

## DX-9100 Digital Controller, Version 2

The DX-9100 digital controller is the ideal digital control solution for multiple chiller or boiler plant control applications, for air handling units or for distributed lighting and related electrical equipment control applications.

As a standalone controller, the DX has both the hardware and software flexibility to adapt to the control requirements in its targeted applications. Along with its outstanding control flexibility, the controller can extend its input and output point capability by communicating with input/output (I/O) extension modules on an extension bus. The controller provides monitoring and control of all connected points at an integral LED display and keyboard or from a separate DT-9100 display unit.

The DT-9100 display unit, with a text and graphic LCD screen and keypad, provides a standard and customized presentation of data according to the application and customer requirements.

Both the DX-9100 controller and the DT-9100 display unit can be mounted within an electrical enclosure or in a cabinet door, and the DT-9100 display unit can also be mounted directly onto the controller within a panel, on a wall or can be used as a portable device.

When the DX controller is integrated into a Metasys® system, point and control information is available throughout the network and at all Metasys operator workstations.



Figure 1: DX-9100-8454

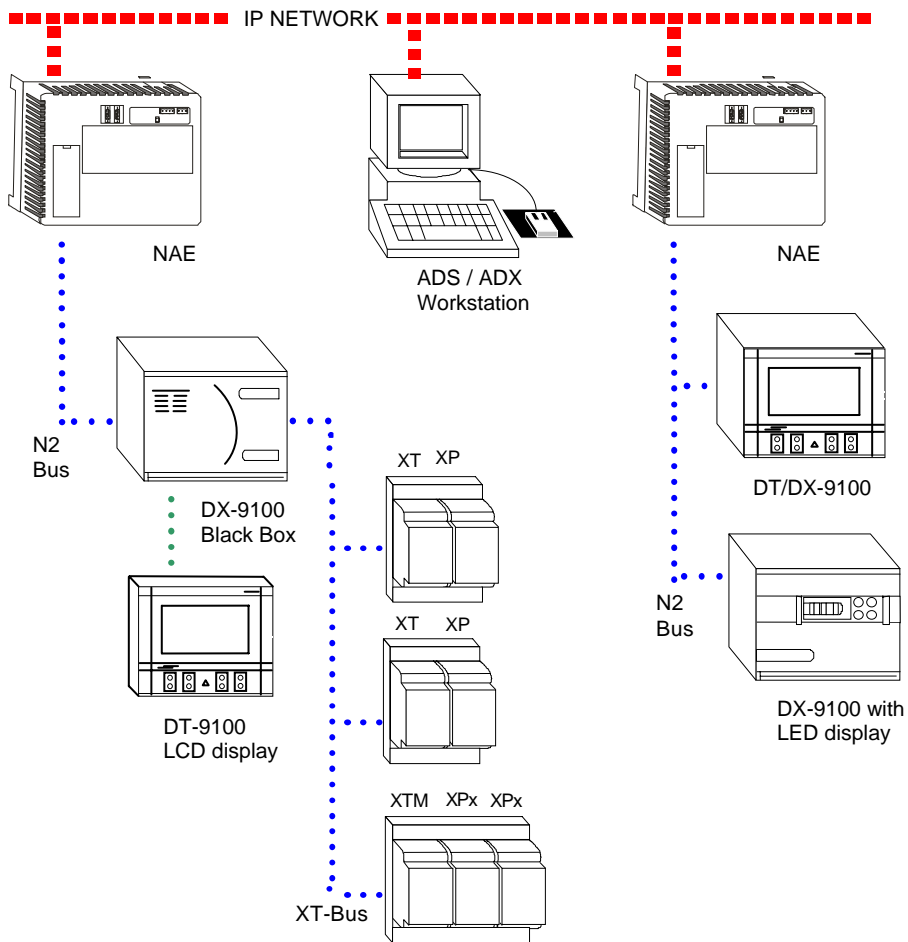


Figure 2: DT-9100-8204

Features and Benefits	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Full set of control algorithms in software modules</li> <li><input type="checkbox"/> Graphic configuration tool</li> </ul>	Easy to configure for a wide range of standard and special applications
<ul style="list-style-type: none"> <li><input type="checkbox"/> Standalone control</li> <li><input type="checkbox"/> Real-time clock and time programs</li> <li><input type="checkbox"/> Trend data storage</li> </ul>	Distributed control for system reliability
<ul style="list-style-type: none"> <li><input type="checkbox"/> Extension bus for additional I/O points</li> <li><input type="checkbox"/> Extension modules for a variety of analog and digital I/O combinations</li> </ul>	Modular hardware set for low-cost installation in the various applications
Continued on the next page...	

## Features and Benefits (Cont.)

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Model with integral display and control panel</b></li> <li><input type="checkbox"/> <b>Text and graphic display unit (DT-9100) – for one or up to eight DX controllers on N2 Bus network</b></li> <li><input type="checkbox"/> <b>Extension modules with manual override switches</b></li> </ul> | <p>Multiple display and override possibilities are available for the controller, close to or remote from the controlled equipment</p> |
| <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>N2 Bus communications</b></li> <li><input type="checkbox"/> <b>Dynamic data access capabilities with Metasys system network</b></li> </ul>   | <p>Facility-wide control efficiency and cost-effective information availability</p>   |



**Figure 3: DX-9100 Digital Controller, Version 2, on the Metasys System Network**

## Flexible Installation and Display Options

The DX-9100 digital controller, Version 2, is available with an integral LED display and keyboard that gives access to control data for the technical user, mainly to commission and service the controller. This controller model may be installed within an electrical enclosure using the mounting base or fixed into a cabinet door using the mounting frame to give access to the display without opening the cabinet.

The controller is also available without an integral display and keyboard as a “Black Box” model for use with the DT-9100 display unit. In this case the DT-9100 display unit may be mounted in the cabinet door or attached to the front cover of the controller within the cabinet. This latter option enables the display unit to be used when the door is wide open and the

display unit can easily be detached from the controller and used as a hand-held portable device.

The mounting base and mounting frame have all the terminals and connections to enable the field wiring to be completed before installing the controller.

The DT-9100 display unit is supplied with a panel mounting kit and a kit is available to enable the unit to be surface mounted, for example, on a wall. The display unit can also be used as a portable device, and a standard 230 VAC/12 VDC adaptor can be used to power it. A flexible cable is provided to connect the display unit to the DX-9100 controller.



**Figure 4: DX Controller with LED Display and Keyboard on Panel Mounting Base**



**Figure 5: DX-9100 with LED Display and Keyboard in Cabinet Door Mounting Frame**



**Figure 6: DX Controller – Black Box – on Panel Mounting Base**



**Figure 7: DX Controller with DT-9100 Display Unit on Panel Mounting Base**



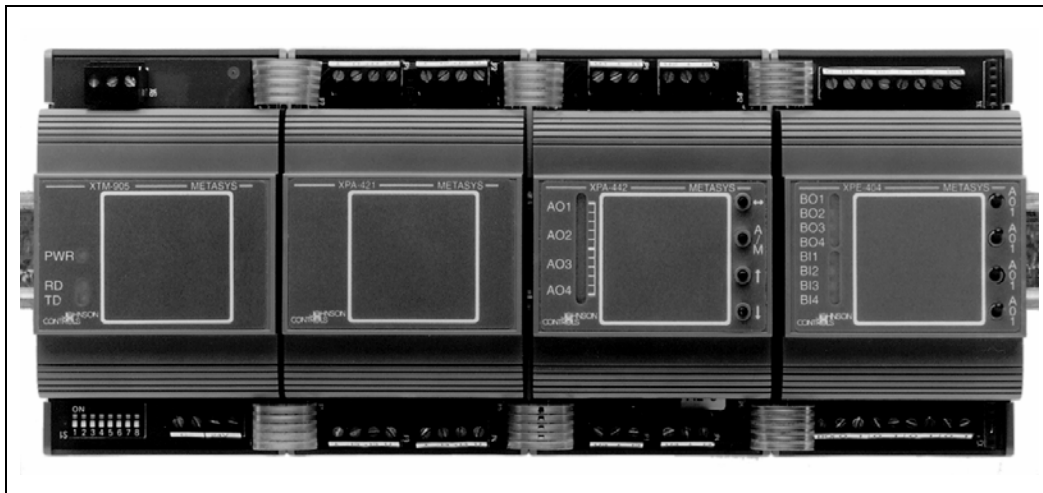
## Extension Modules

The extension (XT-9100 and XTM-905) and expansion (XP-910x and XPx) modules may be mounted next to the controller on the same DIN rail, or remotely, up to 1200 m from the controller.

An extension module set is assembled from sub-modules, providing various combinations of

analog and digital (binary) I/O points. Up to eight extension modules can be connected to the extension bus.

The XTM extension module and its expansion modules provide a wider and more flexible range of I/O options as well as a manual override option on outputs.



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Figure 8: Extension Modules with Manual Override

## Sensors and Actuators to Complete the System

The DX-9100 controller and extension modules are matched to a family of sensors and actuators for the control valves and dampers needed to complete the control of chiller and boiler plants, HVAC units and other refrigeration and heating equipment. Its sensor inputs can accept 0-10V transmitters and passive temperature sensors from the Johnson Controls

range, as well as industry standard 4-20mA transmitters. Outputs are available to control both proportional and incremental electric actuators, as well as motor control relays, staged heating and cooling and other electrical equipment such as lighting control relays. Pneumatic actuators may be controlled by the use of an external transducer.



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**Figure 9: Flow Temperature Sensor**



**Figure 10: Room Temperature Sensor**

**Table 1: Point Configuration**

Point Type	Quantity			Characteristics
	DX-9100	XT	XTM	
Analog Inputs	8	6	4/8	0-10 VDC (impedance 300 K $\Omega$ ) 0/4-20 mA DC (impedance 100 $\Omega$ ) RTD Ni1000 (JCI), A99 (JCI), and Pt1000 (DIN) XTM only: RTD Pt100 (DIN), Ni100 (DIN), potentiometer (5 kOhm)
Digital (Binary) Inputs	8	4/8/16	4/8/16	Dry Contacts (potential free)
Digital (Binary) Outputs	6	4/8/16	2...4/8/16	24 VAC Triacs (minimum 0.05 A, maximum 0.5 A) XT/XTM only: Relay Contact (250 VAC 3 amps) XTM only: Relays with momentary, magnetically latched or electrical hold operation
Analog Outputs	4 4	2	4/8	0-10 VDC (10 mA maximum) or 0/4-20 mA DC 0-10 VDC (10 mA maximum) only

**Table 2: XT Bus Configuration**

Maximum number of XT/XTMs per DX-9100	8
Maximum number of I/Os for each XT/XTM	8 analog + 8 digital (binary), or 16 digital (binary)
Maximum number of I/Os from XT/XTMs per DX-9100	64

## **C**onvenient Configuration Setup

The DX-9100 digital controller does not need to be programmed in the traditional sense. Instead, the control algorithms, time programs and input/output point assignments are configured with the use of a Graphic Configuration Tool, which runs under the Windows® operating system. The graphic software is installed on a laptop computer which is plugged into the controller's RS-232-C port for loading the application configuration into the controller.

The DX controller operating system is stored in Flash memory. Configuration data and parameters loaded into the controller and into the extension modules are stored in EEPROM, so there is no need to reload software after a loss of power. Real time and operating data in the controller are stored in battery backed RAM.

Configuring a controller and its extension modules is a simple matter of selecting the desired module types to form a flow chart diagram, connecting inputs to control and logic blocks, and closing the control loop by making the connection from the control and logic blocks to the outputs. As the flow chart is being filled in, the set point parameters, gains, alarm limits, start and stop times, etc., are added to the control and logic blocks and inputs and outputs to complete the configuration. Names may be entered for inputs, outputs and operating parameters for use in the optional display unit or for electronic transfer to the Metasys Workstation data file.

## **I**ntegral Display Panel

Once the controller and its extension modules are configured, the operating parameters and input/output values can be seen at the display panel built into the controller. Outputs can be manually overridden and operating parameters may be changed by an operator who has plugged his security key into the controller. The same information viewed on the face of the controller can be displayed and changed from any of the Metasys operator devices, or from the Graphic Configuration Tool when in online commissioning mode.

## **D**isplay Unit (DT-9100)

The display unit provides similar features to the integral display panel, but the data which appears on the screen is adapted to suit the application with user-defined names for each value displayed. The control of outputs and modification of operating parameters is password protected. Trend logs are shown in graphic format and the main screen may show the controlled equipment as a graphic diagram with actual values displayed. The unit can monitor up to eight DX controllers on an N2 Bus and generate alarms and keeps a log of alarms with the time and date of occurrence. The display unit is configured using the Graphic Configuration Tool.

## **A**pplication Flexibility

The DX-9100 digital controller can be configured to meet a wide variety of basic HVAC and multiple boiler or chiller central plant applications. Configurations may be pre-configured for common applications to use as a foundation to customize your particular needs. If the pre-configured examples don't cover your needs, you can start with a blank flow chart template on the Graphic Configuration Tool, and configure a totally customized process to meet your specific application requirements.

In addition, points unused in the control application can be used for supplementary supervisory purposes by the Metasys network.



**Table 3: Flow Chart Module Configuration Options**

Flow Chart Module	Configuration Options
<b>Analog Inputs</b>	Sensor/transmitter ranging High/low limits Filter constants Square root
<b>Control Blocks</b>	PID loops Remote reset logic Operation modes Control limits and alarms Sequencer and step control logic
<b>Digital Inputs</b>	Source points for logic functions Pulse counters with scaling factor (minimum 50ms on / 50ms off for DX and minimum 20ms on / 20ms off for XT/XTM)
<b>Calculation Blocks</b>	Averaging Minimum or maximum select Enthalpy, wet bulb and dew point Input selector Arithmetic calculator Compare logic Line segment function Timer functions Run-time counter Totalizer and Integrator
<b>Logic Blocks</b>	"And", "Or", "Not" State change detect "Set" and "reset" of parameters
<b>Time Schedule Blocks</b>	Yearly holiday calendar Start-stop times for days of week and holidays Optimal start/stop modules (2 modules available)
<b>Analog Outputs</b>	High/low ranging
<b>Digital Outputs (DX-9100 Controller)</b>	Incremental, with or without feedback Duration adjust type On/off, including pulse and start/stop
<b>Digital Outputs (XT/XTM Modules)</b>	On/off, including pulse
<b>Trend Log (for DT-9100 only)</b>	12 channels Analog or binary values Sample rate Full buffer (read request) indicator

## **N**etworking Capabilities

As powerful as the DX-9100 digital controller is by itself or with extension modules, your facility will benefit even more when controllers are part of a larger Metasys system network. A Metasys Network Automation Engine can be programmed to provide added energy management and supervisory control capabilities, such as trend log, historical data storage, electrical demand limiting and more.

The Metasys dynamic data access networking software, available from the Network Automation Engine, makes information from each controller available throughout the facility, so that it is possible, for example, to reset the boiler or chiller discharge temperature set point based on the demand requirements of a group of terminal unit controllers. Dynamic data access also makes sensor values, operating status, and other parameters in the controller available to operators anywhere in your facility.

## **P**recise, Flexible Control

The DX-9100 controller represents the best way to fully optimize the operation of your refrigeration, heating, HVAC or lighting equipment control applications. It can be used as a member of the fully integrated Metasys system, or as a standalone controller, with or without the DT-9100 display unit. It combines ease of setup and operation, flexibility of application, and precise control for comfort and energy management.

## **P**assword Protection of Configurations

The DX controller has an optional feature to prevent unauthorized access to its software configuration. When a configuration is loaded by the Graphic Configuration Tool with a user-defined password, it cannot be uploaded by another tool unless the password is entered.

This feature has been designed to protect standard configurations of OEM (Original Equipment Manufacturer) users.

# Specifications

## DX-9100 Digital Controller, Version 2

<b>Product</b>	<i>DX-9100 Digital Controller, Version 2</i> DX-9100-8454 Controller with LED Display and Keyboard DX-9100-8004 "Black Box" Controller DX-9100-8996 Cabinet Door Mounting Frame DX-9100-8997 Panel Mounting Base DTDX-91-8004 Kit with DT-9100-8204, DX-9100-8004 and DX-9100-8997
<b>Physical Inputs and Outputs</b>	See Table 1
<b>Microprocessor and Memory:</b> (Firmware Version 2.5 and later)	Microprocessor: Hitachi Type: H8S/2350 16 bit RAM: 32 Kbytes EEPROM: 8 Kbytes Flash: 256 Kbytes
<b>Power Requirements</b>	24 VAC $\pm$ 15 %, 10 VA (at 24 VAC) at 50/60 Hz
<b>Ambient Operating Conditions</b>	0° to 40°C / 32° to 100°F 10 to 90% RH Noncondensing
<b>Ambient Storage Conditions</b>	-20° to 70°C / 0° to 160°F 5 to 95% RH Noncondensing
<b>N2 Communications</b>	RS485 interface at 9600 baud
<b>Dimensions (H x W x D)</b>	
<b>Controller with Cabinet Door Mounting Frame</b>	164 x 200 x 114mm / 6.5 x 7.9 x 4.5 in.
<b>Controller with Panel Mounting Base</b>	200 x 184 x 95 mm / 7.9 x 7.3 x 3.8 in. Allow minimum of 160 mm / 6.3 in. depth for hinged door clearance.
<b>Black Box Controller with Panel Mounting Base</b>	200 x 184 x 87mm / 7.9 x 7.3 x 3.5 in
<b>DT-9100, Black Box Controller and Panel Mounting Base</b>	200 x 184 x 135mm / 7.9 x 7.3 x 5.4 in. Allow minimum of 20mm / 0.8 in clearance on each side for DT mounting clips.
<b>Shipping Weight</b>	Controller: 1.8 kg / 4 lbs Panel Mounting Base: 0.8 kg / 1 lb 12 oz Cabinet Door Mounting Frame: 0.8 kg / 1 lb 12 oz
<b>Agency Listings</b>	CE Directive 89/336/EEC EN50081-1 / EN61000-6-3 and EN50082-2 / EN61000-6-2 UL Listed, CSA Certified, FCC Compliant

## DT-9100 Display Unit

<b>Product Codes</b>	DT-9100-8204 Display Unit with Panel Mounting Kit DT-9100-8902 Wall Mounting Kit DT-9100-8901 12 VDC Power Supply for 230 VAC Source DT-9100-6802 Serial communications flat cable 2m long
<b>Communication</b>	RS-232-C (spiral cable provided)
<b>Power Requirements</b>	24 VAC +15%/-10%, 4 VA (at 24 VAC) or 9 to 18 VDC, 2 VA
<b>Dimensions (H x W x D)</b>	150 x 180 x 47 mm / 5.9 x 7.1 x 1.9 in.
<b>Shipping Weight</b>	0.78 kg / 1 lb 12 oz

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**Agency Listings** CE Directive 89/336/EEC  
EN50081-1 / EN61000-6-3 and EN50082-1 / EN61000-6-1  
UL Listed, CSA Certified, FCC Compliant

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## Extension and Expansion Modules

<b>Product Codes</b>	<i>XT and XP Modules without Manual Override</i>		
	XT-9100	Extension Module	5.5 VA
	XP-9102	6 Analog Inputs, 2 Analog Outputs	4 VA
	XP-9103	8 Digital (Binary) Outputs (triacs)	-
	XP-9104	4 Digital (Binary) Inputs, 4 Digital Outputs (triacs)	1 VA
	XP-9105	8 Digital (Binary) Inputs	2 VA
	XP-9106	4 Digital (Binary) Outputs (relay) (European Model)	6 VA
	XP-9107	4 Digital (Binary) Outputs (relay) (North American UL Model)	6 VA
	(See also Table 1)		
<b>Product Codes</b>	<i>XTM and XPx Expansion Modules with Manual Override Option on Outputs</i>		
	XTM-905	Extension Module	5.5 VA
	XPA-421	4 Analog Inputs	4 VA
	XPA-442	4 Analog Outputs	6 VA
	XPA-821	6 Analog Inputs, 2 Analog Outputs	4 VA
	XPB-821	8 Binary Inputs	3 VA
	XPM-401	4 Binary Inputs, 2 Momentary Relay Binary Outputs	4 VA
	XPL-401	4 Binary Inputs, 3 Latching Relay Binary Outputs	5 VA
	XPE-401	4 Binary Inputs, 3 Electrically Latching Relay Binary Outputs	5 VA
	XPE-404	4 Binary Inputs, 4 Electrically Latching Relay Binary Outputs	6 VA
	XPT-401	4 Binary Inputs, 4 Binary Outputs (Triacs)	2 VA
	XPT-861	8 Binary Outputs (Triacs) (Manual Override not available.)	-
	(See also Table 1)		
<b>Agency Listing</b>	All Modules: CE Directive 89/336/EEC EN50081-1 / EN61000-6-3 and EN50082-1 / EN61000-6-1 TR-9100, XPM, XPL and XPE only: CE Directive 73/23/EEC EN 60730 All modules, except XPA-4xx-x: UL Listed, CSA Certified, FCC Compliant		
<b>Power Requirements</b>			
<b>Extension Module</b>	24 VAC +10% / -15 %, 50/60 Hz, 5.5 VA at 24 VAC		
<b>Expansion Modules</b>	24 VAC +10% / -15 %, 50/60 Hz, see above for VA ratings at 24 VAC		
<b>Transformer Module</b>	230 VAC, 50/60 Hz, maximum output 12 VA		
<b>Dimensions (H x W x D) (1 Module)</b>	118 x 70 x 57 mm / 4.7 x 2.8 x 2.3 in.		
<b>Shipping Weight</b>	Extension Module: 0.15 kg / 5.3 oz Expansion Module: 0.12 - 0.25 kg / 4.2 - 8.8 oz, depending on module type Transformer Module: 0.47 kg / 1 lb 1 oz		

*The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.*

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