–METASYS®

Air Handling Unit Controller

The Metasys® Air Handling Unit (AHU) Controller is a complete digital control system for most common air handling configurations, including single zone, variable air volume, multi-zone, and dual duct. The AHU Controller is designed to reduce energy expenses while keeping occupant comfort its top priority, and meets both goals admirably.

The AHU Controller has both hardware and software flexibility to adapt to many control variations in both new construction and retrofit applications. It can communicate on the Metasys N2 Bus, seamlessly providing all point and control information to the rest of the network. In a smaller facility, the AHU Controller is the perfect standalone controller. In either case, the AHU Controller, like the rest of Metasys, is simple to operate--and simply outstanding at providing efficient control and management of your facility's mechanical systems.

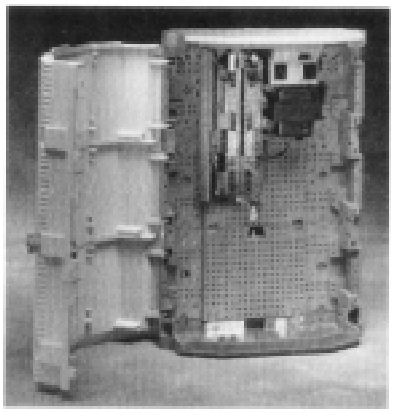

Figure 1: Air Handling Unit Controller

Features and Benefits

❑ **Standalone Control of Each Air Handling Unit**	System reliability
❑ **Network Communications Over N2 Bus**	Facility-wide control efficiencies and cost effective sensor sharing
❑ **Fully Integrated Modular Packaging**	Purchase only needed parts
❑ **Complete Line of Compatible Sensors, Actuators, and Accessories**	Total system solution
❑ **Interfaces to Both Pneumatic and Electric Actuators**	Low cost installation for both new construction and retrofit applications

Code No. LIT-635055

*M*odular Hardware Packaging

The AHU103 family of compatible components make it ideal for field installation. The AHU103 has four basic parts: the controller board, base module, transformer/power box, and enclosure. The EWC type enclosure provides ease of mounting and wiring. The enclosure also provides additional space for mounting field gear. The base module AHU100 comes pre-mounted in the enclosure, providing screw termination for the system inputs and outputs.

The AHU102 controller electronics is a separate circuit board that plugs into the base, which provides easy service and protection of the electronics during installation. The AHU103 includes the AHU102 controller board. A 100 VA transformer is provided for the AHU102 control electronics and output loads. The power box, also furnished, has two AC outlets and a power switch for the transformer. A latching door on the power box provides easy access to the AC power wiring for the installer. The entire enclosure has a lockable door for security.

One or more Line Voltage Relay kits can be added to the enclosure. Each kit provides two pilot duty switched outputs. The kit contains two SPDT relays, each of which can be controlled by any of the AHU Controller's binary output points. Each relay kit also includes a manual Hand-Off-Auto (HOA) switch for local overrides. The HOA switches can be monitored by a binary input on the AHU Controller. This allows an alarm report whenever an output has been placed in the "Hand" or "Off" positions.

One or two function module kits can also be installed into the AHU103 enclosure. Each houses two to four function modules, which provide the AHU Controller with direct connection to differential pressure inputs and pneumatic transmitters.

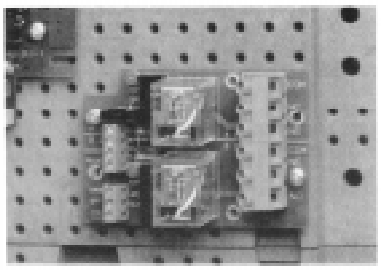

Figure 2: Relay Kit (AS-RLY002)

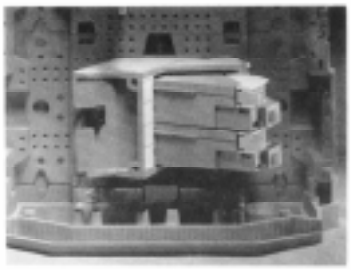

Figure 3: Function Module Kit (AS-FMK102)

Components

Described below are the components of the AHU103 and a family of compatible devices. The system may be configured for any combination of electric or pneumatic requirements.

EWC Enclosures

The AHU103 is installed in a 3-high EWC enclosure, which provides space for mounting field gear. If more space is required, additional sections (EN-EXP101-0) can be added. A section can also be added with a view window to monitor equipment.

Controller Base Module (AS-AHU100)

The AHU100 board plugs into the base module where all field and local terminations are connected. The base module provides terminations for an optically isolated N2 Bus, power supply, zone bus, and two phone jacks to connect the controller to a laptop PC, Zone Terminal Unit (ZTU), or Metastat™ with terminals.

Cable connections are available for the line voltage relay boards and function modules.

Controller Electronics Board (AS-AHU102)

The controller board plugs into the AHU100 module. The AHU102 is temperature rated for equipment room application, and will process 16 inputs and 16 outputs, directly wired, as shown in Table 1.

When connected to a Metasys Network or Metasys Companion™, the controller board communicates to the system via the N2 Bus. Whether in a network or standalone configuration, communications to the laptop PC, ZT, and digital actuators are via the Zone Bus.

Table 1: Sensors and Actuators

Point Type	Quantity	Characteristics
Analog Inputs	8	Jumper selectable for the following types: 0 to 10 VDC from any type of transmitter, range adjustable (0 to 5 VDC, 1 to 2 VDC, etc.) 4 to 20 mA from any type of transmitter, (range adjustable) IAP Function Module (0 to 25 psi) IDP Function Module (0 to 10.0 in wg or ± 5 in wg, 7 ranges) Resistance, (1000 ohms nominal) from nickel, 1000 ohm platinum sensors, or silicon temperature sensors
Binary Inputs	8	0 to 15 VDC, dry contact, TTL thresholds
Binary Outputs	10	24 VAC Triacs @ 0.5 amps. Optional Relay Kit (AS-RLY002-0) available for 240 VAC @ 5 amps per relay.
Analog Outputs	6	0 to 20 mA to any type of receiver or to the OAP Function Module. Output zero and span are adjustable. 0 to 10 VDC (using a 500 ohm resistor) to any type of actuator, range adjustable. Zone Bus for up to six M100CGA-2 Actuators, which duplicate the analog outputs.

Zone Terminal (AS-ZTU100)

The Zone Terminal (ZT) is a person/controller interface developed as an easy-to-use controller adjustment and indication device. The ZT is designed for the user who needs a direct method to monitor and adjust points in the controller. The ZT plugs directly into the AHU Controller, or it may be used at any remote Zone Bus location through a function module kit, relay kit, or Metastat.

The ZT can also be permanently connected to an AHU Controller by mounting the unit on a nearby wall, directly to the door of the AHU103 enclosure or inside the EWC enclosure, using the wall mount base. The dedicated ZT provides alarm indication and scheduling for the controller, thereby completing the standalone AHU Controller strategy.

Function Module Kit (AS-FMK102)

The function module kit provides the enclosure and termination board to connect up to four, single-slot Function Modules (FMs) to the AHU. The applicable modules (ordered separately) may be from any mix of IAP, IDP, or OAP FMs (see below). Tubing connections and field terminations are simple due to the tubing and tie wrap anchors provided. Multiple kits may be used per controller, limited by the controller's input/output capacity.

The kit mounts either inside the AHU103 enclosure or remotely. When mounted remotely, a phone jack on the kit extends the controller's Zone Bus to allow easy setup and troubleshooting by the laptop PC from a remote location.

IAP 101-0 Input Pressure to Electric Analog Transducer

The IAP is a pneumatic transducer interface, converting input air pressure (0 to 25 psi) to an analog signal range (0 to 20 mA). It occupies one slot in the FMK, and is identical and interchangeable with IAPs used with other Metasys devices. The AS-CBL100 kits provide quick connections for two IAP/IDP modules mounted side by side.

The separately ordered Pneumatic Connector Module (FM-PCM101) provides rough-in port connections for the tubing, then plugs into the IAP at commissioning.

IDP Series Static or Velocity Pressure Transducer

Each IDP Function Module converts static or velocity pressure (range depends on the particular IDP type) to a 0 to 20 mA analog signal. It occupies one slot in the FMK, and is identical and interchangeable with IDPs used with other Metasys devices.

The separately ordered Pneumatic Connector Module (FM-PCM101) provides rough-in port connections for the tubing, then plugs into the IDP at commissioning.

OAP103-0/102-0 Analog Output--Electric to Air Pressure Transducer

The OAP is a pneumatic transducer that accepts a 0 to 20 mA analog signal from the controller and provides a corresponding air pressure output (user set from a 0 psi base). It occupies two contiguous slots in the FMK. Cable connections are provided using an optional cable kit (screw type terminal connections are used when the FMK102-0 is remotely mounted).

The OAP103-0/102-0 provides a local Auto/Manual switch, which can be wired back to a binary input at the controller to inform the Metasys Network of the switch status. The OAP102-0 and OAP103-0 are ordered separately.

Relay Modules (AS-RLY100, RLY050, RLY002)

The RLY100 includes 4 relays; the RLY050 and RLY002 include 2 relays. The RLY050 and RLY100 come with a metal enclosure with conduit knock-outs for both low and line voltages. The RLY002 is a single module with standoffs for mounting in the EWC and other enclosures. A phone jack in any RLY provides communications to the controller by extending the Zone Bus.

The relays contain contacts which are Form C type SPDT rated for line voltage. The relays are UL/CSA approved and have an output rating per relay of up to 250 VAC at 5 amps AC inductive load. Each relay has an LED to indicate an energized state and a Hand-Off-Auto switch to provide local control. The Hand-Off modes can be wired back to a binary input at the controller to supply manual override status information to the Metasys Network.

When a Relay board is installed within three feet of the controller, CBL100 cable kits are available to connect the controller's binary outputs to the relays. When the module is remote from the controller, connections are made with discrete wiring, using screw terminals.

Multiple Relay Modules may be connected to a controller. In addition, jumper wires can operate multiple relays per controller binary output (e.g., 3 PDT action).

Convenient Configuration Setup

The AHU Controller does not need to be programmed in the traditional sense. Instead, the control algorithms and input/output point assignments are configured with the use of the HVAC PRO for Windows™ software tool. The HVAC PRO for Windows runs on a laptop computer plugged directly into the AHU Controller or into a phone jack at the connected Metastat room sensor. These jacks are connected back to the AHU Controller over a 3-wire cable called a Zone Bus. Programs loaded into the AHU Controller are saved in non-volatile EEPROM memory, so there is no need to reload software after a loss of power.

Programming an AHU Controller is a simple matter of responding to a series of "yes/no" and multiple choice questions, and specifying setpoints and other parameters. No previous software programming experience is required. The AHU Controller has a library of proven control sequences and Proportional-Integral-Derivative (PID) algorithms that are automatically configured into a total system sequence-of-operation in response to your answers to the questions.

Once configured, the AHU Controller's operating parameters, such as setpoints, gains, alarm limits, and so forth may be changed from any Metasys operator device.

Standalone Configuration

The controller connects to function modules, relay kits, and the Zone Terminal using discrete wiring, whether those modules are mounted adjacently or remotely. The Zone Bus accommodates daisy chain, star, or combination configurations for M100CGA-2, laptop PC or ZTU connections.

Access to the standalone AHU system is through the laptop PC or Zone Terminal, which connects to a phone jack on the controller termination board. Phone jacks are also mounted on function module kits and CBLCON's, extending the Zone Bus when kit locations are remote.

Using the HVAC PRO for Windows software, an operator configures, commissions, and diagnoses the entire standalone system.

Figures 4 and 5 show the arrangement of different AHU installations: an all-electric installation and-pneumatic installation.

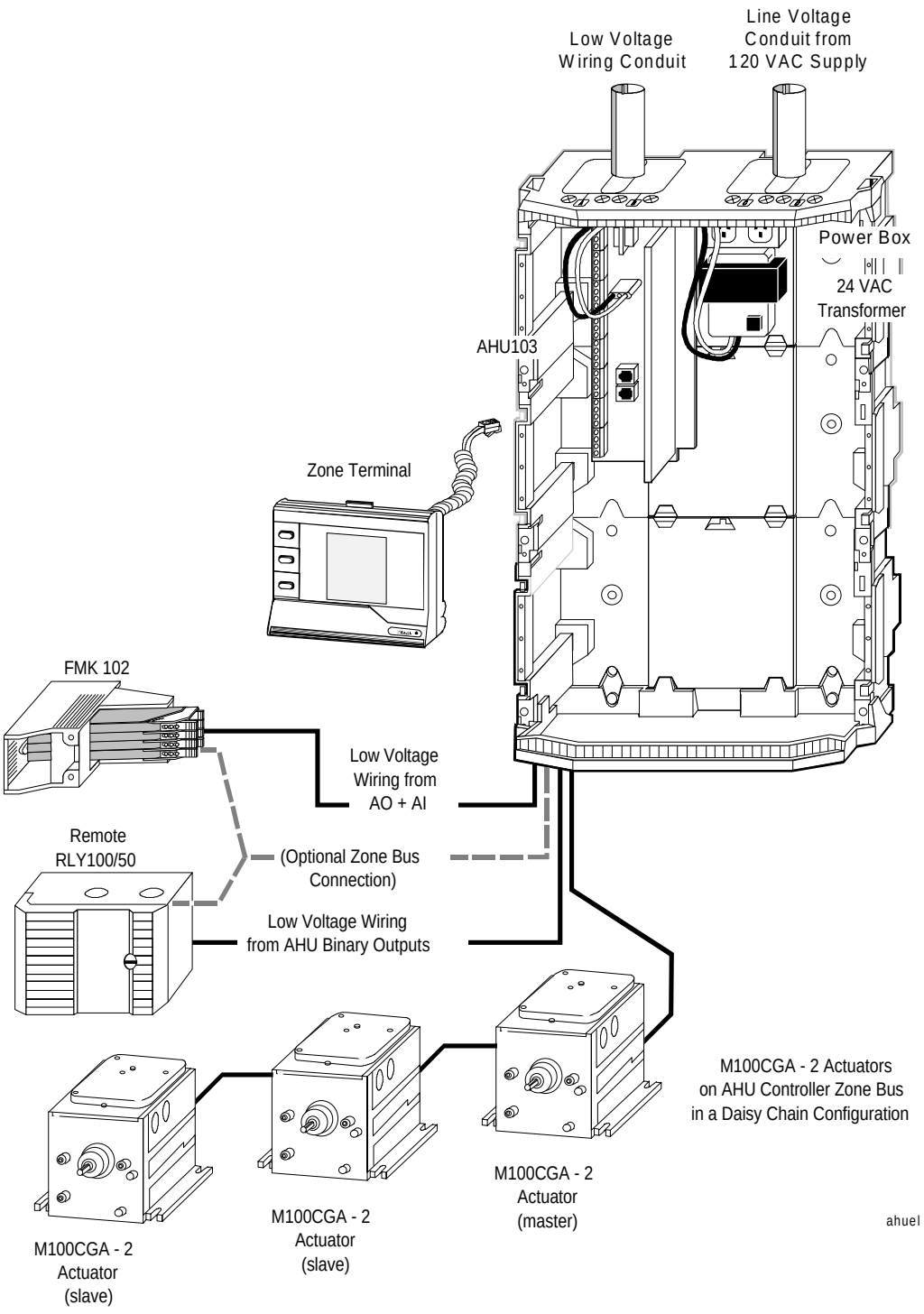

Figure 4: Auxiliary Gear Mounted Remote to AHU Controller

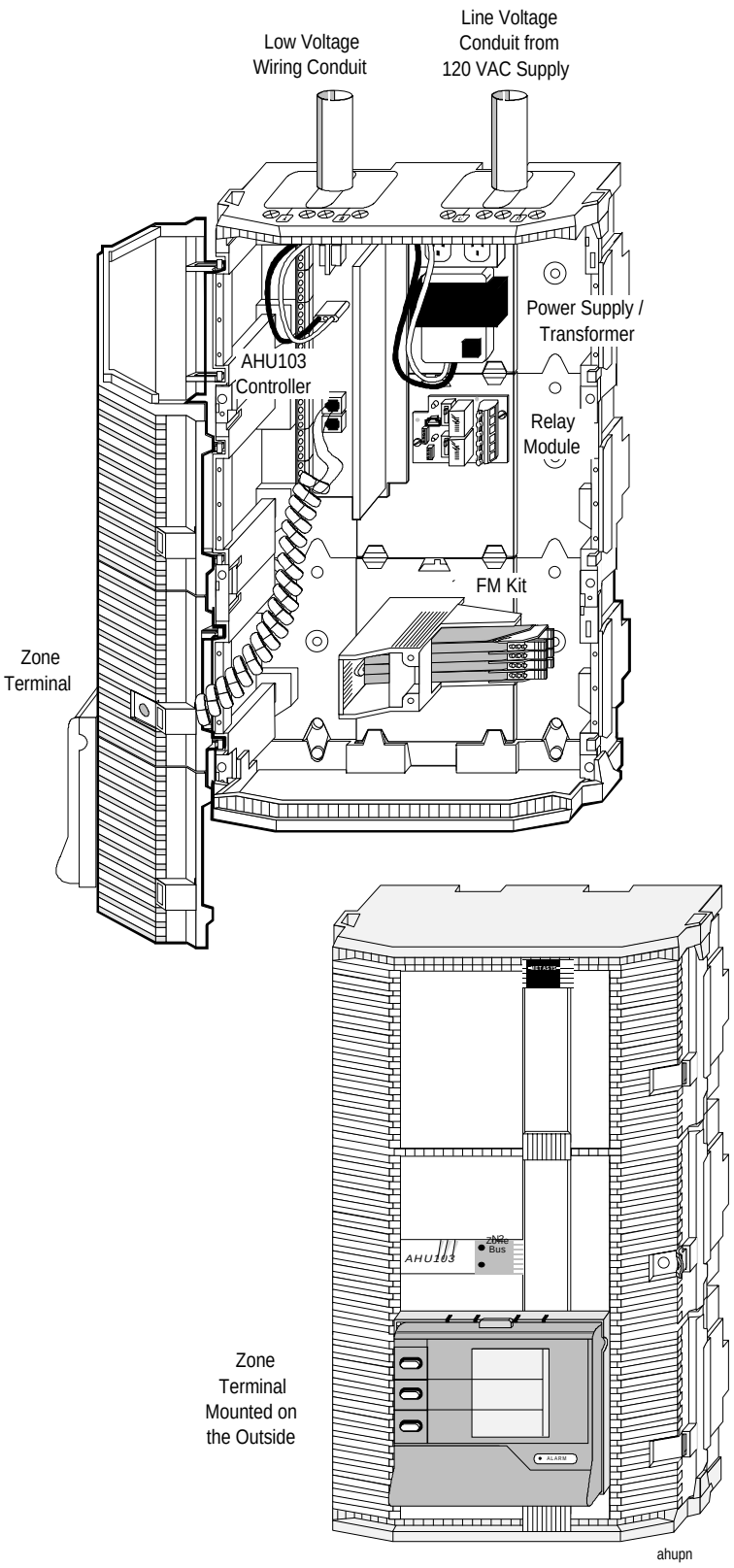

Figure 5: Auxiliary Gear Mounted Inside Universal Packaging Module (UPM)

Metasys Network Configuration

As powerful as the AHU Controller is by itself, your facility will benefit even more when AHU Controllers are part of a larger Metasys Network. Each AHU Controller can connect to the Metasys N2 Bus (Figure 6). Either a Network Control Unit or Companion System can be programmed to provide added energy management and supervisory control capabilities, including optimal start, demand limiting, load rolling, run time totalization, and more.

Metasys Dynamic Data Access™ networking software, available from the Network Control Unit, makes all information from each AHU Controller available throughout the facility. Therefore it is possible, for example, to reset chiller or boiler temperatures based on the load demands of the AHU Controllers throughout the facility. All HVAC control is still handled by the AHU locally.

The full functions of the Operator Workstation and Network Terminal apply to the AHU: displaying values, setting points, and changing parameters. An optional Zone Terminal is the local operator interface to the AHU.

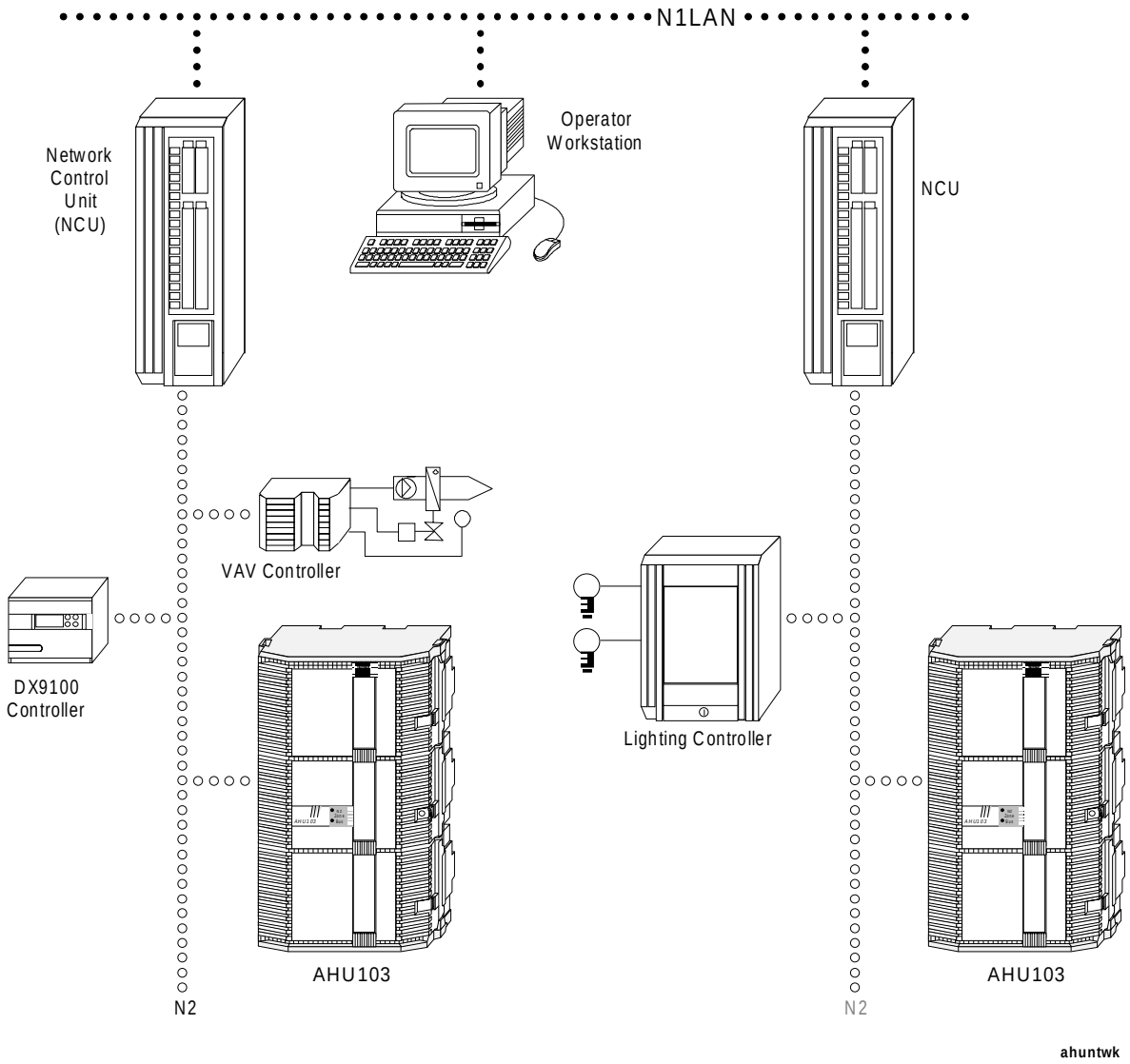

Figure 6: AHU Controller in Metasys Network

Metasys Companion Configuration

The Metasys Companion connects to the AHU Controller over an independent N2 Bus (Figure 7). User access is through the Companion, which implements built-in energy management programs throughout the devices on the Bus.

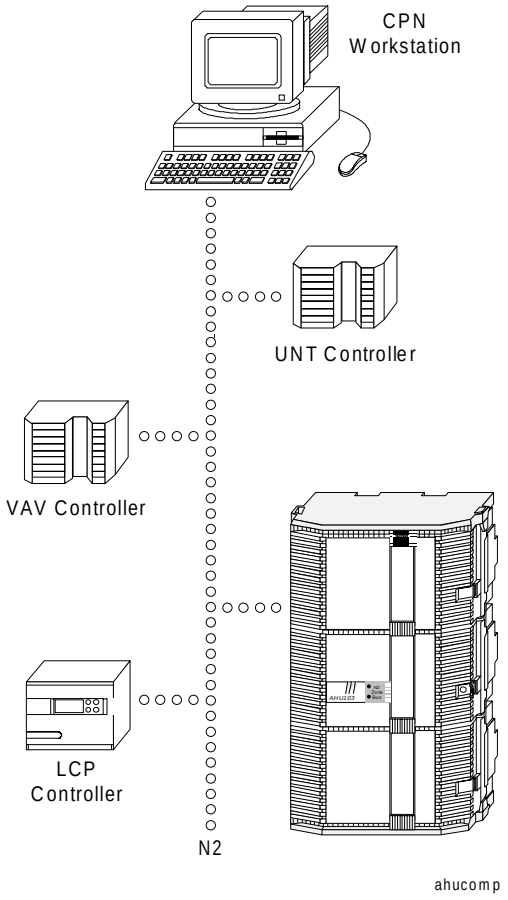

Figure 7: AHU Controller in Companion System

Sensors and Actuators to Complete the System

The AHU Controller is matched with a family of sensors, actuators, control valves, and dampers needed to complete the control of any air handler. Its sensor inputs can accept both economical passive temperature sensors as well as industry standard 4 to 20 mA or 0 to 10 VDC transmitters. Outputs are available to control both electric and pneumatic actuators, as well as motor starters and staged heating and cooling.

*A*pplication Flexibility

The AHU Controller can be configured in software to control single and dual path air handlers using either mixed air or 100% outside air. In addition, points unused in the air handler control scheme can be used in independent control loops, or in supervisory monitoring and control applications by the Metasys Network.

Table 2: Applications and Options

Application Classifications	Software Options
Primary Equipment Types	Mixed air single path Mixed air dual path 100% outside air single path 100% outside air dual path
Primary Control Strategies	Room control Room control of cooling, room reset of heating Return/exhaust air control, constant discharge setpoint Room reset of discharge setpoint Return air reset of discharge setpoint Hot/cold deck reset from coldest/warmest zone
Economizer Strategies	Dry bulb Enthalpy comparison Outside air enthalpy Differential outside/return air temperature Binary input from external economizer Vent and purge operation
Minimum Outside Air Strategies	Single damper with minimum position Separate damper--2-position Separate damper--minimum air flow station
Air Quality	Minimum position or min. flow reset by CO_2 sensor
Preheat Configuration	2-position Face and bypass valve control Modulated single coil Staged electric heat Circulating pump on/off logic Preheat lockout logic
Continued on next page . . .	

Application Classifications (Cont.)	Software Options
Heating Configuration	2-position with face and bypass control Modulated single coil Staged electric heat Modulated common heating/cooling coil Circulating pump on/off logic Heating lockout logic
Cooling Configuration	2-position with face and bypass control Modulated single coil Staged DX Modulated common heating/cooling coil Circulating pump on/off logic Cooling lockout logic
Dehumidification	High signal select with cooling command Addition of dehumidification and cooling commands
Humidification	Modulated steam valve Staged electric heaters
Fan Start/Stop	Supply fan only Supply fan and return fan
Static Pressure Control	Single supply fan Two speed fan Variable speed fan
Fan Volume Matching	Single supply and single return fan, differential CFM
Unused Input/Output Control Loops	Analog input to analog output Analog input to binary output Binary input to analog output Binary input to binary output
Unoccupied Control	Setup and setback Night cycle Morning warmup and cooldown

*M*ore Software Capabilities

You can assign high and low alarm limits to all analog inputs, which alerts the operator at the Metasys Operator Workstation or Companion terminal when a problem occurs, such as a temperature or static pressure exceeding a safe value.

The AHU Controller also maintains a software time-of-day clock and can store back-up on/off schedules. These schedules will keep your fan systems in the proper operating mode even if there is a communication failure with the Network Control Unit or Companion controller. The ZT can extend this single schedule to a yearly one with holidays.

*C*onclusion

As either a member of the fully integrated system or as a standalone controller, the AHU Controller represents the best way to fully optimize the operation of your air handlers. It combines the best of ease of setup and operation, flexibility of application, and precise control for comfort and energy management.

Specifications

Product	AS-AHU103-300 Enclosure, Transformer, Base Module and Controller Electronics Board
Power Requirements	24 VAC, 50/60 Hz at 100 VA (from XFR100-0 Module) (AHU102 requires 16 VA, this does not include the power required for binary outputs)
Ambient Operating Cond.	32° to 122°F (0° to 50°C) 10 to 90% RH
Ambient Storage Cond.	-40° to 158°F (-40° to 70°C) 10 to 90% RH
Dimensions (H x W x D)	22.9 in. x 15.5 in. x 5.6 in. (58.2 cm x 39.4 cm x 14.2 cm)
Shipping Weight	20.0 lb (9.07 kg)
Agency Compliance	FCC Part 15, Subpart J, Class A UL916 UL864 CSA C22.2 -205 IEEE 472 IEEE 518 IEEE 587 category A+B
Agency Listings	UL Listed and CSA Certified as part of the Metasys Network.
Accessories	**(Order Separately)**
Zone Terminal	AS-ZTU100-1
ZT Wall Base	AS-ZTUWMB-0
Transformer Kit	AS-XFR100-0 (included in AHU103), AS-XFR050-0
Function Module Kit	AS-FMK102-0 or AS-FMK100-0
HVAC PRO for Windows Interface	AS-CLBPRO-2 or MM-CVT101-0
Line Voltage Relay Kits	AS-RLY100-0, AS-RLY050-0, AS-RLY002-0
Generic Enclosure Kit	EN-EWC35-0 (included in AHU103)
Interconnect Cables	AS-CBL100-0
UPM Expansion Kit	EN-EXP101 Enclosure Expansion EN-WIN101 Window
Repair Parts	AS-AHU100-0, AS-AHU102-0

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.

JOHNSON CONTROLS

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