Modular Room Control (MRC) Series Network Architecture

Application

This document specifies the multiple architectural design options for the Central Interface Network (CINET) of the MRC series of controls. It includes the local network within the hotel room to the network that connects the individual floors to the Central Interface Server (CIS). The network architecture has the flexibility to allow wired or wireless operation, using RS485 and RS232 topology.

The CIS computer can communicate with all the stations in the property. A station can take the form of a MRC digital thermostat or other control products (for example, Central Electronic Lock System [CELS]).

The CIS communicates with the stations via the CINET, a data-bus that acts like a Local Area Network (LAN), connecting all the stations to the CINET and to each other.

The CINET is physically broken into two groups: the Riser segment and the Floor segments. The Riser segment connects the CIS to the Floor Bridges; the Floor segment connects the Floor Bridges with the stations.

The bridges are active, smart devices that route the CINET signals at their input and retransmit the signals on their output to drive a separate segment. The bridges are used at the CIS end to drive the risers and at each floor to drive the stations.

Installation

Following are the four items needed for Centrally Controlled Energy Management System (EMS):

- the MRC Digital Thermostat with motion sensor and door switch in the guest room
- a Floor Bridge on each floor (each bridge serving up to 50 rooms)
- a Riser Bridge (serving up to 40 Floor Bridges)
- a Central Interface Server (serving up to 8 Riser Bridges) with associated Windows® Personal Computer (PC) display terminals

Adding a single twisted pair of wires (22-gage minimum) from the back of an MRC digital thermostat to a Floor Bridge device, then serially connecting the Floor Bridges together with a single twisted pair of wires down to a Riser Bridge, and then connecting the Riser Bridge to the CIS, real-time central control of all guest room Heating, Ventilating, and Air Conditioning (HVAC) equipment in the hotel is achieved.

Another element required is a Property Management System (PMS) server. The PMS easily interfaces with the CIS server to provide guest check-in and checkout information in order to properly determine whether the guest room is rented or unrented.

Wiring

Standard CINET Wiring and Components

Floor Bridge

Mount the Floor Bridge to a wall or backboard in a location where the network cable from the guest rooms can be easily terminated and allows efficient routing between additional Floor Bridges and the Riser Bridge. The network cable from the thermostats is terminated at the Floor Bridge terminal strip. See Figure 6 and Figure 7 for detailed wiring connections.

The Floor Bridge is available in a single bridge or dual bridge configuration. The dual bridge would commonly be used to consolidate mounting locations or where a high volume of controls needs to be mounted on each floor.

Riser Bridge

Mount the Riser Bridge to a wall or backboard in the location where the network cable from the Floor Bridges can be easily terminated and allows efficient routing between the Riser Bridge and the CIS terminal. The Riser Bridge should be located no more than 25 ft (7.6 m) in distance from the CIS. The network cables from the Floor Bridges is terminated at the Riser Bridge terminal strip. See Figure 8 for detailed wiring connections.

The Riser Bridge is configured with dual bridge controls installed. Since the loss of the Riser Bridge would lose communication to the entire property, the second control is redundant and used only as a backup.

Central Interface Server (CIS)

The CIS is a **host** computer that can communicate with all the stations in the property. It includes a PC tower, monitor, keyboard, mouse, and color printer. The CIS software resides on the server and allows additional Central Interface Terminals (CITs) to communicate with the system from additional locations.

The software that is purchased with the system on a per room basis (MRC19-CIT) is loaded onto the MRC19-CIS5 server at the factory.

Wiring Connections Required for CINET

CAUTION: Risk of Electrical Shock.
Before applying power, make all wiring connection and check the connections. Short-circuited or improperly connected wires may result in permanent damage to the unit.

IMPORTANT: Make all wiring connections in accordance with the National Electrical Code (NEC) and all local regulations.

There are five wiring connections needed to implement the standard CINET configuration. Starting from the hotel **basement**, these are:

- CIS to Property Management System (PMS)

  The connection between the CIS and the PMS is a standard RS232 serial cable. The length of the cable should not exceed 100 feet (30.5 m).

- CIS to User Terminals (CITs)

  Data flow between the CIS and CITs is through the hotel's Ethernet or LAN, which is typically a twisted pair of wires.

- CIS to Riser Bridges

  The connection between the CIS and the Riser Bridge is a flat phone grade cable with an 8-pin plug at the CIS end and a 6-pin plug at the Riser Bridge end. This cable is included with the Riser Bridge.

- Riser Bridge to First Floor Bridge and Between Floor Bridges

  The connection from the Riser Bridge to the first Floor Bridge is typically a standard 18 gage twisted pair of wires or equivalent, which connects to the appropriate terminal block on the bridges at either end. The same wiring is used between Floor Bridges.

Note: When riser cabling is run close to line voltage cables, it is recommended that it be shielded. The shielding must be grounded at one end, typically at the Floor Bridge for the floor segment and the Riser Bridge for the riser segment.

- Floor Bridge to MRC Thermostat

  The connection from the Floor Bridge to the thermostats should be a standard 22 gage or higher twisted pair of wires. The connection to the MRC is at the low-voltage terminal pins 5 and 6 (see Figure 1).

  The wiring topology of the floor can be either daisy chain, Star (Home Run) or T-Tap (see Figure 2 through Figure 4).

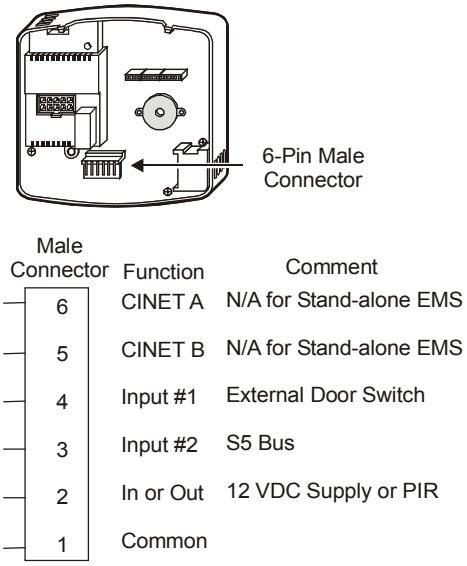


Figure 1: 6-Pin Connector Location and Functionality

Table 1: Standard Cable Recommendations

Connections	Cable Recommended	Distance Limitation
CI Server to PMS Server	RS232 Serial Cable	25 feet (7.6m)
CI Server to CIT Terminals	LAN	None
CI Server to Riser Bridges	RS232 Serial Cable Supplied with Riser	25 feet (7.6 m)
Riser Bridge to Floor Bridges	RS485 18 GA Twisted Pair	1,000 feet (305 m)
Floor Bridge to MRC Thermostat	RS485 22 GA Twisted Pair	2,500 feet (762 m)

Wiring Topology

The design of this system is unique in that it allows for multiple options for wiring the room thermostats to the Floor Bridges. It also allows for a combination of these options to be used, allowing maximum flexibility when developing the CINET wiring strategy, or working under restrictive conditions within a retrofit application.

The same options that are available for wiring between the rooms and the Floor Bridge can also be deployed when wiring the Floor Bridges to the Riser Bridge. For example, in a facility that has three towers, the rooms on each floor could be connected with a T-tap configuration to the Floor Bridge, while each Floor Bridge within the tower is connected to the next Floor Bridge using daisy-chain configuration. The last Floor Bridge in each tower could be home run to the Riser Bridge. See Figure 2 through Figure 4.

Daisy Chain

This is the most common method of wiring the rooms in the floor. The CINET twisted pair starts in the distribution cabinet and is connected to the Floor Bridge. From there a single twisted pair is run from room to room, with the wires being terminated at each thermostat within the room. The wire ends at the last thermostat in the line, and there is no need for end-of-line termination. See Figure 2.

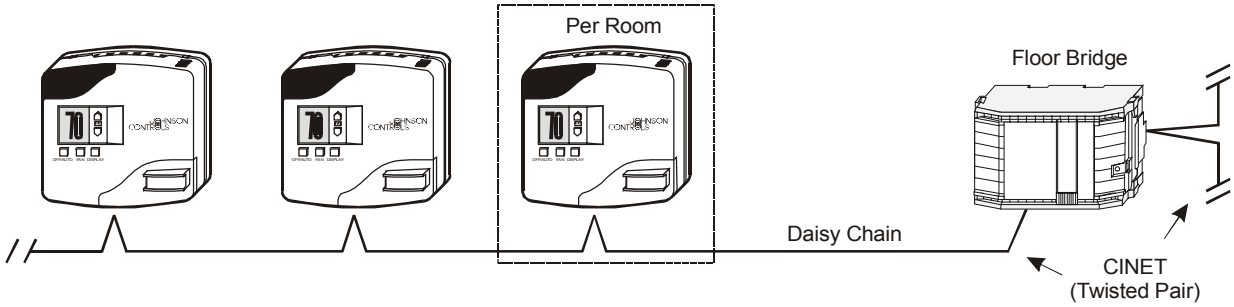


Figure 2: Daisy Chain Floor Wiring

Star (Home Run)

This configuration is used when the floor is already wired for telephones in each room, with an extra pair of wires available. The spare wires-pair to each room starts at the distribution cabinet and is run directly to the room.

All the pairs of wires in the cabinet are connected in parallel, observing polarity, and the common pair is connected to the Floor Bridge. When this option is used, it is suggested that a terminal block be added to facilitate the high volume of terminations that is required. See Figure 3.

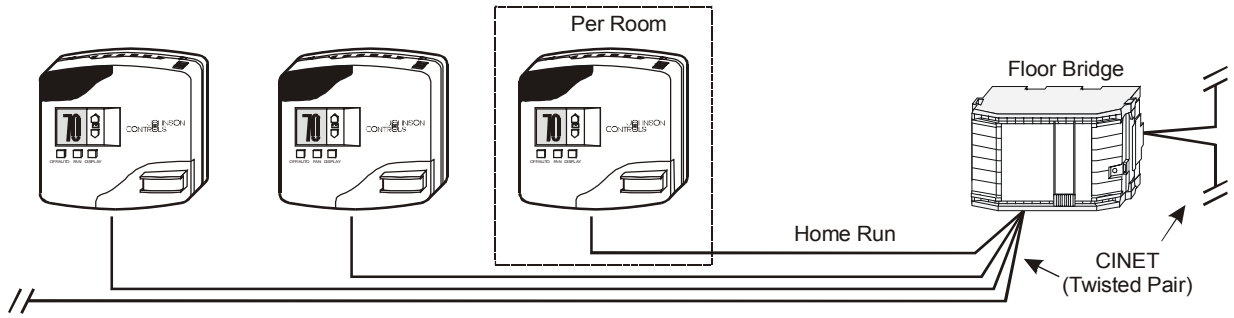


Figure 3: Star (Home Run) Floor Wiring

T-Tap

In this method, a cable is strung starting with the distribution cabinet and ending in the last room on the floor. The connection for each room is then tapped into the cable at a point close to the room.

The advantage of this approach is that the cabling is the shortest. The disadvantage is that the tapping connections may require service in the future and may not be readily accessible. See Figure 4.

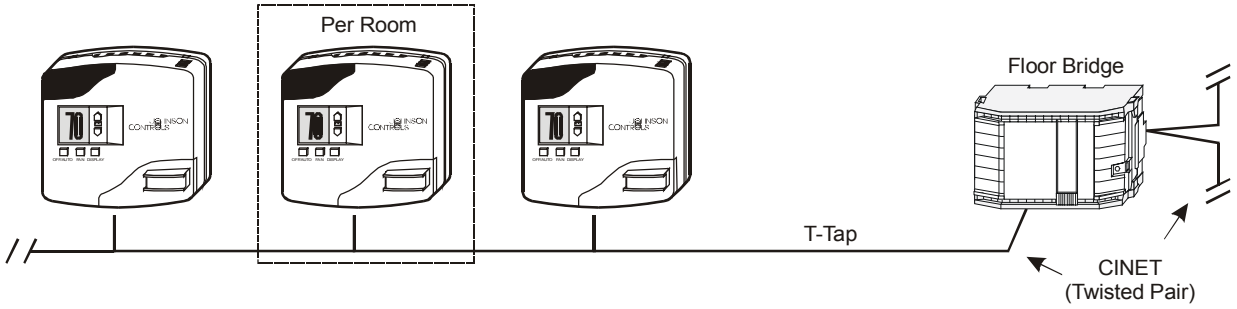


Figure 4: T-Tap Floor Wiring

Floor Bridge, Riser Bridge and CIS Connection

Each Floor Bridge is capable of handling up to 50 devices on its CINET. Each Riser Bridge is capable of handling up to 40 Floor Bridges. Each CIS is capable of handling up to 8 Riser Bridges.

In a typical application, only one Riser Bridge is required. Each Floor Bridge is connected to the Riser Bridge as previously discussed. Within the Riser Bridge is a flat phone cable used to connect the Riser Bridge to the CIS and COM PORT 1. If more than one Riser Bridge is required, then the additional COM ports are required within the CIS.

Note: Refer to Figure 6 through Figure 8 for more detailed information on the wiring terminations for the single and dual Floor Bridge and dual Riser Bridge.

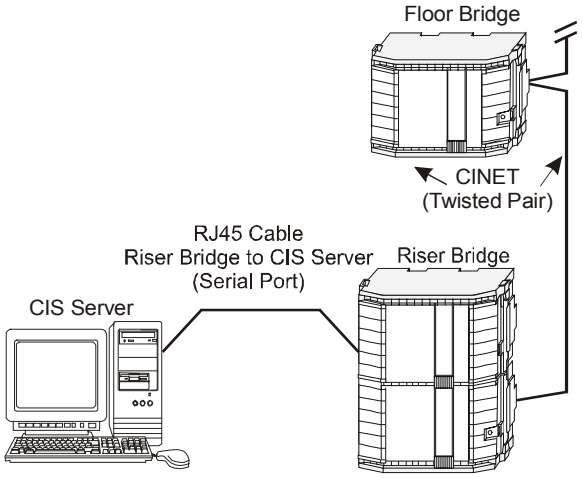
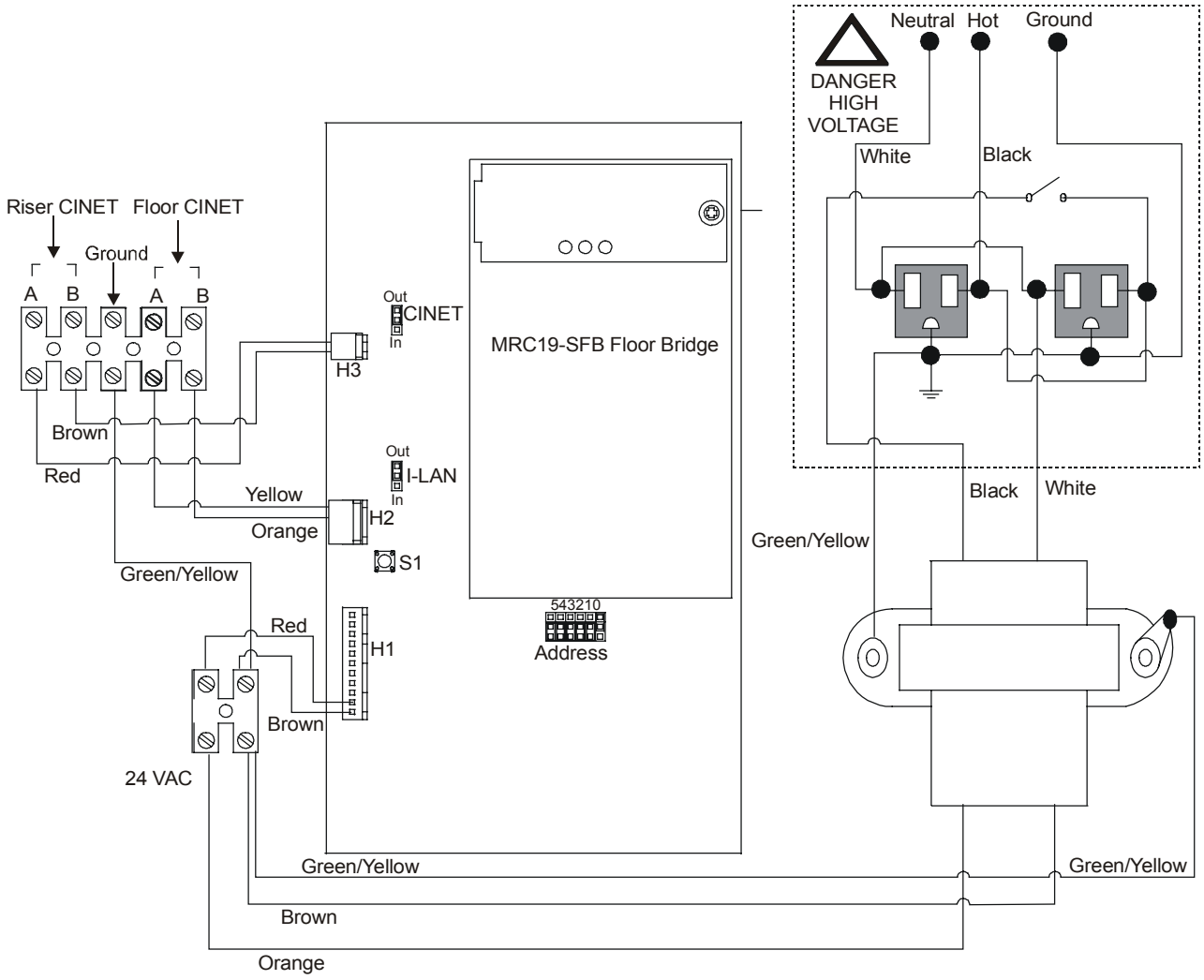
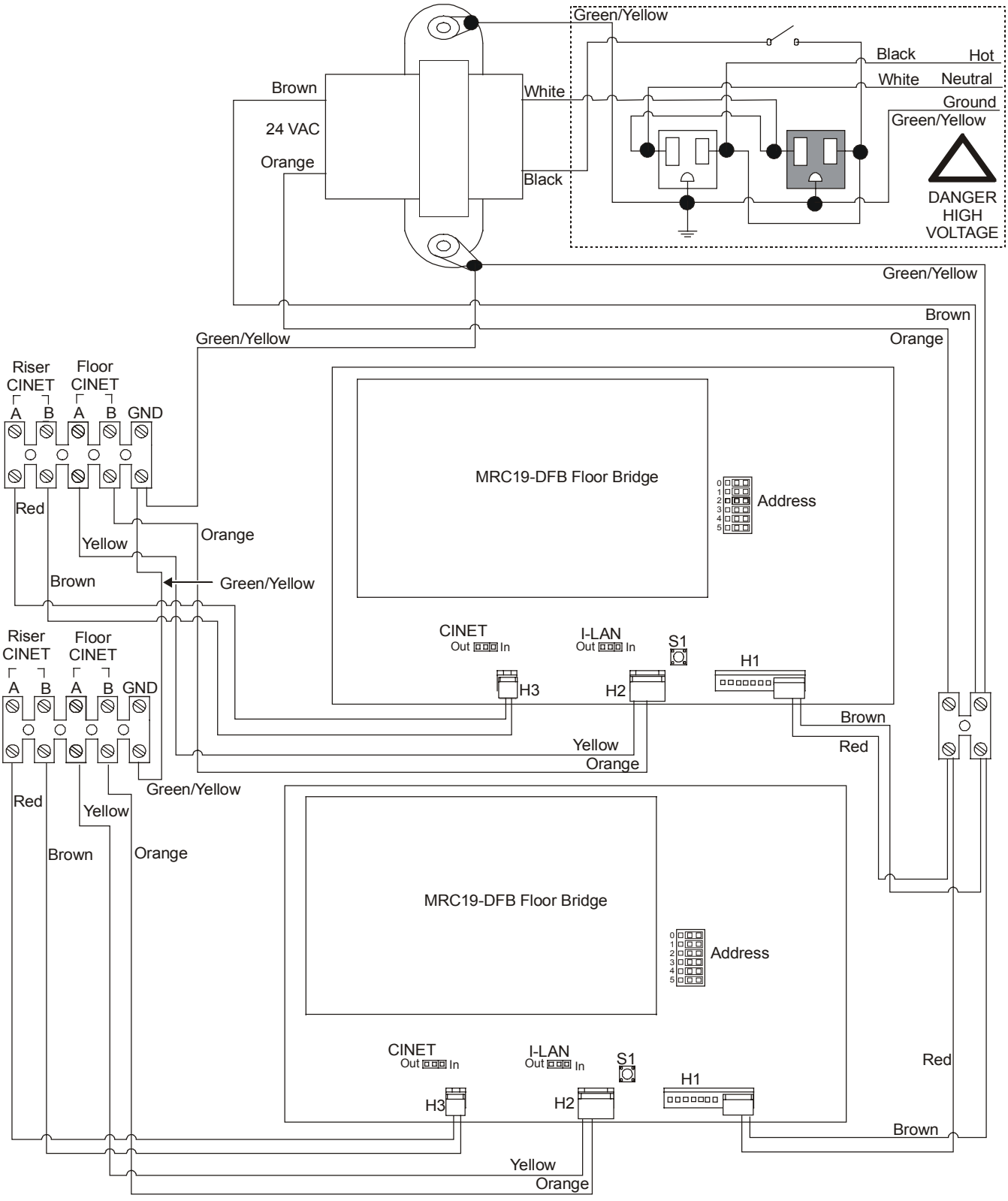


Figure 5: Floor Bridge, Riser Bridge, and CIS Connection



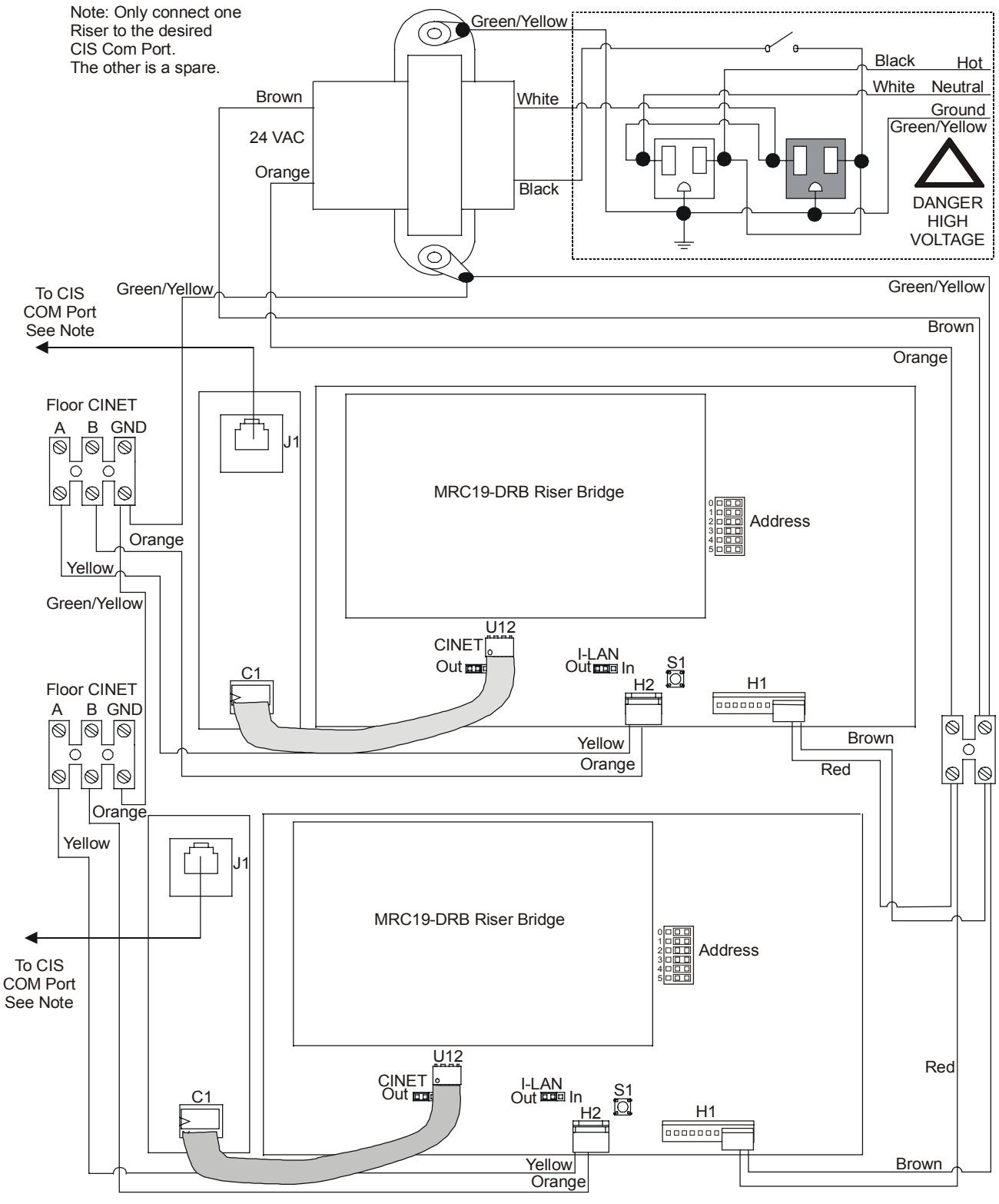
110 VAC model shown - 220 VAC model does not include recepts.

Figure 6: Single Floor Bridge Wiring



110 VAC model shown - 220 VAC model does not include recepts.

Figure 7: Dual Floor Bridge Wiring



110 VAC model shown - 220 VAC model does not include recepts.

Figure 8: Riser Bridge Wiring

Interfacing the CIS with Other Hotel Systems

It is frequently necessary or desirable that the CIS communicate with other hotel systems in order to optimize performance. These interfaces are usually straightforward and require only a few days for programming. When an interface has been implemented in a hotel property with a particular vendor, it can typically be replicated in other properties without further programming work.

The physical connection between the CIS and other systems is a standard RS232 cable.

Following is a brief description of **other** major systems for which interfaces may be needed.

Property Management Systems (PMSs)

The PMS is a type of system used by the vast majority of hotels for all primary accounting and administrative functions. These include checking guests in and out, maintaining guest billing folios, processing payments, and coordinating reservations flow.

The CIS must automatically receive check-in and checkout data from the PMS in order to execute the **rented/unrented** setback strategy for energy management.

The following list of PMSs are available for integration into the CIS:

- Lodging Management Systems (LMS)
- Fidelio®
- Hotel Information Systems® (HIS)
- Multi Systems, Inc. (MSI)
- Lanmark
- Hilton 21
- Megasys®

The companies identified are the parent companies and they may have variations in the products they produce. If clarification is required or integration to another PMS manufacturer is desired, please contact Johnson Controls for assistance.

IMPORTANT: Johnson Controls does not supply Property Management System software.

Door Lock Systems

There are numerous door lock manufacturers within the hotel market place, and most door locks are typically installed in a stand-alone configuration. The ability to interface with the door locks on a real-time basis is becoming more critical to hotel operations. You can use the Central Electronic Lock System (CELS) that is a part of the MRC controls package, to control locks in real time and online.

Note: Refer to the *Modular Room Control Smart Infrared Transceiver (MRC19-SIRx) and Central Electronic Lock Systems (CELS) Installation Instructions (Part No. 24-9778-73)* for additional technical information.

The following lists of door lock manufacturers are available for integration into the CIS:

- Safeloc
- Timelox

The companies identified are the parent companies and they may have variations in the products they produce. If clarification is required, please contact Johnson Controls for assistance.

IMPORTANT: Johnson Controls does not supply Door Lock Systems and their software.

Pre-Wiring the Hotel and Guest Rooms

This information is to provide an overview for the installation of an Integrated Guest room Control system and the requirements for the high-voltage and low-voltage cable, conduit, mounting boxes, and devices in hotel guest rooms.

IMPORTANT: Compliance with the National Electrical Code (NEC), local building codes, regulations, fire codes, or other requirements must be taken into consideration and take precedence over any instructions or recommendations provided in this document.

Cable and wire specifications contained in this document represent the minimum gage wire acceptable for use with the system. Heavier wire gage can be used where it currently exists, is being specified, or is used in conjunction with a different system or structured cable plant installation.

General Description

The MRC Thermostat is a powerful, expandable multi-purpose device. Its core is a Direct Digital Control (DDC) illuminated thermostat designed to control virtually any Fan Coil Unit (FCU) or Packaged Terminal Air Conditioning (PTAC) found in hotel guest rooms. The MRC can be equipped with an on-board Infrared (IR) Transceiver and/or a Passive Infrared (PIR) occupancy sensor. Coupled with a magnetic door switch (wired or wireless), the MRC becomes the brain of a highly effective energy management system for guest rooms.

When connected to CI Network (CINET) with a pair of low-voltage wires, an even more powerful, centrally controlled EMS package is created. Further, the MRC is readily expandable to include functionality such as humidity control, outside temperature display, mini-bar access reporting, occupancy reporting to housekeeping, automatic control of lights and much more. Either infrared or low-voltage wiring can control it remotely.

Cabling Requirements

Only guest room cabling is required for the basic stand-alone DDC control energy management system. See Table 1.

Central Interface Cabling (CINET) is required when a centrally controlled system is being provided and installed. See Table 1.

Specifications, drawings and other requirements provided in this document are based on a typical guest room and hotel configuration. You may need to vary or modify these specifications for unique or unusual installation conditions, or to meet special architectural or building code requirements.

Guest Room Cabling

MRC Thermostat

IMPORTANT: Make sure the earth ground connection is made at the MRC Thermostat to avoid ground loop interference.

- **High-Voltage Controlled Fan Coil (120 volt to 277 volt)**

  When providing high-voltage fan coil control, the MRC Thermostat is typically mounted on a double-gang electrical box with a separation barrier provided between the high-voltage and low-voltage. Alternatively, where there is a single-gang box (as in a retrofit application) being used, the thermostat may be “off-set” mounted, placing the high-voltage section of the thermostat over the single-gang box and the low-voltage section to a “low-voltage mount” (Caddy MP-1 or similar) mounting device.

  A conduit designed for a capacity of seven-conductors, 16-gage wire (or as required by building code) is provided between the thermostat and the fan coil unit in accordance with local electrical codes. The conduit is connected at the fan coil unit as specified by the manufacturer or as existing.

  When installing a Centrally Controlled System, one 24-gage (minimum) twisted pair (category-3 or -5 optional) cable is provided from the thermostat to the point of connection of the central interface cabling in the guest room. Where permitted by code, this cable may be run in the same conduit as the high-voltage wire. Where this is not permitted the low-voltage cable can be run “free air” unless otherwise specified by the architect or owner. Plenum cable is provided as building code requires.

- **Low-Voltage Controlled Fan Coil (24 volt)**

  When providing low-voltage fan coil control the MRC Thermostat is typically mounted on a double-gang electrical box. Alternatively, where there is only a single-gang box (as in a retrofit application), the thermostat may be “offset” mounted placing the low-voltage section of the thermostat over the single-gang box. The other side can be attached to a “low-voltage mount” (Caddy MP-1 or similar) mounting device.

  A conduit designed for a capacity of seven-conductors, 22-gage wire (or as required by building code) is provided between the thermostat and the fan coil unit in accordance with local electrical codes. The conduit is connected at the fan coil unit as specified by the manufacturer or as existing. If a conduit is not provided, this cable may be installed “free-air”.

When installing a Centrally Controlled System, one 24-gage (minimum) twisted pair (category-3 or -5 optional) cable is provided from the thermostat to the point of connection of the central interface cabling in the guest room. Where permitted by code, this cable may be run in the same conduit as the high-voltage wire. Where this is not permitted, the low-voltage cable can be run "free-air" unless otherwise specified by the architect or owner or as dictated by local building code. Plenum cable is provided as building code requires.

Note: Additional conductors may be required if other devices are connected to the MRC Thermostat.

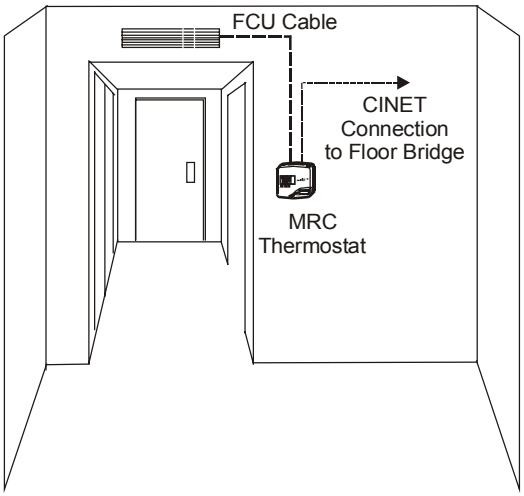


Figure 9: MRC Thermostat Installation

Motion Detector Sensor (PIR) Nonintegrated Thermostat

Note: Refer to the *Modular Room Control MRC19-PIR Series Motion Detector Sensors Installation Instructions (Part No. 24-9778-49)* for more detailed installation and wiring instructions.

- **Wall Mount**

  In each room where a nonintegrated motion sensor is required, run a four-conductor, 24-gage cable from the location of the motion sensor (typically the corner of the room) and any other low-voltage cables directly to the MRC Thermostat (see Figure 10). Leave a minimum of 12 in. (305 mm) of extra cable at the thermostat for connections.

  One end of the cable should extend directly out of the corner, 1-1/2 in. (38 mm) below the bottom of the crown molding (refer to architectural plans for crown molding dimensions). A minimum of 12 in. (305 mm) of extra cable should extend beyond the finished wall surface.

  Note: The sensor is corner mounted and does not cover the cable if it is more than 3/4 in. (19 mm) out of the corner. The specific location of the motion sensor is determined by establishing where the optimal coverage of the room occurs. The owner, project architect, and (or) interior designer must review and approve the location.

  The other end of the cable runs (along with any other low-voltage cables) to the back of the MRC Thermostat. Leave a minimum of 12 in. (305 mm) of extra cable at the thermostat for connections.

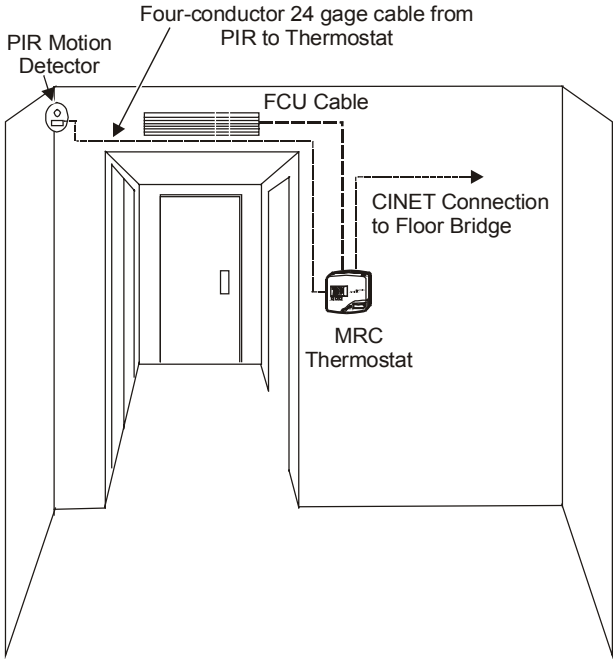


Figure 10: MRC19-PIR Motion Sensor Installation

- **Ceiling Mount**

  Mount the detector on a firm section of ceiling at a height of between 8 and 15 ft. (2.44 and 4.57 m) and well away from neon or fluorescent lights.

  Run a four-conductor, 24-gage cable from the location of the motion detector (along with any other low-voltage cables) to the MRC Thermostat. Leave a minimum of 12 in. (305 mm) of extra cable at the thermostat for connections.

Magnetic Door Switches

IMPORTANT: New Construction. At the time of doorframe installation, the cable must be pulled through a pre-drilled hole in the hollow metal door header. This allows for installation of the door switch at a later date. (The door must also be pre-drilled to accept the magnet side of the door switch.)

- **Wired (MRC19-MDS0)**

  In each room, run a two-conductor, 24-gage [minimum] cable from the thermostat to the doorframe location (see Figure 11) extending through the door header framing leaving a minimum of 5 in. (127 mm) of extra cable. The cable extends through the center of the framing approximately 5 in. (127 mm) in from the top (or side) corner of the door.

  The other end of the cable runs (along with any other low-voltage cables) to the back of the MRC Thermostat. A minimum of 12 in. (305 mm) of extra cable should be left at the thermostat location for termination.

  Note: If an MRC19-PKG0 Do-Not-Disturb/ Make-Up-Room (DND/MUR) external plate is being used, the cable from the MRC19-MDS can be terminated at the location of the MRC19-PKG0. A minimum of 12 in. of extra cable is left at the MRC19-PKG0 location for connection to the MRC19-PKG0. This method of installation eliminates the need to run the cable directly to the MRC Thermostat.

  The MRC19-MDS0 is a normally open reed magnet switch. Electrically, the contacts are closed when the reed switch is in close proximity to a suitable magnet. Figure 11 identifies the recommended mounting method for the switch in a hotel guest room environment. The location of the contact was selected so that the switch detects a door that is resting against the frame but is not latched. Placing the switch closer to the hinge of the door provides a “door closed” indication with increasingly open angle.

  Note: The MRC19-MDS0 has a “lip” that protrudes below the frame of the door. The spacing between the door and the frame must be able to accommodate this lip (which is about 0.060” thick).

  The switch and the mating magnet may also be installed horizontally near the top, as shown in Figure 11 as an alternate location. For installation in a wooden door/frame, the depth of the hole in the frame should be 2 in. (51 mm) and the depth of the hole in the door should be 1 in. (25.4 mm).

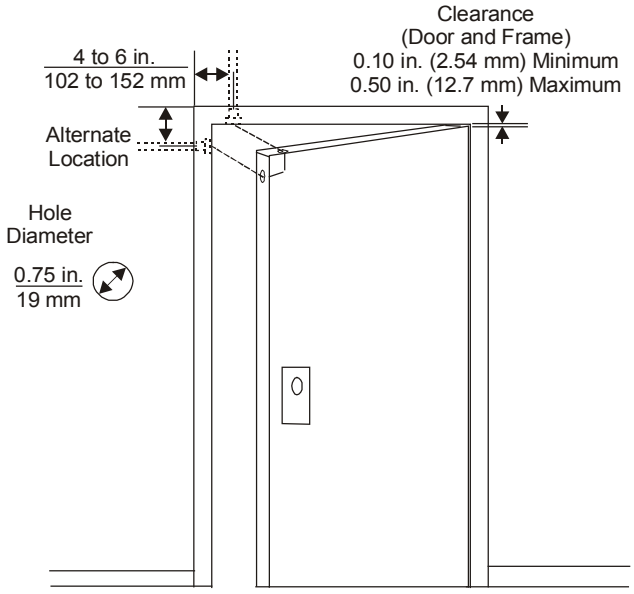


Figure 11: MRC19-MDS0 Installation, in. (mm)

- **Wireless (MRC19-MDS2 or MRC19-MDS3**

  When the MRC19-MDS2 or MDS3 wireless door switch is used, it includes the wire required to run between the IR transmitter and the Magnetic Door Switch. Mount the IR transmitter, typically above or to the side of the doorframe casing and then route the wire through the wall and extend through the door header framing (see Figure 12). The cable is to extend through the center of the framing approximately 5 in. (127 mm) in from the top (or side) corner of the door or where otherwise specified.

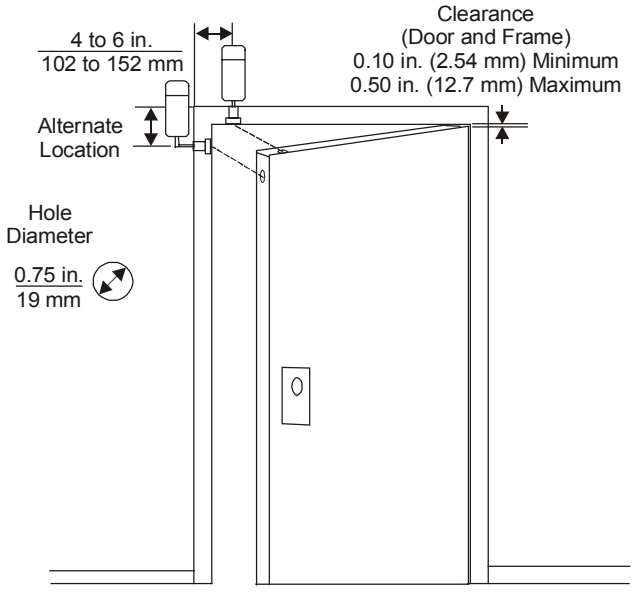


Figure 12: MRC19-MDSx Installation, in. (mm)

MRC19-PKG0 External Door Plate

Note: Refer to the *Do-Not-Disturb/ Make-Up-Room/Door Chime Kit Installation Instructions (Part No. 24-9778-22)* for more detailed installation and wiring instructions.

The MRC19-PKG0 kit includes an external doorplate with door chime, “Do-Not-Disturb” and “Make-Up-Room” message appears. This plate allows ringing the chime inside the guest room and provides a lettered LED indication if the guest requests privacy. There is also a discreet LED indicator if the guest wishes the room to be made up. Additionally, it can indicate current room occupancy status to staff members.

This low-voltage device is mounted on a standard 2-gang box, plaster ring or Caddy MP-1 low-voltage mount (or similar) and is typically mounted at standard switch height. The architect, designer, or owner specifies the actual mounting height and location.

A four-conductor (twisted pair) 24-gage wire [minimum] cable is required between the MRC19-PKG0 and the MRC Thermostat. This cable runs [along with any other low-voltage cables] to the back of the MRC Thermostat (see Figure 13). A minimum of 12 in. (305 mm) of extra cable is left at the thermostat location for termination.

A minimum of 12 in. (305 mm) of extra cable is also left at the mounting location of the MRC19-PKG0 for connections and terminations.

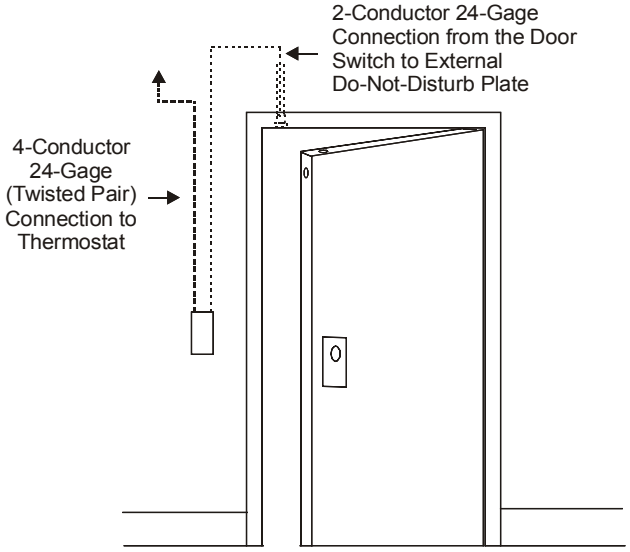


Figure 13: External Door Plate Installation

Technical Specifications

Product	MRC Series Digital Thermostat
Power Requirements	24 VAC at 60/60 Hz, 24 VDC Nominal, 2.4 VA (MRC19-3xxxx and MRC19-4xxxx) 100 to 240 VAC at 50/60 Hz, 2.4 VA (MRC19-5xxxx) 265 to 277 VAC at 50/60 Hz, 2.4 VA (MRC19-6xxxx) 110 VAC at 60/60 Hz, 8.0 VA (MRC19-SFB1), 16 VA (MRC19-DFB1and MRC19-DRB1) 220 VAC at 60/60 Hz, 8.0 VA (MRC19-SFB2), 16 VA (MRC19-DFB2and MRC19-DRB2)
Agency Listings	FCC UL CSA
Ambient Operating Conditions	41 to 149°F (5 to 65°C) 0-95% RH noncondensing
Ambient Storage Conditions	33 to 149°F (1 to 65°C)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

JOHNSON CONTROLS

Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

Printed in U.S.A.
www.johnsoncontrols.com