

■General

The Unified Controller nv series, a line of Toshiba's industrial controllers, takes over the traits of the "Integrated Controller V series," the existing controller lineup which has gained a favorable reputation. The nv series is equipped with an I/O system called "TC-net I/O," which is based on the industry's first 100-Mbps double loop network. As a result, the high speed performance required in the electric control field as well as the online maintainability required in the instrumentation field can be simultaneously achieved by the same hardware. Thus, the nv series provides the unified supervisory control system featuring the high speed performance, reliability and economic efficiency not just in the instrumentation field but also in the electric control and electric power fields.

The controller also enables to continue the use of application resources accumulated by users over many years, while allowing the succession of engineering tool, supervisory control network and operator station from the existing model.

As the successor L model of the Integrated Controller V series, the type 2 controller of the Unified Controller nv series is a DCS model controller that mainly performs the instrumentation loop control.

■Features

The type 2 controller has the following features.

- (1) Equipped with the industry's first high speed serial I/O system "TC-net I/O"

It is the industry's first field I/O system that enables a transmission speed of 100 Mbps and the double loop configuration. The system can collect high speed I/O data, and the minimum preset time for collection cycle is 100 μ s. In the standard setup, the transmission path has a double loop configuration (with sending and receiving lines). Furthermore, the double-loop network may be provided as a duplexed configuration.

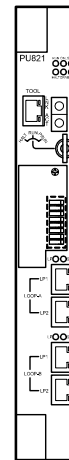


Fig. 1 type2 controller (PU821)

- (2) Computing power enhanced by the direct execution of IEC language by hardware

The controller is designed to execute the international standard language IEC 61131-3 instructions by ASIC on a hardware basis. Thus, the minimum execution time for the sequence instruction word is 20 ns (1/2 that of Toshiba's existing models). Also, the control cycle can be set to 0.5 ms at the minimum.

- (3) Higher reliability enabled by the redundant module configuration and the use of ECC circuit in the internal memory

The controller is applicable to the duplexed system configuration with two sets of power supplies, CPUs and transmission modules. In addition, an ECC circuit in the internal memory of each module makes it possible not just to detect errors but also correct the values in erroneous areas. Furthermore, a highly integrated ASIC design is adopted to reduce the number of parts used in complicated circuits, thereby minimizing the failure rate.



SAFETY INSTRUCTIONS

- This product was designed and manufactured for use in general manufacturing equipment systems (for process control, production line control, etc.). It was not designed or manufactured for use with equipment employed under circumstances which pose a direct threat to human life, or with systems consisting of such equipment. Before using this product for such purposes, please consult a sales representative.
- This product was manufactured under rigorous quality control. However, when employing this product with facilities which may pose a threat to human life, or with facilities for which serious consequences may be foreseen, please take special care to ensure the construction of a system which is safe with respect to system operation, maintenance and management.
- This product requires electrical and mechanical installation. Please consult your vendor, a specialized service provider, or a Toshiba sales representative regarding installation. Improper installation may result in electric shocks or fire.
- Please read all related documentation prior to use of this product, and use product only as described in the documentation.

nv series type2

- (4) Higher reliability enabled by a redundant, gigabit configuration for the supervisory control network
The supervisory control network supports a 1-Gbps Ethernet transmission, and the transmission path can be provided as a duplexed configuration. In addition, the global standard Real-Time Ethernet "TC-net 100" can be used for the network among controllers. The existing products can be connected via a switching hub or a gateway.
- (5) Ensures the succession of three basic elements in the supervisory control system
 - Engineering tool:
The engineering tool is compliant with the international standard IEC 61131-3, which has been adopted since the existing model. In order to enhance the usability, users are allowed to customize symbols to their taste.
 - Supervisory control network:
The supervisory control network is compliant with the Open Network Ethernet and supports a transmission speed of 1 Gbps. The existing "TC-net 100" Real-Time Ethernet can also be used.
 - Operator station:
Because the existing operator station "OIS-DS" is connectable, the operability of the predecessor model is inherited. Moreover, functions as an OPC server can be added to the OIS-DS.

■System Configuration

The Unified Controller nv series type2 is a controller with functions to be used in an instrumentation system. It can constitute an instrumentation system by connecting to the Operator Station OIS-DS for Toshiba CIE Integrated Control System TOSDIC-CIE/DS via Ethernet, or to the TC-net I/O via the TC-net I/O bus.

The controller basically has redundant configuration.

Fig. 2 shows example of the configuration of type2 Controller system.

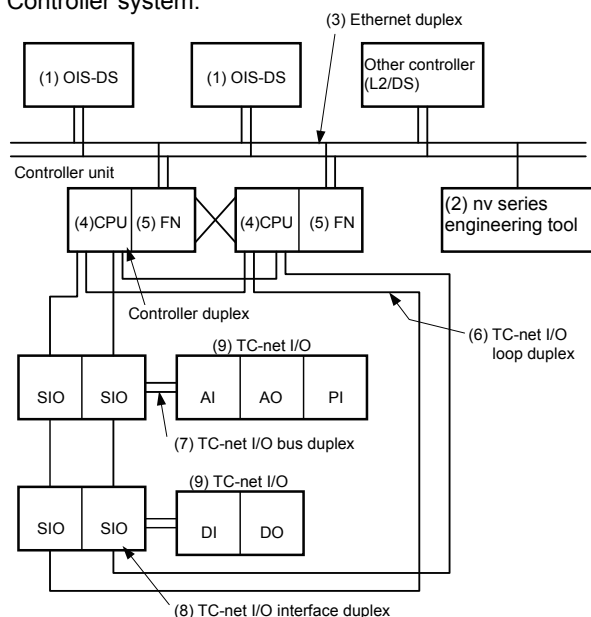


Fig. 2 type2 controller system configuration (example)

- (1) OIS-DS
The OIS-DS, TOSDIC-CIE standard HMI(human interface), supports the nv series type2 controller. The OIS-DS standard software of nv series-compliant version is required. For details, contact one of Toshiba's sales representatives.
- (2) nv series nV-Tool
The Unified Controller nV-Tool(V-Tool) supports the nv series type2 controller as an upward compatible function. Engineering and maintenance can be done in exactly the same environment as the Integrated Controller. The Unified Controller nv series nV-Tool (V-Tool) is common for the nv series controllers type1 and type2.
The Unified Controller nv series nV-Tool is used via the control LAN, or by connecting to the dedicated connector on the front panel of the controller module. The Unified Controller nv series nV-Tool tool must be connected to the controller module of the A system.
- (3) Ethernet
A control LAN is configured with duplex Ethernet (100M/1G).
For the OIS-DS, an interface module according to the Ethernet speed is required.
- (4) Controller unit (CPU)
The Unified Controller nv series type2 controller unit main body (CPU) forms a control station in combination with the Ethernet interface module dedicated for communication with the OIS-DS. Duplexing by station is the standard configuration.
The controller supports one system of TC-net I/O loop. To use multiple loops, an extended interface is required.
- (5) Ethernet interface module (FN)
This is the dedicated Ethernet interface module to connect the Unified Controller nv series type2 and OIS-DS.
- (6) TC-net I/O loop
This is the network to connect the unified controller unit to TC-net I/O. For the type2 controller, only duplex loop is supported.
- (7) TC-net I/O bus
This is a local bus to connect the TC-net I/O interface of the unified controller unit and TC-net I/O module. It is duplex by standard.
- (8) TC-net I/O interface
This is the interface to connect the Unified Controller nv series controller unit and TC-net I/O module. For type2, only duplexing is supported.
To support I/O of the conventional model, a TC-net I/O interface with dedicated interface functions is required.
- (9) TC-net I/O
This is the input/output module of the Unified Controller nv series.

■ Controller Unit Configuration

● Single system configuration

In single system configuration, power supply module, controller module and station bus module are implemented into base unit (BU816). I/O signals are connected to the unified controller TC-net I/O series.

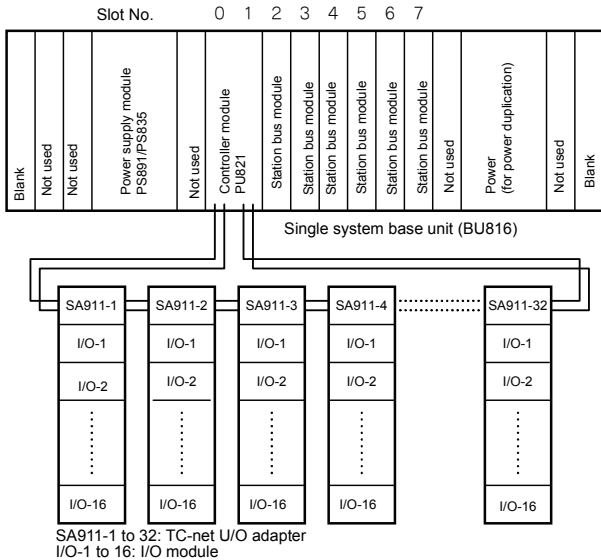


Fig. 3 Single configuration with single base (example)

● Duplex system configuration

In duplex system configuration, some modules are installed into base unit (BU825). The duplex system is a standby redundant system with duplexed controller unit main body.

In the duplex system, the system executing control is called online, and the system in the standby state is called standby. Also, when they are started up simultaneously, the system that starts up preferentially as online is called primary, and the system that starts up as standby is called secondary.

The duplex system has one chassis duplex configuration.

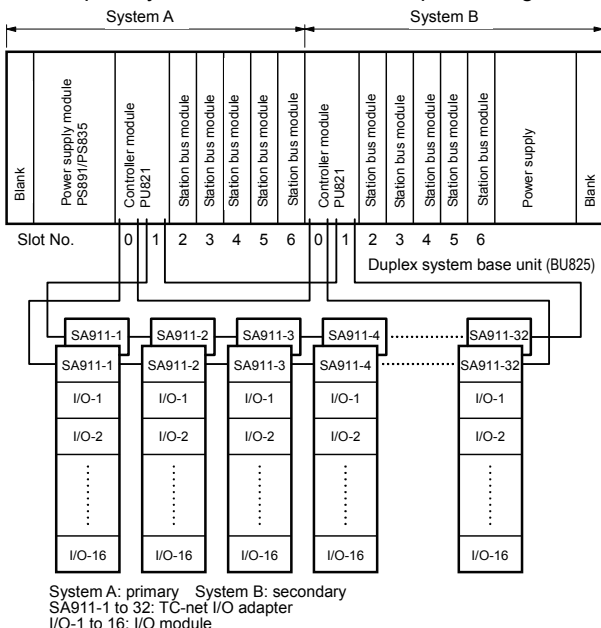


Fig. 4 Duplex configuration with duplex base (example)

■ Module Configuration

Pet-name	Base unit (BU825)						
	Slot 0/1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7
Controller							
PU821	○	-	-	-	-	-	-
Station bus module (transfer module) (Note 1)							
FN812	-	○	○	○	○	○	○
Station bus module (TC-NET I/O interface module) (Note 2)							
TN8** (Note 3)	-	○	○	○	○	○	○

(Note1) Only 1 FN812 can be implemented for the transfer module.

(Note2) Up to 3 TC-NET I/O interface module can be implemented (in the future).

(Note3) *See the respective station bus module instruction for the "*" of the pet-name.

Fig. 5 Modules that can be installed to the base unit

■ I/O Configuration

● High speed serial TC-net I/O series

In the Unified Controller nv series type2, I/O is connected in the configuration with duplex TC-net I/O loop.

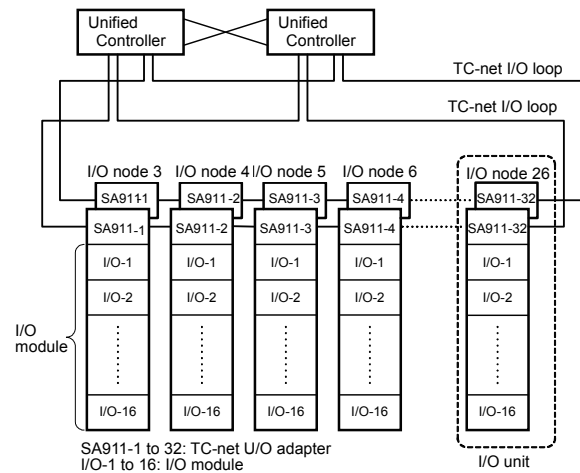


Fig. 6 Controller and TC-net I/O configuration

● G3 I/O series

To support the conventional model, G3 I/O, the TC-net I/O interface with the dedicated interface function is required.

The TC-net I/O interface for G3 I/O is under development.

● Intelligent I/O

To support the conventional model, intelligent I/O, the TC-net I/O interface with the dedicated interface function is required.

The TC-net I/O interface for intelligent I/O will be developed in the future.

● F series I/O

To support the conventional model, F series I/O, the TC-net I/O interface with the dedicated interface function is required.

nv series type2

■Engineering Tool

The engineering tool (nV-Tool) includes a new instrumentation function block, a new instrumentation tag editor, a full graphics editor, a text editor and a custom symbol editor. These are software for creating control programs of the Unified Controller nv series and the Unified Controller V series, and for performing operation check and maintenance of the controllers. The engineering tool is compliant with the international standard IEC 61131-3, and can be used for online programming as well as offline programming in stand-alone mode without the connection to the main unit.

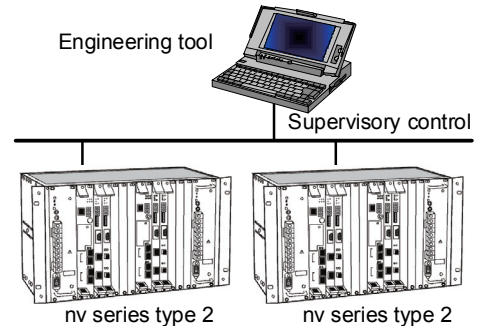


Fig. 7 Configuration of engineering tool

■Specifications

●General specifications

Table 1 General specification

Item	Specification	Remarks
Operating ambient temperature	0°C to 55°C; 40°C or less on average over 24 hours	(Note 1)
Storage temperature	-40 to 70°C	
Operating ambient relative humidity	10% to 95%RH, Level RH2 (no condensation)	(Note 2)
Dust	Dust 0.3 mg/m ³ (no conductive dust permitted)	
Pollution level	2 (usually no conductive pollution) or less	IEC 61131-2
Corrosive gas	No corrosive gas permitted. No silicone-containing material permitted.	(Note 3)
Operating altitude	2,000 m or less	
Resistance to vibration (vibration immunity)	IEC 60068-2-6, test Fc compatible, X, Y, Z 10 cycles each	(Note 4)
Impact resistance (impact immunity)	IEC 60068-2-27, test Ea compatible 147 m/s ² (3 orthogonal axes, 3 times each)	
Insulation resistance	500 VDC Megger 10 MΩ or more	Between Power and GND terminals I/O: Refer to the Individual Specification.
Dielectric strength	2,000 VAC 1 min	Between Power and GND terminals I/O: Refer to the Individual Specification.
Free fall	Shipping package: 1,000 mm For product package: 300 mm	

Item	Specification	Remarks
Noise immunity		
Fast transient	AC power: 2 kV DC power: 2 kV (section of 10 m or less is unnecessary) I/O power DC: 1kV (section of 10 m or less is unnecessary) AC-I/O: 2kV (unshielded cable) DC-I/O: 1kV (unshielded cable) Analog I/O: 1kV (shielded cable)	
Electrostatic discharge	4 kV (contact discharge) Level ESD-3	
Radiated electromagnetic field	10 V/m	
Impulse noise	Power wire Noise voltage: 1,500 V Pulse width: 1μs/100 ns	
EMC zone	Zone B (including Zone A)	
Ground	D-class grounding with ground resistance of 100Ω or less (prescribed by the Japanese Ministerial Ordinance)	(Note 5)
Structure	Open type	
Installation site	In indoor control board	
Cooling system	Standard: Forced air cooling	
Weight	Approx. 16 kg BU825 (duplexed chassis, full slot installed)	
Outside dimensions	Primary block 431.8 (W), 482.6 (W1) x 265.9 (H) x 238 (D)	W1 dimensions include the support bracket.
Standard satisfied	IEC 61131-2 CE marking, C-tick mark UL508	

(Note1) The reference temperature was measured at the 50 mm position below the underside of the base unit.

(Note2) For long-term storage, store spares in a dark location while avoiding high temperature and humidity.

For long-term storage of the product, adjust the temperature and humidity to 0°C to 40°C and 20% to 80%RH (no condensation), and adjust the rate of change in temperature to 10°C/h.

Especially for the battery or power supply, a high ambient temperature affects the available period. Store the product at the room temperature (25°C) or less.

(Note3) None of the following constituents must be contained hydrogen sulfide, sulfuric acid gas, chlorine gas, nitrogen oxides (NOx), sulfur oxides (SOx), ammonia, silicon gas, and other corrosive gas

(Note4) $5 \leq f < 9$ Hz : Half amplitude 3.1 mm

$9 \leq f < 150$ Hz : Constant acceleration 9.8m/s²

$10 \leq f < 57$ Hz : Half amplitude 0.075 mm

$57 \leq f < 150$ Hz : Constant acceleration 9.8 m/s²

(Note5) Grounding other than D-class grounding (e.g., mesh ground) may apply to the system, provided that the same effect as for D-class grounding can be obtained. For grounding other than D-class grounding, the client verifies the effect of grounding.

•Function specifications

Table 2 Controller module PU821 function specification

Item		Specification	
Control method		Stored program/cyclic scan	
Processor	Control processor	General-purpose processor	
	Language processor (LP)	Dedicated LSI	
	I/O processor	Dedicated LSI	
Execution method	Scan	High-speed scan (HS)	10 to 500ms/10ms units 1 task/128 program
		Main scan (MS)	100 to 10000ms/100msunits 1 task/512 program
	Input/output method	Batch I/O	Allowed
		Direct I/O	Allowed
Interruption	Interruption	Event (EV)	8 task
		Interruption (IP)	16 task
	Interruption detection performance	20μs × n intrupt. + 100μs or less n: Detected number of status change	
Program size		512 k step 1990POU (Note)	
Control data size	Local variables/User global variables		256K word
	IQ register		16K word
	System register (ZW)		8K word
	Data register (DW)		64K word
I/O	Built-in	Number of nodes	32
		Max. No. of units	32
		Max. No. of slots	512(32 units × 16 slots)
	Extension (SIF connection)	Number of SIF	3
		Number of nodes	96
		Max. No. of units	96
		Max. No. of slots	1536(96 units × 16 slots)
	Batch input/output update time	Built-in	1μs/word or less
		Extension	3μs/word or less
	Direct input/output update time	Built-in	1μs/word or less
Extension		3μs/word or less	
Programming language		LD/FBD/SFC/ST	
Duplex	Tracking time		2ms/Kword
	Duplex switching time		500ms or less
Execution time	Bit	Contact	0.02μs
		Coil	0.06μs
	Integer	Transfer	0.02μs
		Addition/ Subtraction	0.02μs
		Multiplication	0.06μs

Item		Specification	
Execution time	Integer	Division	0.48μs
	floating point	Transfer	0.12μs
		Addition/ Subtraction	0.06μs
		Multiplication	0.12μs
Transmission port	nV-Tool connection (direct connection)		Built-in Ethernet
	nV-Tool connection (network)		via FN812
	Socket communication (instruction word)		via FN812
	Synchronous trend		via FN812
Supported network	Station bus module		OIS-DS connection (FN812), TC-net (TN821, TN822)
	TC-net I/O bus module		Ethernet (Note 1), FL-net (FL911), MODBUS (Note 1) Profibus-DP (Note 1)
RAS	Diagnosis		Power fail check, battery check, LP function check, I/O processor function check, illegal instruction detection, WDT, system ROM BCC check, peripheral LSI check, ECC check of all memories, station bus access parity check and time out, I/O status check.
	Monitoring		System status display (incl. I/O status display), trace (error, event, transmission), program run time measurement, program execution congestion detection
	Debug/maintenance		Online status display, backup/restore function, defrag, online maintenance function, simulation function
Process tag	Indicator		#PV 1024 tags
	Controller		#LP 320 tags
	Digital instrument		#PB 1280 tags
	Sequence		#SQ 64 tags

(Note 1) under development

nv series type2

•Power module specifications

Table 3 Power module specification

Item	Specification		Remarks
Model	PS891	PS835	
Rated voltage	100/110/120/200 /220/240 VAC	2DC4V	
Voltage tolerance range	85 to 132 / 170 to 264 VAC	20.4 to 28.8 VDC	
Rated frequency	50/60 Hz	DC	
Frequency tolerance	47 to 53 / 57 to 63 Hz	—	
Permitted duration of instantaneous power failure	0.5 cycle (10ms) or less	10ms or less	
Permitted percentage of waveform distortion	10% or less	—	For rated input voltage
Ripple percentage tolerance	—	5% or less	For rated input voltage
Maximum power consumption	220 VA (200 W) or less With power factor improved	200 W or less	
Rated current	2.5 A	10 A	
Leakage current	1.5 mA or less	—	
Rush current	25 A max 10 ms	10 A or less 10 ms	For rated input voltage After 5 s or longer halt
Dielectric strength	500 VDC Megger or more	10 MΩ	Between Power and GND terminals
Withstand voltage	2,000 VAC 1 min		Between Power and GND terminals
Ground	D-class grounding with ground resistance of 100Ω or less (prescribed by the Japanese Ministerial Ordinance)		
Output rating	5 V, 25 A (for internal logic) 12 V, 1 A (for fan)		
Protection circuits	Overvoltage, overcurrent, and overheat protection		
Duplexing of power output	Supported		When BU816 is used
Ancillary functions			
Status display LED	POWER (green) ALARM (red)		
RUN contact	Dry A contact		
Switch	Switch with a lock		
Slot width	3 slots occupied (approx 60 mm)		
Weight	2,000 g		
Outside dimensions	Approx. 262 x 165 x 60.6 mm (excluding protrusions)		
External wire terminal block	10 terminals - M3.5 machine screw (fixed)		
Overhaul	Recommended replacement cycle of aluminum electrolytic capacitor: 8 years Requirements: Average ambient temperature 40 °C, forced air cooling		Desired value

•Controller module specifications

Table 4 Controller module specification (hardware)

Item	Specification	Remarks
Model	PU811, PU821	
Substrates	2 sheets	
MPU	SH7751R (SH4)	
Bus width	32 bits	
Operating frequency	66 MHz	
Throughput	360 MIPS / 1.4 GFLOPS (for an operating frequency of 200 MHz/hr)	From MPU data book ADJ-602-215 A(H)
Arithmetic processor	LP	
Bus width	32 bits	
Operating frequency	50 MHz	
Throughput	20 ns /contact	
Current consumption	6 A (typical)	
Slot width	2 slots occupied	8HP
Weight	800 g	
Outside dimensions	Approx. 262 x 237 x 40.30 mm (excluding protrusions) Substrate size: 233.35 x 160.00 mm	
Status display LED	RUN, ONL, STBY, HALT, ERR, and BATT	
Bus I/F		
Station bus	C-PCI-compatible	
Tracking bus	LVDS (electrical level)	
TC-net I/O loop	TC-net 100 loop	
Switch		
Operation mode switch	HALT/RUN/P-RUN	
Setting switch	Dip switches 8 poles (front panel) 8 poles (on substrate)	
Connector	2 rotary switches, hex	Address setting of IP address
nV-Tool	RJ45 1 piece	Ethernet 10BASE-T
TC-net I/O loop	RJ45 4 pieces (dual loop)	
Maintenance	Dedicated	Not disclosed to users
Data backup	Shutdown sequence plus battery	
Shutdown sequence	Secure the time of execution with the capacitor	PT8C1 Recommended replacement cycle: 8 years
Battery	Equivalent to ER3 3.6 V, 1,000 mAh	
Backup time	Total period of power outage 90 days	
Maximum replacement cycle	5 years (availability factor 95%)	

●TC-net I/O supporting specifications

Table 5 TC-net I/O specification

Loop configuration	1
Nodes	max. 32 nodes (Note 1)
Node no.	3 to 34 (Note 2)
Units per one node	1
Number of implementable I/O modules per unit	max. 16
Number of implementable special I/O modules	max. 16 (Note 3)

(Note1) C-net I/O: 24 node, Intelligent I/O (in the future): 4 node, G3 I/O (in the future): 4 node

(Note2) C-net I/O: 3 to 26, Intelligent I/O (in the future): 27 to 30, G3 I/O (in the future): 31 to 34

(Note3) Special modules indicate FL-net, Profibus-DP (Note 4), MODBUS (Note 4) and Ethernet (Note 4). For details, refer to "High-Speed Serial I/O System TC-net I/O Operation Manual" (6F8C1240).

(Note4) under development

* Refer to "High-speed Serial I/O System TC-net I/O (EJV-220)" General specifications, for detailed specifications of TC-net I/O module.

■Outside Dimensions

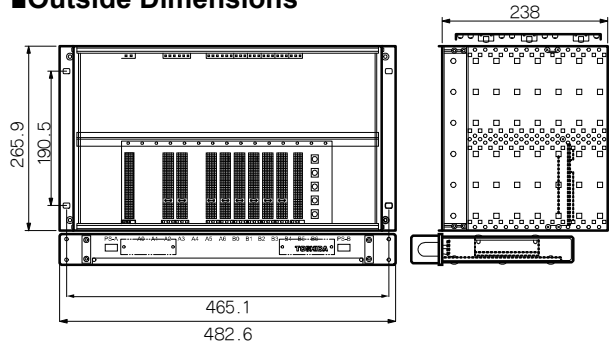


Fig. 9 Outside dimensions of base unit BU816 and fan unit FA813

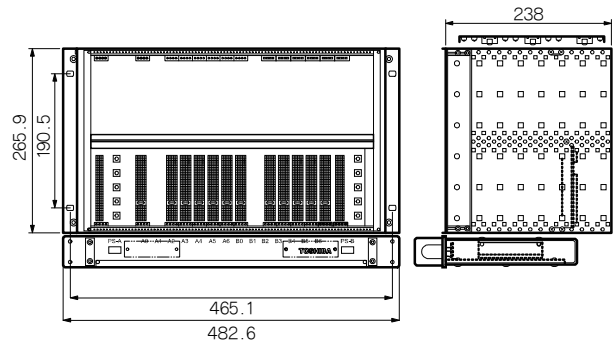


Fig.9 Outside dimensions of base unit BU825 and fan unit FA824

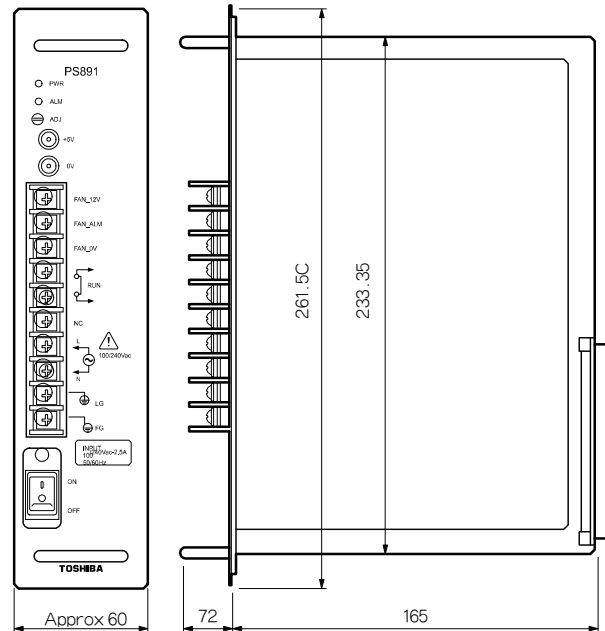


Fig. 10 Outside dimensions of power module PS892

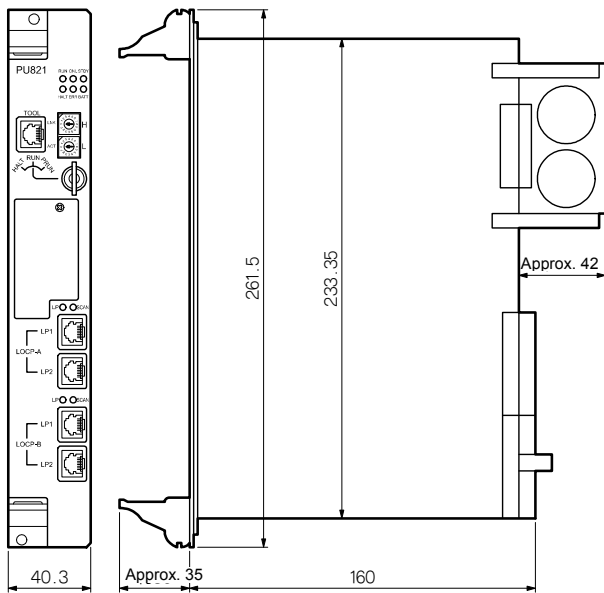


Fig. 11 Outside dimensions of controller modules PU821

■Cautions for Installation

1. Installation

When installing the units, please pay due consideration to the operation, maintenance and ambient conditions.

- (1) Install the units in locations where the installation requirements in the specifications are met.
- (2) Do not install the units directly on devices that generate a large amount of heat (heaters, transformers, high capacity resistors, etc).
- (3) Use the units at temperatures from 0-55 °C.
- (4) In dusty places, keep the units in a dust-proof cubicle.
- (5) To ensure the safety upon maintenance and operation, keep the units as far as possible from high-voltage devices or power equipment. Alternatively, shield the units from such devices by using an iron plate or the like.
- (6) To ensure proper ventilation, the distance between the base and expansion units should be at least 100 mm.

2. Wiring

- (1) The extension I/O cable and the I/O line should be placed at least 200 mm away from the power line or power equipment.
- (2) The I/O lines of the heavy current system (AC I/O line) and the weak current system (DC and pulse I/O lines) should be separated from each other. Also, wiring ducts should be separately provided for the both systems.

■Information required upon your order

1. Model numbers and the quantities of the units, modules and peripherals.
2. Input/output list
3. Network configuration if data transmission is performed.

- Microsoft and Windows are registered trademarks of Microsoft Corporation in the U.S.A. and other countries.
- Product names referred to in this manual may be used as trademarks or registered trademarks by their respective companies.

Printed in Japan

©May 2009 (TDOC) 1st edition

The contents are subject to change without notice for design change or other reasons.