

Industrial Controller, μ PIBOC-I Model 1000

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Abstract

With the performance improvements for manufacturing and inspection systems, the industry calls for higher performance of industrial Personal Computers (PCs) and controllers. In addition, in order to realize the compact design of the system, the industrial controllers have to be compact as well in order to be installed in the system. Industrial controllers are therefore required to offer both high performance and a compact design. We need to work out such industrial challenges.

The industrial controller, μ PIBOC-I Model 1000, is our latest dedicated system component model. Its industrial control box is compact and comes with a high-performance processor. This product meets customers' needs in a wider variety of markets.

1 Preface

Recently, mobile terminals such as smartphones, tablet computers, and home electronics appliances such as LCD TVs, etc., went digital at an accelerated speed. Along with this market trend, the market for manufacturing and inspection systems for semiconductor devices and Flat Panel Displays (FPDs) has expanded. Such systems are high-precision machines doing various processing work. Since the work calls for high performance in precision and speed, several industrial controllers are installed for system control; for this reason, manufacturing systems tend to increase in size. In order to curtail sizing problems, the system suppliers have to address a compact design for system components in addressing the challenge.

Normal desktop Personal Computers (PCs) on the market have some drawbacks such as big industrial control box size, low reliability, and it is also difficult to supply the same model for a long time in a reliable manner. As a result, for the module unit systems, it is common to use a module type of industrial controller featuring a compact design and high reliability. As industrial controllers to be used in manufacturing and inspection systems, we released the industrial controllers, μ PIBOC-I Series. These industrial controllers offer a compact design, high performance, reliability, and a guaranteed stable

product supply for a long duration of time. We received positive reviews from our customers in each industrial market.

This paper introduces the features of the Model 1000, which is the top end model of μ PIBOC-I Series. Model 1000 involves two types of models: a model with Intel Core i7 2.53GHz and a model with Celeron 1.86GHz.

2 Features of μ PIBOC-I Series

2.1 Features of μ PIBOC-I Model 1000

μ PIBOC-I Model 1000 is an industrial controller located in the industrial control box. A flexible configuration can be realized by its expansion slots for peripheral functions or expansion. **Fig. 1** shows an external appearance of each type and **Fig. 2** shows the system configuration. Considering improved maintenance, μ PIBOC-I Model 1000 is designed to concentrate maintenance parts on front side; therefore, this unit is suitable for use as a system module controller for manufacturing and/or inspection systems.

(1) Shape interchangeability

A short-size Single Board Computer (SBC) is adopted for the processor module. In keeping up with the progress of processor chips, we designed to have the performance improved by swapping the SBC module. The latest μ PIBOC-I Series is the 6th generation of μ PIBOC-I Model which are: Model

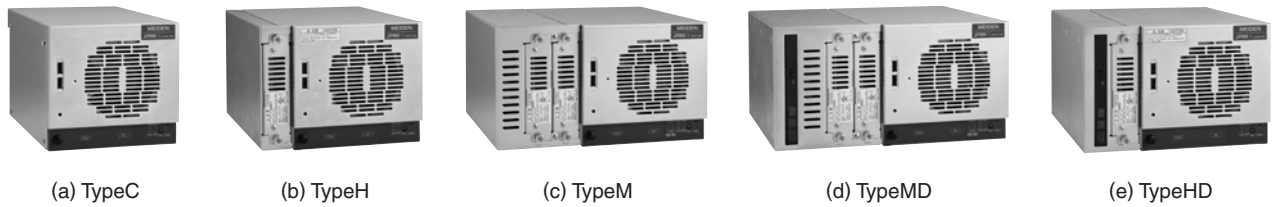


Fig. 1 μ PIBOC-I Model 1000 Series

Each product comes in a compact industrial control box type. The necessary slots for peripheral functions can be selected to meet its application needs.

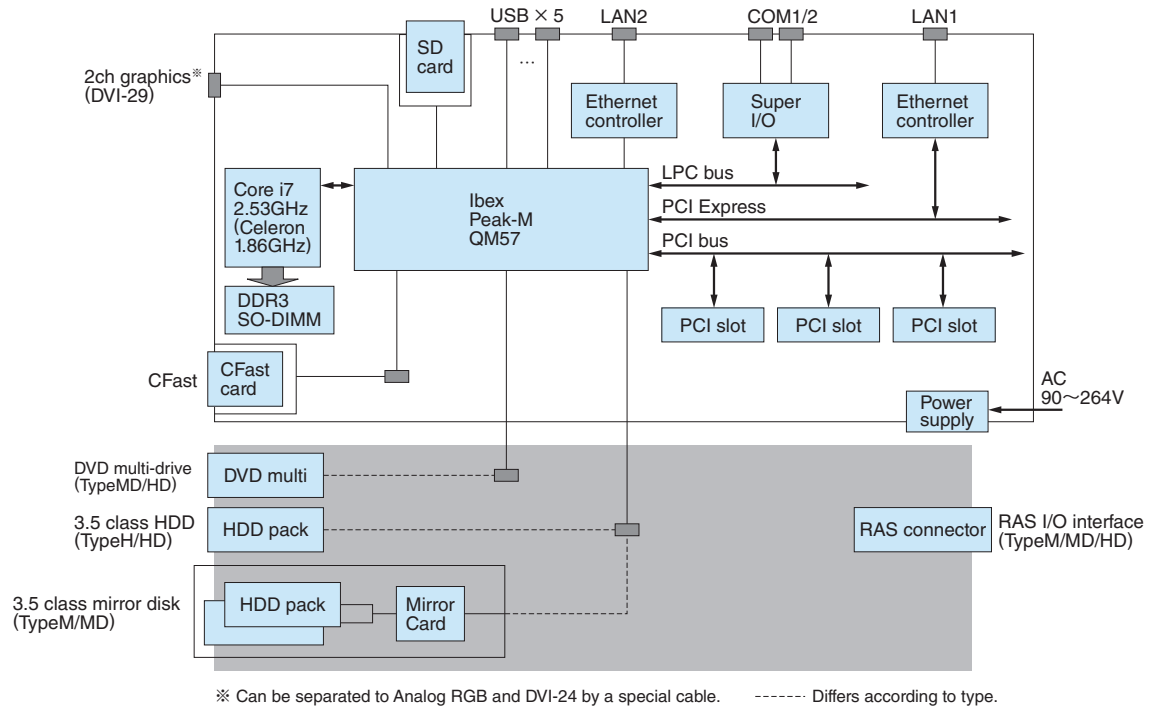


Fig. 2 System Configuration of μ PIBOC-I Model 1000 Series

The system configuration diagram of μ PIBOC-I Model 1000 Series is shown.

700 → 750 → 800 → 850 → 950 → 1000. This model comes with the same shape without changing the external size in every release. Such a design policy is reasonable in order not to affect any structural design for equipment.

(2) High performance

Table 1 shows basic specifications. For μ PIBOC-I Model 1000, two types of models are available: a high-end model with a low power consumption type dual-core processor Core i7 2.53GHz and a standard model with the dual-core processor Celeron 1.86GHz. Both types use the Intel QM57 for the chip set. We realize a lengthy product supply based on the Intel's long-time supply program (EIA: Embedded Intel Architecture). The main memory can be added by two DDR3 SDRAM cards slots with a maximum of 4GB each for a total of 8GB.

(3) Compact industrial control box

The basic unit of μ PIBOC-I Model 1000 comes in a industrial control box configuration of W160 × H148 × D250mm. By adding the necessary function slot for the customer, we designed to keep a compact and light mass industrial control box model. For product lineups, the following configurations are available:

- (a) Diskless specification (TypeC)
 - (b) HDD specification (TypeH)
 - (c) Mirror disk specification (TypeM)
 - (d) Mirror disk + DVD multi-drive specification (TypeMD)
 - (e) HDD + DVD multi-drive specification (TypeHD)
- (4) High expansibility

The basic unit in a compact size comes with the PCI bus (short size) × 3slots, CFast card slot (CFast: Standard stipulated by Compact Flash Associ-

Table 1 Basic Specifications of μ PIBOC-I Model 1000

The basic specifications of μ PIBOC-I Model 1000 are shown.

Item	Specifications
Processor	High-end model: Intel Core i7-610E 2.53GHz Standard model: Intel Celeron P4505 1.86GHz
Primary cache	Command/data: 32KB each (Embedded in CPU)
Secondary cache	256KB (Embedded in CPU)
Tertiary cache	4MB (Core i7) (Embedded in CPU) 2MB (Celeron) (Embedded in CPU)
Chip set	Intel IbexPeak-M QM57
BIOS	Phoenix BIOS (LegacyUSB, USB boot applicable)
Main memory	2GB~4GB DDR3 SO-DIMM (Attached with ECC) ×2 slot mounting possible (Loading of 8GB Max. possible)
HDD	TypeC: Nil. TypeH/HD: 3.5 class 250GB × 1
	TypeM/MD: 3.5 class 250GB × 2 (Mirror disk)
CFAST card slot	SATA connection × 1 pc. mounting possible
SD card slot	SDHC × 1 pc. mounting possible
DVD multi-drive	TypeMD/HD: 1 pc. Loaded
Extension bus	Conforming to PCI Bus Standard 2.1: 3-slot (short size)
Extension power supply	DC+5V/+12V/-12V
Battery unit (optional)	Connection of add-on type battery unit enabled Backup possible in the case of service interruption Nickel-Hydrogen battery adopted
Main display function	•Power display •Disk access display •Disk error display •Error display •Watchdog error display
Main operating switch	•Power switch •Reset switch
Serial interface	RS-232C × 2ch (Connector: D-SUB 9P plug connector)
Ethernet interface	10Base-T/100Base-TX/1000Base-T × 2 (Connector: RJ-45 connector)
Graphics interface	DVI-I × 1ch [2-screen display enabled for Analog/Digital] (Connector: DVI-I connector)
USB interface	USB2.0 × 5ch (Front 2ch/Rear 3ch)
Remote switch interface	Remote switch input × 1ch (Front)
External dimensions and mass	TypeC: W160 × H148 × D250mm, Approx. 4.5kg TypeH: W197 × H148 × D250mm, Approx. 6.5kg TypeM: W262 × H148 × D250mm, Approx. 8.0kg TypeMD: W290 × H148 × D250mm, Approx. 8.5kg TypeHD: W227 × H148 × D250mm, Approx. 7.0kg

**Fig. 3 Battery On-Board Model**

When a special battery unit is installed at the top of the box, μ PIBOC-I Model 1000 can be in synch with the power unit. It can work against a power outage or a momentary voltage dip.

ation), SD card slot (SD: Secure Digital memory card), and USB × 5 ports (USB2.0).

(5) High reliability

With the use of a dedicated reinforced power supply unit and a long-life fan unit, the design life is 7 years under the circumstances of 5 ~ 40°C (5 ~ 45°C for TypeC). By selecting the dedicated RAS (Reliability Availability Serviceability) functions as an adopted standard feature, hardware malfunction and software error can be monitored, and an error indicator is provided, if any. There is also a function to send notices to applications. There are measures for taking precautions against failures and responding to any trouble in the case of a malfunction.

(6) Front-panel maintenance

μ PIBOC-I Model 1000 is designed to have a industrial control box structure with due consideration of the system module. The maintenance of the CFAST card and HDD can therefore be carried out in front of the box. This layout reduces maintenance labor-hours at the time of periodic replacement (HDD is recommended to be replaced at the intervals of 3 years). It is also effective in reducing the total system downtime. For the mirror disk model, even though one side of the HDD fails, the other HDD can continue system operation. Replacement of a faulty disk is possible without system shutdown.

(7) Rich interfaces

The PC/AT architecture of the business world standard is adopted. It is designed to support RS-232C × 2, USB2.0 × 5, 2ch graphics (analog RGB/DVI interface) × 1, and network (10Base-T/100Base-TX/1000Base-T) × 2ch. In addition, it is provided with a remote terminal for the ON/OFF control of the power supply.

(8) Special battery unit

μ PIBOC-I Model 1000 is provided with a special battery unit in an integrated structure and compact design and does not require external wiring. The battery unit can be installed on top of the box. **Fig. 3** shows an external view. When a power outage occurs, such an error code notice can be given

to applications in synch with the RAS functions, and it can perform the shutdown processing of the OS. The battery is an environmentally-conscious nickel-hydrogen lead-free type.

(9) Various standards compliant

Table 2 shows environmental specifications. μ PIBOC-I Model 1000 meets the environmental specifications necessary for industrial controllers. In addition, it has acquired the certificates of the VCCI, FCC, and UL Standards. It is also designed to meet the requirements for the CE Marking Low Voltage Directive and the EMC Directive. These compliances are for overseas markets. It also conforms to the RoHS (Restriction of Hazardous Substances) Directive with an environmentally-conscious design.

2.2 Features of Software

(1) Support for Windows XP Professional

We released a Windows XP Professional Model which requires no activation for license registration

Table 2 Environmental Specifications of μ PIBOC-I Model 1000

The environmental specifications of μ PIBOC-I Model 1000 are shown.

Item		Specification
Ambient temperature	In operation	5~40°C (5~45°C for TypeC)
	Out of service	-10~60°C
Ambient humidity	In operation	20~80%RH (No dew condensation)
	Out of service	10~90%RH (No dew condensation)
Durability against vibration in XYZ directions		Continuous vibration: 4.9m/s ² (TypeC) JEITA IT-1004 Class S Continuous vibration: 2.0m/s ² (TypeH/M/MD/HD) JEITA IT-1004 Class B
Durability against vibration in XYZ directions, 3 times each	In operation	19.6m/s ²
	Out of service	147m/s ²
Ambient environment		Not very dusty Freedom from corrosive gases and/or conductive dust
Power input		AC90~264V, 50/60±3Hz
Insulation resistance		DC500V 20MΩ or more (between AC input and FG)
Withstand voltage		AC1500V 50, 60Hz/1 minute (between AC input and FG)
Durability against input noise		AC input 1kB _{p-p} 50ns~1μs pulses
Non-operating short-break time		20ms or below
Earthing		Class D earthing
Inrush current		30A Max.
Power consumption		260W Max.

to Microsoft Corporation; therefore, it does not require any authentication work at the time of, for example, exchange of OS during controller installation or maintenance service, or hardware replacement. This can greatly improve the working efficiency.

It is already 13 years since Windows XP was released from Microsoft Corporation. We adopted an embedded OS to enable the long time stable supply. It can be supplied until the end of 2016.

We are currently planning to produce a Window 7 model.

(2) Support of Windows Embedded Standard 2009

Windows Embedded Standard 2009 is a specialized embedded type of OS based on Windows XP Professional SP3. Using a dedicated development environment, we can extract the essential component functions, which is suitable for working with a capacity-limited memory device such as a silicon disk (SSD or USB memory).

We use Windows Embedded Standard 2009 for a CFast card to realize a diskless feature and high reliability. The CFast card has a limitation in the over-writing frequency. We protect the OS data by using the OS's EWF (Enhanced Write Filter) function.

(3) RAS functions as a standard feature

The standard μ PIBOC-I Model 1000 supports the RAS functions. **Table 3** shows the RAS functional specifications. By the RAS functions, it is pos-

Table 3 Functional Specifications of μ PIBOC-I Model 1000

Functional specifications of μ PIBOC-I Model 1000 are shown. Since RAS I/O interface is installed in TypeM/MD/HD, exchange of I/O with external equipment is possible.

	TypeC/H	TypeM/MD/HD
Software power supply OFF	○	○
Detection of power supply error	○	○
Detection of CPU thermal error	○	○
Detection of WDT error	○	○
Detection of casing fan stop	○	○
Detection of HDD error	○	○
Preliminary preservation	○	○
Remote power ON/OFF	○	○
Error LED	○	○
Remote reset input	×	○
UPS outage interrupt input	×	○
Fan stop output	×	○
Thermal error output	×	○
WDT error output	×	○
Σ error output	×	○

sible to generate an error code notice even when any malfunction occurs in equipment. It is also possible to shutdown the system safely.

3 Postscript

This paper introduced the features of μ PIBOC-I Model 1000. This is a dedicated model for a system model. It is a compact and industrial controller with high performance and high reliability. This model is expected to be used for many applications in a var-

ious industrial fields such as manufacturing systems, inspection systems, various terminals, medical equipment, etc.

We will continue to promote functional improvements for system module controllers, and also enhance option unit offerings. We will promote our product development to meet the needs of our customers.

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