

Industrial Computers, μ PORT M5A

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Abstract

Our industrial computers, called “ μ PORT Series,” are high-performance computer products developed exclusively to monitor and control various social infrastructure systems such as electric power networks, water processing (drinking water and sewage treatment plants), railways, and industrial systems. We recently developed a new flagship model called “ μ PORT M5A.”

Compared with our conventional model, μ PORT M5 Model 200, this product offers better computing performance and improved reliability by adopting a better Central Processing Unit (CPU). For a high reliability design, we secured the thermal and key component redundancy. In addition, our design conforms to the Electro Magnetic Compatibility (EMC) standards. We worked hard to make this model an easy-to-use product, with a better design, and realized a compact design and backward compatibility for retrofitting work.

1 Preface

Our industrial computers, called “ μ PORT Series,” have been used to monitor and control various social infrastructure systems. They have long contributed to the stable operation of these systems.

Our new model, μ PORT M5A, is designed (1) to meet the market demands on the product such as continuous 24/7 operation and stable long-term product supply and (2) to offer high-quality stable operation. Since a server-class CPU is installed and a latest user interface standard is adopted, performance has been greatly improved compared with our conventional model. In order to cope with system redundancy, the number of points to manage Digital Input/Digital Output (DI/DO) signals and the number of Ethernet ports are increased. We offer line-ups of duplex power supply systems and Redundant Arrays of Inexpensive Disks (RAID) model storage. In doing so, we improved reliability by the system redundancy. For the use of desktop PC mode, we improved the ease of use and renovated the design to offer better visuals.

This paper introduces our latest industrial computer model, μ PORT M5A, that can easily realize system redundancy through the redundancy of major parts. We aim to offer better usability and

reliability by positively adopting industrial de-facto standards and latest technologies.

2 Outline of the Product

Table 1 shows basic specifications. **Table 2** shows the operating condition specifications. **Fig. 1** shows an external appearance. **Fig. 2** shows the block diagram.

2.1 Adoption of a High-Performance Processor

(1) Processor

An Intel Xeon E3-1268Lv3 (2.30 GHz) processor is adopted for the CPU. It offers a high processing capability of the quad core.

(2) Chipset

By adopting a C226 chipset for the server, it complies with the high-speed interfaces such as PCI Express3.0, USB3.0, and SATA3.0. This improves IO access performance.

(3) Large-capacity memory

Two chips of DDR3-SDRAM (Double Data Rate 3 – Synchronous Dynamic Access Memory) are mounted to a maximum of 16GB to enable running multiple large memory applications. In addition, we realized high reliability by complying with the Error Correction Code (ECC) memory.

Table 1 Basic Specifications

Basic specifications of μ PORT M5A are shown.

Item	Specifications
Product name	μ PORT M5A
CPU	Intel Xeon E3-1268Lv3 (2.30 GHz)
Cache	8MB SmartCache
Chip set	Intel C226
Main memory	2-slot (Max. 8 pcs \times 2GB modules) DDR3 SO-DIMM (1333MT/s): With ECC
System drive	Hardware mirror model: 2.5 inch HDD SSD model: 2.5 inch SSD
Expansion slot	PCI slot: 3 slots (32-bit at 33 MHz) PCI Express3.0 (\times 8): 1 slot PCI Express3.0 (\times 4): 1 slot
Graphic function	DVI-D: 1 port (1920 \times 1200Max.) VGA: 1 port (1920 \times 1200Max.)
USB	USB3.0: 4ch (Back side) USB2.0: 2ch (Front side)
Network	1000BASE-TX: 4ch (Wake-on-LAN compliant)
Serial	Dsub 9-pin: 2ch
Audio	LINE OUT: 1 port
DI/DO	General-purpose DI: 8 points, general-purpose DO: 8 points Alarm: 2 types (2 contact points for redundancy)
BIOS	Phoenix BIOS installed
OS	Windows10 IoT LTSC2016 64-bit version Red Hat Enterprise Linux7.2 64-bit version Windows Server 2016 64-bit version
RAS functions	WDT: 2 types, monitoring of fan, power supply, temperature, SMART, and memory, log acquisition, error code display, self-diagnostic function
Dust-proof filter	Mounting-enabled
Main body size	W350 \times H160 \times D370mm (TYP)
Main body mass	13.0kg Max.

2.2 High Scalability

(1) Expansion bus

Eight lanes of PCI Express and another four lanes of PCI Express are accommodated in each slot. An image processing board or a gigabit Ethernet board can be connected for high-speed performance requirements. There are three PCI slots on a motherboard. This means conventional PCI card can be inserted into the PCI slot on it. As such, we can accommodate the retrofitting work requirement.

2.3 High-Reliability Design

(1) Thermal design

We conducted thermal analysis on the cooling air from the fan installed in the front area in order to determine an optimal airflow amount of cooling air across the heat generating components such as CPU, etc. Based on the result of this thermal analysis, we determined the fan position, ventilation hole

Table 2 Operating Condition Specifications

Operating condition specifications of μ PORT M5A are shown.

Item	Specifications
Ambient temperature	5~40°C
Ambient humidity	20~80%RH
Resistance to vibration	\pm 0.25mm (1~14Hz) 1.96m/s ² (14~100Hz)
Shock resistance	19.6m/s ² (11ms sinusoidal half wave)
Ambient conditions	Free from rigorous dust contamination Free from corrosive gases and conductive dust
Acoustic environment	95dB Max.
Power input	Single-phase AC 100~240V
Dielectric strength	AC-FG: AC1500V
Insulation resistance	AC-FG: DC500V 20M Ω or above
Incoming noise durability	AC input 1kV _{p-p} 50ns~1 μ s pulses
Non-sensitive short-break time	20ms Max.
Grounding	Class D grounding
Power consumption	480VA Max.
Inrush current	40A Max.

**Fig. 1 μ PORT M5A**

External appearance of μ PORT M5A is shown.

position, size, and necessity for wind guide. By the verification test, we confirmed the thermal redundancy and realized high reliability.

(2) Redundancy

To cope with duplex systems, two Ethernet ports for higher and lower level network communication are equipped as standard. The DI/DO ports to indicate system's status and alarming conditions are also equipped in doubled amounts of items compared with our conventional model. We are the managing system redundancy this way.

Further, we made the AC/DC power supply unit into a redundant power supply system. This means even if either power supply fails, the system can continue to operate without stopping the device since the power units are hot-swap (the removal and replacement of a power module without shutting

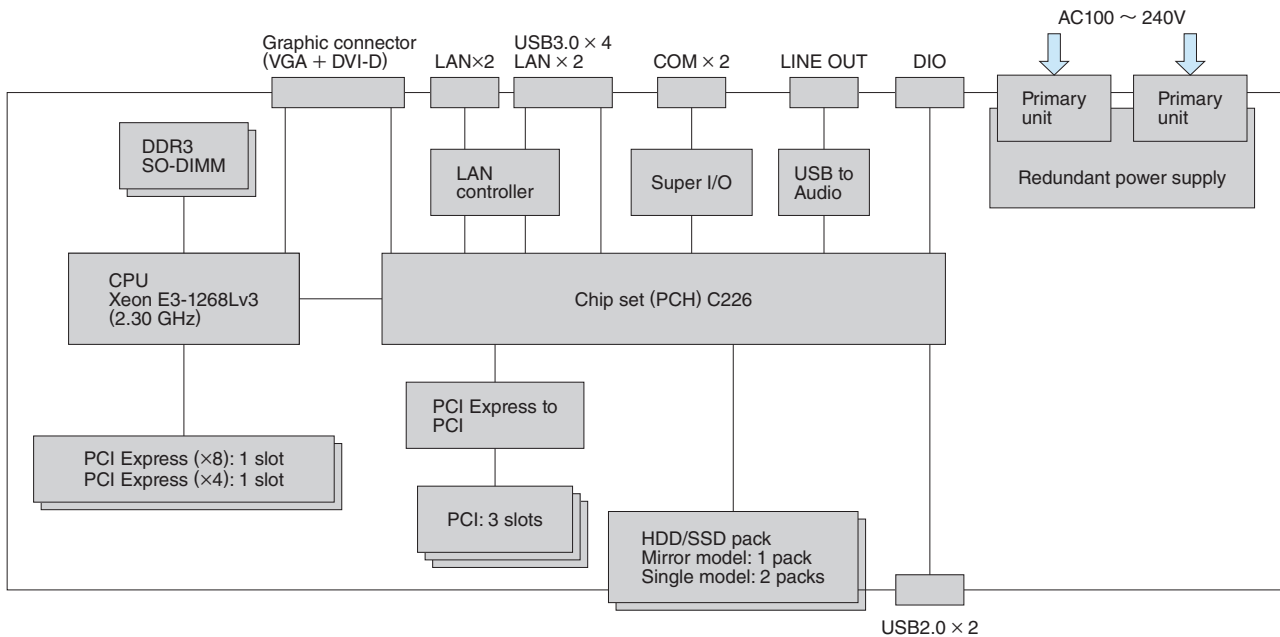


Fig. 2 Block Diagram

A block diagram of μ PORT M5A is shown.

down the system.) The Hard Disk Drive (HDD) model is equipped with Hardware (H/W) Redundant Array of Independent Disk (RAID) in order to secure system disk redundancy.

(3) Electromagnetic Compatibility (EMC)

This equipment is manufactured in accordance with relevant EMC standards such as IEC61000-6-2 and IEC61000-6-4. Accordingly, it has the ability of working correctly in different electronic devices and components, even in the presence of other devices that emit electromagnetic waves. This capability is required for general industrial electronic devices and products.

(4) Reliability Availability Serviceability (RAS) functions

By drawing on our extensive experience, RAS functions are accommodated. It can detect various kinds of error such as fan malfunction, thermal abnormality, power supply error, HDD error, and many other unusual phenomena. **Table 3** shows the RAS specifications.

2.4 Ease of Use and Design Improvement

Fig. 3 shows a front view and **Fig. 4** shows a back view. We improved the ease of use by integrating various functions on the front. Such functions are for maintenance work, status display, and operation work (which are needed after start-up operation of this device).

Table 3 RAS Specifications

The RAS functions are shown. It can detect equipment error early on and can reduce the meantime to repair.

Item	Specifications
Watchdog timer	SW runaway monitoring (timer value: 5~127s) 2ch
Fan monitoring	Monitoring of casing fan and power supply fan
Thermal error detection	CPU and casing temperature monitoring
Power supply monitoring	Power unit error monitoring
Mirror error detection	Mirror disk error monitoring
ECC error detection	Memory ECC error monitoring
Preventive maintenance alarm	Announcement of replacing time for life-limited parts
Error code display	7-segment 2-digit
General-purpose DI/DO	8 points each

As a part of our design change, compared with the conventional model, we completely improved the aesthetics of μ PORT Series developing a chic design in black.

As a part of our design change, compared with the conventional model, the equipment volume was reduced by about 36% and the mass by about 15% making it an eco-friendly product. For installation, we took into account of the backward (retrofit) compatibility. As such, the new product is designed to enable easy replacement from our conventional models.

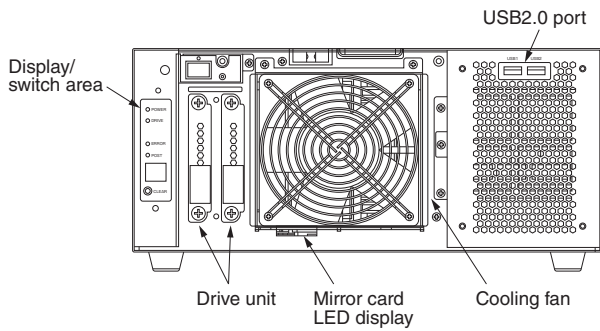


Fig. 3 Front View

This is a design featuring easy maintenance, clear display, and ease of operation.

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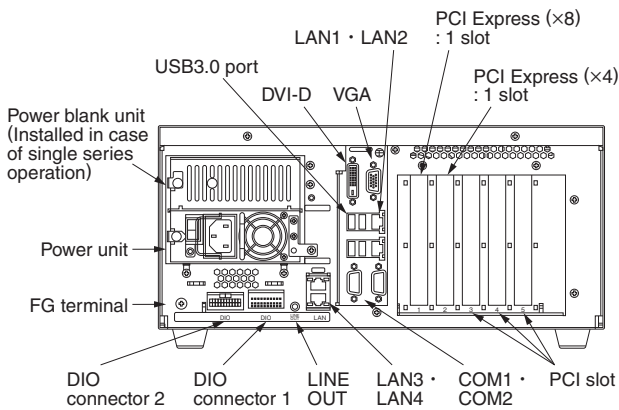


Fig. 4 Back View

It is designed to connect with the external devices in a compact manner.

2.5 Applicable Operating Systems (OSes)

Since the product can be operated under various 64-bit OSes, it can run large memory applications. In addition, since the product can run on

Windows 10 OS, Windows Server OS, and Linux OS, you can install suitable application software according to the system application.

3 Postscript

μ PORT M5A developed is our flagship model of μ PORT Series. It has high performance, high functions, high scalability, and high reliability. It is currently being used in various fields such as servers for the monitoring and control of infrastructure systems, etc. In doing so, we expect that our product will positively contribute to our society.

Going forward, we will work to improve functions and reliability, and continue to develop more easy-to-use products to meet on-site requirements.

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