



## Overview

The NS Series Network Sensors function directly with *Metasys*® system Field Equipment Controllers (FECs), Metasys Network and Control Engines (NCEs), Advanced Application Field Equipment Controller (FACs), Metasys VAV Box Equipment Controllers (CVM), General Purpose Application Controllers (CGM), Input/Output Modules (IOMs), VAV Modular Assembly (VMA16) Controllers, and Facility Explorer™ FX-PC Series Programmable Controllers (FX-PCGs, FX-PCVs, and FX-PCXs). The sensors are also compatible with Verasys® and Johnson Controls® Smart Equipment.

The NS Series Network Sensors monitor zone temperature, relative humidity, carbon dioxide (CO<sub>2</sub>), motion, and local temperature setpoint adjustments. The sensor transmits this data to a controller on the Sensor/Actuator (SA) bus.

Some NS Series Network Sensors models include an onboard passive infrared (PIR) occupancy sensor that detects motion to determine if a space is occupied. This feature maximizes up to 30% energy savings in high-energy usage environments such as schools, dormitories, offices, hospitals, and hotels by adjusting the temperature of the space based on the occupancy status. In addition, the PIR occupancy sensor facilitates trending of floor space usage in these environments.

Some models of the NS Series Network Sensors include a touch display to view zone temperature, RH, CO<sub>2</sub>, and adjust the zone temperature setpoint and fan speed. These models have the capability to set the default display to temperature, RH, or temperature setpoint. On these display models the user can also choose between degrees Fahrenheit (F) and degrees Celsius (C). To prevent tampering with the sensor, display models also include a screen lockout feature.

The display models include the following fan speeds:

- Automatic
- Off
- Low
- Medium
- High

The user can use the occupancy override function to signal to the controller that the zone is occupied and to override the scheduled mode.

Some models also have a Warmer/Cooler interface to adjust the zone temperature. Instead of a display, these models have two cap touch buttons with seven LED lights that represent the current setpoint.

All models have DIP switches to set a unique address for applications that require multiple sensors. For communication wiring flexibility, they also include both modular phone jacks, and screw terminals to terminate the wiring connecting the sensors to the controller.

**Note:** To connect the NS Series Network Sensor to the same SA bus segment, use only one of the two connection methods, either the modular phone jack or the screw terminals.

Each network sensor includes a SA bus access port, allowing for accessories to connect to the SA bus. Through this connector, the user can use accessories to service or commission the connected controller or gain access to any other controller on the same field controller (FC) bus.

The NS Series Network Sensors can be surface mounted or vertical wallbox mounted to meet the requirements of the specific application. All display models are optimized for the California Energy Code (Title 24). To suit specific architectural and interior design needs, all models come with either black or white enclosures.

All sensors are serialized for quality and warranty purposes. Based on the serial number, the user can obtain factory calibration certificates.

Modern enclosures in black or white design themes are available in the following three styles:

- LCD fixed segment display: View zone temperature, RH, CO<sub>2</sub>, occupancy status, and adjust the zone temperature setpoint and fan speed. These models have the capability to set the default display to temperature, RH or temperature setpoint. On these display models, you can also choose between degrees Fahrenheit (F) and degrees Celsius (C).
- Warmer/Cooler interface: This interface incorporates cap touch buttons with seven LED lights that represent the current setpoint status.
- No display: The NS Series Network Sensors are available in high gloss black or white with or without the Johnson Controls logo.

## ■ Features and benefits

| Features  | Benefits  |
|---|---|
| <b>BACnet® MS/TP protocol communication</b>   | Provides compatibility with Metasys system field controllers, Facility Explorer programmable controllers as well as Verasys and Johnson Controls Smart Equipment in a proven communication network. |
| <b>Single and multifunctional sensors</b>   | Choose temperature, humidity, CO <sub>2</sub> , and occupancy sensing depending on HVAC needs.  |
| <b>Large backlit fixed segment display available on some models</b>                             | Provides real-time status of the environment with backlighting activated during user interaction.   |
| <b>Simple temperature setpoint adjustment or Warmer/Cooler mode available on display models</b> | Configure simple setpoint adjustment or Warmer/Cooler mode.   |
| <b>Onboard occupancy sensor available on PIR models</b>   | Maximizes up to 30% energy savings in high-energy usage environments, and facilitates trending of floor space usage.  |
| <b>Temporary occupancy included on all display and Warmer/Cooler models</b>                     | Provides a timed override command, which initiates a temporary occupancy state.   |
| <b>Field-selectable default display setting on display models</b>                               | Toggle between temperature, RH or temperature setpoint on the display, and set the desired default for continuous viewing.  |
| <b>Fahrenheit/Celsius (°F/°C) selectable on display models</b>                                  | Display temperature in degrees Fahrenheit or degrees Celsius.   |
| <b>All display models meet California Energy Code (Title 24)</b>                                | Displays the required State of California Title 24 economizer fault conditions.   |
| <b>All display models include a screen lockout</b>  | Prevents sensor tampering.  |
| <b>Serialized sensors and calibration certificates</b>  | Obtain factory calibration certificates for all models.   |

## ■ Ordering information

Table 1 through Table 6 list the various NS Series Network Sensors available.

### IMPORTANT

The NS Series Network Sensor is intended to provide an input to equipment under normal operating conditions. Where failure or malfunction of the network sensor could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the network sensor.

**Note:** Keep the system software up to date as some NS Series Network Sensor features are not supported in previous releases of Metasys, Facility Explorer, Verasys, or Johnson Controls Smart Equipment system software.

### Repair information

If the NS Series Network Sensor fails to operate within its specifications, replace the unit. For a replacement sensor, contact the nearest Johnson Controls representative.

■ Selection charts

Table 1: NS Series Network Sensor ordering information: temperature, humidity, and CO<sub>2</sub> models (3% RH)

| Product code number | Display and interface information | Johnson Controls logo | Color | PIR occupancy sensor |
|---------------------|-----------------------------------|-----------------------|-------|----------------------|
| NSB8BHC040-0        | No display                        | Yes                   | White | No                   |
| NSB8BHC041-0        |                                   | No                    | White | No                   |
| NSB8BHC042-0        |                                   | Yes                   | Black | No                   |
| NSB8BHC043-0        |                                   | No                    | Black | No                   |
| NSB8MHC040-0        |                                   | Yes                   | White | Yes                  |
| NSB8MHC041-0        |                                   | No                    | White | Yes                  |
| NSB8MHC042-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MHC043-0        |                                   | No                    | Black | Yes                  |
| NSB8BHC240-0        | Fixed segment display             | Yes                   | White | No                   |
| NSB8BHC241-0        |                                   | No                    | White | No                   |
| NSB8BHC242-0        |                                   | Yes                   | Black | No                   |
| NSB8BHC243-0        |                                   | No                    | Black | No                   |
| NSB8MHC240-0        |                                   | Yes                   | White | Yes                  |
| NSB8MHC241-0        |                                   | No                    | White | Yes                  |
| NSB8MHC242-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MHC243-0        |                                   | No                    | Black | Yes                  |

Table 2: NS Series Network Sensor ordering information: temperature and humidity models (3% RH)

| Product code number | Display and interface information | Johnson Controls logo | Color | PIR occupancy sensor |
|---------------------|-----------------------------------|-----------------------|-------|----------------------|
| NSB8BHN240-0        | Fixed segment display             | Yes                   | White | No                   |
| NSB8BHN241-0        |                                   | No                    | White | No                   |
| NSB8BHN242-0        |                                   | Yes                   | Black | No                   |
| NSB8BHN243-0        |                                   | No                    | Black | No                   |
| NSB8MHN240-0        |                                   | Yes                   | White | Yes                  |
| NSB8MHN241-0        |                                   | No                    | White | Yes                  |
| NSB8MHN242-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MHN243-0        |                                   | No                    | Black | Yes                  |
| NSB8BHN040-0        | No display                        | Yes                   | White | No                   |
| NSB8BHN041-0        |                                   | No                    | White | No                   |
| NSB8BHN042-0        |                                   | Yes                   | Black | No                   |
| NSB8BHN043-0        |                                   | No                    | Black | No                   |
| NSB8MHN040-0        |                                   | Yes                   | White | Yes                  |
| NSB8MHN041-0        |                                   | No                    | White | Yes                  |
| NSB8MHN042-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MHN043-0        |                                   | No                    | Black | Yes                  |
| NSB8BHN140-0        | Warmer/Cooler interface           | Yes                   | White | No                   |
| NSB8BHN141-0        |                                   | No                    | White | No                   |
| NSB8BHN142-0        |                                   | Yes                   | Black | No                   |
| NSB8BHN143-0        |                                   | No                    | Black | No                   |

Table 3: NS Series Network Sensor ordering information: temperature and CO<sub>2</sub> models

| Product code number | Display and interface information | Johnson Controls logo | Color | PIR occupancy sensor |
|---------------------|-----------------------------------|-----------------------|-------|----------------------|
| NSB8BTC040-0        | No display                        | Yes                   | White | No                   |
| NSB8BTC041-0        |                                   | No                    | White | No                   |
| NSB8BTC042-0        |                                   | Yes                   | Black | No                   |
| NSB8BTC043-0        |                                   | No                    | Black | No                   |
| NSB8MTC040-0        |                                   | Yes                   | White | Yes                  |
| NSB8MTC041-0        |                                   | No                    | White | Yes                  |
| NSB8MTC042-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MTC043-0        |                                   | No                    | Black | Yes                  |
| NSB8BTC240-0        | Fixed segment display             | Yes                   | White | No                   |
| NSB8BTC241-0        |                                   | No                    | White | No                   |
| NSB8BTC242-0        |                                   | Yes                   | Black | No                   |
| NSB8BTC243-0        |                                   | No                    | Black | No                   |
| NSB8MTC240-0        |                                   | Yes                   | White | Yes                  |
| NSB8MTC241-0        |                                   | No                    | White | Yes                  |
| NSB8MTC242-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MTC243-0        |                                   | No                    | Black | Yes                  |

Table 4: NS Series Network Sensor ordering information: temperature only models

| Product code number | Display and interface information | Johnson Controls logo | Color | PIR occupancy sensor |
|---------------------|-----------------------------------|-----------------------|-------|----------------------|
| NSB8BTN240-0        | Fixed segment display             | Yes                   | White | No                   |
| NSB8BTN241-0        |                                   | No                    | White | No                   |
| NSB8BTN242-0        |                                   | Yes                   | Black | No                   |
| NSB8BTN243-0        |                                   | No                    | Black | No                   |
| NSB8MTN240-0        |                                   | Yes                   | White | Yes                  |
| NSB8MTN241-0        |                                   | No                    | White | Yes                  |
| NSB8MTN242-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MTN243-0        |                                   | No                    | Black | Yes                  |
| NSB8BTN040-0        | No display                        | Yes                   | White | No                   |
| NSB8BTN041-0        |                                   | No                    | White | No                   |
| NSB8BTN042-0        |                                   | Yes                   | Black | No                   |
| NSB8BTN043-0        |                                   | No                    | Black | No                   |
| NSB8MTN040-0        |                                   | Yes                   | White | Yes                  |
| NSB8MTN041-0        |                                   | No                    | White | Yes                  |
| NSB8MTN042-0        |                                   | Yes                   | Black | Yes                  |
| NSB8MTN043-0        |                                   | No                    | Black | Yes                  |
| NSB8BTN140-0        | Warmer/Cooler interface           | Yes                   | White | No                   |
| NSB8BTN141-0        |                                   | No                    | White | No                   |
| NSB8BTN142-0        |                                   | Yes                   | Black | No                   |
| NSB8BTN143-0        |                                   | No                    | Black | No                   |

Table 5: NS Series Network Sensor ordering information: CO<sub>2</sub> only models without display

| Product code number | Johnson Controls logo | Color |
|---------------------|-----------------------|-------|
| NSB8BNC040-0        | Yes                   | White |
| NSB8BNC041-0        | No                    | White |
| NSB8BNC042-0        | Yes                   | Black |
| NSB8BNC043-0        | No                    | Black |

Table 6: NS Series Network Sensor ordering information: temperature and humidity models (2% RH)

| Product code number | Display and interface information | Johnson Controls logo | Color |
|---------------------|-----------------------------------|-----------------------|-------|
| NSB8BPN240-0        | Fixed segment display             | Yes                   | White |
| NSB8BPN241-0        |                                   | No                    | White |
| NSB8BPN242-0        |                                   | Yes                   | Black |
| NSB8BPN243-0        |                                   | No                    | Black |

### NS Sensors with fault code capability error codes

The fault indication comes through the network sensor bus when a network sensor is used in the zone. The LCD indicates the code number for all the required state of California Title 24 economizer fault conditions.


Table 7: Fault code capability error codes

| Display text | California Title 24 economizer fault condition | Possible problem   |
|--------------|--|--|
| <b>E00</b>   | Air temperature sensor failure/fault           | Problem with one of the air temperature sensors. Check outdoor air, return air, or supply air sensors.       |
| <b>E01</b>   | Not economizing when it should                 | The economizer is not using outdoor air when it should.  |
| <b>E02</b>   | Economizing when it should not                 | The economizer is allowing outdoor air inside when the conditions are not suitable for economizer operation. |
| <b>E03</b>   | Damper not modulating                          | The economizer damper is not able to modulate properly. Check damper, linkage to actuator, or the actuator.  |
| <b>E04</b>   | Excess outdoor air                             | The economizer is allowing excess outdoor air inside.  |

## ■ Technical specifications

|  |  |   |   |
|--|--|---|---|
| <b>Supply voltage</b>                                |  | 9.8 VDC to 16.5 VDC; 15 VDC nominal (from SA bus)   |   |
| <b>Current consumption</b>                           | <b>Base current draw (all models)</b>  | 3 mA maximum (non-transmitting)   |   |
|  | <b>CO<sub>2</sub> models</b>   | 15 mA maximum additional current (during measurement)   |   |
|  | <b>Display models - backlight on</b>   | 10 mA additional current  |   |
|  | <b>Warmer/Cooler models - LEDs on</b>  | 8 mA additional current   |   |
|  | <b>Note:</b> SA bus applications are limited to a power load of 210 mA. The best practice when configuring an SA bus is to limit the total available operating power consumption to 120 mA or less. This power level allows you to connect a BTCVT Wireless Commissioning Converter temporarily or a DIS1710 Local Controller Display to the bus for commissioning, adjusting, and monitoring. |   |   |
| <b>Terminations</b>                                  |  | Modular jack and screw terminal block   |   |
| <b>Network sensor addressing</b>                     | <b>All models</b>  | DIP switch set from 199 to 206; factory set at 199  |   |
| <b>Wire size</b>                                     | <b>Modular jack models</b>   | 24 AWG or 26 AWG (0.5 mm or 0.4 mm diameter); three twisted pair (six conductors)   |   |
|  | <b>Screw terminal block models</b>   | 18 AWG to 22 AWG (1 mm to 0.6 mm diameter); 22 AWG (0.6 mm diameter)  |   |
| <b>Communication rate</b>                            |  | Auto-detect: 9.6 kbps, 19.2 kbps, 38.4 kbps, or 76.8 kbps   |   |
| <b>Temperature measurement range</b>                 |  | 32°F/0°C to 104°F/40°C  |   |
| <b>Temperature sensor type</b>                       |  | Digital temperature sensor  |   |
| <b>Humidity sensor type</b>                          |  | Thin film capacitive sensor   |   |
| <b>Ambient conditions</b>                            | <b>Operating</b>   | 32°F to 122°F (0°C to 50°C); 10% to 90% RH, noncondensing; 85°F (29°C) maximum dew point  |   |
|  | <b>Storage</b>   | <b>Display models</b>   | -40°F to 122°F (-40°C to 50°C); 5% to 95% RH, noncondensing |
|  |  | <b>Non-display models</b>   | -40°F to 185°F (-40°C to 70°C); 5% to 95% RH, noncondensing |
| <b>Temperature resolution</b>                        |  | ±0.5°F/±0.5°C   |   |
| <b>Temperature accuracy</b>                          | <b>NS Series Network Zone Sensor</b>   | ±1°F/±0.6°C   |   |
|  | <b>Temperature element only</b>  | ±0.36°F/±0.2°C at 70°F/21°C   |   |
| <b>Humidity element accuracy</b>                     | <b>NSB8BPN24x-0 models</b>   | ±2% RH for 20% to 80% RH at 50°F to 95°F (10°C to 35°C)<br>±4% RH for 10% to 20% and 80% to 90% RH at 50°F to 95°F (10°C to 35°C) |   |
|  | <b>NSB8BHxxxx-0 models</b>   | ±3% RH for 20% to 80% RH at 50°F to 95°F (10°C to 35°C)<br>±6% RH for 10% to 20% and 80% to 90% RH at 50°F to 95°F (10°C to 35°C) |   |
| <b>CO<sub>2</sub> measurement range</b>              |  | 0 ppm - 2000 ppm  |   |
| <b>CO<sub>2</sub> sensor accuracy</b>                | <b>Accuracy</b>  | ±30 ppm ±3% of CO <sub>2</sub> reading at 77°F (25°C) and 978 hPa (1,000 ft/300 m)  |   |
|  | <b>Temperature dependence</b>  | ±1.4 ppm/°F (± 2.5 ppm/°C)  |   |
|  | <b>Pressure dependence</b>   | Refer to the NS8000 Series Network Sensors Installation Instructions (24-11256-00007) for CO <sub>2</sub> altitude compensation.  |   |
| <b>CO<sub>2</sub> sensor operation range</b>         |  | 32°F to 122°F (0°C to 50°C)   |   |
| <b>Time constant</b>                                 |  | 10 minutes nominal at 10 fpm airflow  |   |
| <b>Default temperature setpoint adjustment range</b> |  | 50°F/10°C to 86°F/30°C in 0.5° increments   |   |
| <b>CO<sub>2</sub> sensor lifespan</b>                |  | 10 years under standard operating conditions  |   |
| <b>PIR occupancy sensor motion detection</b>         |  | Minimum 94 angular degrees up to a distance of 26 ft (8m);<br>Based on clear line of sight  |   |

## NS8000 Series

|   |                                  |   |
|---|----------------------------------|---|
|  | <b>United States</b>             | UL Listed, File E107041, CCN PAZX,<br>Under UL 60730-1, Energy Management Equipment<br>FCC Compliant to CFR 47, Part 15, Subpart B, Class B                                   |
|   | <b>Canada</b>                    | cUL Listed, File E107041, CCN PAZX7,<br>Under CAN/CSA E60730-1, Signal Equipment<br>Industry Canada, ICES-003   |
|   | <b>Europe</b>                    | CE Mark – Johnson Controls declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive and RoHS Directive. |
|   | <b>Australia and New Zealand</b> | RCM Mark, Australia/NZ Emissions Compliant  |
|   | <b>China</b>                     | RoHS2   |
| <b>Dimensions (height x width x depth)</b>  |                                  | 3.4 in. x 5 in. x 1.1 in. (85.3 mm x 127.55 mm x 26.8 mm)   |
| <b>Shipping weight</b>  |                                  | 0.4 lb/0.18 kg  |

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 shall not be liable for damages resulting from misapplication or misuse of its products.