

# Synopsys and Yokogawa

## Yokogawa Achieves Industry's Fastest Programmable Logic Controller Performance with Processor Designer



YOKOGAWA ◆

*Our PLC FA-M3V has now reached the fastest performance in the world. I don't think many system design engineers know that they can develop such a high performance application-specific embedded processor using Processor Designer."*

**Hirofumi Okamoto**

Group Leader of the PLC Development Division, Yokogawa Electric Corporation

### Business

Yokogawa Electronic Corporation is engaged in developing businesses that are based on its technologies in the measurement, control, and information fields. The Programmable Logic Controller (PLC) is one of Yokogawa's key products in the area of Production Control and Safety Management.

### Challenges

- ▶ Increase performance of ladder instruction processing speed
- ▶ Lack of experience in C-Compiler development
- ▶ Speed development schedule over traditional (RTL coding) method

### System-Level Design Solution

- ▶ Processor Designer custom processor design tool

### Benefits

- ▶ Automatically generate software development toolchain (C-Compiler, Assembler/Linker & Debugger)
- ▶ Start software design before the processor/DSP is complete
- ▶ Explore and optimize processor architecture to reduce power, gate count, & development time

### Overview

Yokogawa's PLC Development Division designs the Programmable Logic Controller (PLC) or IT machine controllers. Their latest PLC, FA-M3V, offers the industry's fastest ladder instruction processing speed. The range-free multi-controller FA-M3 is a next-generation programmable controller, which achieves high performance through its ultra high-speed processing and stable control features. It incorporates a space-saving compact design, supports versatile ranges with cover for up to 8192 input/output points, and is equipped with a variety of advanced modules, which can be used to configure a wide range of applications.

The FA-M3 has structured programming and uses an object ladder to create an efficient total design, all the way from planning to maintenance. Object ladder is a program development concept aimed at dramatically improving customization efficiency by integrating programs and devices into independent objects (e.g., blocks) on a functional basis.

The FA-M3 offers ultra-high speed processing sensor control function, built-in network function, multiple CPUs, programmable reusability, and supports open network protocols such as

Ethernet, FL-net, DeviceNet, and others while providing a range of modules for use on a variety of networks ranging from field networks to system configuration networks.

### Leading Custom Processor Design Solution

Yokogawa's FA-M3V design team covered LISA coding, C-Compiler, and software design. The design team was specifically looking for a C-Compiler tool when they discovered Processor Designer. Not only did Processor Designer deliver a C-Compiler as part of the automatically generated software development toolchain, Yokogawa was also able to design the processor in the same language (LISA) as the software development toolchain, enabling parallel processing functions such as very long instruction word (VLIW) architecture, and use a low-cost ASIC silicon process.

Processor Designer also automatically generated the instruction set simulator model enabling early software development while the processor was still in development and RTL was not yet available. The team was then able to find bugs at an earlier stage in the design where the software did not match the hardware specification.

In addition the Processor Designer profiling tool allowed the Yokogawa PLC design team to explore and optimize their processor architecture. By optimizing the LISA input specification and hence the resulting generated RTL code, the team was able to reduce power consumption, gate count, and overall system development time while avoiding a re-spin. However, the team's biggest accomplishment

was meeting the ultra high-speed timing goal of 3.75nSec/instruction. This is five times as fast as previous versions.

"Our new PLC FA-M3V has now reached the fastest performance in the world with our 'Vitesse Engine' ASIP for ladder language program processing. I don't think many system design engineers know that they can develop such a high performance application-specific embedded processor using Processor Designer to automate the design and implementation process" said Mr. Okamoto, Group Leader of the PLC Development Division, Yokogawa Electric Corporation.

Yokogawa successfully released the FA-M3V PLC into the market and is now on their way to designing the next generation PLC product. They will continue to use Processor Designer to ensure highest performance.



**FA-M3V**  
V I T E S S E™

*"Processor Designer offered us more than we expected, enabling us to develop software earlier and optimize the processor architecture. Not only did we save money by not outsourcing the project, but we have higher confidence in the results."*

**Hirofumi Okamoto**

Group Leader of the PLC Development Division, Yokogawa Electric Corporation

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