

Development of Industrial Embedded Controller, μ PIBOC-I MODEL1200

Yukinori Yamaguchi,
Keisuke Nakamura,
Yo Suzuki,
Shintaro Nishiwaki

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Abstract

In recent years, industrial computers, which are often used in manufacturing equipment and inspection equipment, have diversified functions, and are required to have higher performance. At the same time, while avoiding changes in the shape and interface of the industrial computer itself as much as possible, stable long-term supply is required.

The industrial controller μ PIBOC-I MODEL1200 that we developed is the latest model with a compact shape that is ideal for embedding in equipment and equipped with a high-performance Central Processing Unit (CPU). It has the same shape as its previous model, μ PIBOC-I MODEL1100, and achieves high performance while maintaining compatibility with customer's manufacturing equipment.

1 Preface

In recent years, mobile terminal devices such as smartphones have become popular due to the further development of communication infrastructures, and there is an increased demand for servers and communication equipment for data centers. Demand for telecommunication-related products will continue to increase due to the social changes brought on by the COVID-19 pandemic, which began in 2020. With the shift to electronic control in automobiles and other factors, the market for device manufacturing equipment and inspection equipment in the semiconductor and liquid crystal display fields will continue to grow. In semiconductor device manufacturing equipment, which is indispensable for mass production, the embedded controllers are required to have compact design, high reliability, and long-term stable supply. Controllers specialized for industrial use are often used. As an industrial controller, we released μ PIBOC-I series, which has a compact design, is suitable for embedded applications, has high performance and reliability, and can be supplied stably for a long period of time. This paper introduces the features of μ PIBOC-I MODEL1200, the latest model in the series.

2 Features of μ PIBOC-I Series

2.1 Features of μ PIBOC-I MODEL1200

μ PIBOC-I MODEL1200 is a box-shaped industrial controller with a lineup of four types of models with different storage media. Fig. 1 shows the external appearance of each type, and Fig. 2 shows the system configuration.

μ PIBOC-I series changes from MODEL700 → 750 → 800/850 → 950 → 1000/1050 → 1100 → 1200,

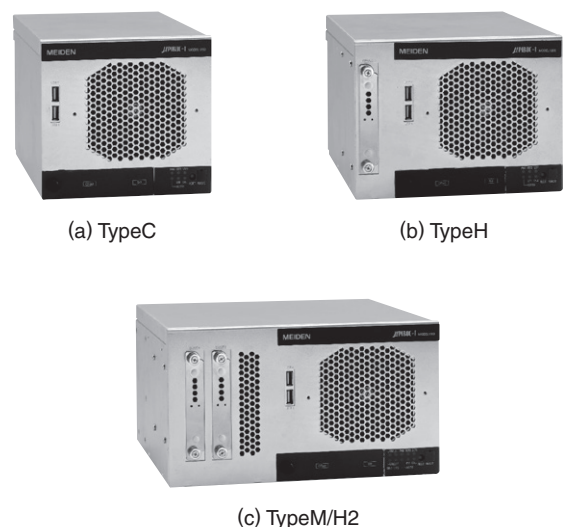


Fig. 1 Types of μ PIBOC-I MODEL1200 Series

External appearance of TypeC, TypeH, TypeM, and TypeH2 are shown.

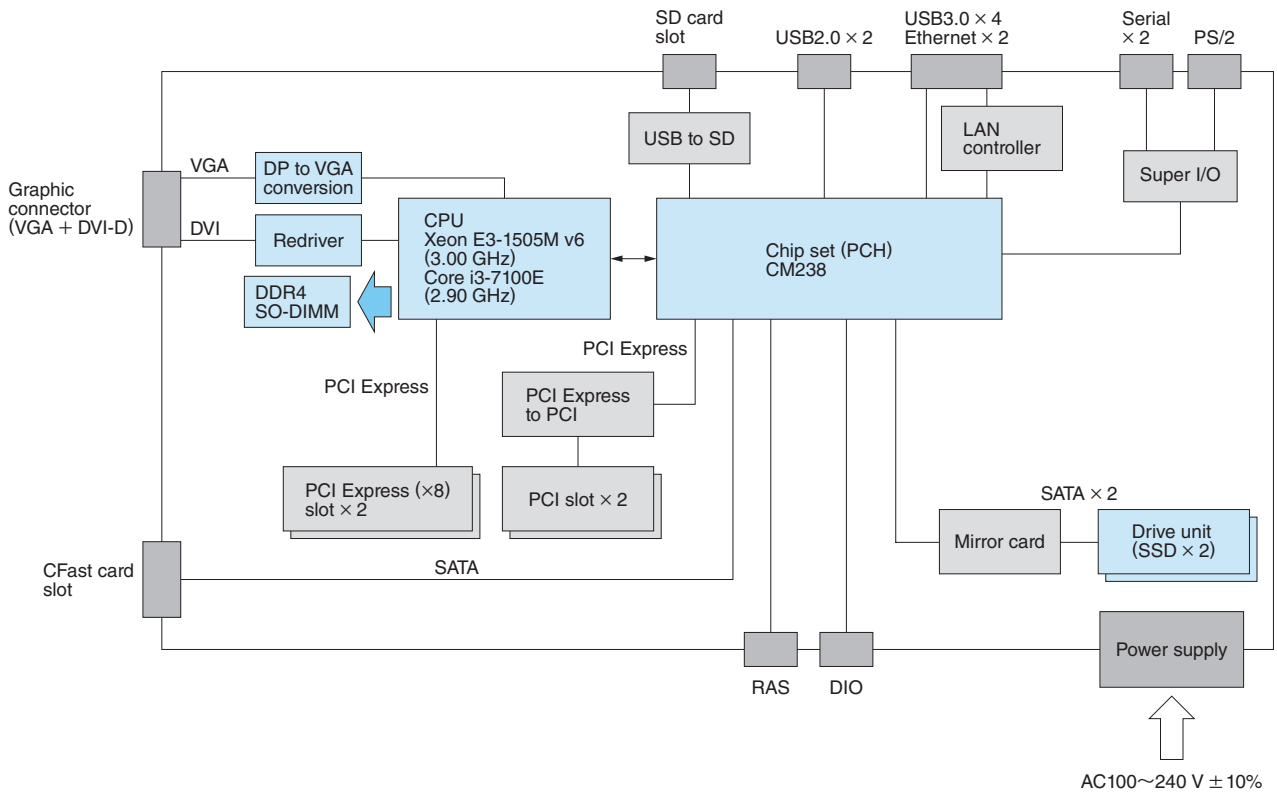


Fig. 2 System Configuration

A system configuration of μ PIBOC-I MODEL1200 is shown.

maintaining the concept of keeping the same external size and concentrating maintenance parts on the front. We considered the maintainability of the equipment. The Central Processing Unit (CPU) performance has been improved, and this is the 7th generation.

(1) High performance

Table 1 shows the basic specifications. μ PIBOC-I MODEL1200 is equipped with the Xeon E3-1505M v6 (3.00 GHz), a 7th generation Intel Core processor for servers and workstations. Equipped with a 4-core/8-thread processor, it has approximately double the operating speed of the MODEL1100. The Core i3-7100E (2.90 GHz), a low-priced model, can also be selected.

(2) Compact housing

The basic unit has a box shape of W160 × H148 × D250 mm, which is common to all μ PIBOC-I series. The product lineup is as follows.

- (a) Diskless specification (TypeC)
- (b) SSD × 1 specification (TypeH)
- (c) Mirror disk specification (TypeM)
- (d) SSD × 2 specification (TypeH2)

(3) High expandability

While achieving a compact size, PCI bus (short

size) × 2 slots and PCI Express (×8) bus × 2 slots were realized (Type C has PCI bus × 3 slots). By installing a PCI Express (×8) bus, it becomes possible to use an image processing board that can perform high-speed data transfer processing. By making a combination with a control I/O board, image capture and control become possible from various types of cameras.

(4) High reliability

A dedicated reinforced power supply and long-life fan are adopted. In addition, a dedicated Reliability Availability Serviceability (RAS) function is installed as standard, which is possible to monitor hardware malfunction and software errors. Such errors can be displayed and a function of sending an announcement to the application is provided. There is a corresponding measure to be taken in the case of a failure as well as a preventive method for protection against failures.

(5) Front-side maintenance

μ PIBOC-I has a housing structure that is designed for embedding, and in consideration of workability during maintenance, parts with limited lifespans (SSD, CFAST, SD card) can be replaced from the front of the housing. For a mirror disk

Table 1 Basic Specifications

The basic specifications of μ PIBOC-I MODEL1200 are shown.

Item		Specifications			
Type		TypeC (UA060/2x1A)	TypeH (UA060/2x2A)	TypeM (UA060/2x4A)	TypeH2 (UA060/2x8A)
Processor		Intel Xeon E3-1505M v6 Base frequency: 3.00 GHz, No. of core/thread: 4Core/8Thread or Intel Corei3-7100E Base frequency: 2.90 GHz, No. of core/thread: 2Core/4Thread			
Chipset		CM238			
Main memory		DDR4 SO-DIMM ECC correspondent. A maximum of 2 boards can be mounted for 8 GB and 16 GB, respectively. Applicable chip standard: DDR4-2400MT/s			
CFast card slot (Fixed)		SATA3.0 correspondent: 1 slot			
Drive unit		Not applicable	A single SSD (256 GB/1 TB) unit installed	SSD (256 GB/1 TB) × 2 SSD (256 GB/1 TB) units can be installed. RAID1 (Hot swap available)	A maximum of 2 SSD (256 GB/1 TB) units can be installed.
Interface	Graphic	[DVI-D] Maximum resolution 1920 × 1200: 1 port		[VGA] Maximum resolution 1920 × 1200: 1 port	
	USB	[Front side] USB2.0: 2 ports [Rear side] USB3.0: 4 ports			
	Serial	RS-232C conforming: 2 ports Max baud rate: 115.2 kbps			
	Ethernet	10BASE-T/1000BASE-T/1000BASE-TX: 2 ports Wake On LAN, Jumbo frame applicable			
	SD card	SDHC conformant: 1 slot			
	Extension slot	PCI (half size): 3 slots	PCI (half size): 2 slots, PCI Express3.0 [x8] (half size): 2 slots		
	PS/2	Not applicable	1 port (keyboard/mouse unit)		
	DIO	Not applicable	General-purpose DI 8 points, General-purpose DO 8 points		
	RAS	Not applicable	Input: Remote reset, UPS service interruption detection Output: Σ error, WDT1 · 2 error, Fan error, TEMP error		
Display	①POWER LED, ②ACCESS LED, ③WDT ERR1 LED, ④WDT ERR2 LED, ⑤ERROR LED, ⑥CALL LED, ⑦DRIVE0 STATUS LED, ⑧DRIVE1 STATUS LED, ⑨DRIVE0 ACCESS LED, ⑩DRIVE1 ACCESS LED ※①~⑥: all types in common, ⑦~⑩: TypeM and TypeH2 only				
Switch	Power switch, RESET switch				
OS	Windows10 IoT Enterprise LTSC 2019 (64 bit) INtime (Expansion real time OS 32 bits) ※Optional				
RAS functions	①CPU chip temperature error, ②Voltage level error, ③Casing fan stop, ④WDT error (System level, application level), ⑤CFast media error, ⑥Drive (SMART or Mirror) error, ⑦ECC error, ⑧Maintained parts expiry date out, ⑨SSD · CFast lifetime error, ⑩UPS service interruption detect, ⑪Power supply error (Battery unit malfunction) ※⑩ and ⑪: Effective when battery unit (UP020/001A) is installed.				
Built-in diagnostic tool	Memory diagnosis, SSD · CFast diagnosis, display (VGA, DVI-D) diagnosis, RTC diagnosis, serial port (RS-232C) diagnosis				
Power input	AC100 V~240 V ± 10%, 50/60 Hz ± 3 Hz				
External dimensions (mm)	W160 × H148 × D250	W197 × H148 × D250	W262 × H148 × D250		
Main body mass (kg)	Approx. 4.5	Approx. 5.0	Approx. 6.0		

model, operation can be continued with an SSD even though the other one fails so that the failed SSD can be replaced by a hot swap feature (removal and replacement of a device while the equipment power supply is ON).

(6) Dedicated battery unit

μ PIBOC-I MODEL1200 can be equipped with the same battery unit that was used in the previous MODEL1100 in consideration of maintainability. This battery has a compact integrated structure that does not require external wiring, and in the event of a power failure, it can be linked with the RAS function to notify applications and perform Operating System (OS) shutdown processing. Fig. 3 shows a model equipped with a dedicated battery unit.

(7) Compliant with various standards

Table 2 shows the environmental specifications. μ PIBOC-I MODEL1200 satisfies the environmental specifications necessary for an industrial controller, and the level of impact on external devices conforms to VCCI/FCC Class A. In addition, we acquired UL standards and the KC mark to respond to safety-conscious design and export to South Korea. Furthermore, the design complies with the Low Voltage Directive and EMC Directive required for CE marking, and consideration is given to the overseas export of equipment incorporated in manufacturing equipment. It also complies with the Restriction of Hazardous Substances (RoHS) directive and is an eco-friendly design.



Fig. 3 Model Equipped with Dedicated Battery Unit

When a battery unit is installed, μ PIBOC-I MODEL1200 becomes capable of taking measures against a service interruption or a momentary voltage drop by linking with the power unit.

Table 2 Environmental Specifications

The environmental specifications of μ PIBOC-I MODEL1200 are shown.

Item	TypeC UA060/ 2x1A	TypeH UA060/ 2x2A	TypeM UA060/ 2x4A	TypeH2 UA060/ 2x8A
Operation temperature	0~50°C			
Air-cooled system	Forced-air-cooled by means of a front fan (Suction air)			
Operation vibration durability in XYZ directions	±0.625 mm (1~14 Hz) 4.9m/s ² (14~100 Hz) 2-bothway logarithmic sweep in XYZ directions; 27 minutes each JEITA IT-1004B ClassS			
Standards	<ul style="list-style-type: none"> • UL62368-1, cUL62368-1 acquired • FCC: Part-15 ClassA conforming • VCCI: ClassA conforming • RoHS conforming • KC: KS C 9832, KS C 9835 			

2.2 Software Features

(1) OS support by Microsoft

Windows10 IoT Enterprise LTSC 2019 (64 bit) was adopted as the OS installed in μ PIBOC-I MODEL1200. Since function update programs are not provided, there is no need to re-evaluate application software due to no functional update programs. During the supply period of μ PIBOC-I MODEL1200, it can be used with the same OS. It also has a lockdown function that prevents problems caused by unnecessary user operations or malfunctions, such as restricting writing to CFast cards and SSDs, restricting access to USB devices, and restricting executable applications.

(2) RAS Function as Standard

μ PIBOC-I MODEL1200 supports the RAS function as a standard. **Table 3** shows the RAS function specifications. With the RAS function, even if an error occurs in the device, the fault is notified and the system can be stopped safely.

Table 3 RAS Function Specifications

RAS function specifications of μ PIBOC-I MODEL1200 are shown.

Item	TypeC UA060/ 2x1A	TypeH UA060/ 2x2A	TypeM UA060/ 2x4A	TypeH2 UA060/ 2x8A
Software power supply OFF	○	○	○	○
Power supply error detection	○	○	○	○
CPU temperature error detection	○	○	○	○
Watchdog timer error detection	○	○	○	○
Casing fan stop detection	○	○	○	○
Drive malfunction (SMART)	○	○	○	○
Drive malfunction (SSD/CFast remaining lifetime)	○	○	○	○
Preventive security alarm	○	○	○	○
Remote power supply ON/OFF	○	○	○	○
Error LED display	○	○	○	○
Remote reset function	—	—	○	○
System error output	—	—	○	○
Crush damp data logging	○	○	○	○
System data telemetry	○	○	○	○
System load telemetry Logging file	○	○	○	○
External I/O support	—	—	○	○

3 Postscript

We introduced the features of μ PIBOC-I MODEL1200. μ PIBOC-I MODEL1200 is a compact controller that is specialized for embedding in equipment that has both high performance and high reliability. It is expected to be applied not only to the fields of manufacturing equipment and inspection equipment, but also to all embedded application fields.

In the future, we will continue to improve the functions of the embedded controller and promote product development that meets market demands.

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