

Industrial Controller, μ PIBOC-I Model 1050

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Abstract

Modular industrial controllers for inspection equipment and manufacturing system are required to assure high reliability and high performance in order to keep up with the improved processing performance of this equipment. In addition, each industrial controller has to perform both controls and inspections independently and to have a compact design, and scalability.

The industrial controller, μ PIBOC-I Model 1050, is the most current model in a compact design with high performance processor and a high-speed interface. We focused on the scalability and it comes standard with two slots for PCIExpress x8. In addition to control-related fields, this product received high positive reviews by our customers in various industrial markets including inspection fields requiring high-speed image processing.

1 Preface

Due to recent popularity of smartphones like the iPhone, mobile phones, and tablets like the iPad, many IT devices are going digital at accelerated speed. Given such trends, the miniaturization of Integrated Circuit (IC) devices has been promoted in semiconductor and liquid crystal fields, and inspection equipment and manufacturing systems are required to assure high performance for nanoscale IC devices.

These inspection equipment and manufacturing systems are high-precision systems where precise processing is carried out. For equipment control and inspection, multiple controllers for different applications are incorporated. Consequently, our challenge is that overall equipment size tends to be large and it calls for a compact design.

The common desktop PCs come in a large casing size and usually do not guarantee 24/7/365 availability. It is also difficult to obtain the equivalent PC models assurance of continued supply of the same products. Compact and highly reliable industrial controllers are therefore generally used. As the modular industrial controllers intended for inspection equipment and manufacturing systems, we have released our industrial controllers, μ PIBOC Series, featuring a compact design, high performance and reliability, and a stable and continuous

supply of the same products. We have received high positive reviews from our customers in many industrial fields.

This paper introduces the features of the Model 1050, which is a high-end model of μ PIBOC-I Series. It comes with Intel's Core i7 processor.

2 Features of μ PIBOC-I Series

2.1 Features of μ PIBOC-I Model 1050

μ PIBOC-I Model 1050 is a box mounted industrial controller. When a file unit is additionally installed, it can incorporate a maximum of 4 units of Type 2.5 Hard Disk Drive (HDD)/ Solid State Drive (SSD) [Maximum capacity: HDD (2TB) and SSD (800GB)]. **Fig. 1** shows an external appearance of the product and **Fig. 2** shows the system configuration. μ PIBOC-I Model 1050 is provided with two slots for PCI Express x8 and offers high-speed processing by using multiple image processing modules.

(1) Processor module

The processor module employs a Single Board Computer (SBC) in a short size, designed in consideration of performance improvements enabled by exchanging the SBC to cope with the progress of processor chips. The processor is equipped with Core i7 that is an equivalent version of μ PIBOC-I Model 1050. Since various interfaces such as GigabitLAN port and USB port are installed, it



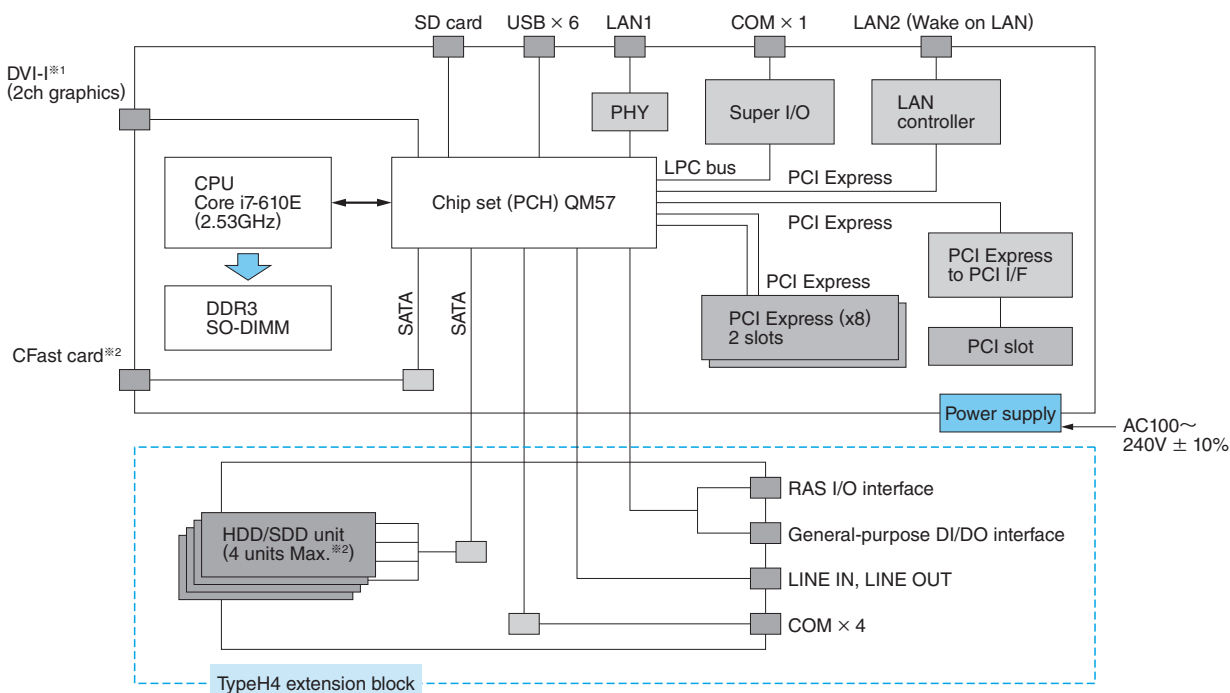
(a) TypeC: Diskless specification



(b) TypeH4: HDD/SDD specification

Fig. 1 μ PIBOC-I Model 1050

The basic unit is designed to allow scalability of file units.



※1: Divergence is possible to analog RGB and DVI-D through a general-purpose cable.
 ※2: A maximum of 3 HDD/SDD units when CFast is used.

Fig. 2 System Configuration of μ PIBOC-I Model 1050

A system configuration diagram of μ PIBOC-I Model 1050 is shown.

emphasizes system scalability.

(2) High performance

Table 1 shows the basic specifications. μ PIBOC -I Model 1050 is equipped with an Intel ultra-low power consumption dual-core processor Core i7/ 2.53GHz. If the application is native to the multicore CPU application, the processing performance can be nearly doubled as compared with a PentiumM 1.8GHz level processor. Since a level QM57 chipset is adopted, it is covered by Intel's long-term Embedded Roadmap of long-term availability. The main memory can incorporate two units of DDR3 SO-DIMM to a maximum of 4GB (8GB in total).

(3) Compact Box Case Mount

The basic unit of μ PIBOC-I Model 1050 is assembled in a box case of W160 × H148 × D250mm. When the customer wants to increase the required quantity of file units, the necessary HDD/SDD can be installed in a small chassis (enclosure). For product lineups, the following configuration is available:

- (a) Diskless specification (TypeC)
- (b) HDD/SDD specification (TypeH4)

(4) High scalability

A small-sized standard unit is equipped with PCI Express x8 (short size) × 2 slots, PCI bus (short size) × 1 slot, high-speed CFast (Standard stipulated

Table 1 Basic Specifications of μ PIBOC-I Model 1050

The basic specifications of the μ PIBOC-I Model 1050 are shown.

Item	Specifications
Processor	Intel Core i7/2.53GHz
Primary cache	Command/data 32kB each (incorporated in CPU)
Secondary cache	256kB (incorporated in CPU)
Tertiary cache	4MB (incorporated in CPU)
Chip set	Intel Ixex Peak-M QM57
BIOS	Phoenix BIOS (applicable to Legacy USB, USB plate)
Main memory	2GB~4GB DDR3 SO-DIMM (with ECC) \times 2 slots possible for loading (loading possible for a maximum of 8GB)
HDD/SSD	TypeC: Nil TypeH4: Type2.5 HDD/SSD \times 4
CFast card slot	SATA connection \times 1 possible for loading
SD card slot	SDHC \times 1 possible for loading
Extension slot	PCI bus standard: 1 slot (short size) PCIExpress (x8): 2 slots (short size)
Extension power supply	DC +5V/+12V/-12V
Battery unit (optional)	Connection possible with add-on type battery unit intended for power backup in the case of a service interruption (Nickel-hydrogen battery adopted)
Main-unit display function	<ul style="list-style-type: none"> • Power indication • Disk access indication • Error indication • Watchdog error indication
Main-unit operating switch	<ul style="list-style-type: none"> • Power switch • Reset switch
Serial interface	TypeC: RS-232C \times 1ch TypeH4: RS-232C \times 5ch (Connector: D-SUB 9P plug connector)
Ethernet interface	10Base-T/100Base-TX/1000Base-T \times 2ch (Connector: RJ-45 connector)
Graphics interface	DVI-I \times 1ch [2-screen Analog/Digital display enabled] (Connector: DVI-I connector)
USB interface	USB2.0 \times 6ch (front 2ch / rear 4ch)
RAS I/O interface	TypeC: Nil TypeH4: (Input) Remote reset, detection of UPS service interruption (Output) Temperature abnormal, fan stop, Σ error, WDT error (Connector: 10P connector)
General-purpose DIO interface	TypeC: Nil Type H4: DI \times 4 points, DO \times 4 points (Connector: 12P connector)
Remote switch interface	Remote switch input \times 1ch (front side)
External size and mass	TypeC: W160 \times H148 \times D250mm, Approx. 4.5kg TypeH4: W262 \times H148 \times D250mm, Approx. 6.5kg

by Compact Flash Association) \times 1 slot conforming to the Serial ATA Standard, and SD (Secure Digital Memory Card) \times 1 slot conforming to the SDHC Specifications.

(5) High reliability

Since an exclusively reinforced power supply and a long-life fan are adopted, an HDD-incorporated model can be used at an ambient temperature of

5 ~ 45°C and an SSD-incorporated model at 0 ~ 50°C, both for 7 years due to the long-life span design. In addition, since even a standard model comes with an exclusive RAS (Reliability, Availability, Serviceability) function, any fault in hardware and software can be monitored. There is an error code indication and it notifies the application. Through such functions, it takes measures for error-prevention and offers the means for trouble-shooting in the case of failure.

(6) Front maintenance

μ PIBOC-I Model 1050 comes with box design with hot-swap bays. For maintenance, various parts such as CFast, SD, HDD, and SSD can be replaced from the front side by the bay. Accordingly, maintenance man-hours can be saved at the time of periodic replacement and reduction of system downtime can be realized.

(7) Rich interfaces for TypeC and TypeH4

Due to the adoption of industry standard PC/AT architecture, 2ch graphic DVI-I interface (branched to analog RGB/DVI-D through an exclusive cable) \times 1ch, GigaBit LAN \times 2ch, RS-232C \times 1ch, USB2.0 \times 6ch, and a remote terminal to control power ON/OFF are supported. In addition, especially on TypeH4 an extension of a file unit is installed so that 4 points of general-purpose DI and DO respectively, RAS I/O, Line IN/OUT RS-232C \times 4ch (5ch in total) can be accommodated.

(8) Various applicable standards

Table 2 shows environmental specifications. μ PIBOC-I Model 1050 satisfies the environmental specifications needed for industrial controllers. In addition, it complies with the VCCI, FCC, and UL Standards and is designed to comply with requirements of the low voltage and EMC directives as the compliance is needed for CE marking. This is due to our products being designed in consideration for overseas markets as it also complies with the RoHS Directives. With its green design, this model also conforms to JIS E4031 (Standard for Vibration and Shock Testing for Railway Car Components). Presently, it is being used as an on-board controller of our contact wire inspection system, CATENARY EYE.

2.2 Features of Software

(1) Windows 7 Ultimate (64bit) support

We released Windows 7 Ultimate which does not require any activation for license registration with Microsoft. With this licensed OS, it does not require the license registration data when replacing any OS at the time of controller installation or main-

Table 2 Environmental Specifications of μ PIBOC-I Model 1050

The environmental specifications of μ PIBOC-I Model 1050 are shown.

Item		Specifications
Ambient temperature	In operation ^{※1}	5~45°C (with HDD, TypeC) 0~50°C (with SSD)
	Out of operation	-10~60°C
Ambient humidity	In operation	20~80%RH (No dew condensation)
	Out of operation	10~90%RH (No dew condensation)
Vibration durability in XYZ directions ^{※2}	In operation	Continuous vibration: 4.9m/s ² (with SSD, TypeC) JEITA IT-1004 Class S Continuous vibration: 2.0m/s ² (with HDD) JEITA IT-1004 Class B
	Out of operation	14.7m/s ²
Impact durability in XYZ directions, repeated 3 times each	In operation	19.6m/s ²
	Out of operation	147m/s ²
Ambient conditions		No exposure to extreme dust contamination Freedom from corrosive gases and conductive dust
Power input		AC100V~240V \pm 10%, 50/60 \pm 3Hz
Insulation resistance		20M Ω or more at 500V DC (between AC input and FG)
Dielectric strength		1500V AC, 50/60Hz for one minute (between AC input and FG)
Input noise durability		AC input 1kV _{p-p} 50ns~1 μ s pulses
Momentary non-operating time		20ms or below
Grounding		Class D grounding
Inrush current		30A Max.
Power consumption		259W Max.

Notes:

※1. The upper limit becomes minus 5°C respectively at the time of protection against dust air filter mounting.

※2. JIS E4031-2008 (division 1st magnitude A) is based upon a model with SSD.

tenance or during the hardware replacement work; this improves working efficiency.

(2) Windows Embedded Standard 7 support

Windows Embedded Standard 7 is an exclu-

sive embedded OS that makes it possible to perform system building by extracting necessary components from functions of Windows 7 Ultimate to use for an exclusive development environment. It is provided only with the functions needed for devices like silicon disks where their capacities are limited; therefore, we can make an embedded OS with a limited capacity.

By loading Windows Embedded Standard 7 in CFast, we can realize diskless design and build a highly reliable system. Although this CFast is limited in terms of re-writable times, re-writing is a typical function of Windows against a memory device. OS data protection is generally performed by using Enhanced Write Filter (EWF) that can inhibit image mapping data writing to the CFast by redirecting all writing demands to other disk partitions or RAM.

3 Postscript

μ PIBOC-I Model 1050 is a compactly design controller as an exclusively system module embedded PC unit without sacrificing high performance or reliability. Based on the features of the basic unit, overall system configuration is designed allowing scalability of file units where HDD/SSD can be additionally installed; thus, we realized the competitive cast model. In addition to the industrial field of inspection equipment and manufacturing system, we can expect the application of our models to the image processing field where high performance image processing capability is required.

Going forward, we will continue to promote the development of our products to meet the requirements of markets by realizing further improvements of functions for embedded PC type controllers.

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