



## Network Control Unit, Network Expansion Unit

*The Network Control Unit (NCU) is a modular, intelligent panel that is the heart of the Metasys® Network. Use an NCU where complex, high-performance control is demanded, such as central plant heating, ventilating, and air-conditioning. The NCU also coordinates independent Application Specific Controllers (ASCs) over a communications network.*

*A companion product, the Network Expansion Unit (NEU), allows you to expand the I/O point and control loop capacity of the NCU. The NEU is a remote panel that communicates with the NCU.*



**Figure 1: NCU/NEU**

<b>Features and Benefits</b>	
<input type="checkbox"/> <b>Modular Design</b>	Accommodates a family of modules for economical installation, service, and future expansion.
<input type="checkbox"/> <b>Molded, Hardened Packaging</b>	Meets the structural and safety standards set by metal, but vastly reduces labor costs.
<input type="checkbox"/> <b>Integrated Auxiliary Gear</b>	Assembles field interfaces (pneumatic and electric) and electronic components into an integrated package for “single panel” installation savings and system reliability.
<input type="checkbox"/> <b>Continuously Self-Tuning Proportional-Integral-Derivative Control Algorithm</b>	Dynamically fine tunes--or changes--control strategy to improve performance and energy efficiency. Makes managing your facility simple.
<input type="checkbox"/> <b>Manual Overrides/Status LED Indicators</b>	Local operator monitoring and control makes the system easy to use.
<input type="checkbox"/> <b>Distributed Architecture</b>	Multiple processor and power supply architecture shares and accelerates control processing ability, dispensing with a headend and improving the system reliability.

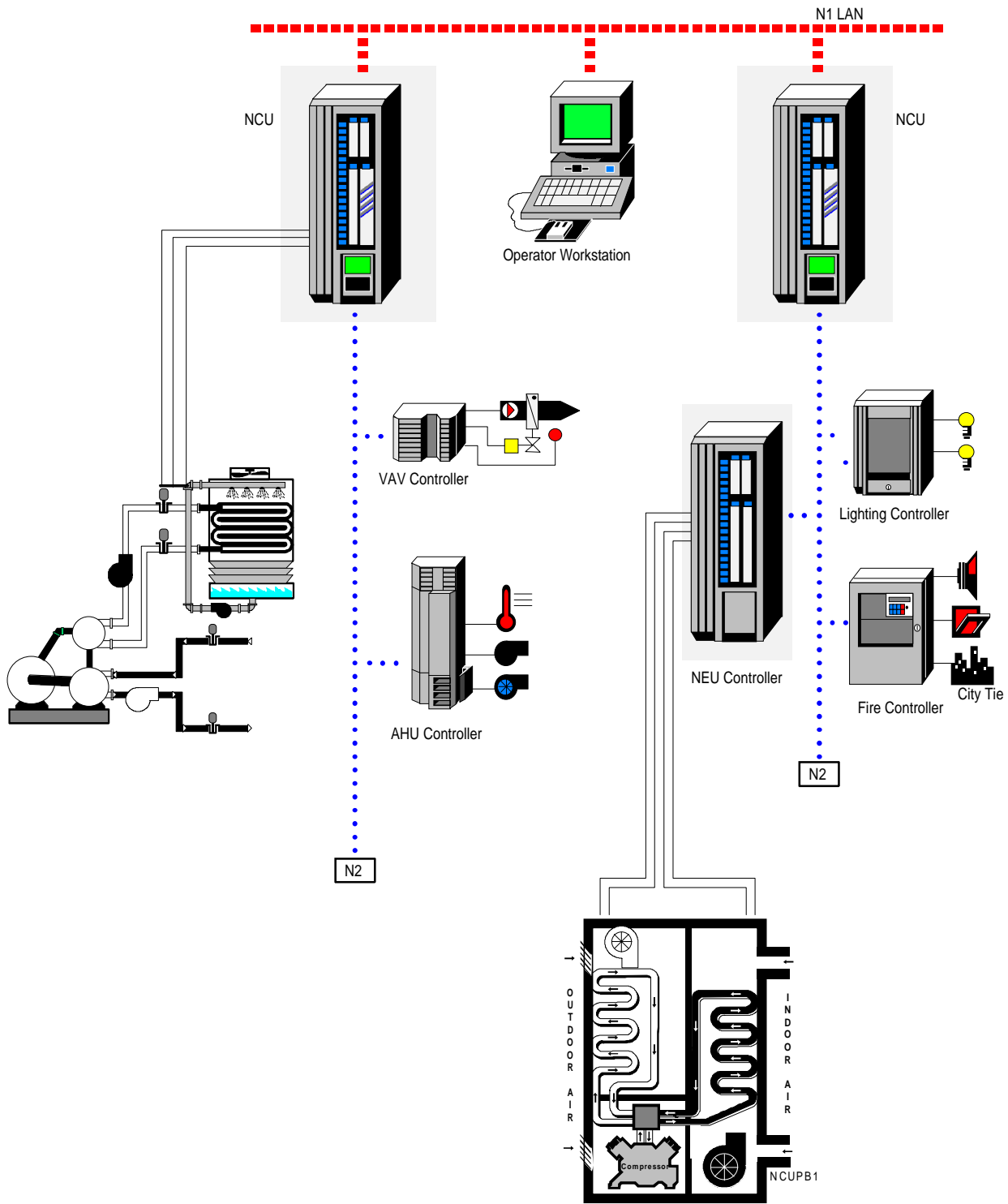


Figure 2: System with Two Network Control Units and One Network Expansion Unit

## **M**odularity for Multiple Applications

The NCU is a high-performance field panel configured from a family of compatible electronic, electrical, and pneumatic modules. This modularity allows the NCU to handle a wide array of control duties.

In small facility applications, an NCU serves as the main control panel. Its flexibility in connecting I/O points makes it the perfect controller for setting up and running all control applications. Using a combination of resident applications and custom user-written programs, the NCU operates equipment at peak efficiency while maintaining optimum occupant comfort. The NCU communicates to the building manager through local override controls, an easy to use Network Terminal, and local or remote graphic Operator Workstations and printers.

Medium and large facilities can use several NCUs, each of them controlling a portion of the facility. NCUs network together via the N1 LAN to share their information. Unlike other systems, this sharing is unlimited and allows any NCU access to any information available to any other NCU. More than just “peer-to-peer,” the ease with which the N1 LAN allows complete information sharing is called Dynamic Data Access™. This is a breakthrough in Facility Management Systems, making practical the ability to totally integrate every facet of a building’s operation on a single network.

By sharing all information with each other over the network, the NCUs are able to take advantage of sophisticated control algorithms to provide facility-wide optimization. Together, the NCUs make thousands of calculations--instantly--to determine the most efficient operations of such things as the chillers under the control of one NCU with the systems under the control of another.

The NCU can serve still another function: as the network operator interface. The NCU organizes information for operator reports and responds to that operator’s commands and program changes. Since each NCU has total access to all NCU data on the N1 LAN, operator access through one NCU is the same as access to all NCUs.

The NCU also coordinates a local network of Application Specific Controllers (ASCs) as they perform HVAC, lighting, fire, and access control functions. In this application, the NCU provides alarm monitoring and integrated control functions for the standalone controllers.

Carrying out even one of these many functions would be a major accomplishment for many controllers, but the Metasys NCU handles them all with ease.

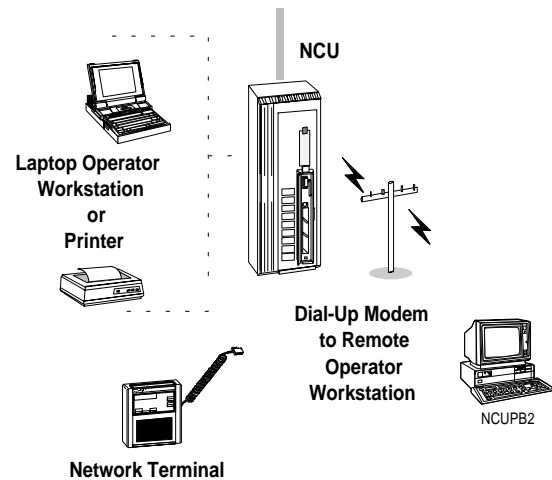
## Simple, Versatile System Access

The building operator has access to the entire Metasys Network through a family of operator interface devices attached to the NCU. Three ports are available for use by operator devices. One port is a standard RS-232 connection to which either an Operator Workstation or output printer may connect.

The second is dedicated to the Network Terminal--a portable or panel mounted input/output device. Like the Operator Workstation, the Network Terminal has access to all parts of the network. It is used for point monitoring, overrides, setpoint adjustments, schedule changes, and parameter modifications.

The third port supports RS-232 connectors including an external modem. This provides access to the entire network via remote monitoring by either an Operator Workstation or an output printer.

The NCU supports a multi-user environment, which means that any number of operators can be accessing information in the NCU at the same time.



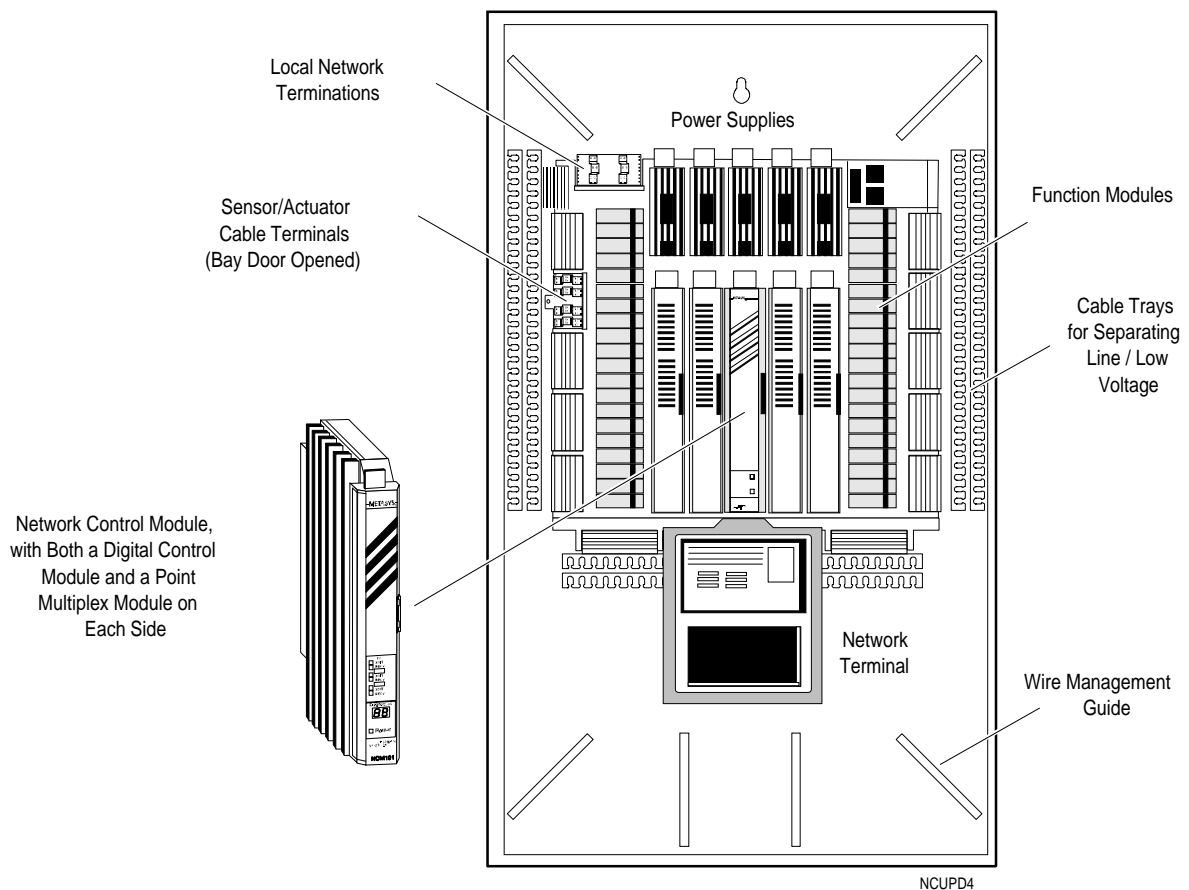
**Figure 3: Multi-User Environment Options**

## Modules--The Foundation of the NCU/NEU

There are five basic types of modules that mount inside an NCU (four inside the NEU):

- Network Control Module (Only in NCU)
- Digital Control Module
- Point Multiplex Modules
- Function Modules
- Power Supplies

The following pages detail the purpose and features of each module type. Together, inside an NCU or NEU, they provide outstanding control performance and reliability in a modular design that's easy to install and service. They combine a library of proven, powerful software features with user-programmed flexibility, making the NCU and NEU cost-effective for a wide variety of custom control applications.



**Figure 4: Modules of the Network Control Unit**

## Network Control Module

The Network Control Module (NCM) is the main processor in the NCU. Fully user-programmable, it is responsible for supervisory control activities for the points and control loops connected to the NCU and all NEUs and application specific controllers with which it communicates on its local buses.

You choose your NCM's configuration, whether as a standalone controller, a node on the N1 LAN working in concert with other NCMs, or as a connectivity path (bringing other systems under Metasys control or interfacing Metasys to a host system). The battery-backed memory of the NCM stores application programs, user data bases, and point histories. Every NCM includes the software features described in this section to coordinate system-wide efficiency, keeping you informed and in control while ensuring occupant safety and comfort.

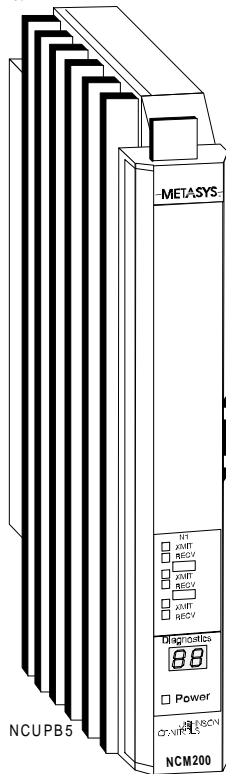


Figure 5: NCM as Plug-in Module

The NCM comes in two different packages, as a plug-in module or as a standalone unit.

As a module (Figure 5), it plugs into the base frame unit and can be combined with Digital Control Modules or Point Expansion Modules.

As a standalone unit (Figure 6), it mounts in a smaller enclosure (Figure 7) for applications that do not require local field I/O. The standalone NCM supports ASCs and NEUs.

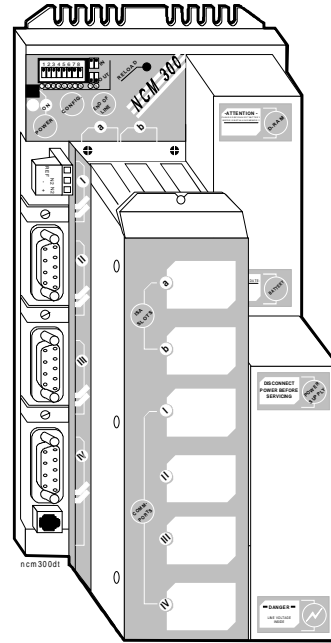
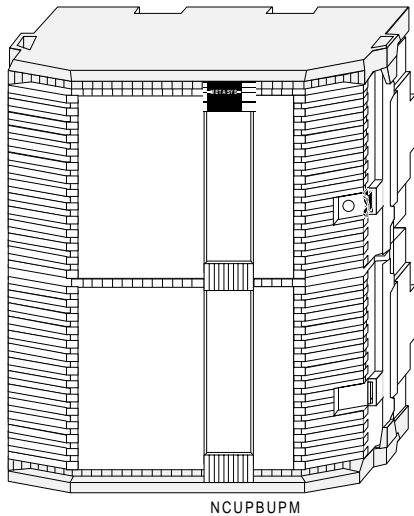


Figure 6: Standalone NCM



**Figure 7: Universal Packaging Module (UPM) for Standalone NCM**

***Scheduling***

Scheduling provides a long-term, system-wide means for issuing commands to points (e.g., on/off, or setpoint adjustment). Establish control on a time-of-day, day-of-week, or calendar basis. Virtually any number of commands may be scheduled per point.

***Totalization***

Capabilities of the NCM include Runtime Totalization, which keeps track of total operation hours for fans, pumps, and other equipment monitored or controlled with a binary point. Analog Totalization and Pulse Totalization monitor the consumption of chilled water, steam, gas, electricity, or other variables measured by either analog or pulse input sensors. Event Totalization counts how many times something has occurred, such as a compressor cycling on and off.

***Demand Limiting***

Demand Limiting monitors your building’s electrical meters and predicts what the electrical demand will be. Should the prediction exceed a target value, the feature temporarily turns off non-essential equipment. The *Load Rolling* feature cycles equipment on and off to reduce electrical power consumption.

***Control Processes***

User-written control processes allow programming of additional application features into the NCM. With the powerful Graphic Programming Language, even a non-programmer can write specialized programs for optimal start time control, night setback, outside air economizer programs, chiller plant optimization, and more. Enter these energy-saving programs from an Operator Workstation, then load them into the NCM over the N1 LAN, or through the direct RS-232 connection.

***Password Protection***

The NCM provides Password Protection. Each operator is assigned an eight character password ID. The ID is programmed to indicate which level of command authority will be granted, and which groups of points the operator has access to.

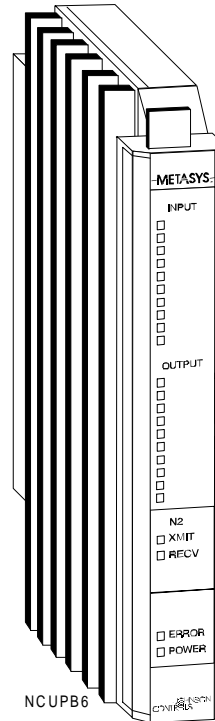
***Trending***

Trending monitors changes in a point’s value over time as a means to collect data when the system is operating properly, and to help diagnose problems in your facility.

## Digital Control Module

The Digital Control Module (DCM) connects points to the NCU/NEU, and performs direct digital control of valves, actuators, variable speed drives, etc. The DCM is actually a co-processor for the NCM, executing Proportional-Integral-Derivative (PID) loop calculations. This frees the NCM to perform duties

such as scheduling, interlocks, and operation sequence. Each DCM supports up to 20 universal input and 20 universal output points. These points can be inputs and outputs for the DCM's PID algorithm, or they can be used independently for supervisory monitoring or control by the NCM.



**Figure 8: Digital Control Module**



## Function Module

Function modules connect the sensor input and control output points to the DCM.

A variety of input function modules exist to provide signal conditioning and protection for the electronics of the DCM. Each input function module can process one—or a combination—of these signal types:

- Pneumatic, including a wide range of differential pneumatic signals
- Binary, dry contact or 120 VDC/VAC
- Voltage, 0-10 VDC or 120 VDC/VAC
- Current, 4-20 mA
- RTD elements, both 1000 and 100 ohms

A variety of output function modules convert the electronic signals of the DCM into signals directly capable of controlling motor starters, actuators, etc.

The types of output control signals include:

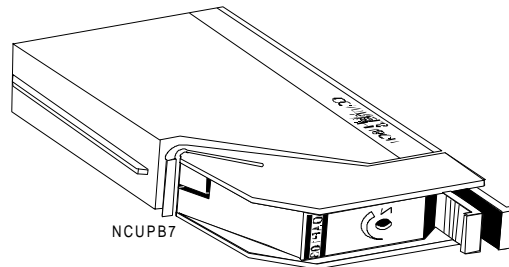
- Pneumatic, 1-19 psi
- Voltage, 0-10 VDC
- Current, 4-20 mA
- Electrically isolated, if a ground reference is in the controlled device
- Binary, for 2-wire, incremental devices
- Triac, to control 24 VAC for 3-wire incremental devices
- Solenoid, for 2-position or switching control of pneumatic circuits
- Relay, including electrically maintained, magnetically latched, or momentary

The output function modules have manual override controls to allow the building operator to directly control both binary and analog outputs. These manual overrides are constantly monitored by the DCM—use of one is immediately reported to the system operator.

The reporting mechanism prevents temporary overrides from becoming permanent, which could compromise energy management plans.

If the output is part of a PI or PID control loop, switching the output into “Manual” also puts the control loop into a tracking mode. The DCM monitors the controlled variable so that it can gracefully bring the output back into control when it is eventually placed back into “Automatic” mode. This feature provides a bumpless transfer of control from manual to automatic modes.

Using function modules makes the DCM compatible with a large variety of sensor and control output types, both electric and pneumatic. In addition, the robust design of the DCM electronics virtually eliminates the need for shielded cable in all but very electrically noisy environments. This means retrofit applications are cost effective for NCUs and NEUs, since most of the building’s existing sensors and actuators can be reused.



**Figure 9: Function Modules Plug into an NCU or NEU**

## Point Multiplex Modules

The Point Multiplex Modules (XM) economically interface points used for monitoring or supervisory control applications. They are perfect for adding point capacity in applications where the power and sophistication of a DCM is unnecessary.

Unlike the DCM, which has universal inputs and outputs characterized by function modules, each XM has a fixed input/output point configuration. All line-voltage relays, manual override controls, and other signal conditioning circuitry are housed with the electronics inside the XM. A family of XMs is available, differing only in point I/O mix. The next two charts index the capabilities of each XM.

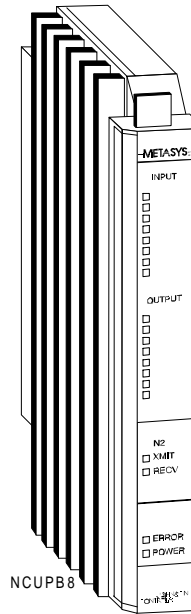


Figure 10: The XRE of the Point Multiplex Family

Table 1: Input-Only Point Multiplex Module

Multiplex Binary (XBN)	
<b>Method</b>	32 inputs monitoring: - Dry contacts - AC - DC - Frequencies of 10 Hz or less
<b>Indicators</b>	32 LEDs (software configured) Point status change reports to NCM
<b>Applications</b>	Monitors the status of 2-position devices such as fans, pumps, or security panels. Voltage input from a starter or pilot device can also indicate that the equipment has changed state. In addition, the XBN can detect pulses from flow meters, electric utility meters, or other pulse output devices whose frequency is 10 Hz or less.

**Table 2: Input/Output Point Multiplex Modules**

	<b>Multiplex Relay Electrically Maintained (XRE)</b>	<b>Multiplex Relay Latched (XRL)</b>	<b>Multiplex Relay Momentary (XRM)</b>
<b>Method</b>	8 inputs: Same as XBN. 8 outputs: Electrically maintained Form C relay outputs.	8 inputs: Same as XBN. 8 outputs: Latching Form C relay outputs.	8 inputs: Same as XBN. 8 outputs: Momentary relay outputs, each with a set of Form A and Form C contacts.
<b>Control Type</b>	2-wire control	2-wire control	3-wire momentary control
<b>Power Failure</b>	The starter circuits de-energize; upon power restoration, the equipment does not immediately restart and cause a surge in demand. The user instead restarts safely and orderly via software commands.	The relay stays in the last position commanded--much like a light switch--even after loss of power.	The starter circuits de-energize; upon power restoration, the equipment does not immediately restart and cause a surge in demand. The user instead restarts safely and orderly via software commands.
<b>Applications</b>	Large air handler fans, large pumps, and other 2-wire devices that require a controlled startup after AC power loss.	Exhaust fans, which require minimal power and would be time consuming to manually restart; enabling circuits, for equipment under separate panel control; or other 2-wire devices that restart immediately after power returns.	Motors, pumps, pulse-on/ pulse-off lighting contactors, and other 3-wire devices that require a controlled startup after AC power loss.

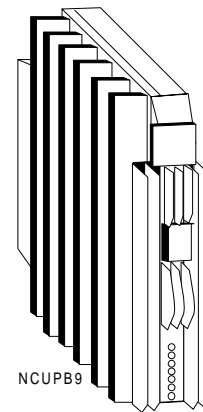
**Power Supply**

A power supply module (one for each electronic module) regulates and filters incoming line-voltage and protects against brownout. To reduce your spare parts inventory, the same model of power supply services all electronic modules.

The advantage of separate power supplies is that they simplify service—you can turn off the power for one module while leaving all other modules in the NCU or NEU fully operational. Multiple power supplies also increase your system’s reliability by eliminating noise propagation between the electronic modules. Since these modules supply power not only to the electronic module itself, but also to all sensors, transducers, and relays connected to that module, they eliminate the need and cost of additional external supplies for the instrumentation.

Finally, the power supply is equipped with the necessary logic to stage a startup: when power

switches on, the power supply protects data integrity and eliminates cycling outputs or false alarm reports.



**Figure 11: Power Supply Module**

# Specifications

<b>Product</b>	Network Control Unit, Network Expansion Unit
<b>Power Requirements</b>	85-264 VAC at 50/60 Hz
<b>Ambient Operating Conditions</b>	32 to 122°F (0 to 50°C) 10 to 90% RH
<b>Ambient Storage Conditions</b>	-40 to 158°F (-40 to 70°C) 5 to 95% RH
<b>Dimensions (H x W x D)</b>	<p><i>10 in. x 28 in. Enclosure-With-Cover (EN-EWC100-0)</i> 10 in. x 28 in. x 8.5 in. (26 x 72 x 22 cm) (Fits 1-slot Base Frame)</p> <p><i>16 in. x 38 in. Enclosure-With-Cover (EN-EWC200-0)</i> 16 in. x 38 in. x 8.5 in. (41 x 97 x 22 cm) (Fits 1-slot or 2-slot Base Frame; auxiliary gear with both configurations)</p> <p><i>26 in. x 48 in. Enclosure-With-Cover (EN-EWC500-0)</i> 26 in. x 46 in. x 8.5 in. (67 x 118 x 22 cm) (Fits 1-slot, Pair of 1-slots, 2-slot, or 5-slot Base Frame(s); auxiliary gear with all configurations)</p> <p><i>Enclosure-With-Cover (EN-EWC20-0)</i> 16 in. x 16 in. x 7.5 in. (41 x 41 x 19 cm) (Fits standalone NCM only)</p>
<b>Agency Compliance</b>	FCC Part 15 Class A; UL 916: CSA C22.2 No. 205 NCM300 UL and CSA Listings pending.
<b>Agency Listings</b>	UL Listed and CSA Certified

*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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