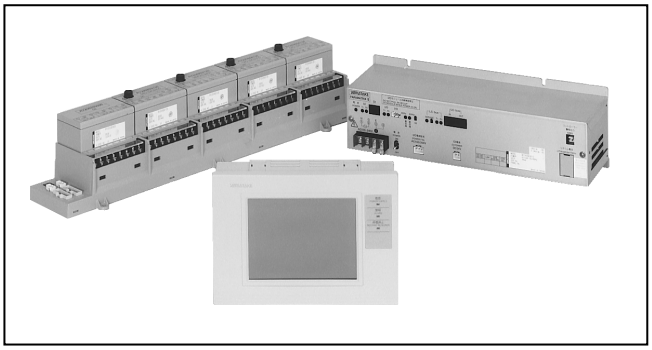
PARAMATRIX™-III Chiller Controller

Model WY7400T

General

PARAMATRIX-III (PMX-III) is a direct digital controller (DDC) specifically designed for sequential control of chiller plant units of building HVAC (heating, ventilation, air-conditioning) systems. The PMX-III Chiller Controller carries out energy-saving control including the optimization of multiple chillers and other chiller plant units in response to the air conditioning load. By communicating with Azbil Corporation's building management system (BMS) called ***savic-net™ FX*** through the operator interface (OI), the PMX-III Chiller Controller provides an environment that supports efficient operation management of chiller plant systems.



Features

- Reliable controller:
  The chiller plant controller PMX-II with a software- based control allows upgraded functions for the PMX-III. Control reliability is ensured even during transitions such as startup/shutdown, failure restoration and power failure restoration, and in abnormal conditions.
- User-friendly controller:
  The color LCD operator interface offers widely improved operability and visibility. A variety of diagnostic display functions and event outputs inform the operators how the PMX-III has controlled/is controlling/is going to control the system, dramatically facilitating complex chiller plant management and control.
- Easy-to-install controller:
  Distributing sensor power supply and sharing external terminal blocks allow direct connection with local devices, reduce the design and manufacturing costs of control panels, and facilitate on-site installation. Replaceable plug-in type input/output (I/O) modules ensure easy maintenance without disconnecting external lines.
- Communication by LonTalk® protocol:
  LonTalk® protocol is adopted for the communication with controllers connected to the BMS.
- Simple wiring:
  Communication cables are connected with modular connections and thus reduce wiring work.

Model Number Configuration

WY7400T*12345678*

1		*2*		*3*		*4*		*5*		*6*		*7*		*8*	
Application type		Number of chillers		Method of multiple units control		Pressure control 1		Pressure control 2		Communication with host system		Others		Power supply	
1	Single-pump system	**4**	4	**3**	Flow rate 1 system (with energy calculation)	**0**	No	**0**	No	**1**	Yes	**0**	Fixed	**B**	200 V AC
		8	8	**4**	Flow rate 4 systems (with energy calculation, 4 systems totalization)	**1**	Proportional bypass								
2	Dual-pump system	**4**	4	**2**	Energy 1 system	**0**	No	**0**	No	**1**	Yes	**0**	Fixed	**B**	200 V AC
		8	8	**6**	Energy 4 systems(with flow-rate totalization)										

Safety Instructions

Please read instructions carefully and use the product as specified in this manual. Be sure to keep this manual near by for ready reference.

Usage Restrictions

This product is targeted for general air conditioning. Do not use this product in a situation where human life may be affected. If this product is used in a clean room or a place where reliability or control accuracy is particularly required, please contact Azbil Corporation's sales representative. Azbil Corporation will not bear any responsibility for the results produced by the operators.

⚠ WARNING

- DANGER: To prevent the risk of severe or fatal electrical shock, always disconnect power source and product power supply before performing any wiring.
- Be sure to ground with 100 Ω or lower ground resistance. Improper grounding may cause electrical shock or fire due to equipment damages.
- Do not disassemble the product. Disassembly may cause electrical shock or product failure.

⚠ CAUTION

- Installation and wiring must be performed by qualified personnel in accordance with all applicable safety standards.
- This product must be operated within its operating ranges specified in this manual. Failure to comply will cause equipment damages.
- This product must be operated under the operating conditions (power, temperature, humidity, vibration, shock, installation position, atmospheric condition, etc) specified in this manual to prevent product failure.
- All wiring must comply with local codes of indoor wiring and electric installation rules.
- Make sure all the wires are tightly connected. Loose connection may cause fire or heat generation.
- Use crimp terminal lugs with insulation for electric wires to be connected to the screw terminals.
- Dispose of this product as an industrial waste in accordance with your local regulations. Do not reuse all or part of this product.

System Configurations

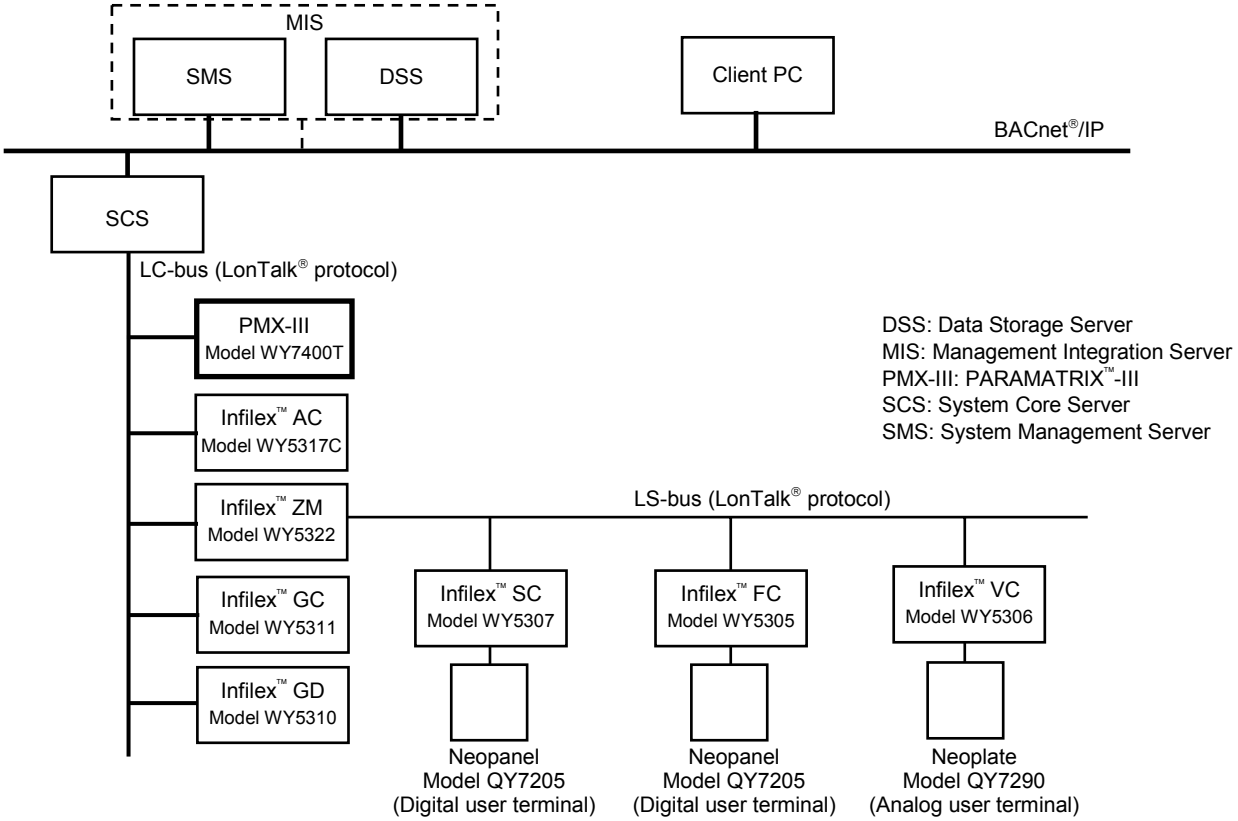


Figure 1. System configuration example of BMS-integrated PMX-III

Notes:

- MIS instead of SMS and DSS may be used for your system.
- On LC-bus (2 lines for 1 channel), max. 50 remote units (also called 'controllers') can be connected. For Infilex ZM, however, max. 10 units can be connected on LC-bus (5 units per 1 line, 2 lines for 1 channel).
- Max. wiring length of LC-bus (2 lines for 1 channel) is 900 m.
- On LS-bus, max. 50 remote units (also called 'sub-controllers') can be connected.
- Max. wiring length of LS-bus is 900 m.

Standalone PMX-III Chiller Controller

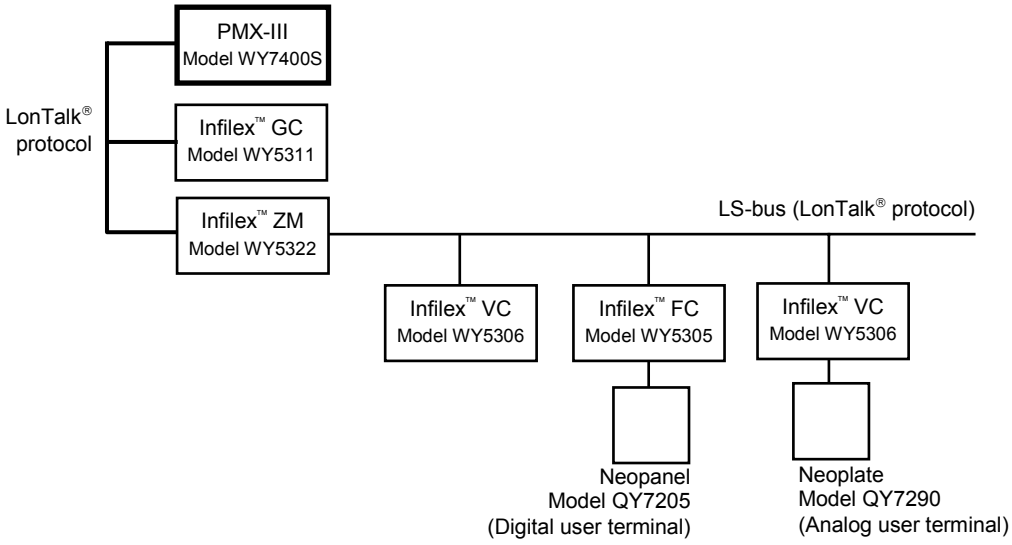


Figure 2. System configuration example of standalone PMX-III

Notes:

- On LS-bus, max. 50 remote units (sub-controllers) can be connected.
- Max. wiring length of LS-bus is 900 m.

Application Examples

Single-pump system

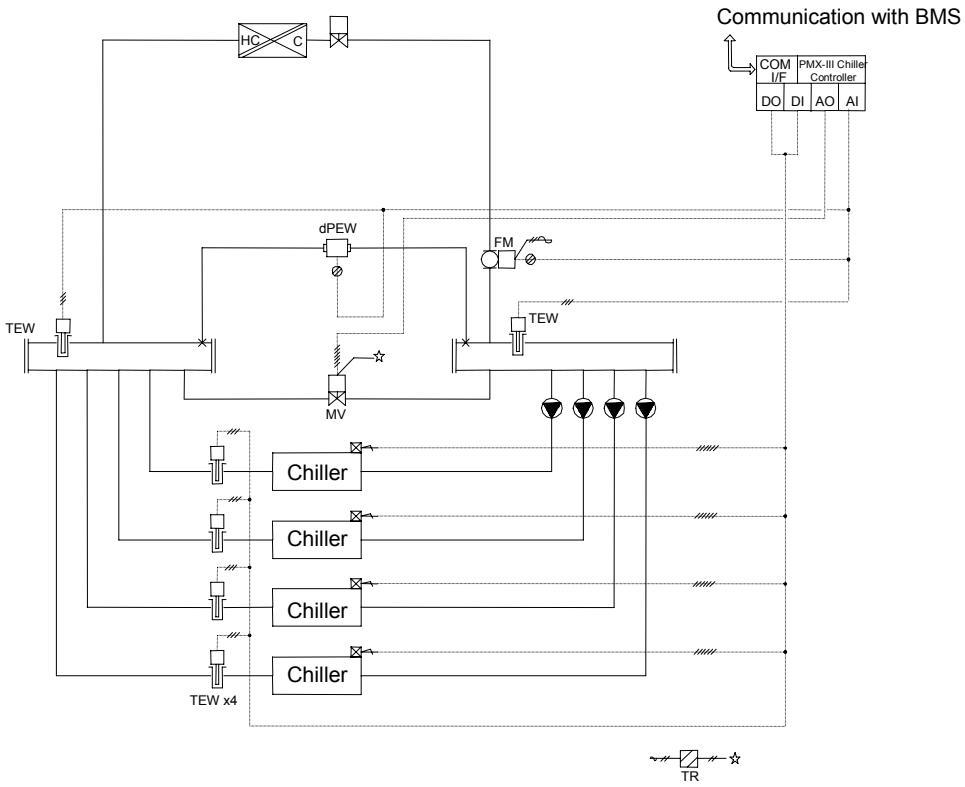


Figure 3. Application example of single-pump system

Dual-pump system

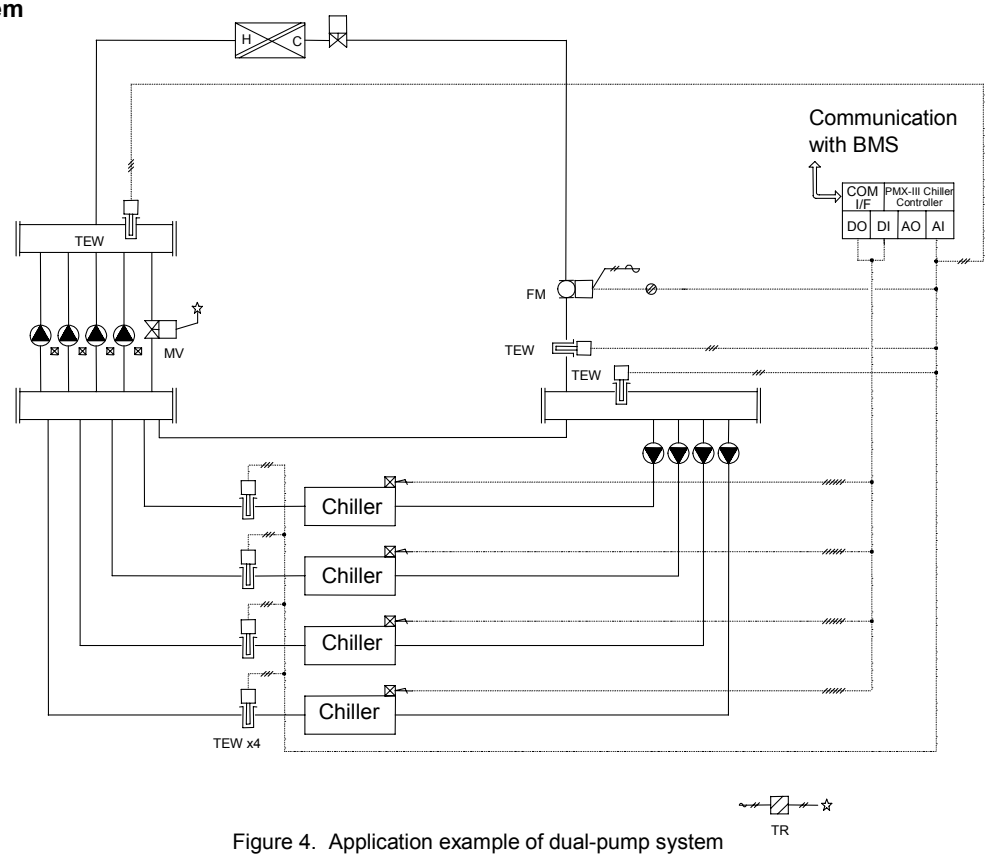


Figure 4. Application example of dual-pump system

PMX-III Configurations

Function block

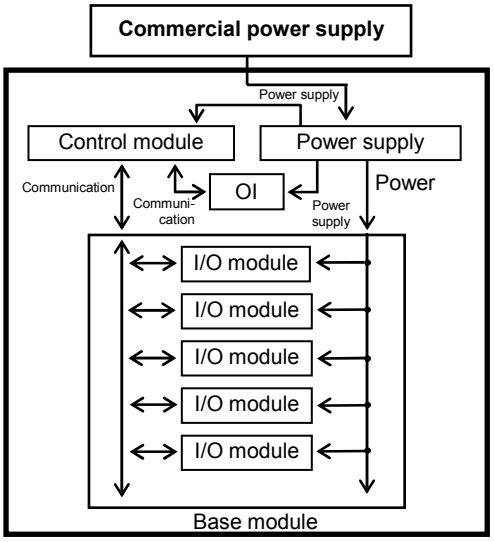


Figure 5. Function block diagram

Hardware configuration

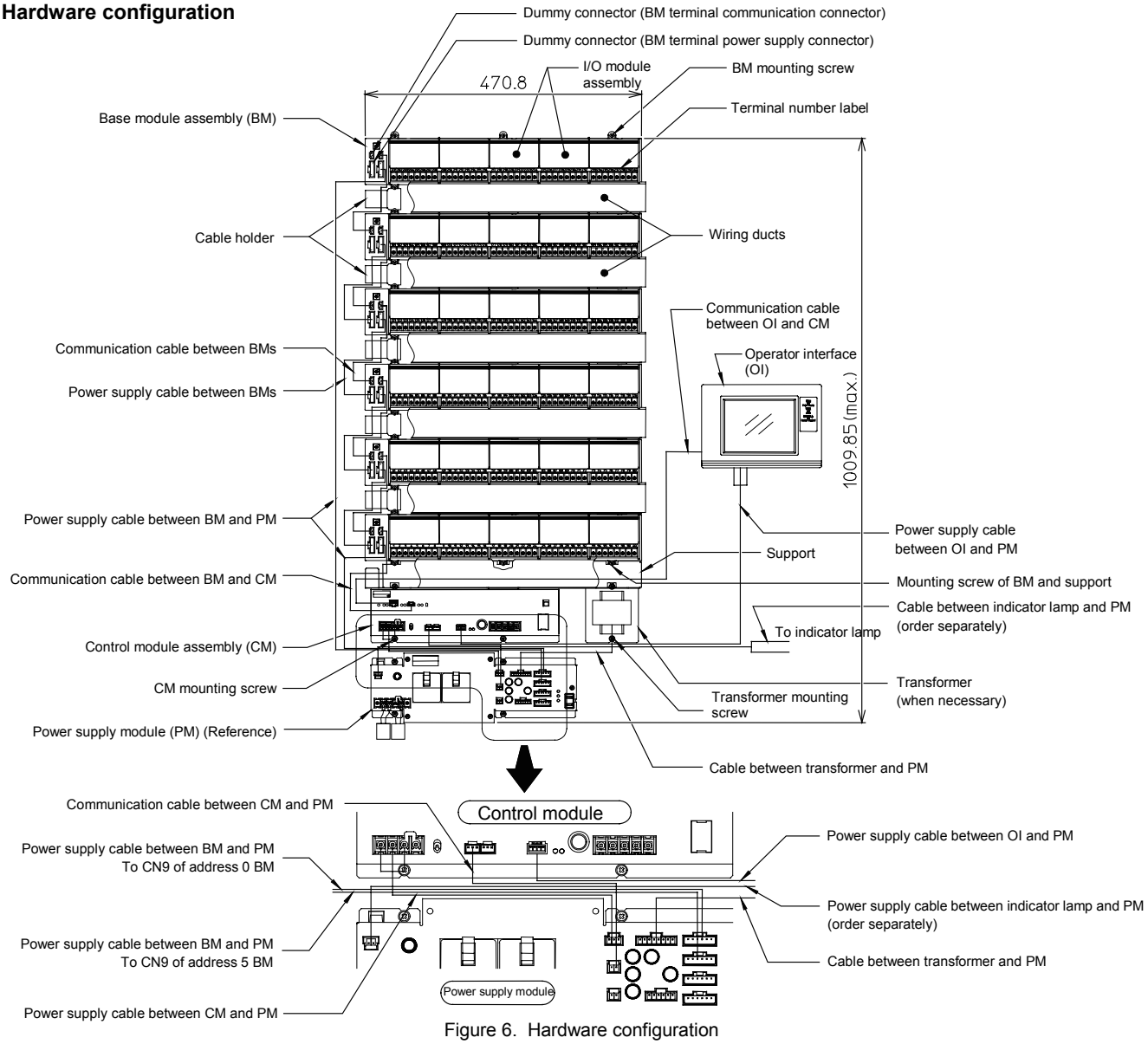


Figure 6. Hardware configuration

Dimensions of the Modules Assembled

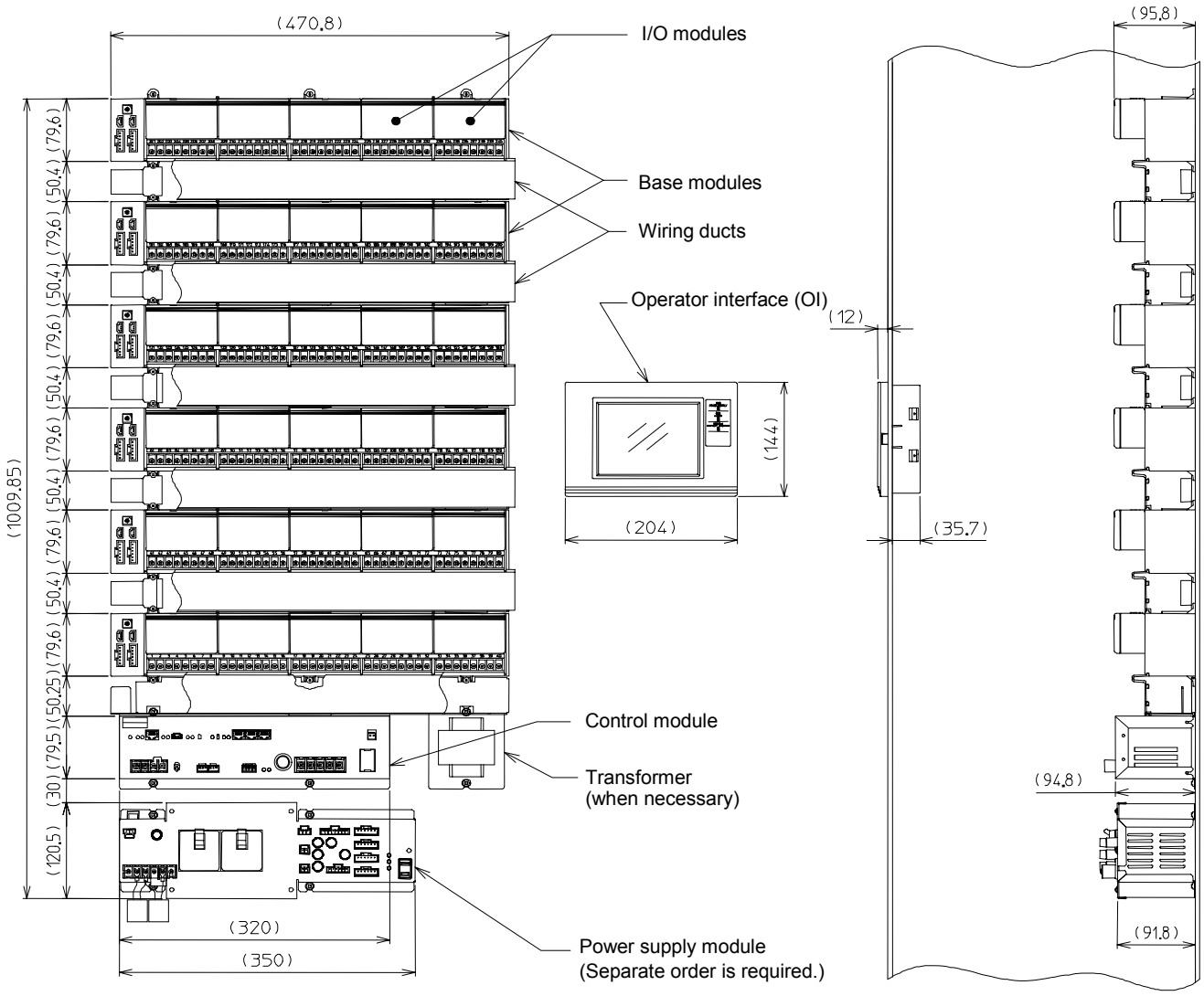


Figure 7. Dimensions (mm)

Note:

PMX-III requires 2 to 5 base modules depending on its model, and thus each model has different dimensions. Refer to the table on the following page for the number of the base modules.

Model Numbers

The number of base modules corresponds to the number of lines shown in the following table.

No. of lines	Model number	Application type	Method of multiple units control	No. of chillers	Pressure control	Communica-tions with host system
3	WY7400T1430010B	Single-pump system	Flow rate 1 system (with energy calculation)	4	No	Yes
3	WY7400T1431010B	Single-pump system	Flow rate 1 system (with energy calculation)	4	Yes	Yes
4	WY7400T1830010B	Single-pump system	Flow rate 1 system (with energy calculation)	8	No	Yes
5	WY7400T1831010B	Single-pump system	Flow rate 1 system (with energy calculation)	8	Yes	Yes
4	WY7400T1440010B	Single-pump system	Flow rate 4 systems (with energy calculation)	4	No	Yes
4	WY7400T1441010B	Single-pump system	Flow rate 4 systems (with energy calculation)	4	Yes	Yes
5	WY7400T1840010B	Single-pump system	Flow rate 4 systems (with energy calculation)	8	No	Yes
5	WY7400T1841010B	Single-pump system	Flow rate 4 systems (with energy calculation)	8	Yes	Yes
3	WY7400T2420010B	Dual-pump system	Energy 1 system	4	No	Yes
4	WY7400T2820010B	Dual-pump system	Energy 1 system	8	No	Yes
3	WY7400T2460010B	Dual-pump system	Energy 4 systems (with energy calculation)	4	No	Yes
5	WY7400T2860010B	Dual-pump system	Energy 4 systems (with energy calculation)	8	No	Yes

Components

Control module

Control module is the core of the PMX-III. PMX-III consists of a combination of a control module, base modules, I/O modules, and an OI (operator interface).

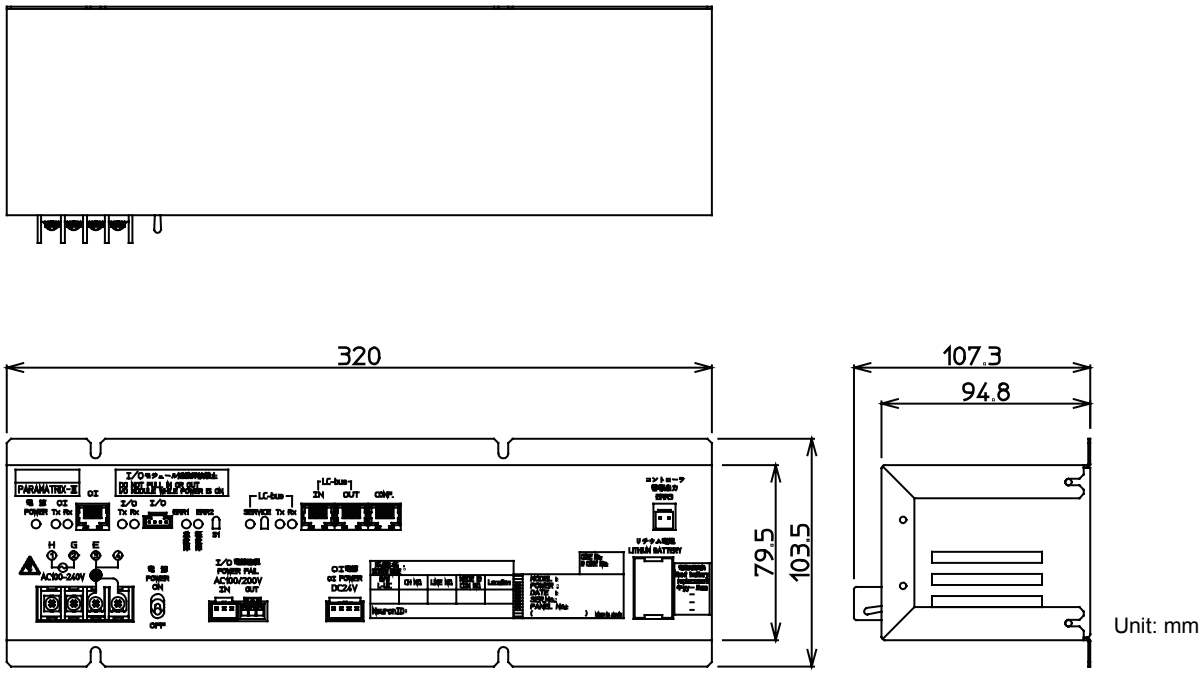


Figure 8. Control module dimensions

I/O modules

The plug-in type I/O modules are the input/output sections of the PMX-III system and load communications LSI to connect with the control module. Power supply and communication interface to the I/O modules are carried out by the base module. I/O modules include: Pt modules (two RTD Pt100 Ω temperature inputs), AI modules (two 4-20 mA DC current inputs), AO modules (one 4-20 mA DC current output), MM modules (one modutrol motor output with feedback), DI modules (five potential free contact inputs), DO modules (four potential free contact (N.O.) outputs), DIO modules (two potential free contact inputs and one 24 V DC voltage instantaneous contact output).

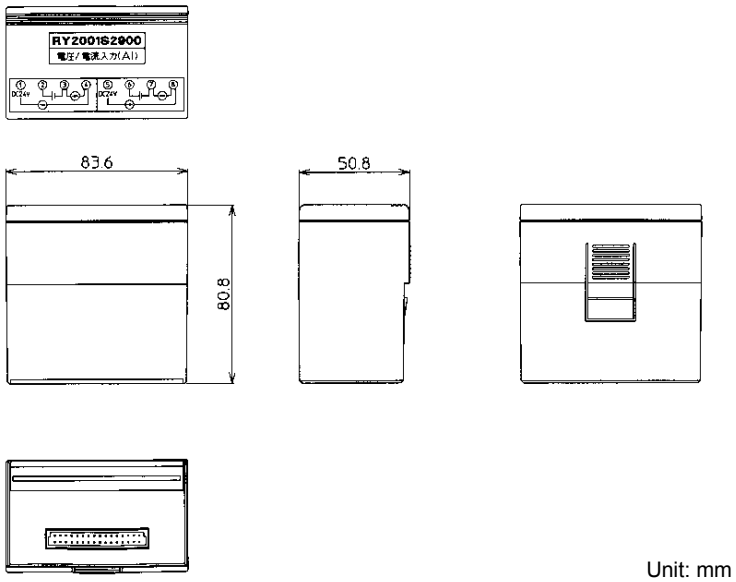


Figure 9. I/O module dimensions

IMPORTANT:

Be sure to disconnect the power before plugging in/out the I/O modules from the base module back panel. Otherwise, PMX-III may get damaged.

Base module

Base module supplies power to I/O modules, and carries out communication connections and address settings for the I/O modules. The base module also functions as a terminal block for the I/O modules. The I/O modules are plug-in type, which can be plugged directly into the base module back panel and can be easily detached without disconnecting their wiring.

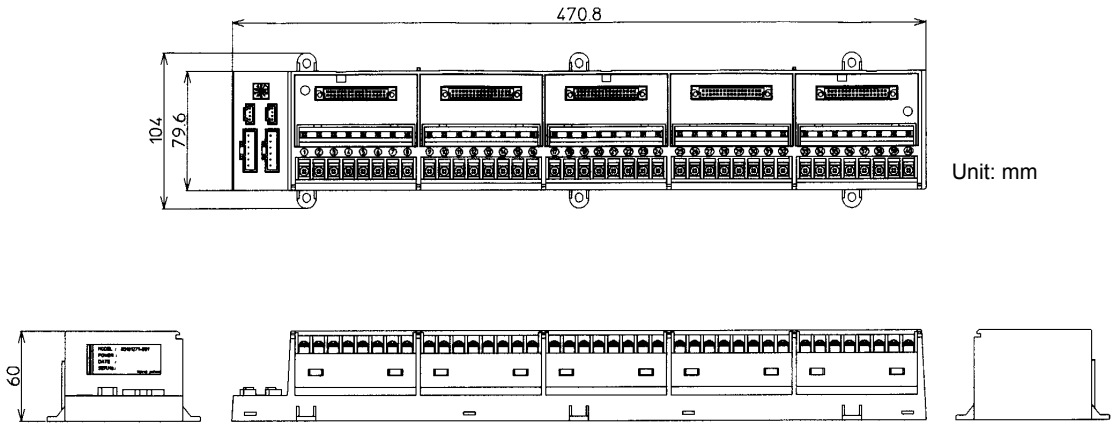


Figure 10. Base module dimensions

Operator interface (OI)

OI is a PMX-III display-setting device having a color touch-panel LCD. Access levels can be classified with password. OI is also used as a parameter-setting device by service personnel. Besides, OI has LED indicators for power supply, alarm and shutdown due to power failure.

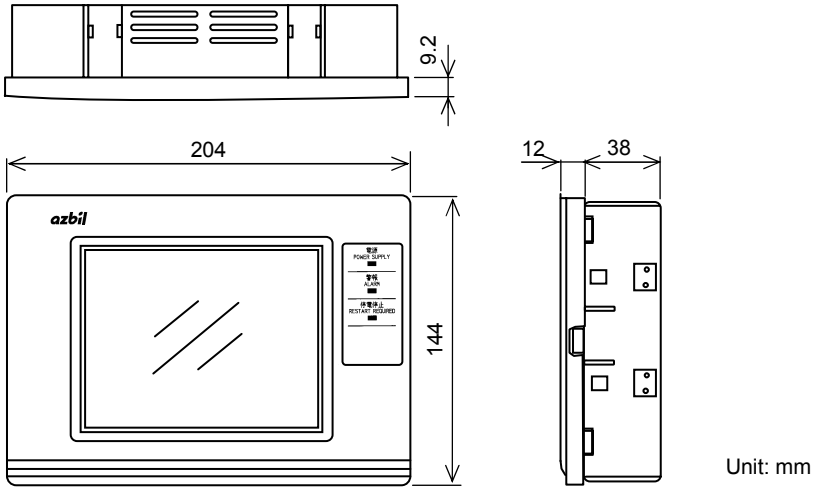


Figure 11. Operator interface dimensions

Accessories

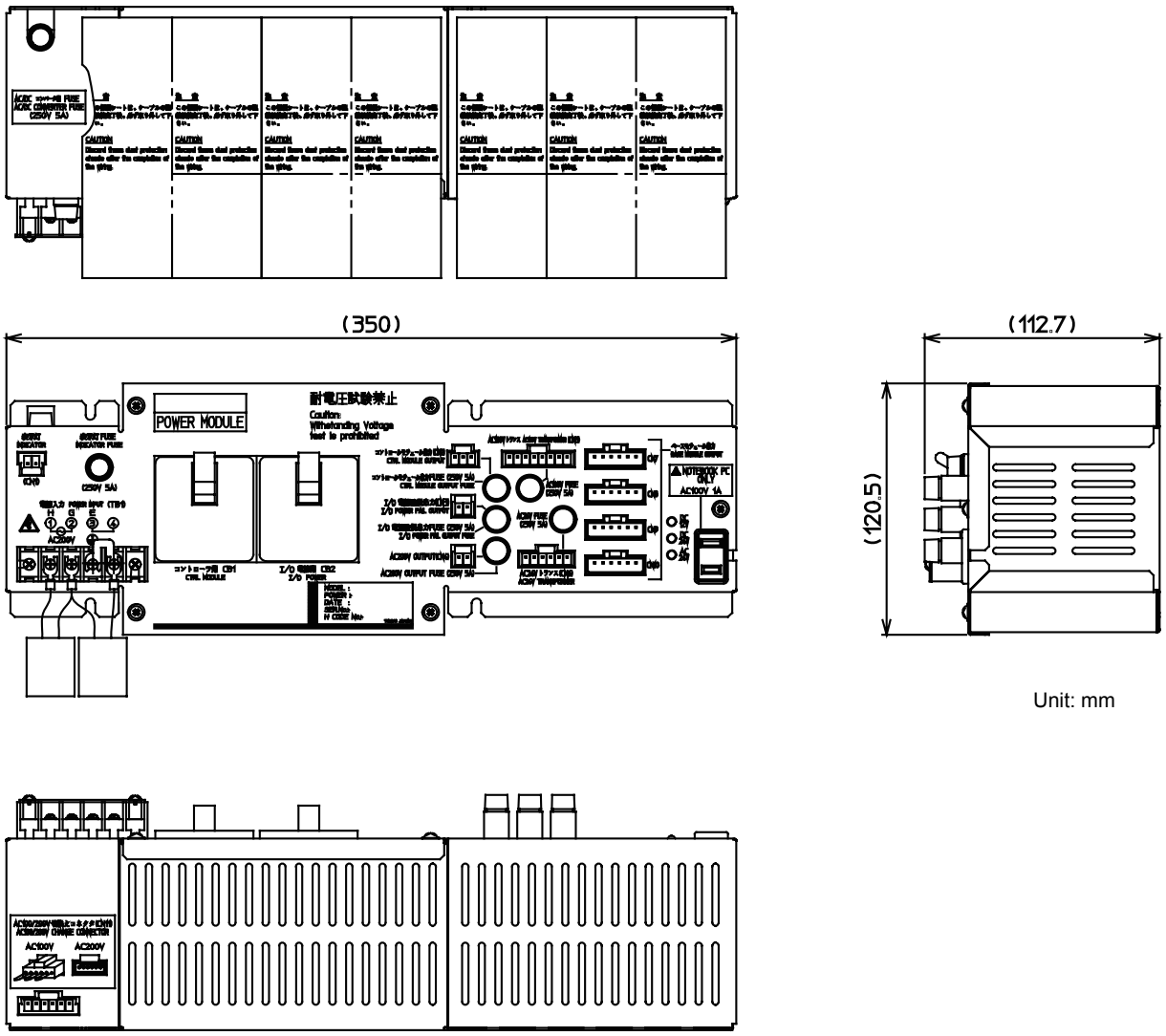
Cable	Power supply cable between control module and power supply module
	I/O power supply monitoring cable between control module and power supply module
	OI power supply cable between control module and OI
	OI communication cable between control module and OI
	Base module power supply cable between power supply module and base module
	Communication cable between base modules
	Communication cable between control module and base module
	Power supply cable between base modules
Others	1 wiring duct for each base module
	1 support
	3 OI mounting brackets
	1 cable holder for each base module except one base module

Power supply module

Power supply module supplies regulated power to all the components of the PMX-III (control modules, base modules I/O modules, and OI).

IMPORTANT:

PMX-III rated voltage is 200 V AC. For 220 to 240 V AC power supply voltage, be sure to provide a transformer to step the voltage down to 200 V AC.



Unit: mm

Figure 12. Power supply module dimensions

Part number	Description
83163539-001	Input voltage: 200 V AC Input rating: Max. 300 VA (Dimensions 120.5 mm H × 350 mm W × 112.7 mm D)
Accessories	- 3 fuses for replacement (250 V 5A) - 1 fuse for replacement (250 V 7A) The following accessories are NOT necessary. Please do not use them. - 200 V AC switchover connector (for CN11) - 200 V AC switchover connector (for CN5) - 3 labels - Instructions for switchover connectors and labels

Basic Specifications

Control module

Item		Specification
Power supply	Rated voltage	200 V AC
	Peripheral power shutdown detection	170 V AC or less
	Frequency	50 Hz/60 Hz
	Power consumption	10 VA
	Ground	Ground resistance 100 Ω or lower
Rated operating conditions	Ambient temperature	0 °C to 50 °C
	Ambient humidity	10 %RH to 90 %RH (non-condensing)
	Vibration	Max. 3.2 m/s² (at 10 to 150 Hz)
Transport/storage conditions	Ambient temperature	-20 °C to 60 °C
	Ambient humidity	5 %RH to 95 %RH (non-condensing)
	Vibration during storage	Max. 3.2 m/s² (at 10 Hz to 150 Hz)
	Vibration during transport	Max. 9.8 m/s² (at 10 Hz to 150 Hz)
LED display	Power supply	POWER LED ON: power supply ON, LED OFF: power supply OFF (green)
	Major alarm	ERR1 LED ON: major alarm or restart, LED OFF: normal (red)
	Minor alarm	ERR2 LED ON: minor alarm or restart, LED OFF: normal (red)
	OI communications	Tx LED flashing: Transmitting (green), Rx LED flashing: Receiving (green)
	I/O communications	Tx LED flashing: Transmitting (green), Rx LED flashing: Receiving (green)
	LC-bus communications LonTalk® protocol)	Tx LED flashing: Transmitting (green), Rx LED flashing: Receiving (green) SERVICE LED: Status of LonTalk communication
Memory protection	Data file	Nonvolatile memory (flash ROM)
	RTC and RAM	Lithium battery backup
Material		Steel plate (hot-dipped with zinc, aluminum, and magnesium)
Weight		1.8 kg

I/O module (1/2)

Item			Specification
Pt	Pt input module		Two RTD Pt100 Ω temperature inputs
	Power consumption		12 V DC: 0.43 W or less for controller 24 V DC: 0.84 W or less for input
	Weight		130 g
AI	Analog input module		Two 4-20 mA DC linear current inputs Two 0-5V/1-5V/0-10V/2-10V DC voltage inputs
	Power consumption		12 V DC: 0.37 W or less for controller 24 V DC: 3.60 W or less for input
	Weight		140 g
AO	Analog output module		One 4-20 mA DC linear current output
	Power consumption		12 V DC: 0.32 W or less for controller 24 V DC: 1.92 W or less for output
	Weight		130 g
MM	Modutrol motor module		One floating output with nominal 135 Ω feedback potentiometer
	Power consumption		12 V DC: 1.15 W or less for controller 24 V DC: 0.48 W or less for output
	Weight		170 g
DI	Digital input module		Five potential free contact inputs
	Power consumption		12 V DC: 0.29 W or less for controller 24 V DC: 0.87 W or less for input
	Weight		120 g
DO	Digital output module		Four potential free contact (N.O.) outputs
	Power consumption		12 V DC: 3.90 W or less for controller
	Weight		190 g
DIO	Digital input/output module		Two potential free contact inputs
			One 24 V DC contact output, one N.O./N.C. contact output
	Power consumption		12 V DC: 2.00 W or less for controller 24 V DC: 0.36 W or less (except external supply) for input/output
	Weight		170 g
Common	Power supply	Rated voltage	12 V DC
			24 V DC
		Operating voltage limits	9.6 V DC to 14.4 V DC
			19.2 V DC to 28.8 V DC

I/O module (2/2)

Item			Specification
Common	Rated operating conditions	Ambient temperature	0 °C to 50 °C
		Ambient humidity	10 %RH to 90 %RH (non-condensing)
		Vibration	Max. 3.2m/s² (at 10 Hz to 150 Hz)
	Transport/storage conditions.	Ambient temperature	-20 °C to 60 °C
		Ambient humidity	5 %RH to 95 %RH (non-condensing)
		Vibration during storage	Max. 3.2 m/s² (at 10 Hz to 150 Hz)
		Vibration during transport	Max. 9.8 m/s² (at 10 Hz to 150 Hz)
	Material		Modified PPE resin molding material

Base module

Item		Specification
Power supply	Rated voltage	12 V DC 24 V DC
	Operating voltage limits	9.6 V DC to 14.4 V DC 19.2 V DC to 28.8 V DC
	Power consumption	Dependent on I/O module
Rated operating conditions	Ambient temperature	0 °C to 50 °C
	Ambient humidity	10 %RH to 90 %RH (non-condensing)
	Vibration	Max. 3.2 m/s² (at 10 to 150 Hz)
Transport/storage conditions	Ambient temperature	-20 °C to 60 °C
	Ambient humidity	5 %RH to 95 %RH (non-condensing)
	Vibration during storage	Max. 3.2 m/s² (at 10 to 150 Hz)
	Vibration during transport	Max. 9.8 m/s² (at 10 to 150 Hz)
Operation unit (rotary switch)		Address
Material	Housing	Modified PPE resin molding material
	Rear cover	Modified PPE resin molding material
	Terminal block	PBT resin molding material (UL*94-V0)
Weight		1.0 kg (except I/O modules)

∗ UL: Underwriters Laboratories

OI

Item			Specification
Power supply	Rated voltage		24 V DC
	Operating voltage limits		21.6 V DC to 26.4 V DC
	Power consumption		15 W
	Ground		Ground resistance 100 Ω or lower
Rated operating conditions	Ambient temperature		0 °C to 45 °C
	Ambient humidity		20 %RH to 85 %RH (non-condensing)
	Vibration		Max. 3.2 m/s² (at 10 to 150 Hz)
Transport/storage conditions	Ambient temperature		-20 °C to 60 °C
	Ambient humidity		10 %RH to 85 %RH (non-condensing)
	Vibration during storage		Max. 3.2 m/s² (at 10 Hz to 150 Hz)
	Vibration during transport		Max. 9.8 m/s² (at 10 Hz to 150 Hz)
Display	Main display screen		5.7 inch STN color LCD (320 × 240 dots) with backlight
	LED	Power supply	LED ON: Power supply ON, LED OFF: Power supply OFF (Green)
		Alarm	LED ON: Trouble (Red)
		Power failure shutdown	LED ON: Waiting for restoration of power failure (Red)
Operation units	Main operation unit		Analog touch panel
	Dip switch		Reset, touch panel adjustment
	Adjuster		Contrast adjustment
Memory protection	Data file		Nonvolatile memory (flash ROM)
	RAM data		Lithium battery backup
Material			Housing, bezel: Modified PPE resin molding material Base: JIS* SPCC, 1.0 mm thick galvanization
Color			Light gray
Weight			1.0 kg

∗ JIS: Japanese Industrial Standards

Input / Output Specifications

Control module

Item	Specification		Connection	Wiring specification
Power supply	Refer to Basic Specifications		Terminal connection (M3.5)	JIS IV 2.0 mm², JIS CVV 2.0 mm² or more
Ground	Ground resistance 100 Ω or lower		Terminal connection (M3.5)	JIS IV 2.0 mm², JIS CVV 2.0 mm² or more
Communication	I/O	Transmission rate: 38.4 Kbps Communication output: RS-485 Number of connectable I/O: 99	Dedicated connector connection	Attached dedicated cable Total wiring length 20 m
	OI	Transmission rate: 4800 bps Communication output: Voltage signal Number of connectable OI: 1	Modular connector connection	Attached dedicated cable
	LC-bus (LonTalk® protocol)	Transmission rate: 78 Kbps Communication output: LonTalk® protocol TP/FT10	Modular connector connection*1	LAN cable*2 Max. 900 m long (for bus connection)
Controller alarm output	Output condition: Major alarm, power supply disconnection, initializing, offline mode (contacts are closed during normal operation) Output method: Potential free contact (N.O.) relay output Contact rating: 24 V DC / 100 V AC max. 500 mA Minimum applicable load: 5 V DC 100 mA		Dedicated connector connection	Dedicated cable Total wiring length 100 m

Notes:

∗1 For the LC-bus connector connection, use Stewart Connector's Plug: Model 940-SP-3088R-W

∗2 LAN cable compliant with EIA/TIA (Electronic Industries Alliance/Telecommunications Industry Association)-568 Category 5 or over (ϕ0.5 mm × 4 poles) is required.
For ∗1 and ∗2, the cable with connector (Part No. DY7210) and the short cable with connector (Part No. DY7220) are available at Azbil Corporation.

I/O module and base module

Item		Specifications	Connection	Wiring specifications
Pt		Signal: RTD Pt100, three-wire Measuring range: -20 °C to 80 °C	Terminal connection (M3.5)	JIS IV 1.25 mm², JCS CVV-S 1.25 mm², JCS CPEV-S ϕ0.9 mm Max. 100 m long
AI		Signal: 4 mA DC to 20 mA DC current input, 0-5V/1-5V/0-10V /2-10V DC voltage input Input impedance: 250 Ω Isolation: Insulated for each input	Terminal connection (M3.5)	JIS IV 1.25 mm², JCS CVV-S 1.25 mm², JCS CPEV-S ϕ0.9 mm Max. 100 m long
AO		Signal: 4 mA DC to 20 mA DC current output Maximum load resistance: 500 Ω Isolation: Insulated for each I/O module	Terminal connection (M3.5)	JIS IV 1.25 mm², JSC CVV-S 1.25 mm², JSC CPEV-S ϕ0.9 mm Max. 100 m long
MM	MM output	Signal: Two potential free contact (N.O.) outputs Contact rating: 250 V AC, 1.5 A, 6 A rush current (COSϕ = 0.4 or more) Minimum applicable load: 5 V DC, 100 mA	Terminal connection (M3.5)	60 V AC/DC or less: JIS IV 1.25 mm², JIS CVV 1.25 mm² Over 60 V AC/DC: JIS IV 2.0 mm², JIS CVV 2.0 mm² Max. 100 m long
	POT input	Signal: Three-wire feedback potentiometer Load resistance range: 100 Ω to 10 kΩ		
DI		Signal: Potential free contact input Rating: 24 V DC, 5 mA	Terminal connection (M3.5)	JIS IV 0.9 mm², JIS CVV 1.25 mm² Max. 100 m long
DO		Signal: Potential free contact (N.O.) output Contact rating: 250 V AC, 1.5 A, 6 A rush current (COSϕ = 0.4 or more) Minimum applicable load: 5 V DC, 100 mA	Terminal connection (M3.5)	60 V AC/DC or less: JIS IV 0.9 mm², JIS CVV 1.25 mm² Over 60 V AC/DC: JIS IV 2.0 mm², JIS CVV 2.0 mm² Max. 100 m long
DIO	DI	Signal: Potential free contact input Input rating: 24 V DC, 5 mA	Terminal connection (M3.5)	60 V AC/DC or less: JIS IV 0.9 mm², JIS CVV 1.25 mm² Over 60 V AC/DC: JIS IV 2.0 mm², JIS CVV 2.0 mm² Max. 100 m long
	DO	Signal: 24 V DC contact (N.O. and N.O./NC) output Contact rating: 250 V AC, 1.5 A, 6 A rush current (COSϕ = 0.4 or more) Output rating: 24 V DC, 1A (Max.)	Terminal connection (M3.5)	
Common	Communi-cation	Transmission rate: 38.4 Kbps Communication output: Dedicated communication	Dedicated connector connection	Dedicated cable (accessory) Max. 20 m long
	Power supply	Refer to Basic Specifications	Dedicated connector connection	Dedicated cable

OI

Item	Specification	Connection	Wiring specification
Power supply	Refer to **Basic Specifications**	Terminal connection (M3.5)	JIS IV 1.25 mm², JIS CVV 1.25 mm², or dedicated cable (accessory)
Ground	Ground resistance 100 Ω or lower	Terminal connection (M3.5)	JIS IV 2.0 mm², JIS CVV 2.0 mm², or dedicated cable (accessory)
Communication	Transmission rate: 4800 bps Communication output: Voltage signal	Modular connector connection	Dedicated cable (accessory)

Input / Output Configurations

Single-pump system communicatable with host system (Model number WY7400T1XXX010B)

Input/output		Description
DI	Automatic/manual changeover	ON: Automatic, OFF: Manual
	Power supply status of target units	DI is used for power failure restoration control when the power supply system of chillers is different from that of PMX-III.
	Chiller n status	DI must send return signal within 2 seconds
	Chiller n alarm	
	Chiller n forced shutdown	DI is used to exclude the chiller n.
	Primary pump status	OR signal for operation status of primary pumps (OFF when all pumps are shut down.)
DO	Group command	Potential free contact (N.O.)
	Advance notice of increase in chillers	Potential free contact (N.O.)
	Chiller n starting	24 V DC contact
AI	Supply water temperature	RTD Pt100 Ω (-20 °C to 80 °C)
	Return water temperature (header side)	RTD Pt100 Ω (-20 °C to 80 °C)
	Load flow rate	4 mA DC to 20 mA DC
	Differential pressure between headers	4 mA DC to 20 mA DC
	Return water temperature (loading side)	RTD Pt100 Ω (-20 °C to 80 °C)
AO	Supply water temperature setting	4 mA DC to 20 mA DC
	Differential pressure setting or bypass valve	Differential pressure setting: 4 mA DC to 20 mA DC Bypass valve: MM output

*n=1 to 2 or 1 to 4 or 1 to 8 (dependent on the model number)

Dual-pump system communicatable with host system (Model number WY7400T2XX0010B)

Input/output		Description
DI	Automatic/manual changeover	ON: Automatic, OFF: Manual
	Power supply status of target units	DI is used for power failure restoration control when the power supply system of chillers is different from that of PMX-III.
	Chiller n status	DI must send return signal within 2 seconds
	Chiller n alarm	
	Chiller n forced shutdown	DI is used to exclude the chiller n.
DO	Group command	Potential free contact (N.O.)
	Chiller n starting	24 V DC contact
AI	Supply water temperature	RTD Pt100 Ω (-20 °C to 80 °C)
	Return water temperature (header side)	RTD Pt100 Ω (-20 °C to 80 °C)
	System m return water temperature	RTD Pt100 Ω (-20 °C to 80 °C)
	System m load flow rate	4 mA DC to 20 mA DC
	Chiller n outlet temperature	RTD Pt100 Ω (-20 °C to 80 °C)
AO	Supply water temperature setting	4 mA DC to 20 mA DC

*n = 1 to 2 or 1 to 4 or 1 to 8 (dependent on the model number)
*m = 1 or 1 to 4 (dependent on the model number)

Control of Chiller Plant Units

Operation management

1) Automatic/manual changeover

Automatic/manual operation is selected by communicating with the host system, by operating the OI, or by inputting DI. Manual operation by DI input takes the highest priority. For others, the latest command takes priority.

- Manual: The operation status immediately before changeover to the manual mode is maintained, and the multiple units control is disabled. During the manual operation, the chiller plant units can be manually started and stopped on site.
- Automatic: The multiple units control is enabled and carried out when the group command is ON.

2) Group command

Group command is executed by communicating with the host system or operating OI.

- Group command ON: Multiple units control is enabled and carried out sequentially under the automatic operation.
- Group command OFF: All the chiller plant units under the automatic operation, not under the manual operation, are sequentially stopped.

3) Daytime/nighttime mode changeover

Daytime/nighttime mode is selected by communicating with the host system or operating OI.

The switchover between daytime and nighttime modes changes the operating sequence table, maximum number of the operating chiller plant units, and load at start-up.

4) Cooling/heating mode changeover

Cooling/heating mode is selected by communicating with the host system or inputting OI.

The switchover between cooling and heating modes changes the operating sequence table, maximum number of the operating chiller plant units, load at start-up, and rated capacity.

Multiple units control

1) Control method

The following two methods are applicable depending on the model (instrumentation type).

- Flow rate method (single-pump system):
  Flow rate is interpreted as the load for multiple units control, and the optimum number of the operating chiller plant units is determined by comparison with the total rated capacity of the operating units. The function of totalizing up to 4 flow rate systems can be selected from the model numbers.
- Energy method (dual-pump system):
  Energy is calculated from supply water temperature, return water temperature and load flow rate, and the optimum number of the operating units is determined by comparison with the total rated capacity of the operating units. The function of calculating and totalizing up to 4 energy systems can be used depending on the model.

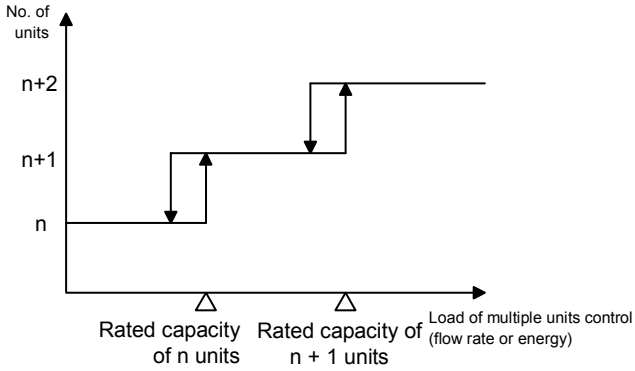


Figure 13. Multiple units control

2) Operating sequence changeover method

There are five operation sequence changeover methods as follows.

- Sequential method:
  The sequences of startup and shutdown are fixed. The unit with the highest priority starts first and stops last.

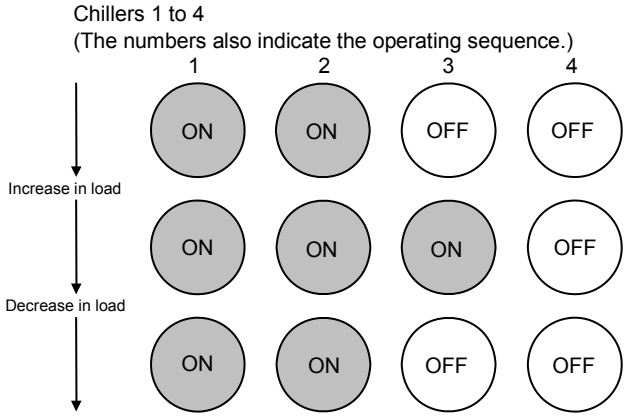


Figure 14. Operation example: Sequential method

- Sequential method with base changeover:
  A sequential method of sorts. After a group command OFF is executed, the operating sequence is shifted when the next group command ON is executed so that the units with the highest priority last time take the lowest this time.
- Rotation method:
  A method for averaging each unit runtime. The operating sequence is shifted so that an unit starting to operate the latest stops last, and a stand-by unit which has been in stop condition for a longer period is started and an running unit which has been operating for a longer period is stopped.

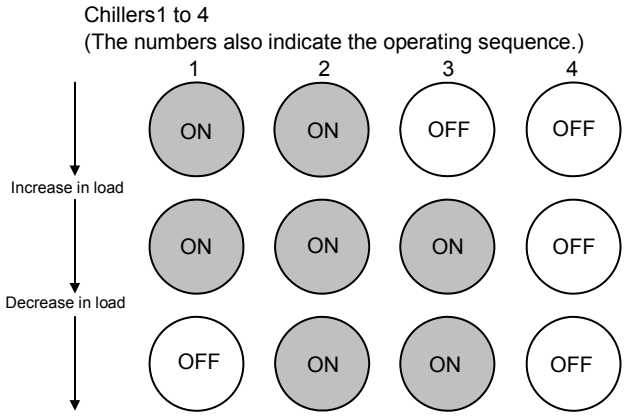


Figure 15. Operation example: Rotation method

- Rotation method with forced increase in the operating units:
  When no increase in the operating units occurs during a certain time period, the operating sequence is rotated by forcibly increasing the operating units.
- Programming method:
  This method is used to combine and operate chiller plant units with different capacities. Up to four groups (types) of capacities are supportable, and up to 12 levels of settings are available for each group. The operating sequence of each group shifts in the rotation method.

Group table setting				
Group	Chiller number			
1	1	—	—	—
2	2	3	4	—
3	—	—	—	—
4	—	—	—	—

For example, one unit with small capacity is registered to Group 1, and three units with large capacities are registered to Group 2. (See the table above.)

Level table setting					
Level	Number of chiller plant units (chillers)				Loading conditions for each level
	Group				
	1	2	3	4	
1	1	0	0	0	Load ≤ Group 1 unit capacity
2	0	1	0	0	Group 1 unit capacity < Load ≤ Group 2 unit capacity
3	1	1	0	0	Group 2 unit capacity < Load ≤ Unit capacities of Group1 plus Group 2
4	0	2	0	0	Unit capacities of Group 1 plus Group 2 < Load ≤ Group 2 unit capacity multiplied by 2
5	1	2	0	0	Group 2 unit capacity multiplied by 2 < Load ≤ Group 1 unit capacity plus Group 2 unit capacity multiplied by 2
6	0	3	0	0	Group 1 unit capacity plus Group 2 unit capacity multiplied by 2 < Load ≤ Group 2 unit capacity multiplied by 3
7	1	3	0	0	Group 2 unit capacity multiplied by 3 < Load
8	-	-	-	-	—
9	-	-	-	-	—
10	-	-	-	-	—
11	-	-	-	-	—
12	-	-	-	-	—

3) Operating sequence table

The operating sequence can be set for each of the following four tables.

- Heating daytime mode
- Heating nighttime mode
- Cooling daytime mode
- Cooling nighttime mode

The operating sequence changeover method is common to all tables. When the table setting is changed, the multiple units control is carried out at the start-up as explained later.

4) Operating sequence adjustment

There are two selectable methods to adjust operating sequence for the changeover of operating sequence tables, the changeover from manual to automatic operation, and the restoration from a failure or a forced stop (for the sequential method only). Refer to the following figures.

- Sequence setting priority method:
  Start and stop of the chiller plant units are executed according to the operating sequence setting all the time.
- Operating units priority method:
  Start and stop of the chiller plant units are executed by having the units in operation take higher priority to operate than standby units. In this case, fewer starts and stops of the units are required.

Sequence setting precedence priority method (sequential)

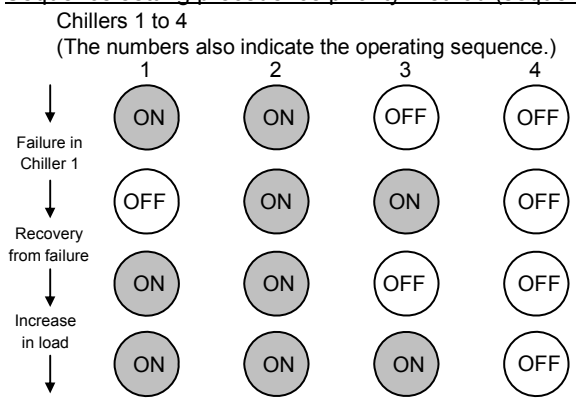


Figure 16. Operation example: Sequential setting priority method (when load is increased)

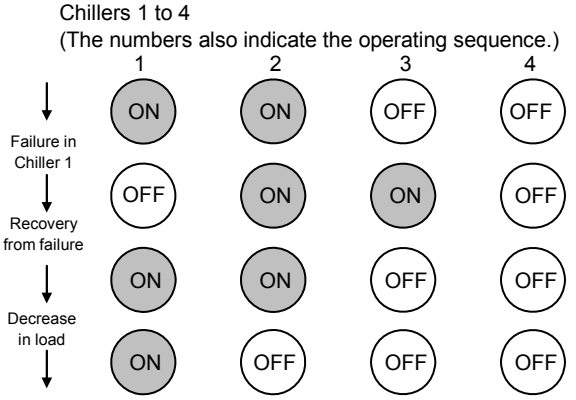


Figure 17. Operation example: Sequential setting priority method (when load is decreased)

Operating units priority method (sequential)

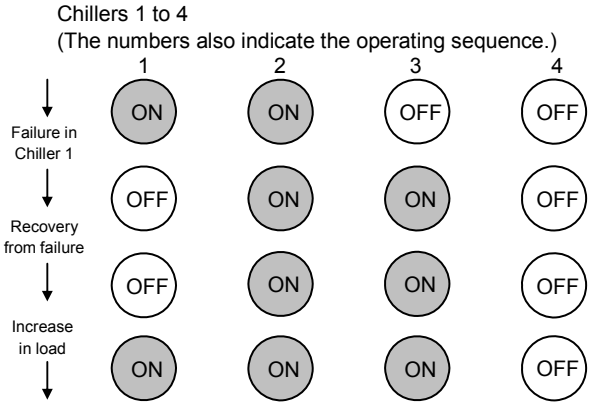


Figure 18. Operation example: Operating units priority method (when load is increased)

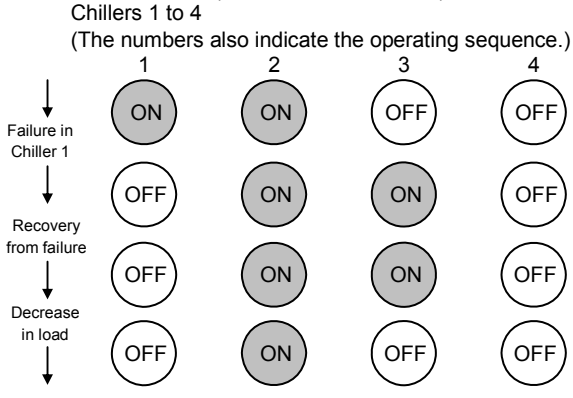


Figure 19. Operation example: Operating units priority method (when load is decreased)

In this case, the units in operation and on standby may be mixed. If the units are started and stopped simultaneously, their capacities may drop due to abnormal rise in pressure or delay in the units startup, and ON/OFF simultaneous operations are required. There are two operations as follows.

- Startup priority for the operation:
  After a certain time period (all the units scheduled ON are sequentially started and ready to work), the units scheduled OFF are sequentially stopped.
- Shutdown priority for the operation:
  After a certain time period (all the units scheduled OFF are sequentially stopped and ready to shut down), the units scheduled ON are sequentially started.

5) Rated capacity setting

The unit rated capacities (flow rate) are set by communicating with the host system and by operating OI. Single-pump system instrumentations are set with flow rate, and dual-pump with energy.

6) Multiple units control at startup

To shorten rise time for the group command ON, multiple units control according to the “load at startup” is necessary. To react to a sudden drop in load during overtime working, forced operation is required for the changeovers between daytime and nighttime as well. When the group command ON is executed and nighttime mode is changed to daytime, actual load needs to be used if it is greater than load at startup. When daytime mode is changed to nighttime, actual load needs to be used if it is smaller than load at startup. The following sixteen types of load at startup can be set:

- Weekday, heating mode, load at daytime startup
- Weekday, heating mode, load at nighttime startup
- Weekday, cooling mode, load at daytime startup
- Weekday, cooling mode, load at nighttime startup
- Holiday, heating mode, load at daytime startup
- Holiday, heating mode, load at nighttime startup
- Holiday, cooling mode, load at daytime startup
- Holiday, cooling mode, load at nighttime startup
- Special day 1, heating mode, load at daytime startup
- Special day 1, heating mode, load at nighttime startup
- Special day 1, cooling mode, load at daytime startup
- Special day 1, cooling mode, load at nighttime startup
- Special day 2, heating mode, load at daytime startup
- Special day 2, heating mode, load at nighttime startup
- Special day 2, cooling mode, load at daytime startup
- Special day 2, cooling mode, load at nighttime startup

Note:
Weekdays, holidays, special days 1 and 2 are set with calendar setting in the host system.

7) Stabilizing control during waiting time

During a certain time period after increase and decrease in the units, multiple units control is disabled.

- Waiting time at the units startup:
  A period including the rise time after startup and the water turnaround time. If the outlet temperatures of all the units reach a certain level at some time even within the set period, the rise time is understood to get expired.
- Waiting time at the units shutdown:
  A period including the remaining operation time after shutdown and the rise time of other operating units.

8) Corrections of multiple units control with temperature

When the return water temperature at header side drops below a certain level for a certain period, correction of decrease in the operating units is necessary. When the supply water temperature reaches a certain level or higher for a certain period, correction of increase in the operating units is necessary.

(Example of cooling mode)

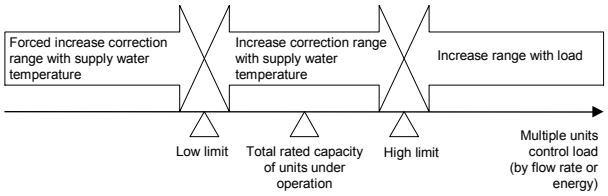


Figure 20. Corrections of multiple units control with temperature

9) Setting: the maximum number of operating units

To secure standby units or to temporarily limit the number of operating units, the maximum number of the units for operation can be set. During the automatic operation or when the group command is ON, up to the maximum number of operating units can be operated. The maximum number of operating units can be set for the following four modes.

- Heating daytime mode
- Heating nighttime mode
- Cooling daytime mode
- Cooling nighttime mode

10) Setting: the minimum number of operating units

During automatic operation or when the group command is ON, more than the minimum number of operating units can be operated. By setting the minimum number to zero, the base unit is stopped when load is low and enhances the operating efficiency (for dual-pump systems only).

11) Omission process

An unit in the following conditions is excluded from multiple units control. However, the unit is included in the total rated capacity during operation.

- Shutdown due to power demand control.
- Shutdown due to power failure control.
- Shutdown due to fire control.
- Shutdown due to forced DI input.
- Shutdown due to unit failure.
- Shutdown or operation due to unmatched status.
- Shutdown during time for anti-repeat or for minimum shutdown.
- Operating sequence setting at zero (unregistered).
- Capacity setting at zero.

Forced shutdown

An individual unit is forcibly stopped (omitted) by forced shutdown with DI input. The forced shutdown takes priority over all the PMX-III start commands.

Single-start

Individual unit can be started and stopped by communicating with the host system or by operating the OI. Single-start takes priority over all the starting commands of PMX-III except forced shutdown. When single-start is executed during automatic operation or when the group command is ON, the units return to be operated with normal multiple units control after expiry of the waiting time for the stabilization and time for anti-repeat and minimum shutdown.

Note:
Single-start is disabled during the automatic operation or when the group command is OFF

Anti-repeat control

For the unit protection, the units are controlled to reboot during anti-repeat time (a certain period after the startup) and minimum shutdown time (a certain period after the shutdown).

Sequential starting control

To prevent in-rush current and water drop, multiple units cannot be started or stopped simultaneously. In this case, the units are started and stopped at certain intervals in registration order regardless of operating sequence.

Power demand control

An individual unit is stopped by the power demand control commanded from the host system. In this case, an alternative unit is not operated so that power consumption does not increase. When power demand control commands for all the units are cancelled, normal multiple units control returns.

Control during failure

When a faulty DI is input or when start/stop failure is occurred (the operation status does not agree with the out-put command in a certain period after the command), the unit under fault/trip condition is excluded from multiple units control. In this case, a standby unit is started for operation even during waiting time for stabilization. Stop command is not output to the failure unit.

There are two ways to reset failures.

- Manual reset: After reasons for the failure are cleared/acknowledged, the stop operation is required by means of communicating with the host system or operating OI. This operation matches the status, and the unit returns to a normal operation.
- Automatic reset: With the failure auto reset time, the PMX-III automatically carries out stop operation when the time is expired. If the faulty DI input is cancelled, this operation matches the status with, and the unit returns to a normal operation.

Pressure control (bypass valve control for single- pump systems only)

The differential pressure between headers is host maintained constant by PID-controlled bypass valves at 0.5-second cycle. Sudden increase in pressure is prevented by forcibly opening bypass valves to a certain degree before group command ON or unit increase.

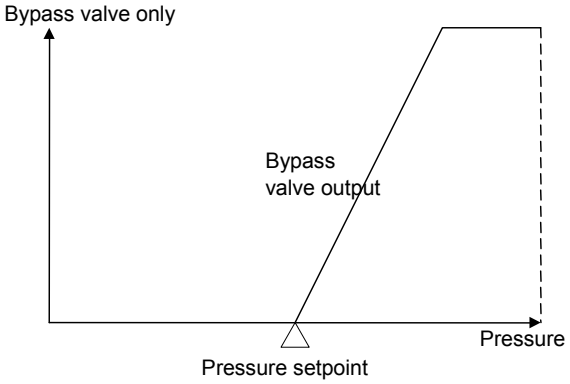


Figure 21. Control of bypass valve and inverter for proportional bypass valve

Power failure restoration control

1) Detection of power failure status

Detected by power failure status sent from the host system or power supply status DI of target units (OFF: power supply, ON: power failure).

2) Operation when power is restored

Automatic /manual changeover	PMX-III power failure	Unit power failure	Power failure time	Operation
Automatic	Yes	Yes	Within a certain time	Multiple units control by the actual load or the load at startup before power failure, which is greater than the other (Anti-repeat for shutdown units due to power failure)
			A certain time or longer	Multiple units control by the load at startup (Anti-repeat for shutdown units due to power failure)
		No	Within a certain time	Multiple units control by the actual load or the load at startup before power failure, which is greater than the other
			A certain time or longer	Multiple units control by the actual load or the load at startup after power failure restoration, which is greater than the other
	No	Yes	—	Multiple units control by the load at startup (Anti-repeat for shutdown units due to power failure)
Manual	Yes	Yes	—	Shutdown of all the units
		No	—	Continuance of the status before power failure
	No	Yes	—	Shutdown of all the units

∗ A certain time varies depending on the configured parameter “panel instantaneous shutdown decision time.” (default:120 seconds / max.: 254 seconds)

Notes:

1. Since the unit power source is supposed to be mains-powered only or mains-powered with private power generation, power failure does not normally occur only at the PMX-III. However, power failure only at PMX-III is described in the table in case that control panel is shut down for maintenance, etc.
2. The unit power failure in the table indicates power failure at all the units. The operation, when unit power supply is shut down for maintenance without changing to manual operation, needs to be on the code of “Control during failure” explained before.
3. Because the unit shutdown due to power failure is not occurred by the multiple units control, stabilizing control during waiting time is not carried out after the shutdown.
4. The operations when manual/automatic operation is switched before/after power failure are not described here in the table.

Operating Diagnostics

Each operating diagnostic data can be displayed on the OI.

- Integrated value
  Integrated value of flow rate, energy, operating time and application rate of units can be displayed.
- Alarm record of operating status changes
  Annunciation history of dates and causes of up to 360 past operations, status changes and alarm can be stored and displayed. (Note that no external output of data is available.)
- Trend chart
  Trend chart of analog data can be displayed on the OI. Up to past 288 data can be stored at 10-minute cycle and a maximum of 4 points per chart and a maximum of 8 charts can be displayed. (Note that no external output of data is available.)

Communications with the Host System

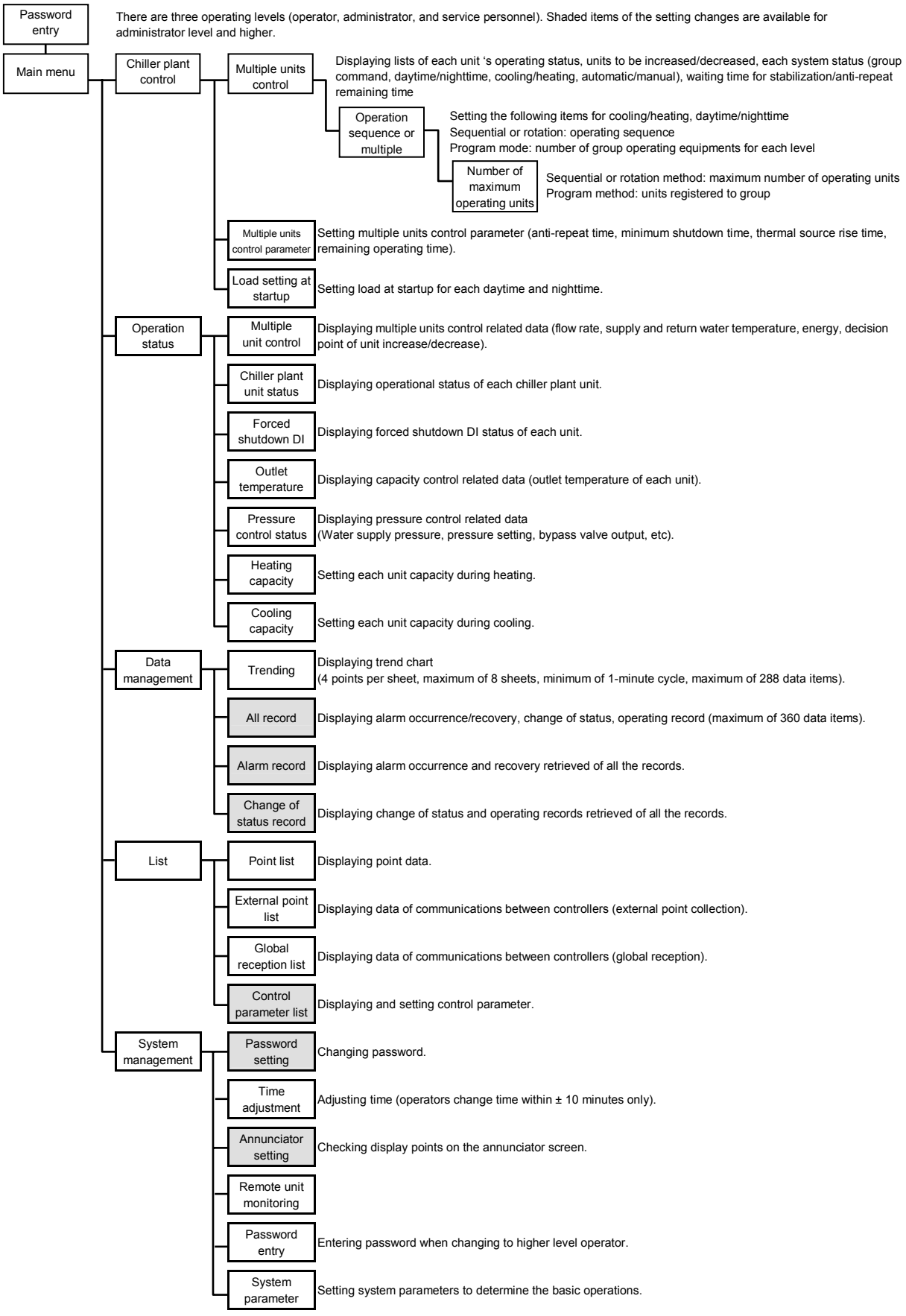
With Azbil Corporation's BMS, ***savic-net FX***, the PMX-III communicates and interfaces the following data besides input and output commands explained before.

- Various settings (supply water temperature setting, unit capacity setting, etc.)
- Various integrated values (flow rate, energy, operating time, application rate of units, etc.)
- Various modes (cooling/heating changeover, daytime/nighttime changeover, etc.)
- Various alarms (remote unit abnormal, analog high/low limit, deviation value alarm)
- Time, date, days of the week, time schedule

Display Function

The PMX-III allows various displays and settings on the OI. This section describes the overview of screen hierarchy.

Note: Screen configurations vary depending on the model.



Connection of Data Setter for LonTalk Communication

Connect the CompactFlash® memory type Data Setter (Model QY5111B) for LonTalk communication to LC-bus port or to CONF. port of PMX-III with the Data Setter adaptor (Part No. DY5301S0000, with separate order required.).
For details of the Data Setter adaptor, refer to its Specifications manual.

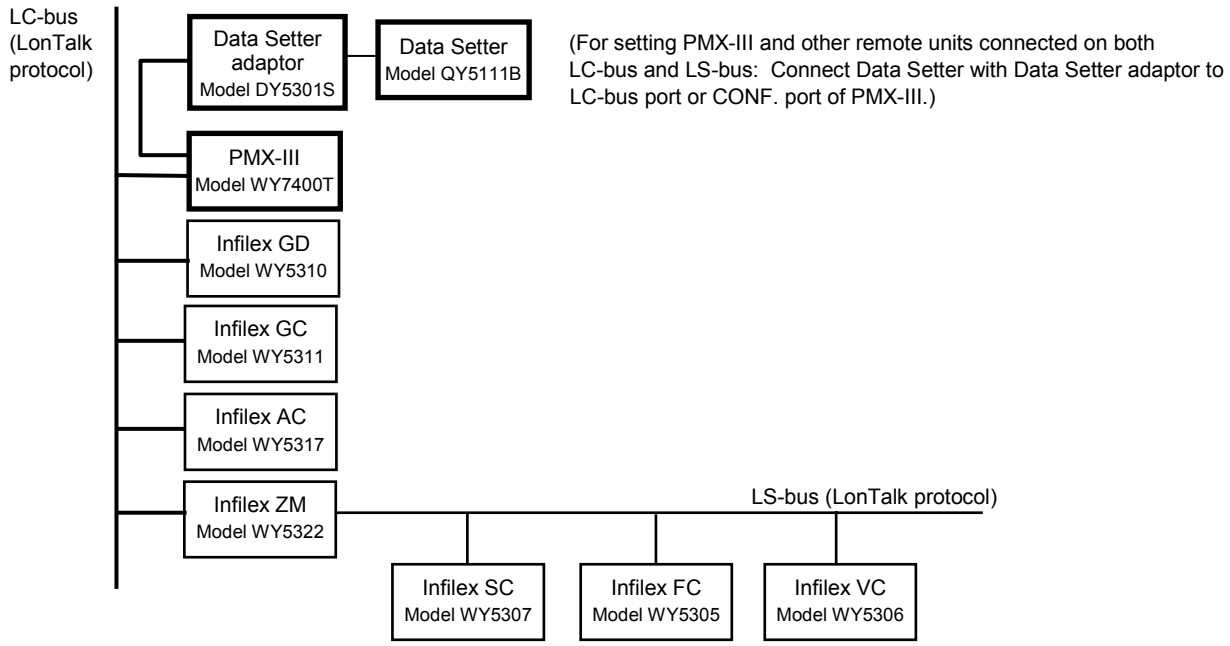


Figure 22. Connection example of Data Setter with Data setter adaptor to LC-bus port/CONF. port of PMX-III

CAUTION

- Replace lithium batteries of Control module and of OI every five years.
- For operation and maintenance, refer to the operation manual.

azbil

Specifications are subject to change without notice.

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Building Systems Company

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