Applications

The new SE-SPU101x controllers replace the RTU-100x controllers. All the RTU100x controllers are discontinued, including the RTU-1003-0 VAV SPU controller. The new SEC product offering provides new controller options.

The SE-SPU101x-1 SEC Unit Control Board (UCB) is a member of the Smart Equipment Controller (SEC) product family. The controller is designed to run a pre-engineered HVAC zoning application and provide the inputs and outputs required for this application.

North American Emissions Compliance

United States

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

Canada

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

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

Installation

Special Tools Needed

- wire strippers
- small flat-head screwdriver
- 22 AWG (0.65 mm) 3-conductor, twisted, shielded cable with a drain wire
  
  Note: This drain wire is used only to group the shielded cable. Do not use this drain wire as a connection to the board.

- wire nuts for 22 AWG drain wire
- electrical tape

Mounting

The manufacturing facility mounts the controller. All of the required power wiring, internal unit sensor wiring, and output wiring is completed and tested at the factory. The control application required for the specific UCB is factory configured and ready for operation.

Wiring

Field Wiring Connections

In addition to power connections, the UCB requires a communication bus connection. Address selection is required for networking with a CCS Building Automation System (BAS).

Power Wiring

The SEC UCB controller is factory wired for 24 VAC power.

IMPORTANT: The 24 VAC power should not be shared with other network devices. Sharing power to other network devices may cause noise, interference, and ground loop problems. You may damage the controller by sharing power to other devices.
In certain cases, you may need to share a 24 V transformer with multiple CCS devices. Be sure that you maintain consistent +, -, and common wiring terminations on the shared CCS devices.

**IMPORTANT:** Do not interchange +, -, and common 24 V terminations when sharing a transformer with multiple CCS devices. Interchanging these terminations can cause damage to the controller.

**Setup and Adjustments**

To quickly set up your CCS network:

1. On each end of the 3-conductor cable, strip the outside insulation back approximately 2 in. (51 mm).
2. Tear off excess foil shield, leaving the bare drain wire and the three insulated conductors.
3. On each end of the three insulated conductors in the cable, strip the insulation back approximately 1/8 to 1/4 in. (4 to 7 mm).
4. Choose a color pattern to follow and insert each of the three conductors into one each of the three terminals on the CCS board communication connector.
5. Tighten each terminal until the wire is secure.
6. Ground the drain wire at one end only of the communication trunk. Do this on the last unit in line.

   Use an existing hole or drill a hole and insert a sheet metal screw in the back plate below the communication connector.

   Wrap the bare drain wire around the screw and tighten the screw. This is the only location where the shield is grounded.
7. Daisy chain the three-conductor wire between the remaining SPUs. Connect the drain wires together with the wire nuts. Follow the stripping and connecting procedure in Step 1 through Step 6.
8. Run the cable from the last unit to the location of the System Manager or Zone Coordinator. Follow the connection instructions for the System Manager or Zone Coordinator. Figure 4 displays an example communication riser.
9. Make sure all the SPUs are powered and operating properly.

**Note:** Be sure you observe polarity of each of the conductors in the communication cable.

**Communication Bus**

The UCB default address is set to 4. The available values range from 0 to 127. To view the UCB Network Address, use the joystick and the two push buttons below the LCD, to navigate through the menus to the Commissioning menu (Figure 1).

![Figure 1: Joystick and Push Buttons on UCB](image)

Up and down movements of the joystick move the > cursor and scroll through the selections in the active section of the menu (Figure 2).

![Figure 2: UCB Top Level Menu](image)

Each menu selection represents either a submenu or a property. Press Enter to display the items in the submenu or the values of the selected property.

Once you navigate to the Commissioning menu, use the cursor to scroll to the Network submenu. From the Address submenu, press Enter to display the current network address. Move up or down with the joystick to display the values of other properties.
Control Board and Wiring Diagrams

Figure 3 shows the location of the communication cable terminations on the SPU controller board. Figure 4 shows the VAV SPU controller communication riser.

* Move the 4-position terminal block from the Thermostat inputs to the FC Bus connection of the communications card.

Figure 3: VAV SPU Control Board Communication Terminations
The shield drain wire must be earth grounded at one and only one point for the entire communication bus segment. (Preferably at the last device.)

**Figure 4: VAV SPU Controller - Example System Communication Riser**
**End-of-Line (EOL) Terminations**

Daisy-chained RS485 protocol networks require end-of-line (EOL) termination to reduce interference. Interference is caused by signal reflection that occurs when data transmissions reach the end of a bus segment and bounce back (Figure 5). The high baud rates on Master-Slave/Token-Passing (MS/TP) bus applications require robust EOL termination and strict adherence to the EOL termination rules.

On a CCS System bus or Zone bus, only one EOL termination is required due to the fewer number of devices on one bus and the shorter wiring length. Specifically, the System bus must always have a System Manager as the EOL device, and the Zone bus must always have a Zone Coordinator as the EOL device. Figure 6 shows a CCS EOL wiring example.

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**Figure 5: Interference**

![Interference Diagram](image)

**Figure 6: CCS EOL Wiring Example**

![Wiring Diagram](image)
Operation

The controllers are supplied in a pre-configured format. You do not need to configure the controller. Refer to the Commercial Comfort System (CCS) Operation Overview Technical Bulletin (LIT-12011617) or the Smart Equipment Controls (SEC) Quick Start Guide (LIT-12011938) for information on operating modes and functionality.

Troubleshooting

Use the following information to troubleshoot the System Manager and Zone Coordinator.

Power Status LED

The display backlight and green Power LED remain lit as long as power is applied to the C and 24V terminals.

The red Fault LED lights, goes off briefly, and then flashes throughout the startup sequence.

The green SA Bus LED lights briefly.

During the startup sequence, the joystick, the Enter button, and the Cancel button are not functional.

The LCD shows a countdown on the top line.

After approximately 15 seconds, the green SA Bus LED does one of the following:

- Lights to indicate the UCB has not established communication and is awaiting communication from SA Bus devices
- Flashes to indicate the UCB established communication with SA Bus devices

After the startup sequence finishes, the display shows XxXx on both lines if no alarm is active. The red Fault LED stops flashing and turns off. The joystick, Enter, and Cancel buttons are operational.

Communication Bus Problems

Several factors may influence the behavior of the communication bus. In addition, certain problems can affect the bus in multiple ways and have multiple symptoms, which makes the exact diagnosis difficult. For example, duplicate addresses on the bus can degrade performance, make the device go offline, or stop communication completely.

Incomplete Address

With the SEC controller for VAV, COBP must have the address switch set to 4 on the zone communication bus. Other settings prevent the SPU from communicating on the System Communication bus.

Duplicate Addresses

Two or more devices on a communication bus cannot have the same address. For example, two SPUs on the System communication bus cannot both have the address 4. If two devices on the same bus have the same address, performance can degrade or serious communication problems may occur. These problems include the devices not coming online or all communication stopping completely.

Check for duplicate addresses in the following ways depending on the severity of the situation:

- If the bus performance is degraded, check the address switch settings at the devices with unreliable communications.
- If a specific device is not communicating, remove the device with communication problems and check if the device address remains online at the System Manager or Zone Coordinator.
- If the bus communication problems are severe, and no communication is present (or if you cannot determine where communication is unreliable), partition (disconnect and isolate a portion of the bus for testing purposes) and test the bus portion connected to the System Manager and Zone Coordinator controllers.
Correcting Physical Communication Bus Problems

The communication bus is subject to a number of physical factors that can affect performance. Consider the following list of common physical problems that affect the communications bus:

- **Check wires**
  - Verify that the wire is 22 AWG (0.65 mm) 3-conductor, twisted, shielded cable.
  - Verify that the shield is continuous and hard-grounded at one end.
- **Check wiring**
  - Check for and eliminate T-Taps (wire configurations that create a T shape) and star configurations.
  - Ensure that the bus is wired in daisy-chain fashion.
  - Verify that appropriate devices have three wires entering and exiting each terminal. (Devices at the ends of the trunk do not have this wiring.)
- **Check EOL switch settings**
  - Verify that the zone bus EOL switch on the Zone Coordinator is set to ON and the Zone Coordinator is located at the end of the zone bus trunk.
  - Verify that only the EOL switch at the end of the system bus is set to ON and all other system bus EOL switches are set to OFF.
- **Check connections, polarity, and lengths**
  - Verify that communications loops are less than approximately 304 m (1,000 ft) total in length.
  - If you are using one transformer to power multiple devices, verify that the device 24 VAC power connection follows the polarity of the common and 24 V terminations (see Power Wiring).
- **Check for opens and shorts**
- **Check terminations**
- **Check addresses**
  - Check for duplicate addresses.
  - Verify that the address range is sequential.
- **Check for sources of interference**
- **Check the status LED to verify power at the controller.**
- **Check bus voltages:**
  - (+) to COM must be within 2.0 to 3.0 VDC
  - (-) to COM must be within 1.5 to 2.54 VDC
  - (+) to (-) must be within 0.3 to 1.0 VDC
  **Note:** Values may fluctuate due to ongoing communications; this operation is normal provided the voltage is within the defined range.

Repair Information

If the Unit Control Board (UCB) fails to operate within its specifications, replace the unit. For a replacement controller, contact the nearest Johnson Controls® representative.
## Technical Specifications

### Unit Control Board with BACnet® Communication

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<th>Product Code Number</th>
<th>Description</th>
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<td>Single-stage Unit Control Board with Field Bus Expansion Module</td>
</tr>
<tr>
<td>SE-SPU1012-1</td>
<td>Dual-stage Unit Control Board with Field Bus Expansion Module</td>
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### Power Supply Requirement

- 24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety

### Power Consumption

- 15 VA maximum

*Note: VA ratings do not include any power supplied to the peripheral devices connected to binary outputs (BOs)*

### Ambient Conditions

- **Operating:** -40 to 158°F (-40 to 70°C); 10 to 90% RH noncondensing
- **UI Operating:** -4 to 158°F (-20 to 70°C); 10 to 90% RH noncondensing
- **Storage:** -40 to 194°F (-40 to 85°C); 5 to 95% RH noncondensing

### Processor

- RX631 Renesas® microcontroller

### Memory

- 2 MB internal program flash, 32 KB internal E2Data flash, 4 MB external serial flash memory

### Input and Output Capabilities

**SE-SPU1011-1:**
- 9 AIs: 7: 10k RTD, 1: 0 to 10 VDC, 1: 24 VAC Voltage Monitor
- 13 BIs: 24 VAC input with contact cleaning circuits
- 5 BOs: 4: relay outputs, 1: Transistor output

**SE-SPU1012-1:**
- 12 AIs: 9: 10k RTD, 2: 0 to 10 VDC, 1: 24 VAC Voltage Monitor
- 1 AOs: 2 to 10 VDC, 10 mA maximum
- 16 BIs: 24 VAC input with contact cleaning circuits
- 8 BOs: 7: relay outputs, 1: transistor output

### Housing

- Unpackaged printed circuit board (PCB) with silkscreen labels

### Mounting

- Mounted with Nylon Standoffs

### Dimensions (Height x Width x Depth)

- 1.44 x 6.5 x 5.27 in. (36 x 165 x 133 mm)

### Shipping Weight

- SE-SPU1011-1 – 3.6 lb (1.63 kg)
- SE-SPU1012-1 – 3.7 lb (1.68 kg)

### Compliance

**United States:**

**Canada:**
- UL Recognized, File E107041, CSA 22.2 No. 236, Signal Equipment Industry Canada, ICES-003 – Recognized