Response to Interrupt Signal

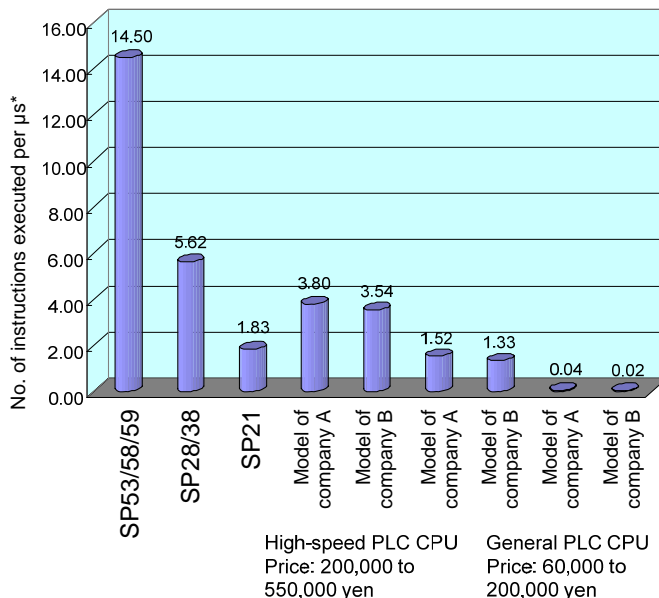
- DC input module allows quick response of 100  $\mu$ s to an interrupt input
- Swift response to a change in input level to implement instantaneous high-speed control

Thanks to the ultra-fast processing speed, there's no need to worry about processing time during programming.

### Why is high-speed processing necessary?

- To carry out complicated calculations (using application instructions) quickly
- To stabilize high-speed mechanical control for higher productivity
- To allow enhanced HMI and diagnostic programs for better operator interface
- To reduce unstable scan time by using network

Comparison of Processing speed



\* No. of instructions executed per  $\mu s$  means the average number of instructions executed in 1  $\mu s$  by the PLC.

### Ultra-fast Execution of Instructions

Basic instruction: 0.0175  $\mu s$  minimum  
Application instruction: 0.070  $\mu s$  minimum

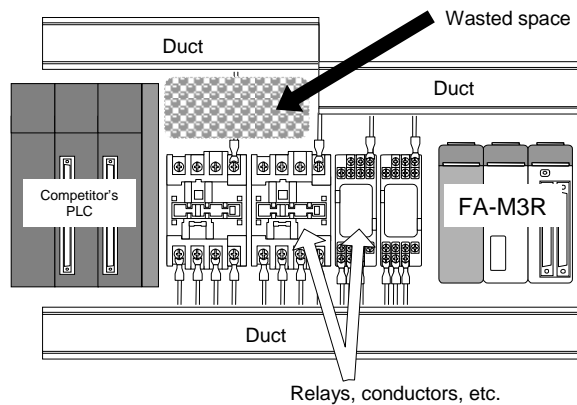
### Comparison with Yokogawa's Older CPU Model on Basic Instruction Execution

Instruction	SP53, SP58, SP59, SP66 or SP67	SP35 (older model)
LD, AND, OR	17.5 to 35 ns	90 ns
Timer	175 ns	360 ns
Transfer	70 ns	180 ns
Comparison	70 ns	180 ns
Addition, subtraction	105 ns	270 ns
Logic operation	105 ns	270 ns

### Comparison with Yokogawa's Older CPU Model on Application Instruction Execution

Instruction	SP58 vs. SP35
Transfer between file registers	74.1 times faster
Index modification (LD)	10.7 times faster
Index modification (MOV)	30.4 times faster
Read/write	6.4 times faster
Timer update	6.7 times faster
BMOV/BSET	12.8 times faster
FOR-NEXT	7.7 times faster

- Why do we need smaller controllers?
- To provide ample room for additional modules
  - To allow installation of the controllers without affecting the machine design and safety of the factory (allowing perspective facilities)
  - To help standardize control panels
  - To minimize the size of the control panel regardless of the controller scale
  - To cut cost



## Design concept: PLC is a substitute for relays

The FA-M3R is packaged into the size of usual relays and conductors and is designed for installation in the same row inside a panel, thus allowing efficient internal panel design.

## Dimensions

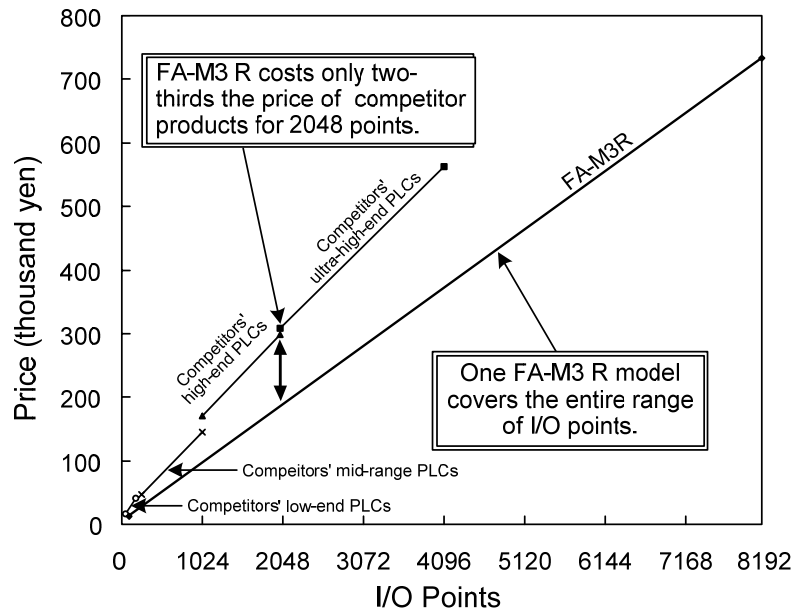
Base Module	Slots	Mounting Dimensions (mm)	Depth of Module* (mm)
F3BU04-0N	4	100 x 147	88.5
F3BU05-0D	5	100 x 205	88.5
F3BU06-0N	6	100 x 205	88.5
F3BU09-0N	9	100 x 322	88.5
F3BU13-0N	13	100 x 439	88.5
F3BU16-0N	16	100 x 537	88.5

\* Dimensions of a base module with I/O modules installed in it (excluding protrusions such as connectors and terminals blocks)



Whatever the number of I/O points, one PLC covers all.

- Better functionality than competitors' high-end PLC, yet cheaper than competitors' low-end PLC
- One model covers an entire range of I/O points, from small to large
- Good expandability independent of scale
- Common modules and parts eliminates need for diverse spares.



## Flexible Combination of Diverse Types of I/O Modules

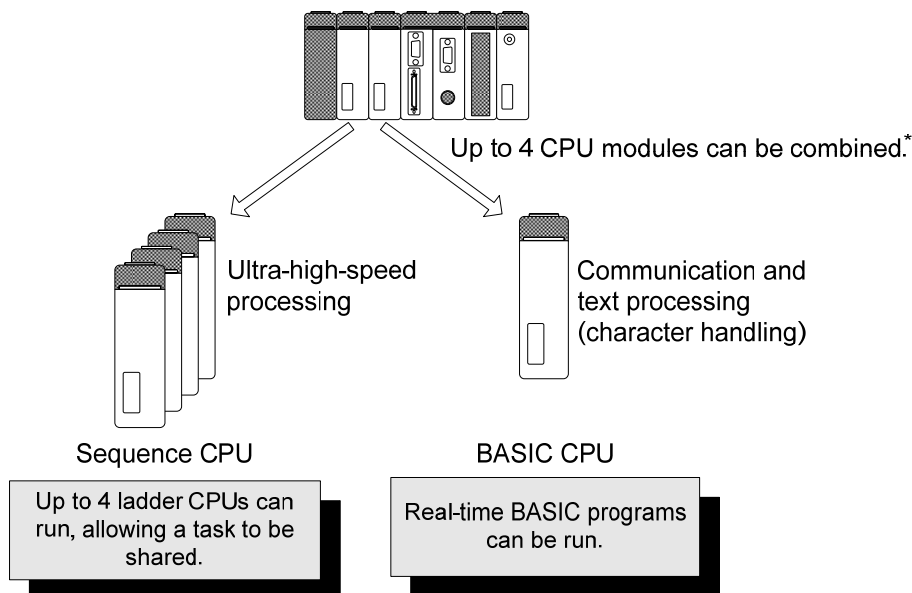
- Offered with various types of I/O modules normally used in high-end PLCs
- Simple access to advanced I/O modules

## Number of I/O Points

- 4 to 288 analog inputs
- 2 to 288 analog outputs
- 1 to 288 axes for positioning
- 4 to 144 pulse inputs
- 1 to 36 serial communication ports (F3RZY, F3RS41)
- 2 to 72 serial communication ports (F3RS22)
- 1 to 8 GP-IB communication ports

Note: Shown above are the maximum numbers of points and ports when the corresponding modules are installed for the maximum numbers independently, and do not mean that all these maximums are available at the same time for the same controller. The maximum number for each item depends on the combination of modules actually installed.

- Use any programming language you like.
- Use the optimal language for your applications.
- Combine languages freely.



\* Only one BASIC CPU module can be installed per controller.

- › Electrical and mechanical engineers may prefer a ladder diagram, while production engineers may prefer BASIC.
  - à The FA-M3R allows free choice of CPUs and programming languages to fit application needs.

Module	Model	Specifications
<b>Sequence CPU module</b>	F3SP21-0N	Object ladder language 10K steps, 0.18 μs/basic instruction
	F3SP28-3S	Object ladder language 30K steps, 0.045 μs/basic instruction
	F3SP38-6S	Object ladder language 120K steps, 0.045 μs/basic instruction
	F3SP53-4S	Object ladder language 56K steps, 0.0175 μs/basic instruction
	F3SP58-6S	Object ladder language 120K steps, 0.0175 μs/basic instruction
	F3SP59-7S	Object ladder language 254K steps, 0.0175 μs/basic instruction
	F3SP66-4S	Object ladder 56K steps, 0.0175 μs/basic instruction, with network functions
	F3SP67-6S	Object ladder 120K steps, 0.0175 μs/basic instruction, with network functions
<b>BASIC CPU Module</b>	F3BP20-0N	YM-BASIC/FA language, 120KB
	F3BP30-0N	YM-BASIC/FA language, 510KB

- Any CPU can directly access I/O modules.
- Different types of CPU modules can exchange data with each other.
- A controller can comprise of a single CPU module or CPU modules of a single type.
- FA-M3R (Sequence CPU or BASIC CPU) can be combined in a multi-CPU configuration.

All CPU types do not require replacement of the memory battery (maintenance free). The service life of this battery exceeds 10 years in standby mode at room temperature but may be shortened when exposed to extreme low or high temperatures.



























































































































- ' Windows and Excel are registered trademarks of Microsoft Corporation.
- ' Intel, MMX, and Pentium are trademarks or registered trademarks of Intel Corporation.
- ' Ethernet is a registered trademark of XEROX Corporation.
- ' Other product and company names appearing in this document are trademarks or registered trademarks of their respective holders.