NAE35/NAE45 Installation Instructions

Application

The Network Automation Engine (NAE) is a web-enabled, Ethernet-based, supervisory device that monitors and controls networks of field-level building automation devices, HVAC equipment, and lighting.

This document describes how to install NAE35 and NAE45 models, which are referred to collectively as network engines, unless otherwise specified. These network engines provide integration to the following network protocols: BACnet/IP, BACnet MS/TP, N2 Bus, and integrations to other building management communication technologies, including Modbus®, M-Bus, and KNX. The network engine at 9.0.7 is shipped with the licenses and drivers for all three communication protocols: Modbus, M-Bus, and KNX.

Important: For existing custom integrations, contact your local Systems Integration Services (SIS) team before an upgrade. Updated drivers can be provided on request.

Note: LonWorks® is no longer supported for an NAE35 or NAE45 at Release 9.0.7. The engine models that feature the LonWorks integration must remain at Release 9.0 or earlier.

Important: In *Metasys*® system smoke control applications, use only the MS-NAE3510-2U and MS-NAE4510-2U models at Release 8.1 that are UL Listed, UUKL 864 Listed, Smoke Control Equipment. For *Metasys* system smoke control applications, you must refer to the *Metasys® System UL 864 10th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System Technical Bulletin (LIT-12012487)* for detailed requirements and procedures for installing and operating UUKL 864 Listed *Metasys* system devices. Failure to meet the requirements or follow the procedures in the *Metasys® System UL 864 10th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System Technical Bulletin (LIT-12012487)* can void the UUKL 864 listing for Smoke Control Equipment.

Installation

Follow these guidelines when installing the network engine:

- Transport the network engine in the original container to minimize vibration and shock damage to the network engine.
- Verify that all the parts shipped with the network engine.
- Do not drop the network engine or subject it to physical shock.
- Do not open the network engine housing (except the data protection battery compartment). The network engine has no user-serviceable parts inside.

Parts included

- one NAE35 or NAE45 with removable terminal plugs
- one data protection battery (installed and connected when the network engine is shipped)
- one Installation Instructions sheet

Materials and special tools needed

- three M4 (#8) fasteners appropriate for the mounting surface
- one 20 cm (8 in.) or longer piece of DIN rail and appropriate hardware for mounting the DIN rail

Part No. 24-10050-6 Rev. Y

2018-12-17

Release 9.0.7

(barcode for factory use only)

MS-NAE35xx-2, MS-NAE45xx-2

Dimensions

Figure 1: Front of NAE4511-2 showing dimensions (mm/in.), physical features, and required mounting space around engine

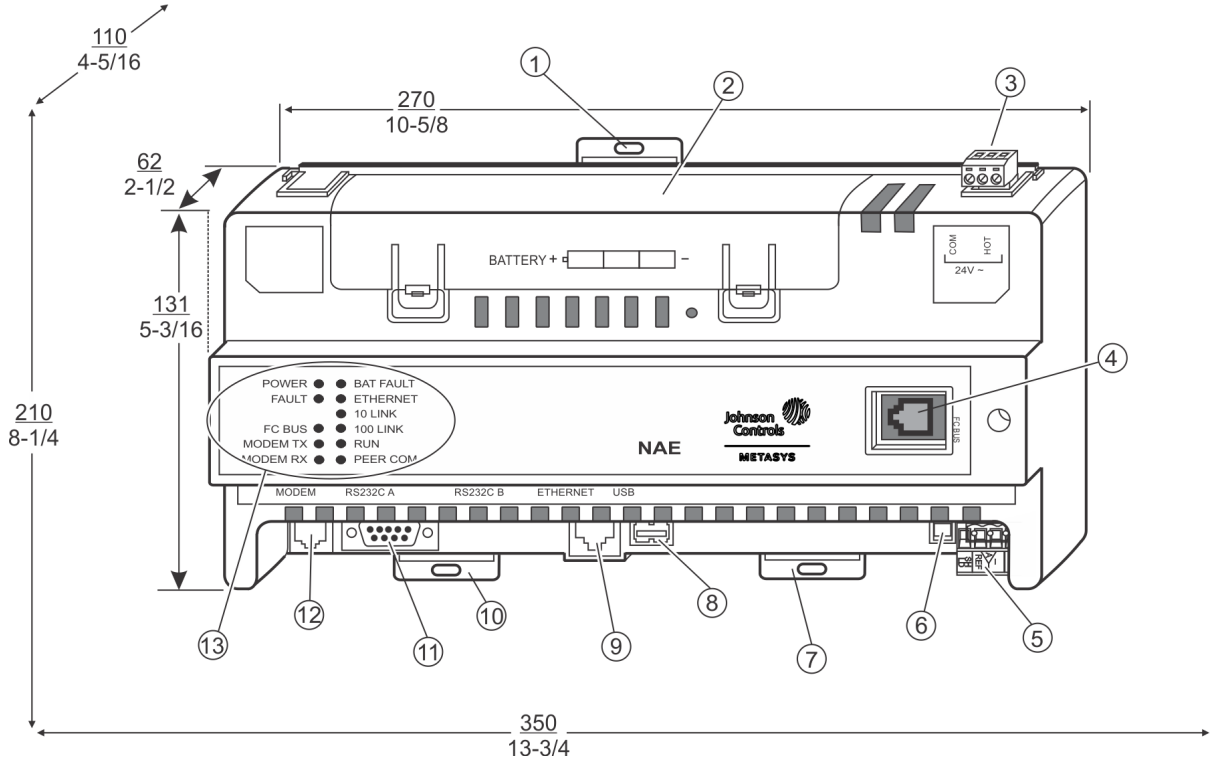


Table 1: NAE45 physical features

Callout	Description
1	Mounting clip
2	Data protection battery compartment
3	24 VAC power terminal
4	6-pin modular field controller service port
5	FC Bus (N2 Bus or FC Bus terminal)
6	End-of-line switch
7	Mounting clip
8	USB port
9	RJ-45 8-pin Ethernet port
10	Mounting clip
11	RS-232 serial port
12	Modem terminal (not functional at Release 9.0.7)
13	System status LEDs

Mounting

Location considerations

Follow these guidelines when mounting a network engine:

- Ensure that the mounting surface can support the network engine and any user-supplied enclosure.
- Mount the network engine in proper orientation (Figure 1).
- Mount the network engine on an even surface in wall mount applications whenever possible. If you must mount the network engine on an uneven surface, be careful not to crack the mounting clips or network engine housing when tightening the screws. Use shims or washers to mount the network engine evenly on the mounting surface.
- Mount the network engine in areas free of corrosive vapors, and observe the environmental limitations listed in the Technical specifications section.
- Allow sufficient space for cable and wire connections and access to the data protection battery and End-of-Line (EOL) switch (Figure 1).
- Do not mount the network engine where the ambient temperature may exceed 50°C (122°F).
- Do not mount the network engine on surfaces prone to vibration or in areas where electromagnetic emissions can interfere with network engine communication.
- Do not obstruct the network engine housing ventilation holes.
- Do not mount power transformers below the network engine.

On applications where the network engine is mounted inside a panel or enclosure, follow these additional guidelines:

- Do not install the network engine in airtight enclosures.
- Do not install heat-generating devices in the enclosure with the network engine that may cause the ambient temperature to exceed 50°C (122°F).

Mounting the Network Engine

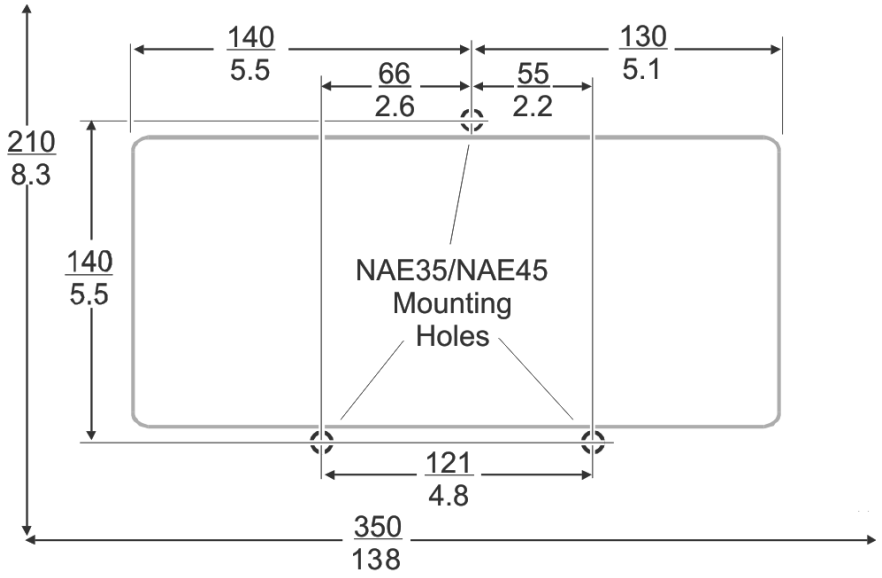
Wall mount applications

Use the holes in the three mounting clips for wall mount applications.

To mount the network engine on a vertical surface:

1. Ensure that all three mounting clips are inserted into the back of the network engine housing, pulled outward, and snapped firmly into the extended position (Figure 3).
2. Mark the location of the three wall mount holes using the dimensions in Figure 2, or hold the network engine up to the wall as a template and mark the locations.
3. Drill holes in the wall at the locations marked in (Figure 2) and insert wall anchors (if necessary).

Figure 2: Network Engine Mounting Screw Hole Dimensions and Mounting Area Requirements (mm/in.)



4. Position the network engine, insert the screws through the holes in the mounting clips, and carefully tighten the screws.

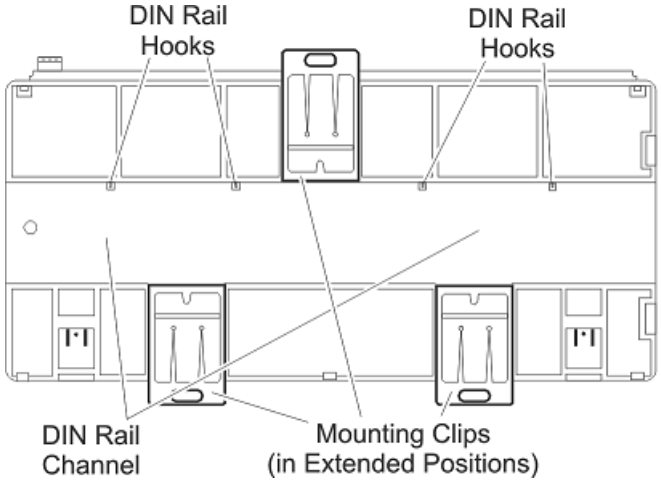
   Important: Do not overtighten the mounting screws. Overtightening the screws may damage the mounting clips or the network engine housing.

DIN rail mount applications

To mount the network engine on a DIN rail:

1. Securely mount a 20 cm (8 in.) or longer section of DIN rail horizontally and centered in the space.
2. Ensure that the bottom two mounting clips are pulled outward and snapped firmly into the extended position (Figure 3).

Figure 3: DIN Rail and Mounting Clip Features on the Back of Network Engine



3. Hang the network engine by the DIN rail hooks (Figure 3) on the top track of the DIN rail, and position the network engine DIN rail channel snugly against the tracks of the DIN rail.

4. Push the bottom mounting clips up to secure the network engine on the DIN rail tracks. To remove the network engine from the DIN rail, snap the bottom DIN clips to the outward extended position, and carefully lift the network engine off the DIN rail.

Enclosure mount applications

Mount the enclosure per the manufacturer's instructions and mount the network engine in the enclosure following the guidelines in the Location considerations and Mounting the Network Engine sections.

Wiring

Power supply, network, and bus connections

See Figure 1 for the location of network engine ports, modular jacks, and terminal blocks.

Power supply

In North America, the network engine requires a dedicated Class 2, 24 VAC, 25 VA minimum power supply. Outside North America, use a 24 VAC SELV transformer at the appropriate rating. The minimum input voltage for the network engine to operate properly is 20 VAC. Maximum power consumption is 25 VA.

FC Bus port

MS-NAE351x-x and **MS-NAE451x-x** models support one N2 Bus trunk or one MS/TP Bus trunk on the FC Bus port. Connect either an N2 Bus trunk or an MS/TP Bus trunk to the 4-wire terminal block plug labeled **FC BUS**.

The Field Controller (FC) Bus connection on an NAE35 and NAE45 is a 4-pin removable, keyed terminal block labeled **FC BUS**. The FC bus connection is an optically isolated RS-485 port with a keyed 4-position terminal block that communicates at 9.6k, 19.2k, 38.4k, or 76.8k baud. Use an FC Bus port to integrate an N2 network, BACnet MS/TP FC Bus trunk, or third-party network into the *Metasys* system.

ⓘ **Note:** N2, BACnet MS/TP, Modbus RTU, and M-Bus have different protocols and network requirements. Do not intermix N2, MS/TP, Modbus, or M-Bus devices on the same FC Bus port.

The SHD connection on the FC terminal block is not connected to any earth ground connection. See Table 2 and Table 3 for more information on bus rules and bus device limits.

FC Bus modular jack

The 6-pin modular jack labeled **FC BUS** is an FC Bus service port for MS/TP applications (only).

ⓘ **Note:** Do **not** connect an N2 trunk to the 6-pin modular FC Bus jack.

Refer to the *N2 Communications Bus Technical Bulletin (LIT-636018)* or the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)* for additional information and guidelines on wiring devices on an N2 trunk or an MS/TP trunk.

LON port

MS-NAE352x-x and MS-NAE452x-x models feature a LonWorks network terminal labeled **LON**. These LonWorks models **do not** support the upgrade to Release 9.0.7. You must keep these models at Release 9.0 or earlier.

Serial ports

The network engine has two RS-232-C serial ports labeled **RS232C A** and **RS232C B** (Figure 1). They are designed for connecting a standard 9-pin female DTE to 9-pin female DTE null modem cable. However, at Release 9.0.7, these serial ports do not support external modems. Also, the **RS232C A** port at Release 9.0.7 is not active.

However, you can use the **RS232C B** port to connect a Modbus RTU third-party integration. For more information on how to use the serial port for third-party vendor integration, refer to the application note for the particular vendor integration you are installing.

USB port

The USB port is labeled **USB** on the NAE. Beginning with Release 9.0.7, the use of the USB port to connect an optional external modem is no longer supported. However, you can use the USB port for debugging purposes when integrating to a third-party protocol (for example, Modbus, M-Bus, or KNX).

Ethernet port

The Ethernet connection (10 or 100 Mbps) is an 8-pin RJ-45 network port (Figure 1). Use the Ethernet port to connect to IP networks.

Wiring the Network Engine

- **Important:** Do not connect 24 VAC supply power to the network engine before finishing wiring and checking all wiring connections. Short circuits or improperly connected wires may result in permanent damage to the equipment.
- **Important:** Use copper conductors only. Make all wiring in accordance with local, national, and regional regulations. The network engine is a low-voltage (<30 VAC) device. Do not exceed the network engine electrical ratings.
- **Important:** Do not remove the terminal block keys. The terminal block plugs and the terminal sockets are keyed to fit together in the correct configuration only.
- **Important:** Prevent any static electric discharge to the network engine. Static electric discharge can damage the network engine and void any warranties.
- **Important:** Make sure the building automation network wiring meets the specifications, rules, and guidelines in the Power supply, network, and bus connections section in this document.

Mount the network engine securely before wiring the network engine. See the Mounting section.

Follow these guidelines when wiring the network engine:

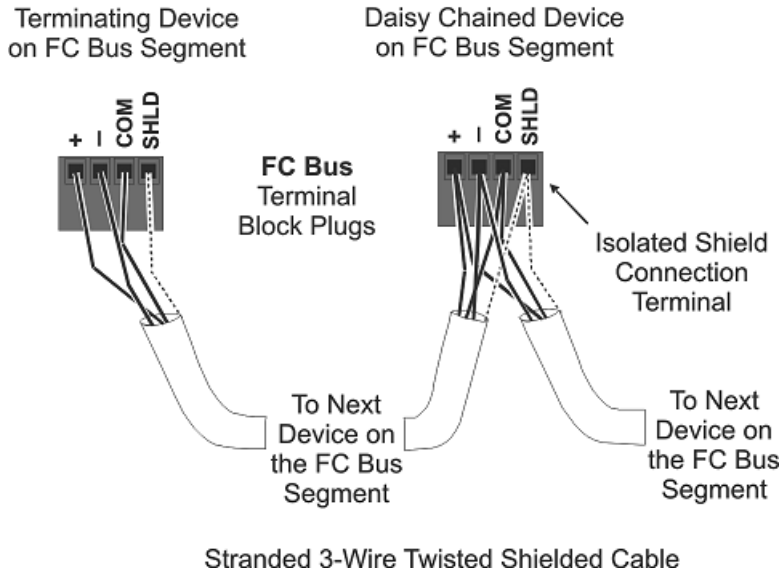
- Route the supply power wires and communication cables at least 50 mm (2 in.) away from the vent slots on the sides of the network engine housing.
- Provide slack in the wires and cables. Keep cables routed neatly around the network engine to promote good ventilation, LED visibility, and ease of service.

Wiring the NAE for N2, MS/TP, or Modbus RTU network

1. Connect the Ethernet cable to the RJ-45, 8-pin Ethernet port on the NAE shown in Figure 1.
2. Connect the field equipment cables to the appropriate ports as follows:
    - For an N2, MS/TP, or Modbus RTU network, connect the 3-wire bus cable to the removable 4-terminal blue plug labeled FC Bus (Figure 4).
    - For Modbus RTU Protocol that uses the RS232C B serial port, use a cable to connect the

RS-232/RS-485 converter to the RS232C B serial port on the NAE. The maximum cable length between devices connected though an RS-232 line depends on the baud rate used. In general, it should not exceed 15 meters at 9600 baud.

Figure 4: FC Bus terminal block and wiring connections



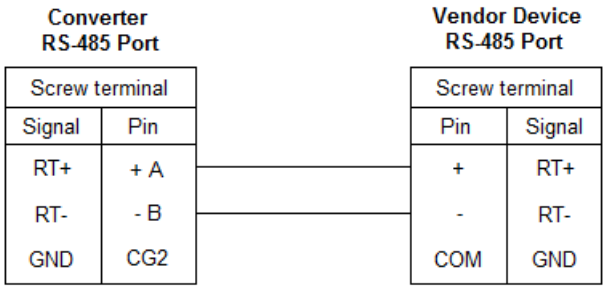
3. Wire from the RS-485 terminal on the converter to the RS-485 port on the vendor device (Figure 5). The RS-485 bus is a two-wire network.

    a. Connect the converter's **+ A** terminal to the device's **+** (or **A**) terminal.

    b. Connect the converter's **- B** terminal to the device's **-** (or **B**) terminal.

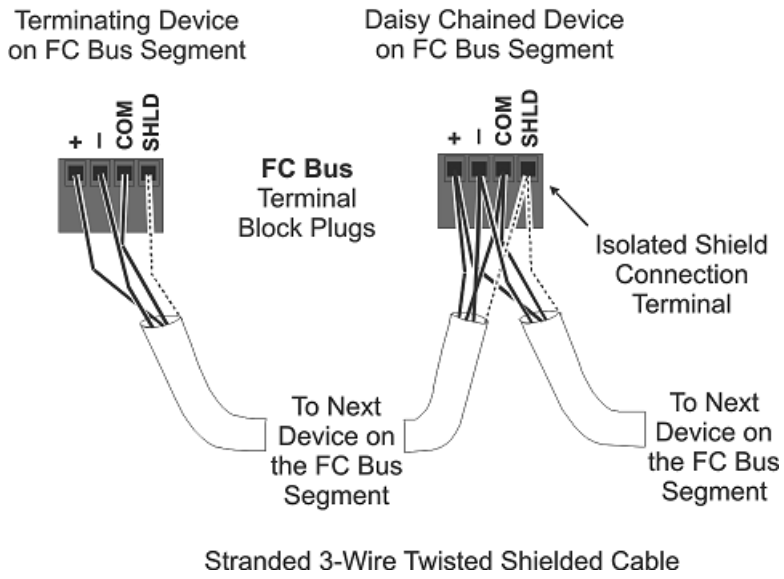
    c. If the device has a Signal Ground or Reference terminal,connect this to the converter's **CG2** terminal.

Figure 5: Connection between converter and device



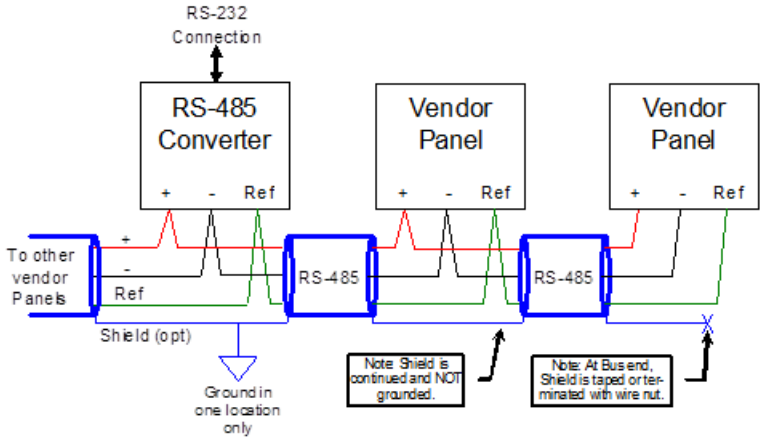
4. To add additional vendor devices, wire from one device to the next as shown in Figure 6. No more than two wires may be connected to each terminal to ensure the daisy chain configuration. See Wiring rules and guidelines for network integrations for the Modbus protocol.

Figure 6: Daisy chained devices



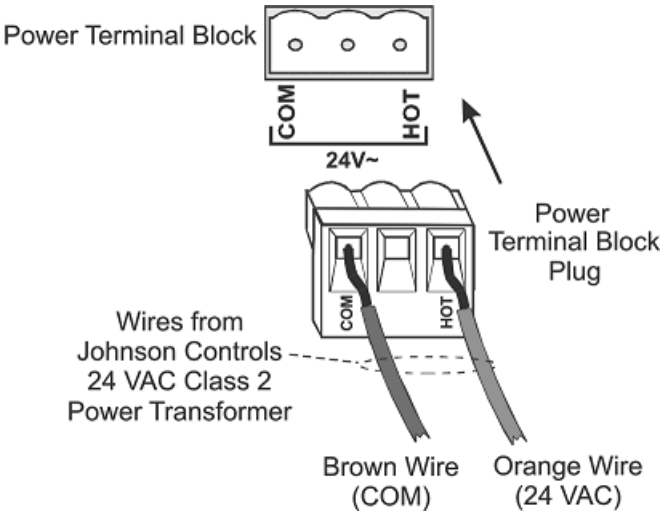
Note: The completed wiring should look similar to Figure 7.

Figure 7: Modbus wiring detail overview



5. Connect the 24 VAC supply power wires from the transformer to the removable power terminal block plug on the NAE (Figure 8).

Figure 8: 24 VAC supply power wiring



Note: Power supply wire colors may be different on transformers not manufactured by Johnson Controls. Follow the transformer manufacturer's instructions and the project installation drawings.

6. Connect the 24 VAC supply power wires from the transformer to the converter. No additional external power adapter is required. Connect the hot and common wires as desired. The NAE does not require an earth ground connection.

   Note: The 24 VAC power should be connected to all network devices so transformer phasing is uniform across the devices. Powering network devices with uniform 24 VAC supply power phasing reduces noise, interference, and ground loop problems.

Wiring the NAE for M-Bus protocol

1. Connect the Ethernet cable to the RJ-45, 8-pin Ethernet port shown in Figure 1.
2. Connect from the RS232C A or RS232C B serial port on the NAE to the RS-232 connector of the level converter. Wire to terminals **GND**, **RxD**, and **TxD** as shown in Figure 9.
3. Wire from the **M-** and **M+** terminals on the level converter (Figure 9) to the meters using a free (star, tree, or line) topology. Specific cabling can vary depending on the topology and site. See Wiring rules and guidelines for network integrations.

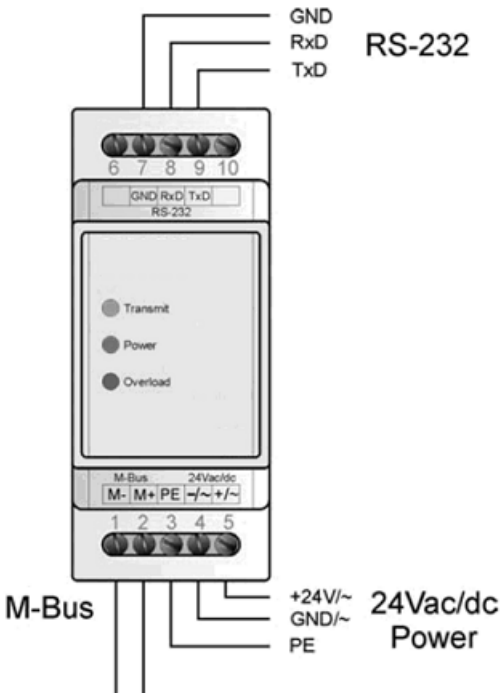
   Note: If the number of M-Bus unit loads or distances exceeds the specifications of a level converter, an M-Bus repeater can be wired to the converter to increase the number of unit loads and distances. The converter shown in Figure 9 is capable of handling up to 6 units loads, while other models can handle up to 100. See Ordering information for a list of M-Bus devices.

4. Connect the 24 VAC supply power wires from the transformer to the removable power terminal block plug on the NAE (Figure 8).

   Note: Power supply wire colors may be different on transformers not manufactured by Johnson Controls. Follow the transformer manufacturer's instructions and the project installation drawings.

5. Connect the 24 VAC supply power wires from the transformer to the **-/~** and **+/~** terminals as shown in Figure 9.

Figure 9: M-Bus Level Converter

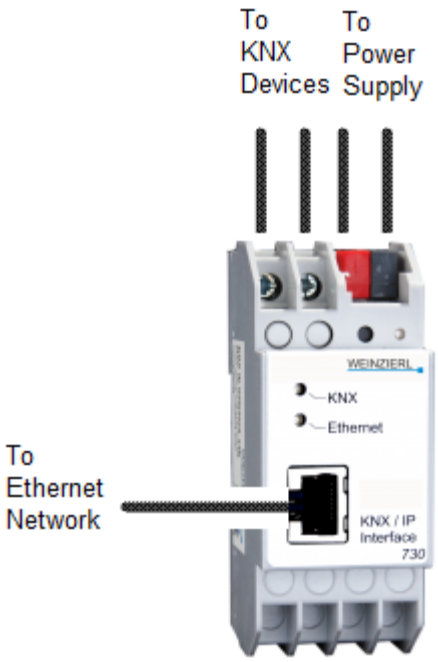


Wiring the NAE for KNX protocol

1. Connect an Ethernet cable to the RJ-45, 8-pin Ethernet port shown in Figure 1.
2. Connect another Ethernet cable to the port on the front of the KNX gateway (Figure 10).

   ⓘ **Note:** Depending on the size of your network, you can use either a KNX Interface or Router as a gateway. The Interface connects the NAE to a single KNX line, while the Router acts as both an Interface and a Line Coupler over Ethernet to connect the NAE to the network, not to a single device.

Figure 10: KNX/IP Interface Router



3. For a single KNX line, wire from the red and black terminals on the gateway to the devices. For multiple KNX lines, wire from the red and black terminals on each gateway to the devices on the same KNX line.

   ⓘ **Note:** Specific cabling can vary depending on the topology and site. See Wiring rules and guidelines for network integrations.

4. Wire each KNX gateway to its own dedicated power supply on the KNX line.

Wiring rules and guidelines for network integrations

Table 2: MS/TP Bus rules

Category	Rules/maximums allowed
General	One MS/TP Bus trunk supported per NAE (on NAE351x-x and NAE451x-x models only)
	Only daisy-chained MS/TP devices
Number of FC Devices Supported	MS-NAE451x-x models support up to 100[1] MS/TP devices total on the FC Bus with no more than two repeaters between an NAE45 and any device and a maximum of 50 devices between repeaters.
	MS-NAE351x-x models support up to 50[1] MS/TP devices total on the FC Bus with no more than two repeaters between the NAE35 and any device and a maximum of 50 devices between repeaters.
Bus Length	1,500 m (5,000 ft) cable per bus segment without a repeater
	4,500 m (15,000 ft) cable from NAE to the farthest FC Bus device (three bus segments of 1,500 m [5,000 ft] each, separated by repeaters)
	2,000 m (6,600 ft) between two fiber modems
Cable Type[2]	Stranded 0.6 mm (22 AWG) 3-wire twisted, shielded cable is recommended. Stranded 0.6 mm (22 AWG) 4-wire (two twisted-pairs) shielded cable is acceptable. ⓘ **Note:** The + and - bus leads should be a twisted pair. On FC Bus applications using 4-wire (two twisted-pairs) cable, isolate and insulate unused conductor. Refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)* for more information.
Terminations	Two FC Bus devices with EOL switches in the ON position, one at each end of each FC Bus segment

1 If the TEC Thermostat Controllers or third-party MS/TP devices are connected to the FC Bus, the maximum total number of MS/TP controllers on an FC Bus is 64 for NAE45 models and 32 for the NAE35 models. The maximum cable length per bus segment is 1,219 m (4,000 ft) and the maximum total FC Bus length is 3,658 m (12,000 ft).

2 Refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)* for more information on alternative cable types and lengths.

Table 3: N2 Bus rules

Category	Rules/maximums allowed
General	MS-NAE351x-x and MS-NAE451x-x models (only) support one N2 Bus trunk.
	Only daisy-chained N2 devices (with maximum stub length of 3 m [10 ft] to any device)
Number of N2 Devices Supported	MS-NAE451x-x models support up to 100 N2 devices (maximum) on the N2 trunk with no more than two repeaters between an NAE45 and any device and a maximum of 50 devices between repeaters.
	MS-NAE351x-x models support up to 50 N2 devices (maximum) on the N2 trunk with no more than two repeaters between an NAE35 and any device and a maximum of 50 devices between repeaters.

Table 3: N2 Bus rules

Category	Rules/maximums allowed
Line Length and Type	1,500 m (5,000 ft) twisted pair cable without a repeater
	4,500 m (15,000 ft) twisted pair cable from NAE35/45 and the farthest N2 device (three segments of 1,500 m [5,000 ft] each, separated by repeaters)
	2,000 m (6,600 ft) between two fiber modems
Cable	Solid or stranded 1.0 mm (18 AWG) 3-wire is recommended. Solid or stranded 0.5 mm (24 AWG) or larger 3-wire or 4-wire (two twisted-pairs) is acceptable. ⓘ **Note:** The + and - bus leads should be a twisted pair. On applications using 4-wire (two twisted-pairs) cable, isolate and insulate unused conductor.
Terminations	**Preferred Termination Configuration:** Two N2 devices with EOL switches in the ON position, one at each end of each N2 Bus segment **Minimally Required Termination Configuration:** At least one N2 device with an EOL switch in the ON position somewhere on each N2 Bus segment

Table 4: Guidelines for LonWorks network bus topology (Release 9.0)

Cable Type	Maximum Segment Length with FTT10 Devices Only[1]	Maximum Segment Length with FTT10 and/or LPT10 Devices[1]
Belden® 85102 Cable	2,700 m (8,850 ft)	2,200 m (7,200 ft)
Belden 8471 Cable	2,700 m (8,850 ft)	2,200 m (7,200 ft)
Level IV 0.6 mm (22 AWG)	1,400 m (4,600 ft)	1,150 m (3,770 ft)
JY (St.) Y 2 x 2 x 0.8	900 m (2,950 ft)	750 m (2,460 ft)

1 For the bus topology, the maximum length stub cable is 3 m (10 ft), and the stub lengths must be calculated into the overall segment length.

Table 5: Guidelines for LonWorks network free topology (Release 9.0)

Cable Type	Maximum Node-to-Node Distance	Maximum Segment Length with FTT10 and/or LPT10 Devices
Belden 85102 Cable	500 m (1,640 ft)	500 m (1,640 ft)
Belden 8471 Cable	500 m (1,640 ft)	500 m (1,640 ft)
Level IV 0.6 mm (22 AWG)	400 m (1,300 ft)	500 m (1,640 ft)
JY (St.) Y 2 x 2 x 0.8	320 m (1,050 ft)	500 m (1,640 ft)

Table 6: Maximum number of devices per LonWorks network segment (Release 9.0)

Device Type	Maximum Allowed
MS-NAE352x-x models	Supports one LONWORKS Network trunk with up to 64 LONWORKS devices (maximum)
MS-NAE452x-x models	Supports one LONWORKS Network trunk with up to 127 LONWORKS devices (maximum)

Table 6: Maximum number of devices per LonWorks network segment (Release 9.0)

Device Type	Maximum Allowed
FTT-10 Nodes Only	64 (if repeaters are not used), 127 (if repeaters are used)
Mixed FTT-10 and LPT-10 Nodes[1]	([FTT10 x 2] + LPT10) < 128
Terminators:	
Bus Topology	2 bus type EOL terminators required (NU-EOL202-0)
Free Topology	1 free topology terminator required (NU-EOL203-0)
Physical Layer Repeaters	Maximum of 1 per segment

1 Each LPT10 channel segment (between repeaters) requires its own power supply. Other factors, such as power consumption of individual LPT10 devices, may limit a segment to fewer devices. The MS-NAE352x-x an MS-NAE452x-x models that support a LonWorks Network trunk do not have an internal network terminator.

Table 7: Ethernet network rules

Category	Rules/Maximums Allowed[1]
General	Point-to-point star topology with network hubs/switches
Number of Devices	Maximum of 100 supervisory devices may be connected to one site in the *Metasys* system.
Line Length and Type	2,000 m (6,600 ft) for plastic/glass fiber optic with external adapter
	100 m (330 ft) CAT5 cable
Terminations	For 10/100 BaseT, no line terminators allowed

1 Refer to the *N1 Ethernet/IP Network Technical Bulletin (LIT-6360175)* for recommended parts and part numbers.

Setup and adjustments

Data protection battery

The network engine is shipped with the data protection battery installed and connected. Do not disconnect the battery for any reason other than to replace a defective battery.

The 24 VAC supply power to the network engine charges the data protection battery. At initial startup, the battery may require a charging period of at least 4 hours before it supports data protection if power fails. Maximum protection (up to 3 consecutive power failures without recharging time) requires a 15-hour charging period.

The data protection battery slowly loses charge when 24 VAC power is removed from the network engine. If the battery completely loses charge, the network engine real-time clock stops.

Whenever a network engine is disconnected from 24 VAC power for over 30 days, ensure that the real-time clock is set properly (from the user interface) and that the network engine is powered long enough to recharge the data protection battery.

Powering on the Network Engine

After applying 24 VAC power, the network engine requires approximately 2 minutes to start up and become operational. See the LED test sequence at startup section.

Startup is complete and the network engine is operational when the (green) RUN LED is On steady and the (red) FAULT LED is Off (Figure 13).

➽ **Important:** Wait for the network engine to complete the start-up sequence and the RUN LED to go On steady before initiating any other action on the network engine.

Disconnecting power from the Network Engine

When 24 VAC supply power to a network engine is disconnected or lost, the network engine is nonoperational, but the POWER LED remains On and the data protection battery continues to power the network engine for approximately 1 to 5 minutes while volatile data is backed up in nonvolatile memory. The RUN LED goes Off when data backup and shutdown are complete.

➽ **Important:** The data protection battery must be installed and charged before disconnecting the 24 VAC supply power.

Setting the end-of-line switch

RS485 serial protocol bus segments require proper EOL termination to reduce interference from signal bounce back on the bus segment.

FC Bus (MS/TP) applications require a terminated device at each end of each FC Bus segment. See the Wiring rules and guidelines for network integrations section for more information on EOL requirements on an FC Bus.

N2 Bus applications require at least one terminated device on each N2 Bus segment, but two terminated devices, one at each end of the N2 Bus segment, are recommended. See the Wiring rules and guidelines for network integrations section for more information on EOL requirements on an N2 Bus.

The network engine is shipped with the EOL switch in the factory default, ON (up) position (Figure 11). See Figure 12 to determine the appropriate EOL switch setting for the network engines on N2 Buses and FC Buses.

Figure 11: FC Bus EOL switch in the factory default ON (up) position

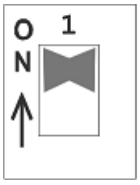
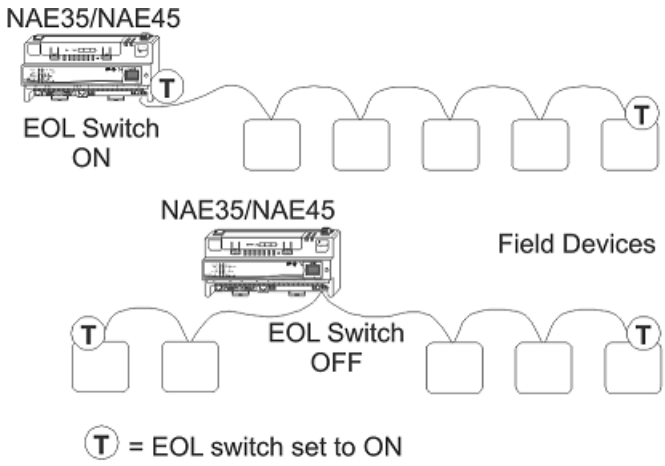


Figure 12: EOL switch setting N2 or MS/TP

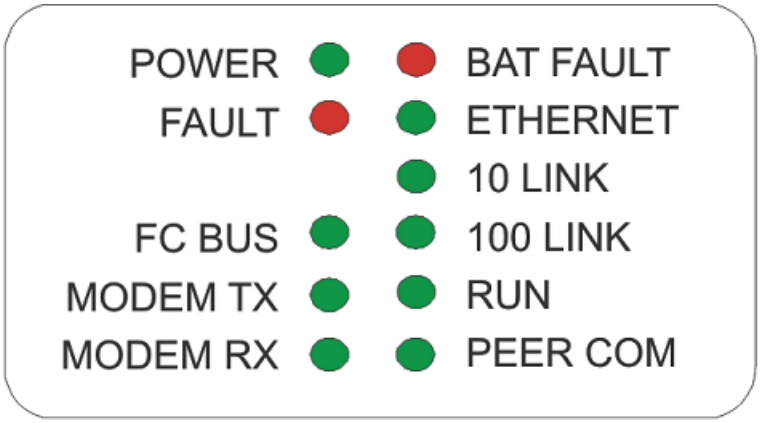


Troubleshooting

LED status indicators

The network engine models have up to 11 LEDs (depending on the model) to indicate power and network communication status. Figure 13 shows the LEDs and Table 8 describes the LED indications.

Figure 13: Network engine LED designations



Note: Some of the LEDs shown in Figure 13 are not used or displayed on some network engine models.

LED test sequence at startup

During startup, the network engine automatically initiates an LED test to verify the operational status of the LEDs. Immediately after connecting supply power, the following LED lighting sequence occurs:

1. The POWER, BAT FAULT, 10 LINK, FAULT, RUN, and PEER COM LEDs turn On, indicating that the OS is booting up. (After 2 seconds, the LEDs may change states depending on site-specific network activity.)
2. The BAT FAULT, PEER COM, and FAULT LEDs shut Off. The RUN LED flashes to indicate that the

network engine software is loading.

3. The LEDs display the status of the network engine. When the RUN LED goes On Steady, startup is complete, and the network engine is operational.

The total time to start the network engine depends on the size of the database and can take several minutes.

See Table 8 for more information on the network engine LEDs. Refer to the *NAE Commissioning Guide (LIT-1201519)* for additional information on troubleshooting a network engine.

Network Engine LED designations

Table 8: Network Engine LED designations, normal status, and descriptions

LED Designation	Normal Status	Descriptions/Other Conditions
POWER (Green)	On Steady	On Steady = Unit is getting power from either the battery or 24 VAC power. Off Steady = Unit is shut down.
ETHERNET (Green)	Flicker	Flicker = Data is transferring on the Ethernet connection. Ethernet traffic is general traffic (may not be for the network engine). Off Steady = No Ethernet traffic, probably indicates a dead Ethernet network or bad Ethernet connection.
10/LINK (Green)	On Steady	On Steady = Ethernet connection is established at 10 Mbps.
100/LINK (Green)	On Steady	On Steady = Ethernet connection is established at 100 Mbps.
FC BUS (Green)	Flicker	Flicker = Normal communications; the FC Bus is transmitting and receiving data. Flickers are generally in sync with data transmission but should not be used to indicate specific transmission times. Off Steady = No field controllers are defined to FC Bus in the network engine.
PEER COM (Green)	Varies (see next column)	Flicker = Data traffic between network engines. For a network engine that is not a Site Director, this LED indicates regular heartbeat communications with the Site Director. For a Site Director NAE, flashes are more frequent and indicate heartbeat communications from all other network engines on the site. For a single network engine on a network without an ADS, there is no flicker.

Table 8: Network Engine LED designations, normal status, and descriptions

LED Designation	Normal Status	Descriptions/Other Conditions
RUN (Green)	On Steady	On Steady = Network engine software is running. On 1 second, Off 1 second = Network engine software is in startup mode. On 0.5 seconds, Off 0.5 seconds = NAE35/45 software is shutting down. Off Steady = Operating system is shutting down or software is not running.
BAT FAULT (Red)	Off Steady	On Steady = Battery defective. Flicker = Data Protection Battery is not installed. Connect or install battery.
FAULT (Red)	Off Steady	On Steady = General Fault. Fault conditions are user configurable in software. Pre-configured fault conditions include excessive CPU flash or memory use, excessive PWB temperature.
MODEM RX	Flicker	Flicker = Network engine modem is connected and receiving data.
MODEM TX	Flicker	Flicker = Network engine modem is connected and transmitting data.

Repair information

If you replace a network engine on a site with a new network engine for any reason or add a new network engine to a site, you must update the site registration to ensure that the new network engine is recognized and able to communicate in the site.

Refer to the *Replacing an NAE* section of the *NAE Commissioning Guide (LIT-1201519)* for information on removing a network engine from service and configuring a replacement network engine to communicate in a *Metasys*® system site.

Except for replacing the data protection battery, the network engine cannot be repaired in the field. If the network engine fails to operate, it must be replaced.

Batteries removed from this device must be recycled or disposed of in accordance with local, national, and regional regulations. Only certified technicians or qualified building maintenance personnel should service Johnson Controls® products.

Ordering information

ⓘ **Note:** Some NAE models are also available in a Buy American version (add a **G** after the product code number). For the European version, add an **E** after the product code number. For repair parts, add **-703** after the product code number.

Table 9: NAE35 ordering information

Product Code Number	Description
MS-NAE35xx-xxx (Base Features of Each NAE35)	NAE35 Network Automation Engines: Requires a 24 VAC power supply. Each model includes one RS-232-C serial port, one USB serial port, one Ethernet port, and an MS-BAT1020-0 Data Protection Battery.
MS-NAE3510-2	Supports one N2 or BACnet MS/TP (RS-485) trunk; includes an additional RS-232-C serial port for optional external modem; supports a maximum of 50 devices on the N2 or BACnet MS/TP trunk.
MS-NAE3511-2 (Release 9.0 only)	Supports one N2 or BACnet MS/TP (RS-485) trunk; includes an internal modem; supports a maximum of 50 devices on the N2 or BACnet MS/TP trunk.
MS-NAE3514-2	Supports one N2 or BACnet MS/TP (RS-485) trunk; features Basic Access support; includes an additional RS-232-C serial port for optional external modem; supports a maximum of 50 devices on the N2 or BACnet MS/TP trunk.
MS-NAE3515-2 (Release 9.0 only)	Supports one N2 or BACnet MS/TP (RS-485) trunk; features Basic Access support; includes an internal modem; supports a maximum of 50 devices on the N2 or BACnet MS/TP trunk.
MS-NAE3520-2 (Release 9.0 only)	Supports one LonWorks trunk, includes an additional RS-232-C serial port for optional external modem. Supports a maximum of 64 devices on the LonWorks trunk.
MS-NAE3521-2 (Release 9.0 only)	Supports one LonWorks trunk, includes an internal modem. Supports a maximum of 64 devices on the LonWorks trunk.
MS-NAE3524-2 (Release 9.0 only)	Supports one LonWorks trunk, features Basic Access support, and includes an additional RS-232-C serial port for optional external modem. Supports a maximum of 64 devices on the LonWorks trunk.
MS-NAE3525-2 (Release 9.0 only)	Supports one LonWorks trunk, features Basic Access support, and includes an internal modem. Supports a maximum of 64 devices on the LonWORKS trunk.

Table 10: NAE45 ordering information

Product Code Number	Description
MS-NAE45xx-xxx (Base features of each NAE45)	NAE45 Network Automation Engines: Requires a 24 VAC power supply. Each model includes one RS-232-C serial port, one USB serial port, one Ethernet port, and an MS-BAT1020-0 Data Protection Battery.
MS-NAE4510-2	Supports one N2 or BACnet MS/TP (RS-485) trunk; includes an additional RS-232-C serial port for optional external modem; supports a maximum of 100 devices on the N2 or BACnet MS/TP trunk.
MS-NAE4511-2 (Release 9.0 only)	Supports one N2 or BACnet MS/TP (RS-485) trunk; includes an internal modem; supports a maximum of 100 devices on the N2 or BACnet MS/TP trunk.
MS-NAE4520-2 (Release 9.0 only)	Supports one LonWorks trunk, includes an additional RS-232-C serial port for optional external modem; supports a maximum of 127 devices on the LonWorks trunk.

Table 10: NAE45 ordering information

Product Code Number	Description
MS-NAE4521-2 (Release 9.0 only)	Supports one LonWorks trunk, includes an internal modem; supports a maximum of 127 devices on the LonWorks trunk.
MS-NAE451L-2	Supports one BACnet MS/TP (RS-485) trunk; supports a maximum of 100 BACnet MS/TP devices on the trunk. (N2 Bus field trunk is not supported.) This model is currently available only in Asia. Contact your local Johnson Controls representative for more information. ⓘ **Note:** The NAE451L-2 requires an MS-ADSLA5U Site Director.

Table 11: NAE35/45 accessories ordering information

Product Code Number	Description
MS-BAT1020-0	Replacement data protection battery for NAE35, NIE39, NAE45, NIE45, NIE49, NCE25, or NIE29. Rechargeable NiMH 3.6 VDC, 500 mAh battery with a typical life of 5 to 7 years at 21°C (70°F) (Higher operating temperatures reduce battery life.)
AS-XFR050-0	Power transformer (Class 2, 24 VAC, 50 VA maximum output), no enclosure

Technical specifications

Table 12: NAE35 and NAE45

Power Requirement	Dedicated nominal 24 VAC, Class 2 power supply (North America), SELV power supply (Europe), at 50/60 Hz (20 VAC minimum to 30 VAC maximum)
Power Consumption	25 VA maximum
Ambient Operating Conditions	0–50°C (32–122°F); 10–90% RH, 30°C (86°F) maximum dew point
Ambient Storage Conditions	-40–70°C (-40–158°F); 5–95% RH, 30°C (86°F) maximum dew point
Data Protection Battery	Supports data protection on power failure. Rechargeable NiMH battery: 3.6 VDC 500 mAh, with a typical life of 5 to 7 years at 21°C (70°F); Product Code Number: MS-BAT1020-0
Processor	192 MHz Renesas® SH4 7760 RISC processor
Memory	128 MB flash nonvolatile memory for operating system, configuration data, and operations data storage and backup128 MB SDRAM for operations data dynamic memory
Operating System	Microsoft® Windows Embedded CE 6.0 (Release 9.0) Buildroot 2017.08.2 with Linux kernel 14.4 (Release 9.0.7) ⓘ **Note:** The Windows Embedded OS sticker on the bottom of the network engine permits downgrading the engine to an older *Metasys* release that uses a Windows Embedded OS.

Table 12: NAE35 and NAE45

Network and Serial Interfaces	One Ethernet port; 10/100 Mbps; 8-pin RJ-45 connector One optically isolated RS-485 port; 9600, 19.2k, 38.4k, or 76.8k baud (depending on protocol); with a pluggable and keyed 4-position terminal block (FC Bus available on NAE351x-1 and NAE451x-1 models only.) One LonWORKS port; FTT10 78 Kbps; pluggable, keyed 3-position terminal block (LonWORKS port available on NAE352x-x and NAE452x models only; Release 9.0) One RS-232-C serial port with standard 9-pin sub-D connector that supports standard baud rates There is a second serial port, on models without an internal modem, that supports an optional, user-supplied external modem. One USB serial port with standard USB connector that supports an optional, user-supplied external modem Option: One telephone port for internal modem; up to 56 Kbps; 6-pin modular connector (network engine models with optional internal modem have one RS-232-C serial port only.)
Housing	Plastic housing material: ABS + polycarbonate UL94-5VB Protection: IP20 (IEC 60529)
Mounting	On flat surface with screws on three mounting clips or a single 35 mm DIN rail
Dimensions (Height x Width x Depth)	131 x 270 x 62 mm (5.2 x 10.6 x 2.5 in.) Minimum space for mounting NAE35/45: 210 x 350 x 110 mm (8.3 x 13.8 x 4.3 in.)
Shipping Weight	1.2 kg (2.7 lb)
Compliance	**United States:** UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A UL Listed, File S4977, UUKL 864 - 10th Edition, Smoke Control Equipment (MS-NAE35x0-2U and MS-NAE45x0-2U models only)
	Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003 UL Listed, File S4977, UUKLC 864 - 10th Edition, Smoke Control Equipment (MS-NAE35x0-2U and MS-NAE45x0-2U models only)
CE	**Europe:** CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive.
	Australia and New Zealand: RCM Mark, Australia/NZ Emissions Compliant
	BACnet International: BTL 135-2004 Listed B-BC

The performance specifications are nominal and conform to acceptable industry standard. 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.

Points of Single Contact

APAC	Europe	NA/SA
JOHNSON CONTROLS	JOHNSON CONTROLS	JOHNSON CONTROLS
C/O CONTROLS PRODUCT MANAGEMENT	WESTENDHOF 3	507 E MICHIGAN ST
NO. 32 CHANGJIJANG RD NEW DISTRICT	45143 ESSEN	MILWAUKEE WI 53202
WUXI JIANGSU PROVINCE 214028	GERMANY	USA
CHINA		

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.