



Building Automation

i-Bean® Wireless Sensor Network

User's Guide

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CAUTION

All device installation, configuration, and reconfiguration must be performed only by qualified service personnel.

Initialization of the product should be performed only by a qualified systems administrator.

Compliance Statement

FCC compliance for Millennial Net's Building Automation system consisting of the following models/components:

- GS-5209Z1 Gateway Server
- RT-5209Z1 Sub-base Router
- RT-5209Z2 Standalone Router

Compliance Statement (Part 15.19)

The Millennial Net Building Automation system complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

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Information subject to change.

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About This Guide

This section provides information related to the content of the user guide:

- ['Audience' on page -xii](#)
- ['How to Use This Guide' on page -xii](#)
- ['Symbols and Conventions' on page -xiii](#)
- ['Contacting Millennial Net' on page -xiv](#)

Audience

This guide is intended for the following qualified service personnel who are responsible for installing and operating the i-Bean Building Automation System:

- System installer
- Hardware technician
- System operator

How to Use This Guide

The sections of this guide provide the following information:

Section	Provides
Chapter 1, "Network Overview"	Overview of the Building Automation system and the i-Bean network.
Chapter 2, "i-Bean Network Hardware"	<ul style="list-style-type: none">- Details of the i-Bean hardware: Gateway Server, Sub-base Routers, and Standalone Routers.- Specifications for each device is also listed here.- Recommendations for implementing a wireless network.
Index	An alphabetical index of topics described in this manual.

Note: For instructions on installing the i-Bean devices described in this guide, refer to the *Quick Start Guide for Building Automation* (P/N DOC-0010).

Symbols and Conventions

This guide uses the following symbols and conventions to emphasize certain information.

Note: A note is used to highlight important information relating to the topic being discussed.

Caution

A caution means that a specific action could cause harm to the equipment or to the data.



Warning

A warning describes an action that could result in physical injury, or destruction of property.



Hazard

A hazard is a particular form of warning related expressly to electric shock.

[Blue text](#) indicates a link to the item within the PDF file.

Italics - Indicate the first occurrence of a new term, book title, and emphasized text.

1. Numbered list - Where the order of the items is important.

- Bulleted list - Where the items are of equal importance and their order is unimportant.

Contacting Millennial Net

World Wide Web

Millennial Net maintains a site on the World Wide Web where information on the company and its products can be found. The URL is:

www.millennialnet.com

Customer Support

For answers to your technical questions, Millennial Net's Customer Service department can be reached at:

phone:
781.222.1030

e-mail:
support@millennialnet.com

Technical Publications

Millennial Net is committed to providing you with quality technical documentation. Your feedback is valuable and appreciated. Please send comments, suggestions, and enhancements regarding this guide or any Millennial Net documentation to:

support@millennialnet.com

Please include the document title, number, and version in your email.

1

Network Overview

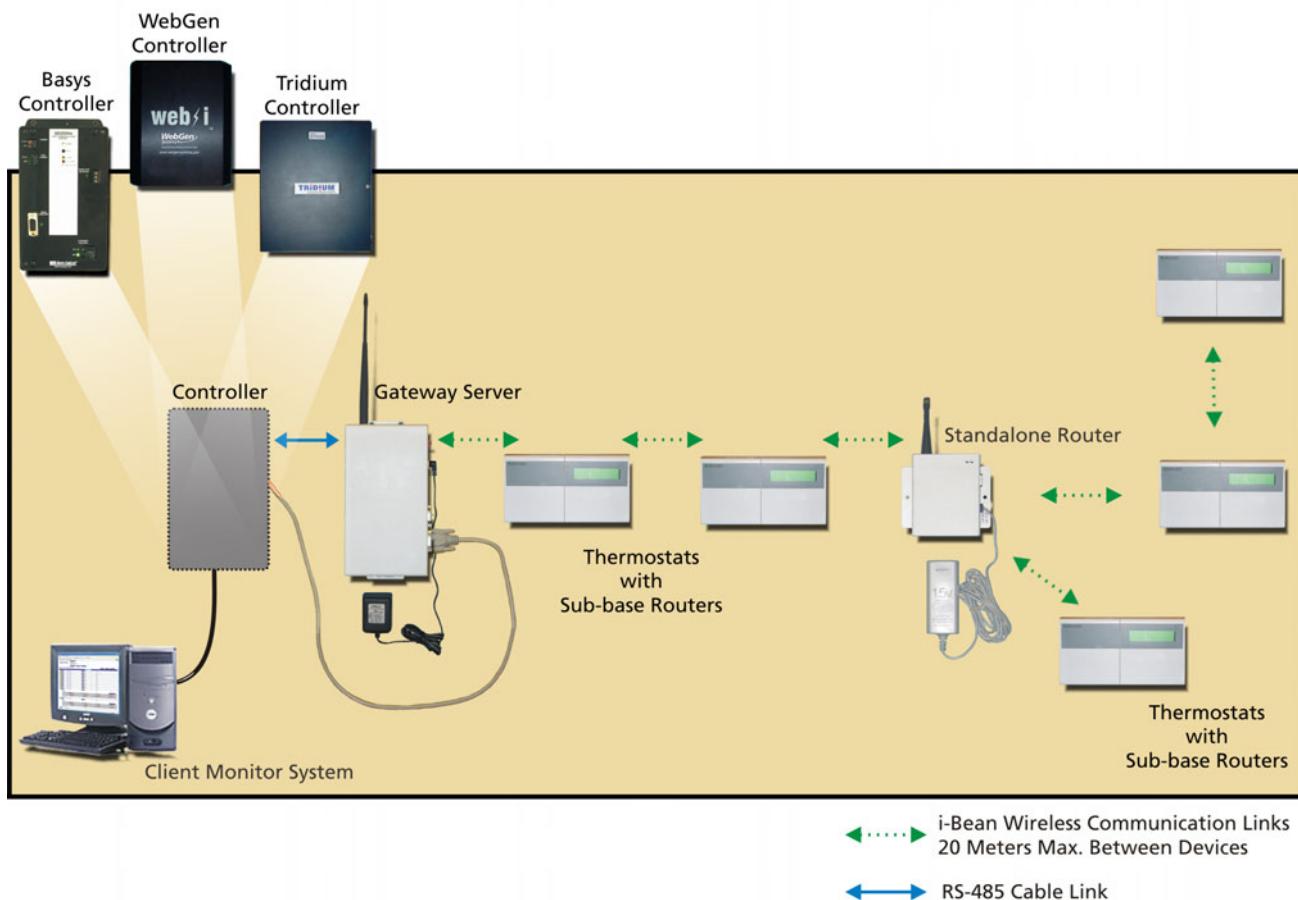
This chapter provides an overview of Millennial Net's Building Automation system. In this chapter you will find:

- ['Product Overview' on page 1-2](#)
- ['General Network Characteristics' on page 1-3](#)
- ['i-Bean Network Overview' on page 1-4](#)

Product Overview

The Building Automation system uses Millennial Net's i-Bean® technology to allow monitoring and configuring of building thermostats over a wireless network. When installed, the i-Bean wireless network replaces the RS-485 bus typically used between the controller and the associated thermostats, eliminating the need for running cables between devices. Millennial Net's Gateway Server provides the interface between the controller and the Millennial Net Sub-base Routers attached to each thermostat. Figure 1-1 provides a view of the various components of the Building Automation system.

Figure 1-1. Millennial Net's Building Automation Wireless Network



Client Monitor System

The client monitor system contains the third party Building Management System for monitoring and control of the thermostats on the wireless network.

Controller

The controller is a data collection and storage device that is designed to communicate directly with TCS/Basys Controls S-series microprocessor-based thermostats over an RS-485 cable. Millennial Net supports the following third party controller models:

- Basys Controller, model: QD2020ie

- WebGen Controller, model: Web-i
- Tridium Controller, model: JACE-403

Gateway Server

Millennial Net's *Gateway Server* translates messages from the controller's RS-485 port to Millennial Net packets for wireless transmission to a thermostat's Sub-base Router and vice versa. The Gateway Server also manages the wireless network.

Sub-base Router (mounted to back of thermostats)

Millennial Net's *Sub-base Router* provides each thermostat with wireless communications. The Sub-base Router converts data on the thermostat's RS-485 line to/from Millennial Net packets.

Standalone Router

Millennial Net's *Standalone Router* is used in applications requiring increased distances between Sub-base Routers, Sub-base Router(s) and the Gateway Server, or to circumvent obstacles preventing good wireless communications.

General Network Characteristics

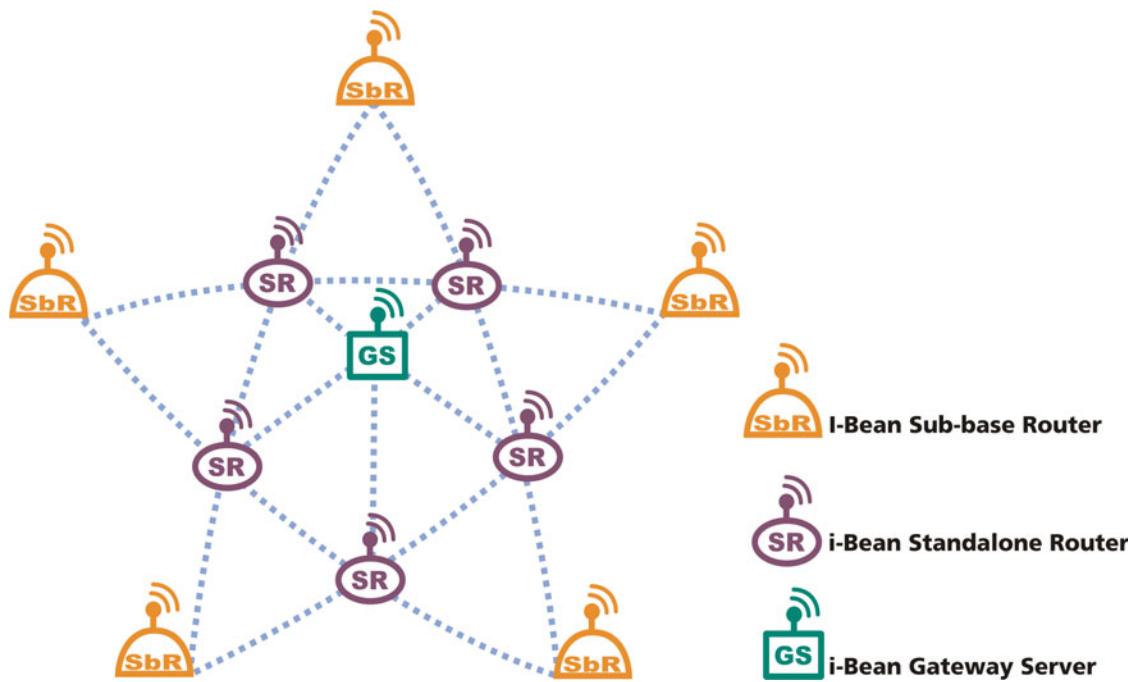
Characteristics of the Building Automation system include the following:

- **Communication path:** Messages are passed from i-Bean node to i-Bean node until they reach their destination, extending the range and allowing for routing around obstacles. Up to six intermediate i-Bean nodes (Sub-base Routers or Standalone Routers) can hop the signal from source to destination.
- **Range:** Typically, 20 meters maximum between any of the i-Bean nodes. This value is based on a same-floor application, in which all the devices are on one floor without any obstacles between them. The actual distances between devices will vary depending on environmental issues, such as the number of floors between devices, construction material, etc.
- **Number of thermostats:** Up to seven thermostats and seven Sub-base Routers and/or Standalone Routers can be used in a wireless network with one controller and one Gateway Server.
- **Polling rate:** Typically, from two to three nodes (Sub-base Routers with attached thermostats or Standalone Routers) per second, depending on network topology. A star network topology, in which Sub-base Routers or Standalone Routers are only one or two hops from the Gateway Server, supports a higher polling rate than a linear topology, in which the furthest node is reached through several hops. For more information on different network topologies, refer to '[i-Bean Network Overview](#)' on page 1-4.
- **Radio frequency:** i-Bean network nodes use the license-free 916 MHz band.
- **FCC Compliance:** All radio components are designed to be compliant with FCC 15.249.

i-Bean Network Overview

Millennial Net's innovative, self-organizing i-Bean network technology combines micro-power sensor interface Sub-base Routers and Standalone Routers with a Gateway Server to form a reliable, scalable Star Mesh wireless network (see [Figure 1-2](#)). This is a unique solution for low data-rate networks that provides fault-tolerant networking. Our patent-pending network protocol creates robust, fully redundant wireless links from the Gateway Server to the Sub-base Routers and optional Standalone Routers through a self-configuring mesh network.

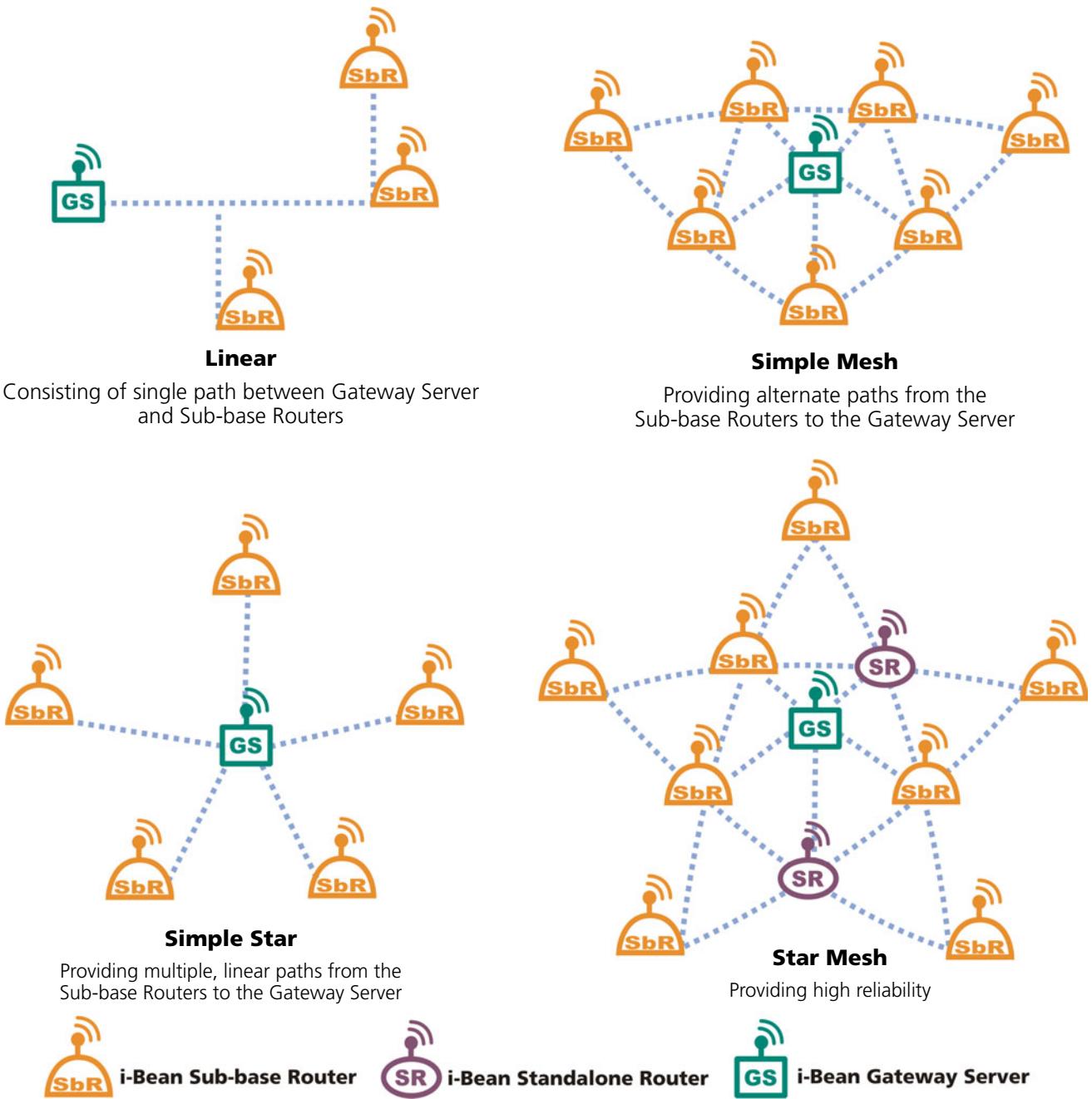
Figure 1-2. i-Bean Network Topology



Each i-Bean network device is configured at the factory with a unique *device ID* and a *group ID*. The device ID identifies the device within a network, while the group ID identifies the i-Bean network that the device is associated with. Both IDs are statically assigned and cannot be changed by a system user. The group ID allows i-Bean devices to establish networks within the same location without interfering with each other. Sub-base Routers and Standalone Routers can join the network only if they have the same group ID that is assigned to the Gateway Server.

The i-Bean network devices self-organize at power-up and re-configure in response to changes in the environment, network traffic, device status, and location. These devices enable mobility and minimize installation and operating costs.

Figure 1-3 illustrates several different possible i-Bean wireless network topologies. Standalone Routers are included randomly in the Star Mesh example to illustrate how they can be placed where needed to increase the communication range between device hops or circumvent obstacles.

Figure 1-3. Sample i-Bean network topologies

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i-Bean Network Hardware

This chapter provides information on the parts associated with each i-Bean device and lists the technical specifications of each device. Also included here is a section containing recommendations for attaining optimal network performance.

- ['Gateway Server' on page 2-2](#)
- ['Sub-base Router' on page 2-4](#)
- ['Standalone Router' on page 2-6](#)
- ['Performance Considerations' on page 2-8](#)

Gateway Server

Shown in Figure 2-1, Millennial Net's Gateway Server (model GS-5209Z1) translates messages from a controller's RS-485 port to Millennial Net packets for wireless transmission to thermostats, and vice versa.

Figure 2-1. Gateway Server and associated parts



Gateway Server Parts

Referring to Figure 2-1, the Gateway Server assembly is shipped with the following items:

1. Gateway Server
2. Gateway Server antenna
3. RS-485 cable (DB-9 to tinned leads)
4. Wall plug-in regulated AC adapter (120 VAC to 12 VDC)

Note: For instructions on installing the Gateway Server, refer to the *Quick Start Guide for Building Automation* (P/N DOC-0010).

Gateway Server Specifications

Components

- RS-485 Network Port:
 - DB-9 (female)
 - Configured internally to 9600, 8, n, 1, no flow control
- Power:
 - Jack for 12 VDC from external regulated AC adapter (included); OD 5.5 mm, ID 2.5 mm; outer connector is ground, inner is +12 V.
 - Slide switch turns device off and on
- READY LED: Illuminates solid after the device initializes (approx. 1 minute)

Power Requirements

- Gateway Server: 12 VDC @ 250 mA (from regulated AC adapter)
- AC adapter: 120 VAC

Dimensions

- Height (without antenna): 9.0" (228 mm), including mounting flanges. Antenna extends height: 7.3" (186 MM) above top of mounting flanges.
- Width: 4.6" (116 mm)
- Depth: 2.4" (60 mm)

Temperature Range

0–55° C, operating

Sub-base Router

Shown in Figure 2-2, Millennial Net's Sub-base Router (model RT-5209Z1) provides the following functionality:

- Provides wireless communications for thermostats via unobtrusive add-on.
- Converts thermostat data on RS-485 line to/from wireless, transceiving in license-free 916 MHz ISM band.
- Fits between Basys model SZ1022 thermostat and wall.
- Accommodates mounting to wall or junction box.
- Passes wiring through the Sub-base Router to the thermostat.
- Powered by same 24 VAC source used by the thermostat.

Figure 2-2. Sub-base Router



Sub-base Router Parts

Referring to Figure 2-2, the Sub-base Router is shipped with the following:

1. Sub-base Router
2. Screws (not shown) for mounting the Sub-base Router to the thermostat.

Note: For instructions on installing the Sub-base Router, refer to the *Quick Start Guide for Building Automation* (P/N DOC-0010).

Sub-base Router Specifications

Components

- RS-485: Screw terminal strip for RS-485 + and RS-485 - connections.
- Power: Screw terminal strip for 24 VAC input (from thermostat)
- System LED:
 - Device Online: Illuminates solid
 - Device Offline: Blinks

Power Requirements

24 VAC @ 50 mA continuous

Dimensions

- Height: 3.7" (95 mm)
- Width: 6.7" (170 mm)
- Depth: 1.1" (28 mm)

Temperature Range

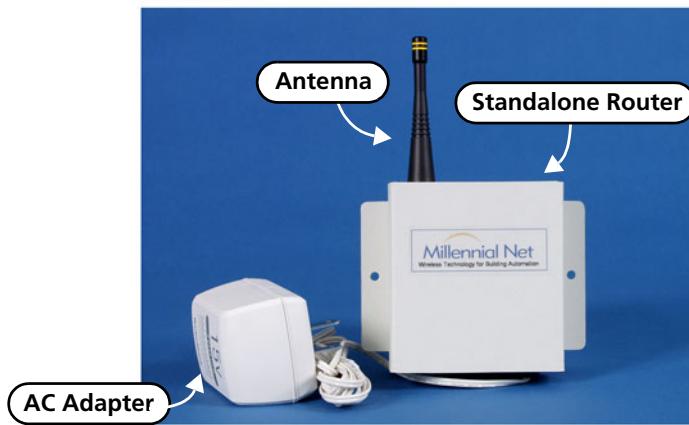
0–55° C, operating

Standalone Router

Shown in Figure 2-3, Millennial Net's Standalone Router (model RT-5209Z2) provides the following functionality:

- Used as repeaters to:
 - Extend the range between a Sub-base Router and the Gateway Server or between Sub-base Routers.
 - Circumvent communication path obstacles.
- May be mounted wherever needed and where 120 VAC power is available.

Figure 2-3. Standalone Router



Standalone Router Parts

Referring to Figure 2-3, the Standalone Router is shipped with the following:

1. Standalone Router with attached regulated AC adapter
2. Screw-on antenna

Note: For instructions on installing the Standalone Router, refer to the *Quick Start Guide for Building Automation* (P/N DOC-0010).

Standalone Router Specifications

Components

- Antenna jack
- Power: Attached regulated AC adapter
- Ready LED: Blinks once every several seconds to indicate communication with Gateway Server

Power Requirements

120 VAC, using attached plug-in regulated AC adapter

Dimensions

- Height: 3.7" (95 mm) plus 2.9" (74 mm) antenna height
- Width: 3.4" (87 mm), including mounting flanges
- Depth: 1.2" (31 mm)

Temperature Range

0–55° C, operating

Performance Considerations

Since the i-Bean wireless network uses radio waves to communicate between devices, there are a number of items that need to be considered when implementing this type of network. This section of the manual provides a number of suggestions that will ensure that your wireless network will operate at its peak level of performance.



Warning

These electronic products are sensitive to electrostatic discharge (ESD). Permanent damage to these devices can result if subjected to high energy electrostatic discharges.

Proper precautions are recommended to avoid performance degradation or loss of functionality.

General Installation Recommendations

When installing the i-Bean wireless network devices, observe the following recommendations when possible for optimal performance:

- **Higher locations for i-Bean devices are generally better than lower locations.** A higher location usually provides a clear communication path over obstacles.
- **Locate i-Bean devices at least one foot from metal shielding on all sides.** Avoid obstacles such as book shelves and file cabinets.
- **Avoid sources of electrical noise, such as motors, pumps, and welding machines.** Locate i-Bean devices at least two feet from fluorescent fixtures.
- **Avoid other devices using 900 MHz Industrial/Scientific/Medical (ISM) band.** This includes such items as cordless phones, intercoms, and walkie-talkies.

Note: For instructions on installing the i-Bean devices, refer to the *Quick Start Guide for Building Automation* (P/N DOC-0010).

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