Guest Room Solutions

Full Service and Luxury
Connected Room Solution for Hotels (RP-C RCU)

Guide Specification

Version 1

Document Version

Version	Description	Author	Date
1.0	Initial version.	Various	09/23/2020
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Abbreviations used within this document

Abbreviation	Long Form
Bell	Door Bell
CRS4H	Connected Room Solution for Hotels
DND	Do not Disturb or Privacy mode
EBOC	Entry-Based Occupancy Control
FCU	Fan Coil Unit
GRE	Guest Room Expert, the monitoring interface for the GRMS
GRMS	Guest Room Management System, the combination of RCU in-room equipment associated network devices and the monitoring system (GRE)
GTP	Glass Touch Panel
GUI	Graphical User Interface
MUR	Make up Room Call or Maid Service Call
PMS	Property Management System
RCU	Room Control Unit or RP-C and associated modules
RP-C	Room Purpose Controller (RCU)

Contents

1 Introduction

The Schneider Electric Hotel Guest Room Solution is focused on delivering exceptional guest satisfaction while optimizing energy efficiency and sustainable performance.

We understand that guest rooms represent up to 42% of guest complaints and that guest room problems can decrease loyalty by 11.6%. As such, it is important to proactively identify any potential issues in the room as well as making the room as intuitive and simple to use as possible.

This can be achieved via connected rooms, through monitoring and control of the room to identify potential issues and increase staff efficiency, therefore reducing overall maintenance cost. This is enabled by the IoT (Internet of Things) technology approach of the Schneider Electric system which connects every device and sensor in the room.

This document details some of the key items that can be expected to be managed within the Full service and Luxury environments. The document is divided into multiple sections, detailing hardware specifications, operational specifications, and features of the Schneider Electric offer.

Each operator has its own set of brand standards that needs to be respected in accordance with the geographical requirements often caused by climate and/or equipment/hardware availability.

The following document details the specifications for the Schneider Electric Connected Room Solution for Hotels. It is intended as a guide for specification requirements and demonstrates the flexibility of the Schneider Electric system.

2 Room Control Unit (RCU) and Associated Hardware

This section details some of the key hardware features that are required by the RCU hardware within the room as it applies to the Full Service and Luxury segments.

The RCU description is based on the SpaceLogic™ IP Controller, Room Purpose Controller (RP-C). The RCU described is both a configurable and freely programmable device. It is supported by the Hotel configuration package, which allows simple and fast room logic set up, whilst maintaining the capability for devices to be customized with specialized logic scripts that may be required for specific projects.

Configurable devices lend themselves to bulk install as seen in Hotels, where only a few different strategies may need to be implemented across many rooms. In this application repeatability and simplicity are mandatory to ensure a reliable, predictable, and manageable installation.

By their nature, configurable devices and the associated software are more stringently tested, as configurable devices are involved in mass rollouts, produced in development labs, and finally, field-tested.

Using the Hotel Application package simplifies the task of device set-up. For example, the configuration of entry-based logic, the association of door switch and occupancy sensors can be completed in minutes. Once the full configuration has passed “mock-up approval”, the configuration can then be replicated for every room of the same type in minutes.

As the RCU is based on both object and/or script programming, any custom changes can be quickly and simply implemented (with the available IO capacity) and rolled in with the base configuration settings for the device, for mass replication.

The RP-C, described in this document, is the heart of the Full Service and Luxury Guest Room Management Solution. The RP-C enables full lighting control, scene control, curtain control, entry-based occupancy control (EBOC), and bedside panel integration for full service and luxury hotels.

As mentioned earlier, the RP-C RCU is a device capable of both configurable and freely programmable configuration methods, so the physical inputs and outputs can be configured for the desired function. There is no fixed *logical* function associated with any particular point only its fixed physical function.

The RP-C-12A, -12B, -12C, and -16A models provide 12 or 16 I/O points, consisting of four different sets of I/O point types. The versatile mix of I/O point types matches a wide variety of applications. The universal inputs/outputs are highly flexible and can be configured as either inputs or outputs.

Universal IO points (UIO) can be individually configured as either digital (relay contact) or analog inputs (voltage or current) or, as analog outputs, (0-10Vdc for dimming, etc.) enabling full use of most point type configurations in a single point.

The RP-C RCU also includes onboard relay outputs selected for capacity and quiet service and for some models, solid-state outputs. See attached data sheets for onboard IO configurations of the different RP-C models.

The RP-C RCU also includes two onboard serial communications ports. One of the serial communications ports, the “Room Bus”, is used for connection of the Extension Modules to expand the input and output capacity of the standard RP-C for more complex applications and protocol interfaces, such as DALI, 10 Channel Relay … etc.

The second serial communications port is used for Sensor Bus (Modbus RTU) devices such as Glass Touch Panels, thermostats, and other in-room Guest facing devices.

The final input/output mix of the RP-C RCU depends on the RPC model choice and the extension modules selected for use (if any).

The RP-C RCU is capable of being combined with the SpaceLogic TC900 series thermostat range for temperature control in the room via the Sensor Bus (Modbus RTU). The TC900 series thermostat is an all-in-one device, with fan speed and valve control included as onboard outputs on the thermostat.

The TC900 series is available in either a pushbutton or a touch screen version. This thermostat is a low-profile device with an 86mm x 86mm footprint and is available as a Line voltage or Extra Low Voltage (ELV) device, with models available to control traditional 3-speed fans, Electronically Commutated Motors (ECM) variable speed fans, and both on/off and proportional actuators via 0-10Vdc signals where required.

In addition to the RP-C capability to interface with traditional wiring devices such as standard switches and pushbuttons, via onboard and modular IO points, the SpaceLogic Glass Touch Panels can be connected directly to the Sensor Bus (Modbus RTU) and used as switching and adjustment points for lighting, scene control, curtain and blind control and courtesy panel control at minimum.

Alternatively or additionally, with the use of the SpaceLogic Glass Touch Panel interfaces, the RP-C controller can be used to control the HVAC based functions, such as setpoint display and control, fan speed/ mode adjustment, system mode settings, such as heating, cooling, automatic changeover or ventilation only if desired.

SpaceLogic Glass Touch Panels can be used as an alternative to the SpaceLogic TC900 Thermostat series providing the ultimate in user interface equipment selection.

When configured without an external thermostat such as the SpaceLogic TC900, the RP-C has either dedicated relay outputs suitable for switching 3-speed fans (up to 4 Amps) and controlling a single electric duct heater (up to 12 Amps), directly. The onboard Universal IO can be used to drive both proportional and/or on/off actuators for the HVAC control within the guest room.

Alternatively, on/off relay outputs onboard the 10-Channel Relay Module can be used to control on/off functionality on connected Fan Coil Units (FCU).

The RP-C RCU aggregates data from all subsystems and devices in the room. This data is then made available to Guest Room Expert, which allows the hotel operator to control and manage individual rooms, or, the entire network of rooms. Hotel staff can easily view room conditions such as occupancy, energy use, temperature, and maintenance needs, along with HVAC, curtain, DND/MUR, door, and window status.

Additionally, the RP-C RCU is capable of communicating with Schneider Electric-based or 3rd party systems via either or both of its 2 onboard Ethernet ports. Door lock integration within the room is possible via its Zigbee interface (Version 1.2). Other standard 3rd party interfaces are available for Property Management Systems (PMS), and Door Lock Systems (Server-to-Server), Housekeeping, blinds or for pushing data to 3rd party application interface connections via an API.

This gives hotel operators visibility and control of rooms throughout the hotel to drive energy efficiency in unoccupied and un-rented rooms, and troubleshoot maintenance issues before they become problems, and improve the Guest experience through Guest Room Expert (GRE) and other 3rd party interfaces.

2.1 Hardware Specifications – RP-C – RCU and Extension Modules

The RP-C RCU is of monolithic construction, with the capability to add extension modules where and when required via the onboard Room Bus communications port. Additionally, SpaceLogic devices and gateways can be added where required enabling integration with standard or custom software routines via the Sensor Bus (Modbus RTU) port.

The RP-C RCU is available in four basic hardware versions:
1. RP-C-12A-F-24V 24Vac or 23-33Vdc Power supply @14W
2. RP-C-12B-F-24V 24Vac or 23-33Vdc Power supply @14W
3. RP-C 12C-F-24V 24Vac or 23-33Vdc Power supply @14W
4. RP-C 16A-F-230V (207-253Vac 50/60Hz @ 65VA maximum)

The RP-C-16A model has a 24 VAC (19 VA) output that can be used to power external loads such as actuators, relays, or indicators. The external loads can be controlled using the controller's solid-state relay (SSR) or relay outputs.

2.1.1 RP-C Unit Specifications

The following specifications apply to the RP-C range of controllers with model-specific differences noted where applicable.
1. CPU Frequency - 500 MHz
2. CPU type - ARM Cortex-A7 single-core
3. Internal SRAM - 6 MB
4. NOR flash memory - 32 MB
5. Memory backup - 128 kB, FRAM, non-volatile
6. Ambient Temperature Operating - 0-50°C normal operation max humidity 95% non-condensing
7. Rooftop installation - -40-+60°C Horizontal mounting only max humidity 95% non-condensing
   Note that the RP-C-16A temperature limits are 0-50°C, whilst RP-C-12A/B/C temperature limits allow for extended rooftop installation limits.
8. Plastic flame rating UL94-5VB
9. Ingress protection rating IP 20
10. Dimensions - 180 W x 110 H x 64 D mm (7.1 W x 4.3 H x 2.5 D in.)
11. Real-Time Clock Accuracy, at 25 °C (77 °F) +/-1 minute per month
12. Real-Time Clock Backup time, at 25 °C (77 °F) 7 days minimum

2.1.2 Regulatory Compliance and Approvals

CE- European Union (EU)

The RP-C-12A, -12B, -12C, and -16A controller models bear the CE mark and comply with the following EU directives:
- 2014/53/EU Radio Equipment Directive (RED)
- 2014/35/EU Low Voltage Directive
- 2011/65/EU Restriction of Hazardous Substances (RoHS) Directive
- 2015/863/EU amending Annex II to Directive 2011/65/EU

FCC- Federal Communications Commission

For the RP-C-12A, -12B, and -12C controller models (FCC ID: DVE-RPC24), the following statements apply.
This device complies with part 15 of the FCC Rules. Operation is subject to the
following two conditions:
- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

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

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device, and the antenna used with the device, must be professionally installed. This device may be operated only with the antenna with which it is authorized (see list below). Any antenna that is of the same type and of equal or less directional gain as the antenna that is authorized with the device may be used with the device.

ISED - Innovation, Science and Economic Development Canada

This Class B digital apparatus complies with the Canadian ICES-003. IC:24775-RPC24

For the RP-C-12A, -12B, and -12C controller models (ISED certification number: 24775-RPC24), the following statements apply.

This digital apparatus does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications (ICES-3).

Cet appareil numérique ne dépasse pas les limites de la classe B pour les émissions radio bruit des appareils numériques, tel qu'énoncé dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada (NMB-3).

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- L'appareil ne doit pas produire de brouillage;
- L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter (24775-RPC24) has been approved by Innovation, Science, and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio (24775-RPC24) a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

EU.BAC – European Building and Automation Controls Association

Certified product (License No. 219832) This product is certified by EU.BAC and conforms to the quality and energy performance criteria outlined by the following European product standard: EN15500. All eu.bac certified products are found on the eu.bac website: www.eubaccert.eu

For the RP-C-16A controller model, an eu.bac approved controller application must operate in the controller to maintain compliance with the eu.bac certification. Approved controller applications, which are pre-configured for fan coil, ceiling systems, and other applications, can be downloaded from the Schneider Electric Building Management System (BMS) Applications website, bms-applications.schneiderelectric.com.

Regulatory Compliance Mark (RCM) – Australian Communications and Media Authority (ACMA)

This equipment complies with the requirements of the relevant AMCA standards made under the Radiocommunications Act 1992 and the Telecommunications Act 1997. These standards are referenced in notices made under section 182 of the Radiocommunications Act and 407 of the Telecommunications Act.

UL Listed

UL 916 Listed products for the United States and Canada. UL file E80146.

2.1.3 Communications Specifications

The following communications features are common to all RP-C models: -
1. Dual 10/100-BASE-TX Ethernet ports- RJ45
2. 1 USB 2.0 device port (mini - B)
3. 1 USB 2.0 host port (type - A), 5 Vdc, 2.5W
4. 1 x Sensor Bus (Modbus RTU) port 24Vdc, 2W, RS485 (RJ45) c/w transient voltage suppression
5. 1 x Room Bus port 24Vdc, 3W, RS485 (RJ45) c/w transient voltage suppression
6. Bluetooth® 5.0 Low Energy compliant (2.402-2.480GHz @10dBm)

When required the RP-C can have added Zigbee connectivity, connected via the onboard USB port, to the additional SmartX Zigbee Adapter/dongle.

The RP-C RCUs use open protocol communications that simplify interoperability, IP configuration, and device management.

The RP-C RCU uses BACnet IP, an open protocol, enabling easy integration with 3rd party systems and vendors for data exchange and device management. The BACnet port for the device is configurable, however the default BACnet port used is port 47808.

The RP-C RCU acts as a BACnet BTL B-AAC (BACnet Advanced Application Controller). See the BACnet Test Laboratories (BTL) home page for the latest listed firmware revisions in the BTL device catalog.

IP addressing can be simplified by using DHCP if the IT department desires.

The RP-C RCUs have a dual-port Ethernet switch, which enables flexible network topologies, using standard Ethernet networks. However, the RP-C RCU can be configured to operate in several different Ethernet network topologies to lower installation costs or for critical applications to improve reliability. See section 2.1.6 of this document for Communications topology choices.

2.1.4 Room Bus Wiring, Devices and Capacities

Where larger IO counts are required RP-C- EXT-XXXX-X-XX extension modules can be used with a maximum of 6 extension modules per RP-C.

The final extension module count (by type) is dependent on the model of extension modules, used however the total number of extension modules connected should not exceed 6 modules maximum.

Cabling between the extension modules and the RP-C controller can be wired in CAT 5 or higher cable, wired as a daisy chain, via the onboard RJ45 connectors, with a maximum length of 72 meters. Normal cabling segregation from noisy devices should be observed.

Regarding capacities per RP-C RCU observe the following configuration rules. The maximum total number of modules allowed per RP-C RCU on the Room Bus is 6 x modules with individual limits per type as per Table 1 below.

Table 1. Architectural Bus Limits

*CRS for Hotels RP-C RCU Serial Port Architecture Guidelines			
Modbus RTU Port (Sensor Bus) Maximum 10 devices*	**Max allowed without exceeding total device count of 10 devices**	**Room Bus Port Maximum 6 devices**	**Max allowed without exceeding total device count of 6 devices**
SpaceLogic TC900 Series Thermostat	**2**/2**	**RP-C-EXT-0-10V-4-PD 4 x AO Module c/w 4 x DI**	**4/6**
SpaceLogic Modbus Glass Touch Panels LSSMBUxxxxx	**8/8**	**RP-C-EXT-DALI-M-PD DALI Module c/w 4 x DI**	**1/6**
SpaceLogic Modbus Glass Touch Panels LSSMTHxxxxx	**2***/8**	**CRS-HH-REL-10 10x DO Module c/w 12 x DI**	**3/6**
SpaceLogic Modbus Glass Touch Panels LSSMKHxxxxx	**1***/8**		

*CRS for Hotels differs from CRS for commercial buildings. CRS for hotels uses Modbus RTU on the Sensor Bus port, therefore the capability to use the Smart X Sensors on the Sensor bus is disabled. Also, there are differences in the Room Bus module capacity. Please check Architectural Guidelines for further information.
**If any TC900 devices are used the onboard FCU configuration cannot be used. The maximum number of SpaceLogic TC900 series thermostats supported is 2.
***This is NOT in addition to LSSMB series panels. The total amount of LSS Glass touch panels allowed per device is 8.

2.1.5 Modbus RTU Sensor Bus (Modbus RTU) Wiring, Devices and Capacities

Table 1 Architectural Bus Limits above shows the Modbus RTU Sensor Bus capacity available with the RPC-RCU for Hotels. Where interface device such as thermostats or Glass Touch Panels as employed the following device limits should be observed:

Cabling between the Sensor Bus (Modbus RTU) modules and the RP-C controller can be wired in CAT 5 or higher cable, wired as a daisy chain, via the onboard RJ45 connectors, with a maximum length of 72 meters. Normal cabling segregation from noisy devices should be observed. Normal cabling segregation from noisy devices should be observed.

2.1.6 Communications and Interface Capabilities

The RP-C RCUs are based on open protocols that simplify interoperability, IP configuration, and device management. IP addressing can be simplified by using DHCP if your IT department desires. The RP-C RCU uses BACnet IP, an open protocol, enabling easy integration with 3rd party systems and vendors for data exchange and device management.:

The RP-C RCUs have a dual-port Ethernet switch, which enables flexible network topologies, using standard Ethernet networks. However, the RP-C RCU can be configured to operate in several different Ethernet network topologies to lower installation costs or for critical applications to improve reliability.

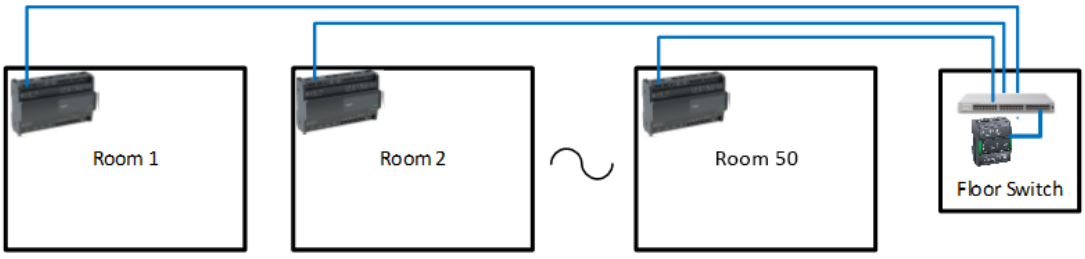

Figure 1. “Star” Architecture – Connect up to 50 RP-C per AS-P. 50 rooms considers 1 x RP-C per room.

The Star topology networking technique depicted above, in figure 1, is the most common Ethernet networking technique where 1 Ethernet switch port is defined for 1 destination port. In a star topology, the RP-C RCU is individually connected to an Ethernet switch. This means 1 x home run Ethernet cable per room if the RP-C RCU is on a separate network.

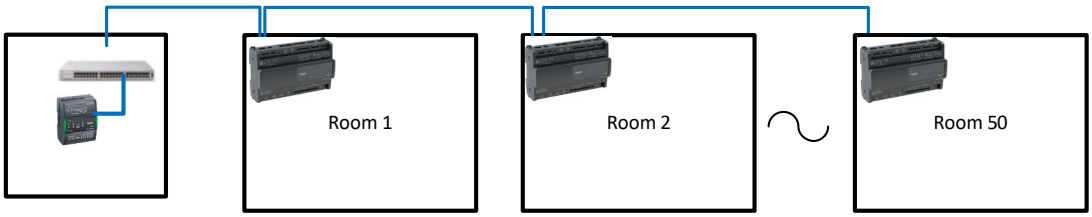

Figure 2. "Daisy Chain" Architecture – Connect 50 RCUs via a single ethernet connection. 50 rooms considers 1 x RP-C per room.

Alternatively, as the RP-C-RCU has two Ethernet ports, it is possible to "daisy chain" the RP-C RCUs, as indicated above in figure 2, providing the desired connectivity to the rooms, but lowering installation time and costs, with one Ethernet switch port looped to up to 50 RP-RCU controllers in a single daisy chain.

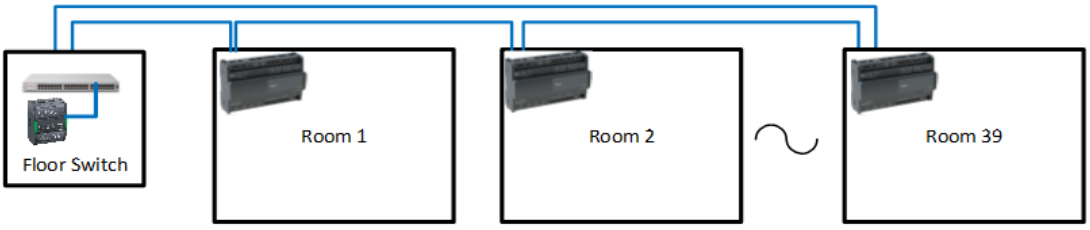

Figure 3. "Ring" Architecture using RSTP – Connect 39 RCUs via a single ethernet connection. 39 rooms considers 1 x RP-C per room.

Finally, for higher reliability it is possible to connect the rooms in a "Ring" topology, as depicted in figure 3 above, using Rapid Spanning Tree Protocol (RSTP). This configuration enables the cable breakages and non-operational controllers to be detected and recovered quickly and easily improving system resiliency and reliability.

When operating on an Ethernet network, the RP-C RCU provides for an optional connection to a variety of Property Management Systems (PMS) via the onboard Ethernet ports of the RP-C controller.

2.2 Application Software for RP-C RCU

The RP-C RCU shall have the capability for an application package to be loaded on site.

The RP-C RCU Hotel Guest Room Application Package will be loaded with the required functionality during testing/mock-up. The application package will contain all logic required to monitor and/or control the HVAC, lighting control, scene control, and other courtesy and operational features of the guest room.

New Application Package versions shall be uploaded to the controller using the EcoStruxure™ WorkStation via ethernet or using the E-Commission tool and uploading via Bluetooth or Wi-Fi using a mobile device.

The RP-C RCU application firmware will be fully factory tested before the commercial release to ensure bug-free application execution. If further "custom" applications are required for a particular application this will be added to the existing application firmware using EcoStruxure WorkStation for configuration and upload purposes.

The commissioning and configuration process shall be accomplished by using the E-Commission App and a mobile device via Bluetooth communications. Some further configuration may be required for Sensor Bus (Modbus RTU) devices such as the Modbus configuration and Room Bus such as Extension Modules configuration.

For the configuration of the Glass Touch Panel communication interface, button and LED, the glass touch panel, must be pre-commissioned with the Modbus Glass Touch Panel Commissioning Tool (MGTP) available from the Exchange or from Tech support.

At a minimum the RCU shall be capable of individually managing:
- Multiple ON/OFF lighting circuits
- Multiple dimming lighting circuits
- Multiple curtain and blind motor installations
- Multiple DND/MUR, BELL courtesy panels
- Multiple Bedside panels in the form of Modbus Glass touch panels or as a set of discrete switches mounted in a panel
- Multiple Occupancy detectors (over a single input channel)
- Multiple Glass touch Panels (maximum 8 panels per RP-C RCU)
- Multiple maintained and/or retractive (pushbutton) switch stations

The RP-C RCU will have a monitoring page, accessible via the E-Commission App, from which the state of all physical inputs and outputs can be monitored and controlled for testing purposes. Analog outputs representative of dimmer outputs will also be monitored and controlled for testing purposes.

The monitoring page in the E-Commission App will also provide the online status of all connected GTPs, thermostats, room controllers, and extension modules.

The rental status of the room will be able to be monitored and manually overridden from the E-Commission App.

The lighting and operational scenes will be capable of being overridden from the E-Commission App.

2.2.1 Lighting Scene Control

A single RP-C RCU is capable of handling up to 4 predefined scenes and 12 individual operational scenes within the guest room. Each scene should be capable of handling up to 20 specific actions related to the scene including lighting control, dimming levels, AC setpoints, AC Fan speed, AC mode.

There will be 4 x predefined scenes:
1. Welcome day
2. Welcome night,
3. Staff
4. Master Off

There will a minimum of 12 x Manual scenes, such as Master On and any other required scenes as per the room design. Each scene should be capable of handling up to 20 separate actions within each of the 12 scenes.

The Restore scene is handled separately, if employed and is not included in the scene count.

The RCU will have an onboard schedule to command the changeover of Day and Night scenes.

Each RCU will be capable of synchronizing the onboard clocks, to the central time server, regularly (default daily) to ensure accurate alignment of all onboard timeclock-based functions irrespective of whether these functions are employed or not.

Scenes will have the capability of being individually identified by entering text into the scene identifier.

All lighting and blind outputs will have the option of being individually named to identify the associated output and input function.

2.2.2 Inputs and Input Mapping

The RP-C RCU will support up to 48 different input control functions for lighting, scenes, curtains, courtesy and AC controls.

Configuration of these inputs shall be carried out through either the EcoStruxure WorkStation interface or the E-Commission App dependent on the function required.

Functions will have fixed names to enable easy identification of the associated functionality. The following functions will include the following command capabilities at a minimum.

Momentary pushbutton or Glass touch panel Control.
- Toggle light
- Dimming (1 gang)
- Dimming (2 gangs)
- Curtain control (1 gang)
- Curtain control (2 gangs)
- Trigger scene
- Toggle scene
- Setpoint
- Fan speed cycle
- Do not disturb (DND)
- Make-up room (MUR)
- Bell

Control lighting via a toggle switch or button -
- Toggle light (toggle button)
- Toggle scene (toggle button)

1 Gang Push button with dimming -
- Short press on/off - dependent on the dimmer state
- Long press dim cycle - up or down dependent on the last action or dimmer position

2 Gang Push button with dimming -
- Short press on/off - will turn the dimmer on/off depending on its present level
- Long press - will cycle the dimmer up or down depending on the button pressed

1 Gang Curtain control -
- Short push will start curtain motor depending on the last action
- 2nd short press will stop the curtain
- Long press will gradually open or close the curtain until the button is released

2 Gang Curtain control -
- Short push will start the curtain motor dependent on the button pushed
- 2nd short press will stop the curtain
- Long press will gradually open or close the curtain until it is open/closed

Trigger Scene -
- Only for use with momentary buttons or GTP
- Activation will cycle the connected scene state

Toggle Scene -
- Only for use with momentary switches or GTP
- Action toggles between two different scenes

Toggle Scene (toggle button) -
- Only for use with toggle switches/buttons
- Action toggles between two different scenes

Restore scene trigger -
- Automatically stored in memory after the guest's first entry

AC Setpoint adjust -
- Configure AC setpoint adjustment buttons when using GTP
- Adjust setpoint depending on the scene state (e.g. Welcome day/night, Master on/off, Restore)

Fan speed cycle – switched speed control via a single button
- Adjust fan speed with a single GTP button
- Adjust fan speed based on the scene state (e.g. Welcome day/night, Master on/off, Restore)

Fan Speed – switched speed control via multiple buttons
- Adjust fan speed with multiple buttons representative of the selected speed via GTP
- Adjust fan speed based on the scene state (e.g. Welcome day/night, Master on/off, Restore)

Courtesy Panel buttons - Functionality will operate as described later in this document.
- Do not disturb (DND)
- Make-up room (MUR)
- DND (Toggle button)
- MUR (Toggle button)
- Bell

°C or °F Selection - where the hotel offers guests the ability to read and control in either Celsius or Fahrenheit, via a Glass touch panel, the measuring units can be set locally at the GTP.
- Temperature scale °C or °F single button press to select

Occupancy input data - where the hotel is using EBOC algorithms, it is necessary to define both door switches and motions sensor inputs.
- Door sensor
- Motion sensor
- Trigger the entry light upon activation of the door sensor

Keycard Input data - where the hotel is using a keycard-based occupancy signal it is necessary to define the keycard input and configure the occupancy logic to suit the application
- Keycard switch input
- Combined with door open timer to signal Cleaning Scene selection

2.2.3 Lighting Control Outputs

The RP-C RCU will be capable of controlling up to 16 lighting outputs per RCU. These outputs can be a variety of digital outputs, analog outputs, and DALI devices, but the combined total must not exceed 16 output channels per RCU.

The RP-C RCU shall support 1 x DALI Extension module; either RP-C-EXT-DALI-MP-D (with power distribution) in geographies that supports 230Vac (+/-10%) voltage supplies or RP-C-EXT-DALI-1 (without power distribution) in geographies that supports a supply voltage range of 110-277VAC. Adherence to the extension module limits indicated in Table 1 Architectural Bus Limits in section “2.4.1 Keycard Switch Occupancy Logic” on page 16 of this document should be noted, as the Hotel Application may differ from other RP-C applications regarding final module count and selection architectures.

The DALI extension module will support both DALI and DALI2 devices, over a single DALI channel, via 4 x DALI connection ports @18Vdc with a maximum DALI supply current of 250mA, and a guaranteed DALI supply current of 64mA.

The DALI extension module will support a maximum of 32 DALI devices on a single RP-C-EXT-DALI-MP-D or RP-C-EXT-DALI-1 module. The DALI lamps will be capable of being combined in groups or individually (with a maximum of 16 groups), independently from the output port which is connected to this particular DALI module. The number of controlled DALI groups cannot exceed the maximum number of lighting control output channels available in the RCU.

Lights that belong to the same DALI group will be controlled simultaneously for switching on/off and dimming.

The DALI module will be capable of managing the connected ballasts and lamp alarms and communicating these alarms to the RP-C for reporting and monitoring purposes, via the Guest Room Management System (GRMS) interface or other relevant parties for processing.

DALI alarms and alerts, as with all other GRMS generated alarms, will be capable of being communicated via several mediums including alarm banners on Guest Room Expert, Email Alerts or via emails to 3rd party forwarding services (e.g. for SMS alerts via 3rd party forwarder).

Where DALI is not used and lighting outputs are defined as dimmable, the dimmer will be capable of accepting a 0-10Vdc signal for dimming purposes. The 0-10Vdc signal will either be generated from the RP-C RCU universal IO

channels or via the RP-C-EXT-0-10-4-PD analog output extension module; however, check the extension module matrix for absolute maximums based on final module selection.

Within the RCU configuration, it will be possible to define a “cut-off” output channel on the RP-C-EXT-0-10-4-PD to enable true off if the dimmer module requires “true off” signaling. Care should be taken to ensure switching limits of a TOTAL of 10 amps per module and 5 Amps per load are not exceeded. The inrush current capacities of these contacts should also be adhered to.

The RP-C-EXT-0-10-4-PD also allows for 4 digital inputs to be shared with the RP-C as dry contacts rated at 0-5Vdc and 2.2mA each input.

The RCU outputs will be capable of being configured to allow for minimum and maximum dimming levels for a given analog output.

The maximum output current for the Analog output on the RP-C RCU is 2mA. The maximum output current for the analog output on the RP-C-EXT-0-10-4-PD is 10mA per output.

The dimming cycle or fade time for each output (time duration for the signal to change from 0-100%) will be capable of being adjusted for each output.

All dimmer units should be pretested during the mock-up period.

Where on/off LED units are used the LED power supply should be furnished with the maximum inrush amps for the power supply. This will enable appropriate sizing of control contactors and/or Zero crossing relays to be selected for the project to reduce relay contact burn out where non-zero crossing outputs are employed.

10-Channel Relay:

- High-performance relays, with high **inrush current capability**, well suited for LED lighting applications
- **12 digital inputs** offer more flexibility for different applications with in-wall switches or sensors
- 10 relay outputs for the control of **Lights & Blinds*** in the hotel guest room
- Power and communications through the room bus
- Status LED for the device
- Rotary switch for address configuration
- Supports blind motors with an operating **High or Low** Voltage of 120 or 240 VAC, 50/60 Hz
- 24 VDC motors controlled by reversing the polarity of the voltage
  - A DPDT (Double Pole Double Throw) relay can be used to connect a 24 VDC motor for which the clockwise/counter-clockwise control is done by changing the polarity of the DC voltage
  - The DPDT relay used in this example is Schneider part # RSB2A080BDPV

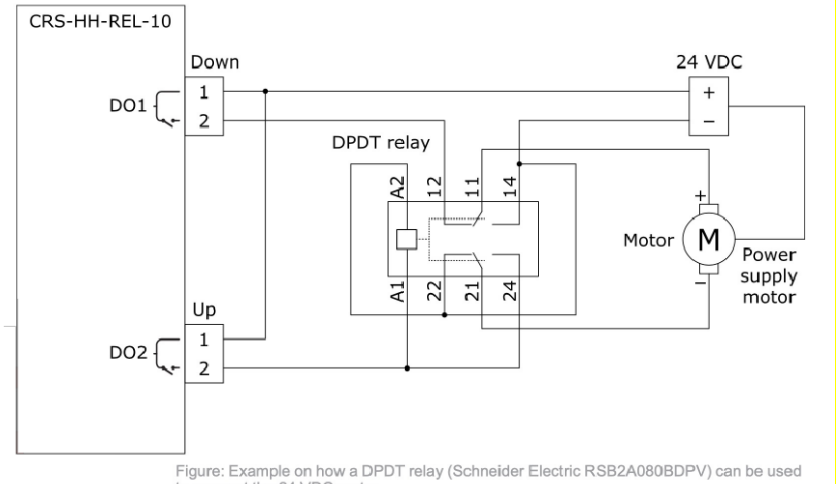

Figure: Example on how a DPDT relay (Schneider Electric RSB2A080BDPV) can be used to connect the 24 VDC motor

- 24 VDC & 120/240 VAC motors designed for dry contact control
  - 2x SSRs (Solid State Relays), one SSR for up & one SSR for down, can be used to connect a 24 VDC motor that is designed for dry contact control (typically with a control voltage of 5 VDC). 120/240 VAC motors designed for dry contact control can be connected similarly.
  - The SSR used in this example is Schneider part # SSM1D26BD. The contact rating for the internal relays (DO1 and DO2) specifies a minimum applicable load of 0.5 W (minimum applied voltage is 12 VDC). An external resistor (R) may be needed to meet the contact rating requirement.

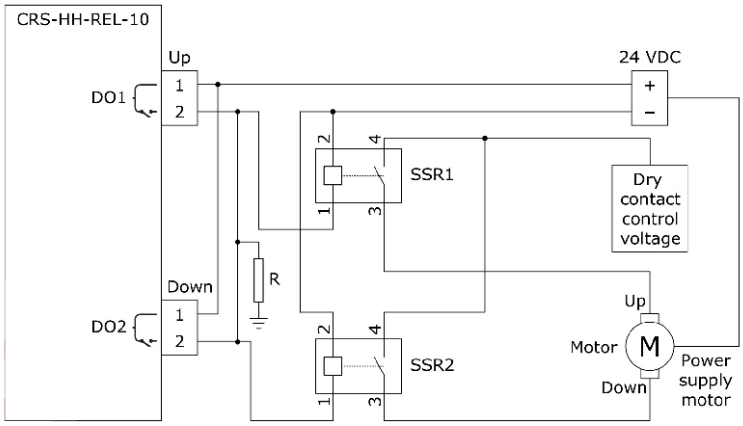

Figure: Example on how two SSRs (Schneider Electric SSM1D26BD) can be used to connect the 24 VDC motor with dry contact control voltage

2.2.4 Curtain Control Outputs

The RCU will be capable of supporting up to 4 curtain/blind stations via a single RCU.

Curtain controls can be associated with modular relay outputs where the curtain control supports dry contact inputs.

Most curtains require two individual inputs (open/close) for curtain control. These would be furnished by any of the above methods.

The run time of the curtain motors will be configurable in the RCU to ensure accurate tracking of the curtain position.

2.2.5 HVAC Unit Controls

The RCU will be capable of communicating with specific room controllers and thermostats as mentioned elsewhere in this document.

The RCU will be capable of communicating zone setpoints to the HVAC controller specified in the room. This setpoint can be transmitted as a single setpoint or as a room “mode” (unrented/rented and unoccupied/occupied) to the controller for processing via onboard registers.

On/off state, cooling heating mode and fan speed will also be able to be transmitted from the RCU to the room thermostat or controller.

The RCU will be capable of supporting up to two (2) of the specified room thermostats (such as the TC900 series) concurrently.

The use of GTP thermostats within the room will allow adjustment of parameters such as setpoint, fan speed, and unit mode on the associated nominated thermostats or room controllers if required in conjunction with thermostat setpoint adjustments. Only support for one HVAC control object (FCU) on board the RP-C RCU. Applications with 2 x FCUs will require the use of 2 x external thermostats, TC900 series or other approved ones.

2.2.6 DND MUR In-Room Courtesy Panel Switch Input Types and General Operation

The RCU will be capable of easily interfacing with both dry contact and GTP courtesy panels and hallway panels.

Where requested and where an RCU is employed, a DND/MUR switch plate will be available inside the room. When DND and/or MUR modes are available in the room, outside the room, on a corridor panel adjacent to the room door, will be a DND/MUR indicator with a bell switch.

Alternatively, the MUR indicator can also be located in the Housekeeping Service area rather than on the public corridor panel, usually with a view for improved Guest Room security. In this case, the corridor panel may only need to indicate DND and have provision for the bell press button.

The in-room courtesy panels can be provided for singular mode use where required. Some service levels/brands may only require DND *or* MUR selection (not both) from within the room. Operationally this should appear as per below.

Physical hardware associated with DND/MUR Courtesy panels installed shall be of the following types:
- Glass Touch Panel (GTP) type panels with on button indicators
- Retractive type (press button) switch types only with indicators on a switch or panel

Maintained position switches for DND and MUR mode activation will not be accepted, where RCUs are employed as automatic cancellation of the previously selected mode is not supported by On/Off type switches.

This limits the number of “false” MUR or DND calls that can become apparent when guests simply switch off the DND and do not then switch off the MUR or vice versa.

DND and MUR are mutually exclusive, meaning that you cannot have DND and MUR selected at the same time.

Where multiple DND/MUR stations are employed within the room, activation of the last requested state will override the previous state of all other switches within the room. No master station is allowed, all courtesy panels will act as peers. The state of the courtesy panel call (MUR or DND activated) will be shown on all panels and reflect the state of the last entered Courtesy panel command.

2.2.7 DND Mode Operational Details

Operationally, when the DND mode is engaged by the guest pressing the DND button within the room, the ability for the doorbell to sound from the bell button being pressed via the corridor panel in the hallway will be disabled.

DND and MUR are mutually exclusive, meaning that you cannot have DND and MUR selected at the same time. The selection of DND will cancel the MUR mode and silence the bell. The selection of the MUR mode will cancel the DND mode.

DND mode can also be enabled from bedside panels if required. Multiple DND and MUR buttons, at various locations within the room are possible.

When multiple DND/MUR courtesy panels are employed the last entered state selected, either DND or MUR, will be served to all stations, and the mutual exclusivity and last state cancellation policy will be maintained.

DND and MUR states can also be transmitted from the RP-C RCU to 3rd party systems such as Housekeeping systems via BACnet IP. DND and MUR mode states should also be available for display on the GRMS GUI status screen for each room (if employed).

DND and MUR states should be able to be displayed at the corridor panel if desired.

Optionally or where required, Extended DND alarms should be able to be created at the server level.

If the DND state has been engaged for longer than 48 hours (adjustable) then an Extended DND Alarm should be activated to ensure Guest safety.

These optional Extended DND-driven Guest welfare checks can be used as safety checks to ensure guests have not been injured, fallen or may have fallen ill. The system should be capable of transmitting these alarms via various

means (Email, SMS, GUI-based alarms, housekeeping interface) to Security, Housekeeping, Front Desk, Engineering or other recipients if and as required by the brand.

Specialized housekeeping interface screens on the GRMS GUI should be available to Housekeeping users where required.

2.2.8 MUR Mode Operational Details

When the MUR mode is activated within the room, via pressing the MUR button, the MUR indicator on the external Corridor panel adjacent to the room door or located in the Maid Service area, will illuminate indicating the room requires cleaning.

If for security reasons, MUR is not displayed at the local door panel it shall be capable of being displayed either in a Housekeeping station(s) on the associated floor or at a centralized location for management.

The system should be capable of local or centralized display of MUR state on Housekeeping panels and, concurrently, on any centralized 3rd party Housekeeping interface software, using BACnet IP, via the GRMS network if employed, to proactively alert the Housekeeping team to the guest requirement.

MUR and DND modes are mutually exclusive, meaning that you cannot have MUR and DND modes selected at the same time. The selection of MUR mode will cancel the DND mode, allowing the bell to operate normally. The selection of the DND mode will cancel the MUR mode instantaneously.

MUR mode can also be transmitted from the RP-C RCU, via BACnet IP, to 3rd party systems such as Housekeeping systems. MUR mode state should also be available on the GRMS GUI for each room.

Specialized housekeeping interface screens on the GRMS GUI should be available to Housekeeping users where required.

2.2.9 Corridor Panel Operational Details

The External corridor panel, where employed should have the following functionality:

- Doorbell activation complete with a backlit icon when activated
- MUR active indication complete with a backlit icon or indicator when active (where required)
- DND active indication complete with a backlit icon or indicator when active (where required)
- Occupancy indication complete with a backlit icon or indicator when active (where required)
- Room Number (where required)

The doorbell button will be of the retractive type or a touch style button where GTPs are employed. The door chime will not operate if the room is in DND mode.

Each indicator will be capable of four (4) different icon colors when several indicators are present on the corridor panel. This will enable Housekeeping staff to quickly determine the room state via the color state of the panel indicators.

Where corridor panels are supplied by the door locking company, the corridor panel will be able to indicate required states via a multicolor led ring surrounding the doorbell. The room state will be generated by the RCU and sent to the door panel either via a local, in-room interface or via a Server-to-Server interface.

Where corridor panels are supplied by the RCU supplier, Backlight colors will be selected at the design stage with a minimum of four (4) colors capability of the icon.

2.2.10 Guest Room Door Lock System (Zigbee ASSA ABLOY Global Solutions Only)

The ASSA ABLOY Global Solutions door lock system can be integrated to Guest Room Expert via Zigbee locally, on a per room basis, using the necessary Zigbee accessories. It normally integrates with the RP-C RCU in this method to provide the following information:

- Door Status: Open, Closed or Ajar. Note that when the Ajar status is triggered, a proper alert must be sent to the security system and when available the CCTV system
- Door locking mechanism: depending on the brand standard, it might be required to set the room to DND when the door is locked. Note that this is not mandatory and sometimes prohibited by brand standards. Do check with the operator.
- Entry Type: Staff or Guest - the door will provide the information on whether the person entering the room is a guest or whether it is part of the staff. The information is used to trigger the appropriate scene. When the guest walks in the Welcome or Restore scene will be triggered while you will have a special scene for staff.
- First or subsequent entry: when the guest comes to the room for the first time, the Welcome scene (daytime or nighttime) will be triggered. On subsequent visits, the Restore scene will be used.
- Courtesy panel data: the in-room data collected from the DND and MUR buttons connected to the RCU can be transmitted to the door entry panel when this is supplied by the door lock provider (e.g. ASSA ABLOY Global Solutions). These signals are then decoded by the door panel and alerted in the specific format as required.

The integration of door locks can also be used to detect if staff members are spending too long in rooms as compared to the baseline for cleaning and servicing (at Automation Server level). Discreet alarm management can be handled and sent to nominated staff only via email or SMS if required.

Integration with both ASSA ABLOY Global Solutions only (via Zigbee) is supported in Version 1.2 and above.

2.3 Lighting – Switch Types and Functions

Physical hardware associated with lighting switches installed shall either be of the GTP panel type, maintained position switch type, retractive type (press button) switch type or combination of any/all that reflects the brand standard requirements of the geography.

2.3.1 Master Off Switch Station(s) Operational Details

Master Off switches act as a single point to shut down all lighting within the room. They are usually located at the exit and near the bedside to allow guests to shut off lights as they exit and to control lights from the bedside panel.

Where a singular Master On/Off station is installed switch control shall either be via GTP panel, maintained position switch or retractive type (press button) switch.

Where multiple Master On/Off stations are employed switches shall be of the GTP or retractive type. This is necessary to ensure proper operation of the system and enable the guest to use master on/off capability from any of the multiple on/off stations employed.

A master on/off control should be available on either one or both bedside panels in order to turn on/off ALL the lights in the guest room including a floor or desk lamp and bathroom lighting or as required by the brand standards.

A second master off can also be available by the door next to the DND/MUR courtesy panel. The door master off button will switch off ALL lighting in the guest room.

Where GTP type bedside panels are employed the following features will be available:

- The first press of any button will wake up the panel and backlight all buttons at a predetermined intensity
- The second press of a button will activate the required function
- After a preset time delay (initially set at 10 seconds) with no button activity, the GTP backlight will return to blackout mode
- Panels will be customizable (at manufacture) regarding button icons, backlight colors, and panel color including USB sockets and power outlets

2.3.2 Bed Side Panel

Depending on the level of service the bedside panel might vary in size and functionality. However, it is recommended to keep the bedside panel as simple as possible.

The bedside panel should normally consist of the following items:
- USB charging ports to recharge phones/tablets/smartwatch
- A large button for the master on/off
- A small light switch for the night light (optional)
- DND button (optional)
- Curtain/sheer open/close (optional)

Although practical, some considerations should be in place to keep things easy to understand for the guest and easy to find at night. This might include a touch of any button on to “wake up” bedside panel with switching action active on 2nd touch of the required button.

2.4 RCU Occupancy Control Strategy Features

Guest room energy savings of up to 40% can be achieved through the implementation of well-designed and properly instrumented entry-based occupancy control when compared with keycard installations. This is especially true in full service and luxury installations where energy density within the guest room, due to additional amenities can be much higher than focused service properties.

All RCUs should be capable of both entry-based logic and keycard logic strategies without “reprogramming”. Configurable devices are especially useful when considering situations where entry-based occupancy control may not *presently* be considered a suitable option however may be considered later in the lifecycle or implemented as budget becomes available.

2.4.1 Keycard Switch Occupancy Logic

Although not the preferred method of control occupancy the RCU should be capable of supporting keycard inputs as an occupancy strategy in particular applications where occupancy sensing may not be a viable method of occupancy control.

Wherever possible, when in-room keycard switches are used, the keycard switch should be of the RFID type that will read the particular sites Facility ID (where available) to minimize the opportunity for using cards from other facilities within the room to operate the keycard switch and waste energy via using non-matching cards within an unoccupied room.

The RCU shall be able to associate any unused input as an input for the keycard switch contact.

The RCU will also be capable of indicating keycard switch status (occupied/unoccupied) via a digital output onboard the RCU or an associated extension module.

Unoccupancy delay timers will be configurable on the RCU to enable a delay for the Guest to leave the room after the keycard has been removed.

A door switch be can used in combination with the keycard occupancy logic. Upon opening the door, an entry light can be turned on to assist the guest to find the keycard slot. This light can be enabled as part of a “nighttime’ schedule and or timed to operate for several minutes and turn off automatically if the keycard slot is not enabled with the delay period.

This door switch can also be used to detect and alarm door ajar issues or set “propped door” cleaning scenes if required by Guest Room Expert.

2.4.2 Entry-Based Occupancy Logic

The RCU will also be capable of being configured with entry-based occupancy control as commonly required in hotels today by combining door entry/exit with movement detection within the room.

The RCU logic will receive door switch data directly via a dry contact input.

The door switch will be able to be configured as Normally Open (NO) or Normally Closed (NC) within the RCU web page interface for the point.

The RCU logic will receive the movement detection signal from the respective sensor via a dry contact input.

The occupancy detector will be able to be configured as Normally Open (NO) or Normally Closed (NC) within the RCU web page interface for the point.

When a PMS or rental signal exists, the ability to provide Welcome and restore scene functionality will be provided in the RCU. Both day and Night welcome scenes can be provided with a defined changeover schedule, normally matching any turndown service period.

AS PIR and other occupancy sensing technologies have a warm-up time, the warm-up time of the sensor should be considered in the programming and act appropriately for the sensor type to minimize false responses.

The RCU logic will include an unoccupancy timer. The unoccupancy timer will begin a short period after a door event has occurred. If no activity is detected in the room within the delay period, the room will be set to unoccupied.

Activity detected within the room by the occupancy detector(s) whilst unoccupied, will trigger the room to the occupied mode. A door event must be triggered to restart the unoccupancy timer.

2.4.3 Property Management System (PMS) Integration

When a PMS interface is included further energy savings and guest satisfaction tools are available. A typical simple PMS integration description is shown in figure 4 below. As the above timeline shows the integration with the PMS system allows deep setback of room setpoints for the HVAC system during unrented periods.

It is also possible to anticipate guest arrival, When the room is set to be rented the deep setback mode, triggered in unrented mode, will be disabled and rented and unoccupied mode will be enabled to prepare the space for the guest's arrival.

The PMS interface is normally "one way" the GRMS receives the relevant room data from the PMS system such as:

- Guest name (regional dependencies)
- Number of guests
- Check out date
- Guest language

Where the PMS allows, the GRMS can possibly send data back to the PMS, alerting the front desk of such information as "Safe Locked", (when such interface information is available to the RCU) and alert the guest to potential valuables left in the safe before check-out and enhance the guest experience.

In the normal PMS interface workflow:

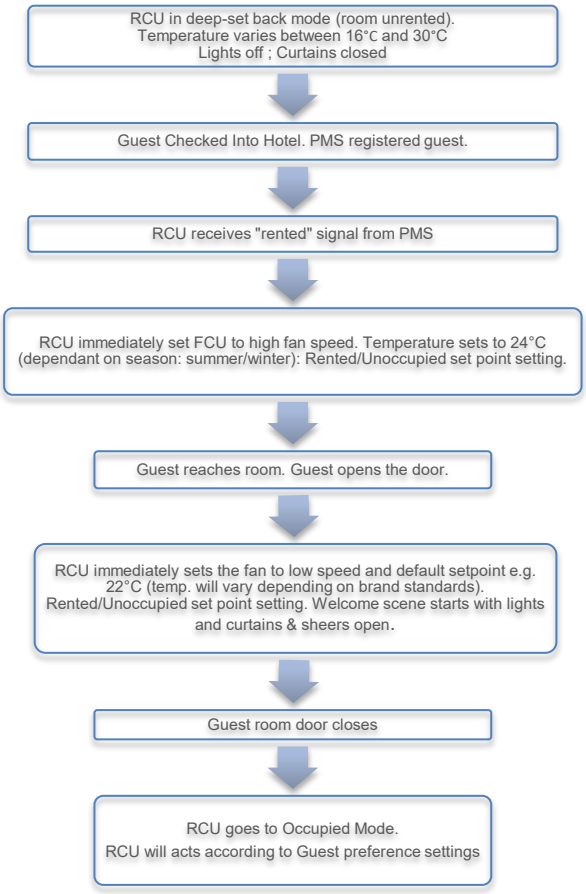

Figure 4 – Normal PMS Interface workflow

2.5 RP-C RCU HVAC Control Strategy Features

Please refer to diagram 2.4.2.1 above for the room modes and functional diagram.

At a minimum the RCU should be able to perform the following functions:

a) Monitor and manage all guestroom FCU thermostat(s). All Guestroom thermostats should include automatic change-over between cooling/heating mode where climates require both heating and cooling modes for the HVAC system.

b) When a balcony door or openable window is present, some brands will require a door switch on the balcony door or window for cutting off the FCU or terminating cooling/heating when they are open. Where possible, by using a digital thermostat with a display, the guest can be alerted to the AC energy management feature (door/window open) by a message displayed on the thermostat screen indicating that the door and/or window is open.

c) When using a thermostat with a digital display, in the nighttime the thermostat will turn off the display when not in use to avoid disturbing the guest

d) Whenever the guestroom door is opened and closed, the RCU and then PIR/microwave sensors will be activated and scan the room for any motions. The sensitivity of the PIR/microwave sensor should be adjustable so even very slight motions can be detected. RCU should remain in occupied mode whenever the PIR/microwave sensors detect any motions inside the guestroom/bathroom and the door has not been re-opened (the status of door contact remain closed) by the guest inside the room. If there is no motion being detected after the main entrance door has been closed and after the pre-set system time delay. RCU can proceed to the unoccupied mode, but the RCU should keep the sensors scanning the room. Once any motion is found, RCU should resume the room status to previous settings.

e) When the RCU detects there is human movement in the room, all in-room controls are released from RCU which allows the user to control everything (e.g. lightings, FCU temperature setpoint, and fan speed, drapes position, etc.). This is the occupied mode.

f) With adjustable time delay function, if the PIR/microwave sensors find no motion inside the room, after a door trigger event, the RCU should be able to close the drapes, shut down the FCU, switch off the lighting, TV, the non-essential sockets. This is the Master Off scene.

g) Under unoccupied/rented mode, the FCU digital thermostat should be automatically reset to the prescribed annual or seasonal setpoint (adjustable thru control GRMS head end). If the unoccupied room temperature reaches the setpoint, then the thermostat should shut down both the FCU blower and cooling or heating valve as applicable. When the room temperature rises above the setpoint, plus the differential applied for unoccupied mode, (adjustable thru the GRMS Head end), the thermostat should restart the FCU and brings down the temperature to the unoccupied setpoint. Some brands, especially in more humid or warmer climates, may desire the fan to continue to run at low speed during the unoccupied mode. This enable pretreated fresh air to be continuously circulated through the room to limit odor build-up and temperature rise in the room

h) When the guests return to the room, once the door has been opened, the door sensor should activate the RCU and all previous settings (such as FCU, lighting modes, etc.) should be resumed to the status before the guests left the room.

i) When in “unrented” mode, the FCU will be in deep setback allowing the temperature to vary and reduce the usage of the FCU as much as possible. The range will be defined by the brand standards, however, a range of between 16°C and 30°C is common. Additionally, when the room is unrented, via a master off scene, all the lights should be turned off and the curtains should be automatically closed. Some brands, especially in more humid or warmer climates, may desire the fan to continue to run at low speed during the unoccupied mode. This enable pretreated fresh air to be continuously circulated through the room to limit odor build-up and temperature rise in the room

2.6 RP-C RCU Occupancy Sensing Strategy Selection and Location

With a door sensor and passive infra-red (PIR) or other technology motion sensors in the living/sleeping area, and, PIR + Microwave (where applicable) sensor in the bathroom, the RCU can detect whether there are guests/staff inside the room via a single input channel.

Sensors for the living/sleeping area should be selected based on the room shape and sensor coverage. Particular attention should be taken to larger areas where small movements need to be detected. Attention should also be taken to when seating locations are on the periphery of the room. The periphery of the room is often where motion sensors may have low small motion coverage.

Small motion coverage is important in seating and bed areas to eliminate false room shutdowns. Small motion is defined as someone typing, someone moving a remote control, someone scratching their face.

Large motion coverage is defined as someone moving a limb, standing up or walking. In some room configurations, multiple sensors or dual technology sensors should be considered to ensure adequate room coverage for small and large motions.

This is especially important where sitting working areas may be on the perimeters of the room. Sensor mapping, (to show the extent of the coverage range of the motion sensors) should be carried out to ensure excellent room coverage under differing conditions.

“Walkthrough testing” and small movement testing should be carried out in all rooms at the mock-up stage to prove sensing requirements are adequate and meet differing occupancy states, dual or single guest occupancy and dual occupancy with a single guest and no movement testing.

Sensor technology selection and associated sensor mapping are extremely important, especially when sensors cannot be ideally/optimally located.

Each sensing technology has its pros and its cons. These should be assessed with regards to the installation in the mock-up room and pre-assessed with motion sensor mapping and small and large motion testing in the mock-up space.

Particular care and attention should be taken in the selection of radar/microwave-based sensors and sensors without sensitivity adjustment should not be used, regardless of the technology used.

Figure 5 below shows the sensing patterns for 3 different sensing technologies. The shape and coverage of the sensors change based on mounting height. It is also important to note that only one of the sensor types mentions a small motion coverage range.

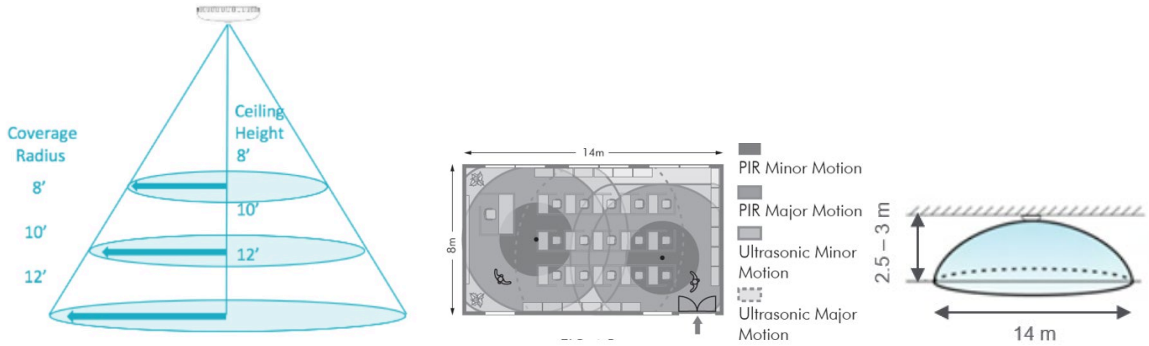

Figure 5 - PIR dual tech and microwave sensing patterns

Occupancy sensor technology selection, range, and sensor mapping are key to providing an effective entry-based occupancy sensing RCU solution.

3 Guest Room Expert

The GRMS (or Guest Room Management System) is the complete system hardware and software such as:

- Input and output devices
- Guest facing interfaces and controls
- RCUs and the associated management controllers or Automation Servers
- The GRMS monitoring head end in this case, Guest Room Expert
- Hotel system interfaces such as the PMS interface or Housekeeping interface.

3.1 Connected Systems

When we consider the GRMS connected systems these are normally interfaces to external or 3rd party servers or other associated hardware for information sharing and automation of associated room states and guest requirements.

Open protocols are encouraged to be used on the GRMS backbone and within the room RCU communications. BACnet IP and/or Web Services can be used as the standard communication protocol between the guest rooms and the centralized system.

The overall communication architecture can be completed over CAT6a cabling using TCP/UDP sockets such as TCP/IP or specific sockets. All cabling in the property should be installed using CAT6a certified with the latest PoE+ standards. The cable connector should also be certified with the latest norms for PoE+ IEC 60512-99-001.

3.1.1 Property Management System Interface

The Property Management System (PMS) should be integrated with the GRMS in full service and luxury hotels to provide the rental status of the room. This interface is provided as a SmartConnector and enables the PMS system to signal rental data to the rooms. The SmartConnector uses Web Services to pass the required PMS data to the Automation Server for processing locally by the RCU. The interface data allows the RCU to control the set-back mode of the room:

- Un-rented: The room will be set to deep-set back mode.
- Rented: The room will be set to set-back or occupied mode depending on the occupancy level of the room.

When available, in addition to the rental status of the room, the PMS will provide the following items:
- Name of the guest, region-dependent, and subject to privacy laws.
- Language preferences to set the guest room settings with the right language and temperature unit of measure. (on the thermostat or when required on a tablet).

3.1.2 Building Management System Interface

The Building Management System (BMS) can be fully integrated into the GRMS to provide any information related to the Fan Coil Unit (FCU) or the VRV/VRF installed in the guest room.

The level of information shared depends on what is available from the FCU or VRV/VRF vendor, but it can include such information as malfunction, maintenance requirement and/or status.

The BMS interface may also require occupancy rate data. It may also require alarms to be passed from the GRMS to the BMS for processing via 3rd party systems.

This is be achieved via Open protocols such as BACnet IP or Modbus TCP. Alarm data cab shared with 3rd party BMS systems via Email or BACnet if required.

If Guest Room Expert 4.0 is employed for the GRMS management and the BMS is based on EcoStruxure Building Operation no interfaces are required, as the BMS and GRMS will share a common digital platform for all services and communications. All BMS and GRMS items can be viewed via a single interface, simplifying systems, unifying data, and improving productivity through the commonality of systems, data and operational knowledge required.

3.1.3 Server-to-Server Guest Room Door Lock System

The door locking system can integrate with the GRMS to provide the following information:
- **Door Status**: Open, Closed or Ajar. Note that when the Ajar status is triggered, a proper alert must be sent to the security system and when available the CCTV system.
- **Door locking mechanism**: Depending on the brand standard, it might be required to set the room to DND when the door is locked. Note that this is not mandatory and sometimes prohibited by brand standards. Do check with the operator.
- **Entry type**: Staff or Guest - the door will provide the information on whether the person entering the room is a guest or whether it is part of the staff. The information is used to trigger the appropriate scene. When the guest walks in the Welcome or Restore scene will be triggered while you will have a special scene for staff.
- **First or subsequent entry**: When the guest comes to the room for the first time, the Welcome scene (daytime or nighttime) will be triggered. On subsequent visits, the Restore scene will be used.
- **Courtesy panel data**: The in-room data collected from the DND and MUR buttons connected to the RCU can be transmitted to the door entry panel when this is supplied by the door lock provider (e.g. ASSA ABLOY Global Solutions). These signals are then decoded by the door panel and alerted in the specific format as required.

3.1.4 In-Room Guest Room Door Lock Interface (ASSA ABLOY Global Solutions)

Using the Zigbee dongle connected to the RP-C USB port to integrate VingCard Zigbee Door Lock with the Connected Room Solutions (CRS) for Hotel. The integration will be done on two (2) levels:
- **Room Level**: Where the Room Controller (RP-C) and the Door Lock will be connected via Zigbee.
- **Server Level**: Using the SmartConnector framework to create a tunnel between the EBO and the Visionline server.

The intent of the Zigbee integration with the VingCard door locks is:
- The in-room integration will allow the application to receive the door events as soon as they occur, avoiding delays from server integration. This will improve the response time and act faster to provide a better guest experience.
- Reduce the equipment and wiring in the room installation since the integration directly with the door lock will replace the VingCard gateway. The RP-C with the SmartConnector will act as a tunnel between the Door Lock in the room and the Visionline server.

The door lock integration tells the room controller exactly who is entering the room (guest, staff) so that the application responds accordingly with the appropriate lighting, temperature, and curtain settings. For example, the Restore Scene is activated when a guest returns to the room—restoring the exact conditions that were set when

the guest left the room. Regarding the integration with the VingCard door locks, the Room Controller (RP-C) will receive:

- All the door events (EMI events) directly from the door lock.
- The EMI events from the door lock.
- All the messages to be sent to the Visionline server.

These messages are encrypted and not processed by the Controller in any way, they will simply be transferred to EBO, where the SmartConnector will poll them and send them to the Visionline server. The SmartConnector will receive all commands and messages from the Visionline server, transfer them to EBO (via EWS) where the Controller will receive them (via BACnet), and send them to the door lock. This mechanism will create the 2-way communication system (tunnel) between the door lock in the room and the Visionline server.

3.2 Cybersecurity

The GRMS RCU's and Automation Servers shall meet all applicable requirements of IEC 62443.

The GRMS network shall be protected from the outside world via configurable firewalls at each point of internet or corporate network connection.

Normally the GRMS network shall be configured on a separate VLAN provided by the hotel operator.

VLANs shall separate all room systems from shell and core systems. Ports on the layer 3 network switches shall be configured to allow the transfer of necessary data between GRMS/RCUs and 3rd party systems.

The ports on the firewall shall be configured to only allow the required information to pass through in the required direction (out of hotel / into hotel).

The management software platform (GRE), Automation Servers and RCUs shall be cybersecurity tested to ensure the risk of a security breach is minimized.

VPN software shall be used for any remote access into Guest Room Expert or the GRMS network.

The GRMS software platform cybersecurity requirements should meet the following requirements at a minimum:

- The GRMS software platform shall be developed using secure development life cycle best practices for software development.
- The GRMS software platform shall be subjected to regular and verifiable best-practice cybersecurity testing by the system supplier. Results of this testing shall be made available upon request prior to deployment of the system.
- The GRMS software platform system supplier shall provide cybersecurity service incident escalation through the help desk on a 7/24/365 basis.
- All GRMS software platform server-level devices shall require access via HTTPS.
- All GRMS Automation Servers shall support SNMP V3 monitoring of network performance and stack statistics for the purpose of managing denial of service attacks.
- The GRMS software platform shall support the feature to auto-logoff any logon that has had no activity for a predefined period.
- The GRMS software platform shall support the feature to alarm on a predetermined period until the default password for each device is changed from the default factory setting.
- The GRMS software platform shall support encrypted password authentication for all web services whether serving or consuming.
- The GRMS software platform shall support single sign-on allowing user authentication information to be shared from one trusted system to another. All cybersecurity standards and practices shall apply to secure the single sign-on.
- The GRMS software platform shall support Active Directory.
- The GRMS software platform shall support password rules required by good security practices to include password complexity, password history, minimum password length, password age, forced password change, invalid login alert, auto lockout after three invalid attempts.
- The GRMS network-level servers shall support encryption standards throughout the network.

3.3 Guest Rooms Expert

Guest Room Expert leverages the connectivity provided by the EcoStruxure for Hotels platform. Built upon open standards and end-to-end cybersecurity, EcoStruxure™ for Hotels GRMS integrates and facilitates data exchange from the Connected Room Solution for Hotels, Guest Room Expert 4.0, a variety of Property Management System platforms, building management system, and door locking systems to improve staff productivity, reduce guest complaints, and enable superior operational efficiency and guest room functionality.

Full visibility of your operational data enables you to improve operations and reduce costs, while increasing guest control and comfort enabling connectivity to our cloud-based advisor suite for automatic fault detection and analysis of building systems.

3.3.1 Guest Room Expert Default Screens

The GRE toolkit provides a web front end for a hotel solution. The below table identifies the screens expected to see at each level. There is also an example screenshot of each screen view expected.

Dashboard Screen	Description
Home Page	Site overview data aggregation. This includes room states, occupancy, as well as courtesy details at site level. This screen shows integration to weather if required, and alarm statuses of other integrations.
Floor Overview	Floor overview data aggregation. This includes room states, occupancy, as well as courtesy details at floor level. *This screen navigates to the room overview dashboard.*
Room Overview	Room overview data aggregation. This includes room states, occupancy, as well as courtesy details at room level. *This screen navigates to each room view 1 dashboard.*
Room View 1 – Room Summary	Room Summary dashboard containing room state, occupancy, courtesy, basic HVAC information, and alarm statuses. *This screen can navigate to the other room view dashboards.*
Room View 2 – Room In-Depth Information	Room In-Depth information dashboard containing room state, occupancy, courtesy, advanced HVAC information, integration alarm statuses, and lighting information. *This screen can navigate to the other room view dashboards.*
Room View 3 – Trends & Charts	Room logs and trends dashboard containing views of historical data of each room. Each tab has an EcoStruxure Building Operation dashboard widget, a trend chart, and a trend chart list to view data. *This screen can navigate to the other room view dashboards.*
Housekeeping Floor Overview	Floor overview data aggregation. This includes room states, occupancy, as well as courtesy details at floor level. *This screen navigates to the housekeeping room overview for each floor.*
Housekeeping Room Overview	Housekeeping room overview data aggregation. This includes room states, occupancy, as well as courtesy details at room level. *There is an option for Housekeeping users to set MUR at this level.*
Site Trends	Site trends dashboard containing views of aggregated historical data at site level. Each tab has an EcoStruxure Building Operation dashboard widget, a trend chart, and a trend chart list to view data.
Alarms	Site alarms view with all alarms. These can be filtered as required. *Note: Room alarm views filtered for each room can be found in the Room View 1 dashboard*

The GRE uses EcoStruxure Building Operation WebStation for its front-end graphics. If the hotel requires a mass change of points, this function requires the use of WorkStation rather than WebStation to complete.

However global searches of individual properties are still possible. Global Searches are part of the GRE to allow you to set values at the RP-C controller level once. It also allows you to configure some parameters with the same functionality.

4 Guest Room Architecture

The following diagram gives an overview of the RP-C RCU when applied within a room.