Honeywell
THE POWER OF CONNECTED | Building

The Power of Simplicity Designed with the User in Mind

LCBS Connect™

LCBS Connect™ solution consists of a technology platform that includes three key components.

- Advanced remote monitoring and alerting with programming capabilities enable facilities managers and service contractors unparalleled system access.
- Cloud-based data storage provides secured access via smartphone, tablet, and personal computers so users can get data they need, when they need it.
- Hardware platform enables precise control of constant volume air handling units with selectable user interface.

TECHNICAL HIGHLIGHTS

- **Advanced monitoring** of system parameters, reports and alerts can be viewed through LCBS Connect cloud remote interface. All system alerts can be sent to specified recipients via SMS and email, giving you 24/7 building system access.
- **Warranty:** Five (5) years for all system components including controller, wall module, sensors, variable frequency drives.
- **LCBS sensors** feature the Honeywell "Sylk" Sensor Bus. This aids in error-free wiring. Temperature, humidity, and carbon dioxide sensors can be connected to this smart sensor bus.
- **Data, parameters, set points, and sensor values** can be viewed and changed through LCBS Connect Wall Module or through LCBS Connect Cloud Remote Interface.
- **Operating modes** (heating, cooling, economizer, automatic, off, occupied, standby, unoccupied) can be initiated through the LCBS Connect Wall Module and LCBS Connect Cloud Remote Interface.
- **Remote user interface** employs HTML5 language. The user interface can be hosted on any remote device including personal computers, tablets, and smartphones.
- **Sensor accuracy:** Humidity 5% range from 10-95%, Temperature 0-2°F across range from - 40-150°F, Calculated Enthalpy -3 to +3 BTU/LB range from 20 BTU/LB to 36 BTU/LB.

APPLICATION HIGHLIGHTS

Controls single- or two-speed air-to-air heat pumps and up to two stages of auxiliary heating; up to three stages heat/three stages cooling control for conventional rooftop units and split systems. All parameters described below can be altered through LCBS Wall module or LCBS remote interface.

Title 24 and IECC Compliance. LCBS Connect is compliant to Title 24 2016 and IECC guidelines.

Ventilation, Economizer Control, Demand Controlled Ventilation. Multiple ASHRAE compliant economizer strategies are supported. Additionally, IAQ, DCV CO_2 air quality control is offered to the economizer strategy. Honeywell Jade economizer functions are included in the LCBS Connect control system.

Flexible Fan Control. Contractors can designate up to six fan speeds associated with a specific control strategy, resulting in energy savings for building owners and customers. Two-speed discrete relay control is also available. Up to six speeds of fan control and be programmed through a variable frequency drive.

Temperature Control. Six heat and cool set points including 1) Occupied heat 2) Occupied cool 3) Standby heat 4) Standby cool 5) Unoccupied heat and 6) Unoccupied cool.

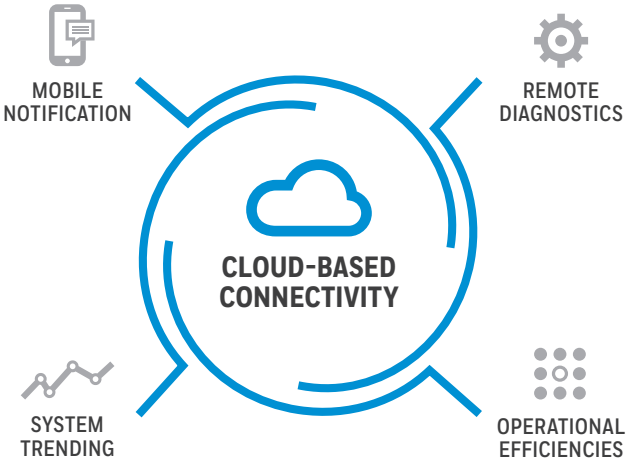
Time of Day, Holiday, Special Schedules. Controller supports 2 occupied/unoccupied periods a day. Scheduled occupancy, occupancy bypass, and bypass supported. Vacation scheduling is supported.

Adaptive Intelligent Recovery. Ensures occupant comfort when they arrive at building. Parameters can be adjusted to account for individual systems, climate differences, and equipment capacity.

Heat Pump "Comfort" and "Energy Saving" Operation Option. Heat pump auxiliary heat recovery is provided so heat pumps run in an energy efficient manner. Comfort can be selected over energy savings as an option.

Dehumidification. Staged reheat control that cycles heating stages in response to a humidity set point. Cooling is locked on as heating is cycled.

Accessory loop control. The LCBS Connect system allows "custom" loops to be defined. Select control sensor, method of control (staged, modulating), PID parameters, and minimum operating parameters.



For more information
To learn more about the capabilities of your LCBS Connect system, visit LCBS.Honeywell.com.

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LCBS CONNECT™

SYSTEM DESCRIPTION

Release Version August 14, 2017

LCBS Connect System Overview

LCBS Connect Solution is a new offering available through Honeywell two-step distribution. It meets the needs of small commercial building owners and HVAC controls and service contractors.

For building owners:

- Efficient environmental controls that lead to reduce energy consumption.
- Monitors building conditions constantly adds ability to remotely control schedules and setpoints.
- 21st Century solution - ability for building managers to see, change temperatures and schedules remotely.

For HVAC contractors:

- Increase service efficiency with LCBS Connect service tools.
- Provide valuable information to customers 24/7/365.
- Retain service contracts through demonstration of service value through sharing information and continuous monitoring.

LCBS Connect Solution – Deliverables

The LCBS Connect Solution offers a new control system with new remote tools and services. These tools will help service contractors provide service **more efficiently and effectively** and **retain service contracts**.

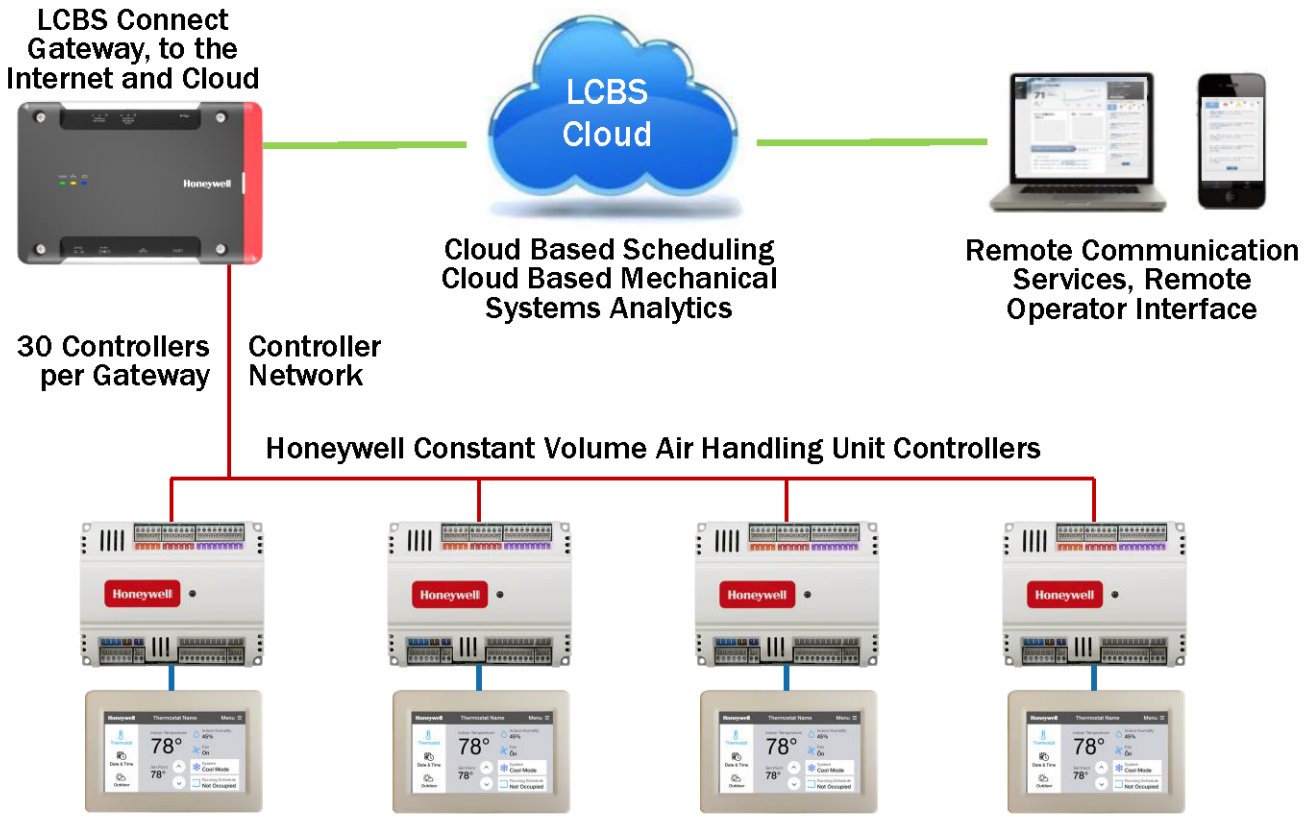
Previous Control Solutions

Previous control system offerings provided by Honeywell have satisfied end users, distributors, and contractors for decades. The new LCBS Connect provides ongoing solutions that can be enhanced and upgraded over the course of the HVAC service contract. Our long-term relationship with customers BEGINS when LCBS Connect is installed. With previous control system sales, that was where the relationship ended.

LCBS Connect System Details

The LCBS Connect Solution supports up to 30 LCBS Connect Controllers per building. For more than 30 controllers, a second LCBS Gateway is needed.

Network configuration and commissioning is highly intuitive and simple. Contractor partners do not need detailed technical knowledge of LonWorks™ network commissioning. The contractor must follow network wiring convention, but is assured of commissioning success indicated by the LEDs on the LCBS Connect Gateway and via the LCBS Wall Module user interface.



LCBS Connect Controller and Wall Module

Unique two piece construction with touch screen color display. The LCBS Connect Wall Module is a compact operator interface that doesn't take much wall space, or can simply be mounted near or in a CHAHU enclosure. The LCBS Connect Wall Module can be connected to the LCBS Connect Controller via reused two conductor low voltage wiring utilizing the Honeywell exclusive "Sylk" bus. This polarity insensitive bus carries control signal, information, and power, making installation simple.

The LCBS Connect Controller is designed for outdoor panel use in temperatures from -40 to 150°F. It can accommodate a number of service sensors including economizer temperature and humidity sensors, filter differential pressure sensors, current sensors, and photocell sensors.

Simple system configuration via local UI

The LCBS Connect Controller can be configured through the LCBS Wall Module on site or remotely through the cloud. It also works immediately "out of the box" until it is configured. Any parameter setting that can be changed using the LCBS Wall Module can also be changed using the LCBS Connect Remote Interface.

Simple system configuration via remote UI

LCBS Connect sites can be accessed through smart phones, tablets, Android and iOS devices, and personal computers. Chrome, Firefox, and Safari browsers are recommended. Settings created locally using the LCBS Connect Controller Wall Module can also be configured remotely using any of these devices.

Gateway connects building site and system to Honeywell “Cloud”

The HVAC service contractor must locate and acquire an Internet connection site. We provide simple rules for our LCBS Connect distributor to help our service contractor support proper connection. The system supports automatic DHCP network address assignation that will meet most needs. For IT professionals and building owners, static IP assignation is also an option.

Maintaining the intention and spirit of simplicity for our target contractor user, the installation of the Internet to site communication device is simple. As the service contractor installs the gateway, a series of LEDs light up to show successful connection of 1] power to the device, 2] controllers to the controller network, 3] device to the Internet, and 4] the device to the Honeywell “Cloud” lcbs.honeywell.com. If all four LEDs are illuminated and not flashing, the LCBS Connect Gateway device has been installed and connected to the Internet and the Honeywell Cloud.

The LCBS Connect gateway is a sophisticated but simple-to-use device, featuring two gigabytes main memory, consumes 10 VA power at 24 VAC, operates at 10/100base-tx, and support Echelon LonWorks based building control network.

Web Interface and Cloud Based Services

Honeywell Cloud based services are an exciting part of the LCBS Connect. Here are the main points:

Our web interface is not an application, it is a series of carefully crafted HTML5 web pages based on Honeywell design principles. Using a web hosted portal versus applications means:

- Faster development turnaround time
- Easier maintenance and upkeep, without having to push app updates that might not get installed

A web-based portal does require Internet access to use, but our customers already use devices that require the Internet to be up all the time. While our target HVAC contractor target customer may occasionally be in equipment rooms with little or no wireless access, they can usually walk out of these areas to establish Internet communication. The development and support savings make the decision simple.

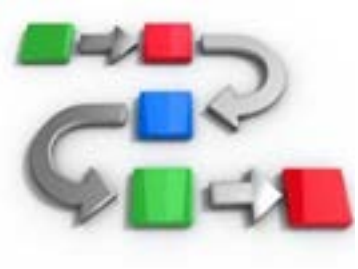
LCBS Contractors will be able to take advantage of numerous remote services that will allow them to service and maintain HVAC equipment more effectively and efficiently. As time goes on, service contractors will be able to select from a variety of tools that will allow them to demonstrate the value of their service to customers. Some of these services are free, and some will be available for a small charge. The LCBS Connect services will be directly acquired from Honeywell by service contractors. LCBS distributors will receive compensation for their sales and technical support efforts in the form of product credits.

Terms and Conditions, License Agreement Execution

The signup process is designed to:

1. Automate the process of executing terms of use and license agreements
2. Build a membership forum for access to support and LCBS Connect updates
3. Make it easy for an LCBS Connect contractor to order Honeywell cloud applications
4. Make it possible to compensate the distributor for contractor web orders.

Process



Honeywell invites distributors, distributors invite contractors, and contractors invite end users, and it's all automated. The LCBS Connect customer database is managed by Salesforce.com (SFDC). All participants must be in the Honeywell Salesforce database before the invitation process is started.

Honeywell Invites an LCBS Distributor

After Honeywell sales professionals identify target LCBS Connect distributors, the target's name, along with key business data, must be entered into SFDC. The Honeywell SFDC administrator sends the designated LCBS Connect distributor business owner an invitation to the LCBS Connect program. The distributor owner is presented with the invitation and the formal Terms of Use agreement. The basic theme of this agreement requests that the distributor understand all aspects of the agreement, treat all Honeywell and customer information in a confidential manner and that they are expected to invite LCBS Connect service contractors to the program. The LCBS Distributor is typically a busy person. They can designate "delegates" that can help them assign their staff members who will assist in the process of signing up contractors. The delegate gets their own credentials so they can enter the Honeywell site.

LCBS Distributor Invites an LCBS Service Contractor

The LCBS Distributor can now invite contractors. It is a core requirement for this program for LCBS Connect Contractor business owners or business leaders be set up in Honeywell's SFDC instances. Before a distributor begins the contractor invitation process, the contractor owner or business leader needs to be set up in Honeywell's SFDC.

The distributor invites a contractor by sending them an invitation via the portal. In this invitation e-mail, the contractor is given credentials to sign into the lcbs.honeywell.com site. Contractors must agree to the LCBS Contractor Agreement. The agreement requires the contractor conform to terms and conditions of the agreement, treat customer information with care and confidence, and invite building owners into the LCBS Connect program. One further aspect of the LCBS Contract Agreement expects that the contractor fully understands that data collected by the system is owned by the customer, not the contractor and not Honeywell. After the contractor accepts the invitation and agreement, they can invite "delegates" and "technicians." Here are some key reasons why there are business owners, delegates, and technicians.

LCBS Connect Contractor Owner	Delegate	Technician
Can use a credit card to purchase HVAC applications from Honeywell. Can invite Delegates and Technicians Can see all buildings in the Owner enterprise	Can change Technician building responsibilities. Can see all buildings in the Owner Enterprise. Is usually a service manager or dispatcher at a service company.	Can see buildings in his or her service area ONLY. It's simple for technicians to compare notes and in conjunction with service manager and dispatcher, maintain appropriate account coverage.

LCBS Service Contractor Invites Building Owner

The LCBS Contractor owner or delegate invites building owners to gain access to their local system.

It will be up to the contractor to designate the building owner and and associate them with the physical building location. This builds the service company's database of building owners. The LCBS Contractor needs to invite the building owner. The LCBS Connect service contractor should inform their customer that they must accept the terms of the agreement to participate.

Important! The LCBS contractor can't access the site and commission the user's site remotely until the building owner accepts the agreement. The agreement indicates that the building owner understands they are accepting the agreement, that Honeywell and the contractor won't distribute their personal information for gain, and that the building owner owns all data accumulated from their site.

Contractually, Honeywell claims the right to use the data for commercial purposes after the data is "anonymized." Honeywell and LCBS Contractors do NOT have the right to associate data with specific building owners.

Cloud-Based Remote Applications

Remote services applications are provided for LCBS Connect HVAC Service contracting professionals in the service language they use every day, not "control-ese." We provide ubiquitous remote access by service and controls contractors over the Internet using smart phone, tablet, and personal computers.

A service contracting firm can have multiple accounts to permit building access to appropriate users. For example, a contracting company owner, service manager, or dispatcher can see all service activity in any building that's in the service contractor's enterprise. Technicians can see service activity for the buildings they service only. Backup resources can be easily designated, maintaining service coverage even when people are on vacation or out sick.

The LCBS Connect Remote Service offer is highly scalable. It works for companies that have one owner and a service manager, and it works for the largest company with hundreds of contracts, vehicles, and service managers and dispatchers.

Sophisticated service and control alerting is available to service contractors. It will be rapidly followed by graphic tools and predictive and preventive service analytics. It's very different from standard BMS alarming. So much, in fact, we've redefined BMS alarming and we now call it "Service Alerting."

Cloud-Based Remote Applications for End User Customers

Building owners and occupants will have limited ability to change data remotely on their personal computing devices, but they will have the ability to change schedules and set points for their HVAC equipment.

Don’t panic

If end users want more control, we can provide contractor login for them. This will set them up as “technicians” to access their own building. Further, many end user, building owner customers have a “self-servicing function.” This is common for many commercial retail chains, school districts, banking and mortgage retail buildings and belt line health care HMOs. These customers can simply set up in-house service professionals with “contractor - technician” personas.

Service Alerting

Why is it different? Why is it Service Contractor Friendly? Honeywell takes great care to make sure that alerting messages are:

1. Explained in easily understandable language
2. Highly actionable and customizable, with threshold values that are easy to change remotely
3. Recorded in detail for customer “proof of value” reporting

Alarming can be **ALARMING** in HVAC Service World. Another important feature of Honeywell alerting is “alarm rain prevention.” Most control systems require that when failures occur, the event is recorded along with the time and maybe some data about the event. These are called alarms. In many environments where customers monitor for alarms, a digital event occurs where there is a rapid toggling or fluttering of electronic relay or an analog value that ignores time, temperature hysteresis and moves rapidly back and forth across an analog value boundary. In the case outlined above, thousands of alarms could be recorded in just a few moments. **For a service contractor, this is a nightmare.**

Honeywell LCBS Connect alerting prevents this in two ways. The first is a simple hysteresis setting. If a rapid change of state occurs, a timer starts to run. As this timer runs, the alert won’t be registered. If the alert condition still exists when the timer expires, an alert is recorded. The second is Pragmatic Alert Logic, or PAL. Our patented PAL watches for repeated changes of state and will not re-report an alert unless the first is dismissed by an LCBS Connect user. After the alert is dismissed, a new alert is reported if the condition still exists.

Alert Management – Features and Capabilities

Alert Management is a key feature of the LCBS Connect solution. Alerting will permit HVAC service contractors to identify issues and problems with their customer’s building sites. Messages can be tailored to be sent to any number of LCBS users. In many cases, the information provided through the alerting service will give the service managers and technician a head start in diagnosing HVAC issues. The technician might even be able to use the Remote Management capabilities to diagnose and solve the problem remotely using their smart phone or tablet.

Key LCBS Connect Alert Management features that will be available for launch

Digital points can be configured as alerts and can be assigned a customized notification protocol. Examples of digital alerts are dirty, fouled air filters and dangerously cold discharge air. Alerts can be stored in the contractor’s Honeywell Cloud database via the Alert Log, and can be sent to LCBS users via text or e-mail. Each user can “silence” alerts so they don’t create downstream disruption, but if they occur again, the user gets an additional notification. In addition to this definition, a timing or hysteresis value can be assigned to prevent rapid alert generation.

Analog points can be configured as alerts and can be assigned a customized notification protocol. Examples of analog alerts are measurement of pollutants lodged in air filters, measurement of current flowing through cables connect to fans and compressors, and CO2 levels, among many others. Alerts can be stored in the contractor's Honeywell Cloud database via the Alert Log, and can be sent to LCBS users via text or e-mail. Each user can "silence" alerts so they don't create downstream disruption, but if they occur again, the user gets an additional notification. In addition to this definition, a timing or hysteresis value can be assigned to prevent rapid alert generation. Users can assign high and low limits for certain sensors.

Zone Demand

LCBS Connect include many HVAC service analytics that will allow the service contractor to operate more effectively. One of these analytics is Zone Demand.

The Zone Demand analytic demonstrates the ability of heating and air conditioning equipment to meet the load required to heat and cool the space.

Please refer to the example image below. The cooling Zone Demand analytic ranges from 0% to 163% 1. At 0% there is no requirement to cool the monitored space to a specific setpoint. Cooling will be energized at a Zone Demand level as small as 1% 2. As the requirement for cooling increases, Zone Demand increases. At 50% Zone Demand 3, we are experiencing half of the capacity required to cool the space. For two stage systems, we should see the second cooling stage energized. At 100% Zone Demand 4, cooling requirement should be performing cooling at total capacity; two stages of cooling should be energized. When we observe more than 100% Zone Demand, we have exceeded the capacity of our cooling equipment, so we will no longer be able to control the cooling setpoint 5. This will be an interesting area for a service contractor. First, does the equipment meet the cooling requirement? Second, is the inability to extract heat being caused by a service issue? This could require service intervention.

Note: If the setpoint is lowered in cooling, Zone Demand will increase. If the setpoint is raised in cooling, Zone Demand will drop, and perhaps all the way to 0% 6. When the setpoint is dynamically changing, i.e. from unoccupied to occupied cooling, Zone Demand will be reset dynamically 7.

This logic works in reverse for heating. Heating Zone Demand analytic ranges from 0% to -163%.

Pre-Defined Condition Analytic Alerts

There are six simple analytics that instantly and accurately determine effective operation of fan, cooling, and heating.

Fan, Proof of Operation; Digital Input Proof

Fan, Type A. Two inputs are required for the Fan Type A analytic: fan output status and a digital input.

This compares what the LCBS Controller is telling the fan to do to what the fan is doing. The "true" condition is when both are "on." If fan command is "on" and digital input is "false," alert is issued.

Fan, Proof of Operation; Air Pressure Proof

Fan, Type B. Two inputs are required for the Fan Type B analytic: fan output status and an analog air flow pressure drop.

This compares what the LCBS Controller is telling the fan to do to pressure drop across filter. It uses analog pressure input from across the filter, measuring pressure drop. A value must be provided that indicates that air is not moving. If the fan is "on" and the filter pressure drop is below the setting, an alert is issued.

Fan, Proof of Operation; Compressor Proof

Fan, Type C. Two inputs are required for the Fan Type C analytic: fan output status and an analog current value from a transformer.

This compares what the LCBS Controller is telling the fan to do to what the fan is doing. If the fain is "on" and amperage is below the setting, an alert is issued.

Compressor, Proof of Operation

Compressor. Two inputs are required for the Compressor analytic: compressor output status and an analog current value from a transformer.

This compares what the LCBS Controller is telling the compressor to do to what the compressor is doing. The "true" condition is when compressor is on and amperage is well above 0.1 A. If compressor is "on" and amperage is below 0.1 A, alert is issued.

Heating, Proof of Operation

Heating. Three inputs are required for proof of heating operation: fan output status, coil entry temperature sensor (mixed air) and coil exit temperature sensor (discharge air).

This compares what the LCBS Controller is telling the heating system to do to what the heating system is doing. It uses the difference between a downstream air temperature sensor and an upstream air temperature sensor. If the value is below a user selected value, an alert is issued.

Cooling, Proof of Operation

Cooling. Three inputs are required for proof of heating operation: fan output status, coil entry temperature sensor (mixed air) and coil exit temperature sensor (discharge air).

This compares what the LCBS Controller is telling the cooling system to do to what the cooling system is doing. It uses the difference between a downstream air temperature sensor and an upstream air temperature sensor. If the value is below a user selected value, an alert is issued.

Ventilation Analytics

There are five (5) simple analytics that instantly and accurately determine inappropriate operation of ventilation systems and components.

One or more ventilation sensors failed

Outdoor, return, or mixed air sensors have failed. An alert is issued if one of these sensors is not providing appropriate readings.

Providing ventilation air when the system should not be doing so

Honeywell algorithm continuously calculates the amount of air required to ventilate or economize properly. If this value is OVER this calculated value, an alert is issued.

Providing too much ventilation air to system

Honeywell algorithm continuously calculates the amount of air required to ventilate or economize properly. If this value is OVER this calculated value, an alert is issued.

System components stuck, not providing appropriate economizer, ventilation control

Honeywell algorithm continuously calculates the amount of air required to ventilate or economize properly. If this value is DIFFERENT from this calculated value, an alert is issued.

Not providing ventilation air to cool the building when the system should be doing so

Honeywell algorithm continuously calculates the amount of air required to ventilate or economize properly. If this value is UNDER this calculated value, an alert is issued.

Dismiss Building Alerts

All alerts can be dismissed, activated, and reactivated by building by any user. The purpose of the process of dismissing is to allow new, similar alerts to occur. Remember, if you don't dismiss an alert, "new' alerts on the same point will NOT be to delegate, technician account. This ensures that alert recipients are not bombarded with alert messages.

Activate and Deactivate Messaging

Messages can be activated or deactivated for anyone with access to a building's LCBS system, allowing dispatchers to assign service technicians as needed.

Multiple Alerts, One Point

Multiple alerts can be assigned to the same point. A service technician may determine that a monitored point is important enough to select multiple alert levels. A good example of this would be for a critical filter. One alert could be activated if the filter media takes a long time to acquire, so this alert could indicate that it's time to order critical filter media. The second alert could be set to go off when the filter is actually loaded to the point where it needs to be replaced.

Customize Messaging

LCBS users, business owners, service managers, dispatchers, and technicians can choose to receive text messages to any smart device. The maximum character length is 160 characters. They can also choose to receive e-mail messages. These messages can be written so they are highly prescriptive and provide specific messaging to help solve the problem.

E-mail messages can contain unlimited characters and information

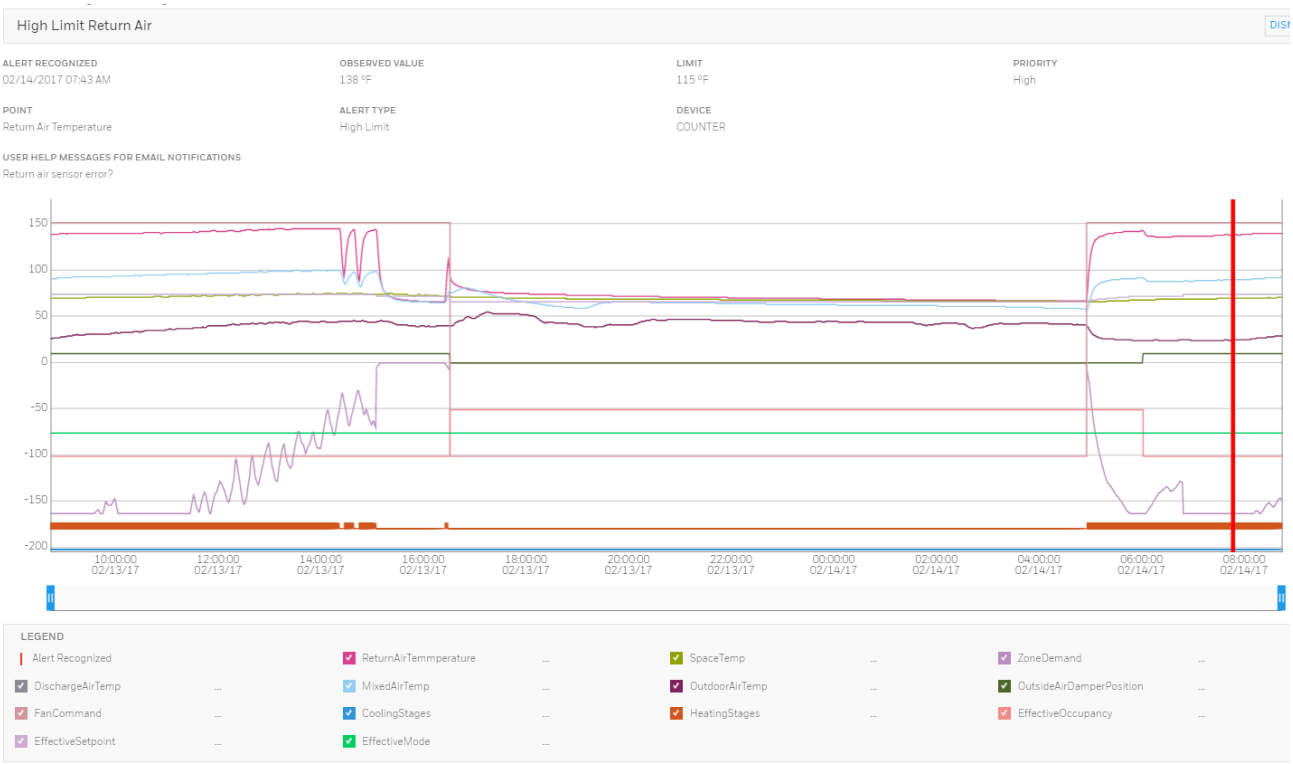
This can include anything, such as the contract limit, who to contact at the site, what process to follow at the site, special catalog numbers for motors, gas, filters, and other parts, etc.

Alert Log

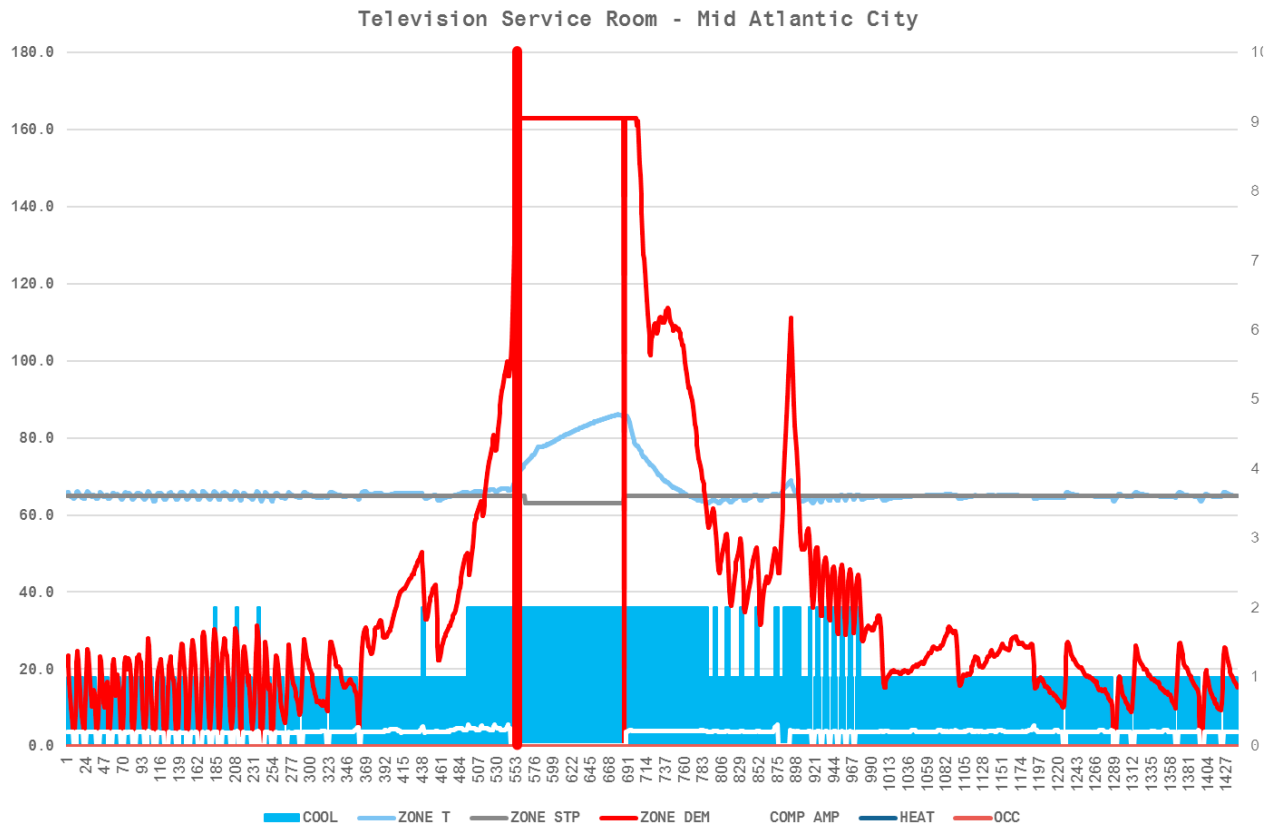
Each alert is stored in an Alert Log that can be accessed by anyone with access to the LCBS system on an enterprise level. The Alert Log not only contains historical data about the alert, it contains graphic data about each alert.

Graphic Representation of Alert Data

The contractor can review graphic data logs to diagnose problems. In addition to a log before an alert occurred, the system continues to log data after the alert. The contractor will be provided a link to interrogate the system and potentially solve the problem remotely.



Graphic data can be manipulated by the user, such as selecting or deselecting points to zoom in on. This allows the user to review data in smaller increments, as 24hours' worth is a lot to consume in one picture. The user can also review individual data values by moving a "wand" across the 24-hour data range to see data in 5-minute increments. Customized Data Acquisition. LCBS Connect permits system users to request and plot 24 hours of data at any time. Data is stored in a conventional comma delimited format and can be converted into a spreadsheets from which graphic creation is easy. Here is an example of the customized data acquisition output:



The chart above tells us volumes about what is happening at this site. At approximately 8:20 AM, load in the service room increases and a second stage of cooling is energized. As you can see from the graphic, the temperature in the room exceeds the set point, indicating that the cooling system it is having a hard time removing heat from the space. At 9:20 AM, compressor amperage goes to zero and the amperage alert is active, indicated by the larger red, vertical bar. The compressor has tripped the circuit breaker. The temperature in the service room rapidly rises from 65F to 85F. The service contractor is notified and got the system back on line about 20 minutes after they arrived. Without LCBS Connect, this problem could have been far worse.

Alerting Points

The Alerting function will give the technician knowledge about what to do and where to go when they arrive at the customer site. See a complete list of LCBS Connect Alerting Points and what they do in Appendix A.

LCBS Connect Local Controller Capabilities

The LCBS Connect Controller features inputs and outputs to support a wide variety of commercial control strategies, data logging, and data capture for advanced service and control analytics. While our LCBS Connect Controller and Wall Module solution operates as a “thermostat” in a stand-alone manner, it provides superior temperature and humidity control and serves up data to the Honeywell Cloud to perform beneficial analytics that will help service contractors do their jobs and keep customers.

On-Site or Remote Configuration

The LCBS Controllers can be configured completely via remote interface or via local LCBS Connect Wall Module display. Key settings can be changed via the LCBS Wall Module and via remote interface.

Flexible, Appropriate Access to Building Occupants

As with many Honeywell control devices, the contractor and building manager can collaborate to provide appropriate access to building dwellers. In some cases, building occupants should have full on-site control of the control system. In other cases, limited access is better. The LCBS Service Contractor and building owner can assign password strategy to local interface device and remote user interface to:

1. Ensure the building owner can manage HVAC to ensure comfort.
2. Limit unauthorized users from disrupting HVAC operation.

LCBS Connect CVAHU Applications

The LCBS Connect Controller controls single- or two-speed air to air heat pumps and up to two stages of auxiliary heating. The controller can provide up to three stages heat, three stages cooling control for conventional rooftop units and split systems.

Temperature Control

LCBS Connect controllers feature six heat and cool set points:

- Occupied heat
- Occupied cool
- Standby heat
- Standby cool
- Unoccupied heat
- Unoccupied cool

Schedules and set points can be changed through LCBS Wall Module and remote interface.

Schedules

The controller can support up to 2 occupied/unoccupied periods a day. Scheduled occupancy, occupancy bypass, and bypass initiated by remote sensor are supported. Vacation scheduling is supported as well. The ability to

temporarily adjust set points to address comfort issues and control deviation is a feature of LCBS control system. Schedules and overrides can be initiated through the LCBS Wall Module and through remote interface.

Adaptive Intelligent Recovery

To make sure building occupants are comfortable when they arrive to work, we provide Adaptive Intelligent Recovery, a long-time Honeywell customer favorite. This feature enables smooth transition of temperature set points from unoccupied to occupied periods. This helps ensure the equipment is not "hammered" to provide excessive heat or cool; the heating/cooling process is gradual. Properly deployed, it can extend equipment life. This also limits the potential impact of starting multiple HVAC units at the same time, which can cause an excessive "demand" registration. If there is a utility tariff in place, this can result in a high energy cost penalty for the customer. Parameters can be adjusted to account for individual systems, climate differences, and equipment capacity via LCBS Wall Module or remote interface. This is described further in the LCBS application manual.

Heat Pump "Comfort" and "Energy Saving" Operation Option

A heat pump auxiliary heat recovery is provided so heat pumps run in an energy efficient manner. Parameters can be adjusted to account for differences in equipment capacity via LCBS Wall Module or remote interface. The LCBS Connect Service Professional can offer an energy saving option for heat pump users, or a comfort option. The latter ensures excellent comfort conditions; the former lets building owners provide basic comfort conditions to building occupants and concentrates on operational efficiency.

Ventilation, Economizer Control

Unlike almost all of our competitors, multiple ASHRAE compliant economizer strategies are supported. We can enable or disable an existing economizer with control relay output. We can also provide direct drive economizer strategy: this features single and dual temperature changeover, and single and dual enthalpy changeover. Key settings can be changed via the controller and via remote interface. Additionally, IAQ, DCV CO2 air quality control is offered to the economizer strategy. We control to CO2 ppm as well as classic DCV control, and set minimum and maximum DCV control positions. Key settings can be changed via the controller and via remote interface.

Title 24 and IECC Compliance

LCBS Connect is compliant to Title 24 2016 and IECC guidelines.

Dehumidification

There are two dehumidification strategies using heating and cooling control. First is a simple dehumidification control that cycles a designated dehumidification device when a dehumidification set point is reached. Second is a staged reheat control that cycles heating stages in response to a humidity set point. Cooling is locked on as heating is cycled. Heating and cooling operate simultaneously to provide dehumidification. Finally, LCBS Connect controllers provide a minimum on time control that extends cooling operation for a designated period. Dehumidification set points and parameters can be changed through the LCBS Wall Module and via remote interface. Please refer to LCBS Application information for details.

Accessory loop control

The LCBS Connect system allows designed loops to be defined. The applier selects the control sensor, method of control (staged, modulating), PID parameters, and minimum operating parameters. These set points and parameters can be changed through the LCBS Wall Module and via remote interface.

Multispeed fan control

The applier can designate up to six fan speeds associated with a specific control strategy. If there is no call for heating and cooling and ventilation is still required, this can keep the supply fan running, providing ventilation at a lower energy rate. These set points and parameters can be changed through the LCBS Wall Module and via remote interface. This is required by law in many locations in the USA.

LCBS Control System Inputs, Outputs

Analog Inputs	**Digital Inputs**
• Space Temperature (on board LCBS Wall Module) • Space Humidity (on board LCBS Wall Module) • Space or Return CO2 (Connect to LCBS Controller or Sylk Bus) • Discharge Air Temperature Outside Air Temperature (20K) • Mixed Air Temperature (20K) • Filter Differential Pressure (0-10 VDC) • Monitor Sensor (Up to three: one temperature, two user defined; one 20K, two 0-10 VDC) • Fan or Compressor Current Sensor	• Fan Flow Status (dry contact) • Occupancy Sensor (dry contact) • Dirty Filter (dry contact) • Pulse Meter, energy, flow logic (dry or electronic pulsing contact) • System shutdown (dry contact) • Monitor Switch (dry contact) • Economizer Enable(dry contact)
Analog Outputs	**Digital Outputs**
• Economizer (0-10 VDC) • Accessory Loop 1 (0-10 VDC) • Accessory Loop 2 (0-10 VDC)	• Auxiliary Economizer (dry contact) • Occupancy (dry contact) • Free Output (dry contact) • Heating, Cooling, Fan, Reversing Valve (dry contact)

Network Sensors

- TR40 (Address=3), Space Temperature, Relative Humidity, CO2; TR40 (Address=4), TR40 (Address=5), TR40 (Address=6), Space Temperature only
- C7400S (Address=8), Outdoor Temperature and Relative Humidity, Overrides UI
- C7400S (Address=9), Return Air Temperature and Relative Humidity
- Space Multi-Temperature Option (Ability to Average Sensor Inputs)

Remote Services LCBS Connect Controller Remote Setting and Configuration

Remote configuration of the LCBS Connect Controller provides abundant flexibility and power to system users.

Remote Settings

It is essential that LCBS Connect Service Contractor Specialists have access to remote settings. In many cases, well-intentioned building owners and managers make changes attempting to make occupants more comfortable. This can unintentionally cause long-term system performance problems, unnecessary service calls to the site, and system failures.

For example, a business manager might change the configuration setting to “Cool/Off” because building occupants are hot. If this setting is not changed back, it could stay that way through the heating season. The next time heating is required, it won’t come on. Fortunately, the service contractor and technician can change the setting remotely. The alert that would be triggered in this case is Zone Demand.

Setting Specifics	Notes
Basic Heating and Cooling Settings, Set point Options	These are essential remotely adjustable settings, including occupancy, fan operation, and system switch setting. All temperature set points can be altered from this portal. These remotely adjustable settings can save a trip to a jobsite.
RH and CO2 Limits	If humidity or air quality control are implemented at a site, an LCBS user can change these settings and limits remotely.

Remote Configuration

Remote Configuration is provided so that experienced LCBS Connect professionals can remotely perform final configuration to new sites. Occasionally, a well-intentioned user will unwittingly alter configuration settings. Remote Configuration saves on the aggravation of unneeded truck rolls.

As a rule, you and your service technicians should be at the customer site to observe the results of configuration alteration if the system has already been commissioned.

Configuration Specifics	Notes
Conventional CVAHU operation to Air to Air CVAHU Heat Pump operation. Stages of compressor, heating used (up to three cool, three heat).	Not recommended to configure remotely. If the system is improperly set up initially via LCBS Wall Module, remote capability would be necessary.
Fan Operation in Heat Mode	Not recommended to configure remotely If the system is improperly set up initially via LCBS Wall Module, remote capability would be necessary.
System Switch	A commonly abused configuration parameter. If set incorrectly, remote capability is necessary.
Heating, Cooling Lockout, Limit, Operation configuration	There are 16 remotely adjustable equipment control option settings. Some have more remote adjustability value than others. Individuals doing on-site or remote adjustments should observe equipment operation closely after changing adjustments.

Configuration Specifics	Notes
Adaptive Intelligent Recovery configuration	There are 9 adjustment options available for Adaptive Intelligent Recovery. These values could change if initial assumptions about equipment capacity are incorrect. Results of on-site or remote adjustments should be monitored closely.
Ventilation, Economizer, Demand Controlled Ventilation	In some cases, it is possible to change ventilation and economizer settings, particularly minimum ventilation and changeover, high limit settings. It is not advised to enable extreme control strategy alterations remotely; they should be done at the site so technician can observe results.
Sensor Selection	Sensor selection can be performed remotely, although care must be taken not to leave jobsite without assigning primary control sensor to respective control loops.
Terminal Assignments	Terminal assignments can be done remotely, but care must be taken to have LCBS Connect control systems operating properly before technician leaves jobsite.
Dehumidification	Dehumidification configurations can be changed remotely, but the technician should observe the outcome of changing the configuration.

Appendix A – Point Alert Listing

Sensor Name	Digital Alerts	High Limit Analog Alerts	Low Limit Analog Alerts	Sensor Malfunction Alert	Description and Use Cases
Dirty Filter Digital	●	●		●	Indicates the state of the Dirty Filter digital input.
Proof of Airflow Digital	●	●		●	Indicates the current state of the Fan Status digital input. When fan output is on and fan status is off, this may indicate a fan failure or the fan has been manually turned off at the motor starter. When fan output is off and fan status is on, this may indicate the fan has been manually turned on at the motor starter.
Free Digital Output	●	●		●	User Defined
System Shutdown	●	●		●	Indicates any input that needs to shut down the roof-top unit. Among these: freezing coil condition, smoke shutdown from a smoke detection system, any system anomaly that requires HVAC system shutdown.
User Configured Input	●	●		●	Monitor Switch: Indicates the state of the Monitor Switch digital input.
Pulse Meter	●	●		●	When a pulse meter is configured, this value is the calculated Pulse Meter value.
Return Air Enthalpy	●	●		●	Return Air Enthalpy

Sensor Name	Digital Alerts	High Limit Analog Alerts	Low Limit Analog Alerts	Sensor Malfunction Alert	Description and Use Cases
Return Air Humidity	●	●		●	Return Air Relative Humidity (RH)
Return Air Temperature	●	●		●	Return Air Temperature
Indoor CO2	●	●		●	Space CO2
Indoor Humidity	●	●		●	Space Relative Humidity (RH)
Indoor Temperature	●	●	●	●	Space Temperature
Compressor Current Transformer Sensor	●	●		●	Indicates compressor current in amps when input UI6 is configured to measure compressor current.
Discharge Air Temperature	●	●	●	●	Discharge Air Temperature
Fan Current Transformer Sensor	●	●		●	Indicates fan current in amps when input UI6 is configured to measure fan current.
Filter Static Pressure	●	●	●	●	Indicates the pressure drop across the filter when input UI5 is configured to measure Filter Pressure.
Mixed Air Temperature	●	●	●	●	Mixed Air Temperature
Outdoor Air Damper Actuator	●	●		●	Indicates current Outdoor Air Damper position
Outdoor Air Enthalpy	●	●		●	Outdoor Air Enthalpy
Outdoor Air Humidity	●	●		●	Outdoor Air Relative Humidity (RH)
Outdoor Temperature	●	●	●	●	Outdoor Air Temperature
Zone Demand	●	●	●	●	The effective zone demand of the controller. A positive value indicates a cooling load and a negative value indicates a heating load.
Monitor Sensor 1	●	●	●	●	When input UI5 is configured to “Monitor sensor,” this indicates the value read by the sensor. This is a 0-10 VDC sensor.
Monitor Sensor 2	●	●	●	●	When input UI6 is configured to “Monitor sensor,” this indicates the value read by the sensor. This is a 0-10 VDC sensor.
Monitor Temperature	●	●	●	●	When input UI2 is configured to “Monitor Temperature” this indicates the value read by the sensor. To be clear, this is a temperature sensor.
Y1 Runtime	●	●		●	Compressor run time stage 1, circuit 1
Y2 Runtime	●	●		●	Compressor run time stage 2, circuit 2
Y3 Runtime	●	●		●	Compressor run time stage 3, circuit 3

Sensor Name	Digital Alerts	High Limit Analog Alerts	Low Limit Analog Alerts	Sensor Malfunction Alert	Description and Use Cases
G Runtime	●	●		●	Fan run time
W1 Runtime	●	●		●	Heat run time stage 1
W2 Runtime	●	●		●	Heat run time stage 2
W3 Runtime	●	●		●	Heat run time stage 3
Sylk Address 3 CO2	●	●		●	TR40 remote wall module CO2, Sylk bus address 3
Sylk Address 3 Humidity	●	●		●	TR40 remote wall module humidity, Sylk bus address 3
Sylk Address 3 Temperature	●	●	●	●	Temperature measured by TR40 remote wall module at Sylk bus address 3.
Sylk Address 4 Temperature	●	●	●	●	Temperature measured by TR40 remote wall module at Sylk bus address 4.
Sylk Address 5 Temperature	●	●	●	●	Temperature measured by TR40 remote wall module at Sylk bus address 5.
Sylk Address 6 Temperature	●	●	●	●	Temperature measured by TR40 remote wall module at Sylk bus address 6.
Sylk Address 8 Humidity	●	●		●	Outdoor Air relative humidity measured by C7400S sensor at Sylk bus address 8.
Sylk Address 8 Temperature		●	●	●	Outdoor Air temperature measured by C7400S sensor at Sylk bus address 8.
Sylk Address 9 Relative Humidity		●		●	Outdoor Air relative humidity measured by C7400S sensor at Sylk bus address 9.
Sylk Address 9 Temperature		●	●	●	Outdoor Air temperature measured by C7400S sensor at Sylk bus address 9.
Local TS120 Sensor Relative Humidity		●		●	TS120 wall module relative humidity
Local TS120 Sensor Temperature		●	●	●	TS120 wall module temperature

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Honeywell LCBS Connect

INSTALLATION GUIDE

WELCOME

Please use this document as a resource to help you plan and complete the LCBS Connect system installation. As a contractor, please consult with your LCBS Connect distributor to help you with technical details, estimating support, system training, and enabling/commissioning the LCBS Connect remote user interface. There is a large amount of backup presale and technical documentation that will augment this documentation.

Outline

This document will cover the following topics at a high level.

1. **Important Tips**
2. **Controls:** Determining controls that you need to construct complete LCBS Connect system
3. **Network:** What you need to know to install the controller network
4. **Wiring:** Requirements and how to wire the system components to controllers
5. **Gateway Installation**
6. **Web App:** LCBS Connect remote user interface installation

Important Tips

Research gateway installation with your customer before installing.
If you wait to do the research during general system installation, you will find that your installation time will be unacceptable to you. Use the “Introduction to LCBS Connect — Information Technology Background” as a resource tool with your customers in advance of your general installation.

Do not mount the C7400S, C7250A “Grey Sensors” directly against mounting surface.
We’ve found that sensors do not read the proper temperature and humidity readings if they are mounted directly on a surface. This is due to the radiant and convective temperature coupling of the metal surfaces to the sensor case, which causes the sensor to accurately measure an average of the surface and the air. Use the 50053060-001 sensor mounting bracket if you apply these sensors.

Address grey sensors via addressing settings before installation.
Refer to this document and other technical information to set these switches correctly before installation. If these switches are not set correctly, the sensor will fail to function properly.

Set jumpers and scale sensors.
It is essential to set physical jumper Honeywell current sensors. You need to match this scaling, either via LCBS Connect wall module or LCBS Connect Web UI. If you don’t, CT output will read incorrectly.

Set differential pressure sensors, set switches.
Make sure that you set the physical switches on the Honeywell P7640 device to measure 0 to 2.5 inches of water column. Please check this setting on the sensor. Further, you will need polyethylene tubing running to the high pressure side of the filter. Please refer to installation information if you need help determining proper poly tube positioning relating to the filter.

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Controls

Determining controls that you need to develop a complete system

At bare minimum, an LCBS Connect controller and wall module are necessary to provide control of a standard constant volume air handling unit. Both devices are provided in the box and are “matched” to operate together. A 24 VAC power supply is required to power the LCBS Connect control system. In most cases this power is available from the constant volume air handling unit, in the low voltage control panel of the HVAC system.

Basic Controller. Select One for Each RTU, Split System, Heat Pump		
Part Number	**Description**	**Detail**
YCRL6438SR1000	LCBS Controller, Wall Module Package. This is the base, mandatory requirement to start LCBS Connect site installation.	LCBS Controller and Wall Module, Matched Pair. This is the mandatory, set of products required to start your customers LCBS Connect system. Wiring needed to power device, to connect low voltage control, and drop from HVAC unit to wall module.
Data to Cloud. Select One for up to 30 Controllers		
Part Number	**Description**	**Detail**
LGW1000, WPM-8000	Gateway. This device is needed to collect site data and deposit the data in the Cloud for downstream processing and retrieval.	The LGW1000 needs a 24 VAC power supply OR the WPM-8000 transformer (plugs into 120 VAC handy box). Connect LCBS Controller network to the Gateway Connect RJ45 connector from customer switch, router to the Gateway.
Network Termination. One per Network		
Part Number	**Description**	**Detail**
209541B FTT	Network Termination Device.	This device is used to bias LCBS Connect controller network. One device is typically used to bias network. This is described in “Network construction” Look at diagram attached to this document. Install this device as shown ONLY!
Economizer. One per Constant Volume Air Handling System		
Part Number	**Description**	**Detail**
M7215A1008	Economizer Actuator, Foot Mount... the Black Motor	Replace actuator if over ten years old. This actuator form factor is typically in place in about 80% of installed actuators in North America. Technical Specification: 25 lb-in, SR Black Motor, 2 - 10 VDC control, 24 VAC power 8 VA
-OR- MS7503A2030	Economizer Actuator, Direct Coupled	Functional replacement for the Black Motor. Need crank arm kit. Technical Specification: 24 lb-in, SR Direct Coupled Actuator, 2 - 10 VDC Control, 24 VAC Power 6 VA
STRN-CRK-01	Crank Arm Kit for Direct Coupled Actuator	Order with MS7503A2030 to Replace M7215A or M7215B Actuator

Economizer Discharge, Mixed, Return Air, Duct Sensors		
Part Number	**Description**	**Detail**
C7400S1000	Duct Mount Temperature, Humidity Sensor. Sensor network is called the “Sylk” Network.	Required for LCBS Connect economizer control. Each device as one humidity and one temperature sensor. Two (2) required for Differential Enthalpy control. Grey plastic enclosure, must use Duct Mount offset.
C7250A1001	20K Duct Mount, Outdoor Temperature Sensor. Grey enclosure form factor.	This form factor is NOT RECOMMENDED for mixed air sensing. Grey plastic enclosure, use Duct Mount Kit
50053060-001	Duct Mount Sensor Offset bracket	Required where C7400S1000 and C7250A1001 are mounted to keep sensing device in air stream.
Economizer Discharge, Mixed, Return Air, Duct Sensors		
Part Number	**Description**	**Detail**
C7041B2005/U	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Six (6) inch stainless steel probe on mounting bracket. Temperature sensor -40 to 250 °F
C7770A1040/U	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Six (6) foot plenum rated cable. Temperature sensor -40 to 250 °F
C7041B2013/U	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Twelve (12) foot plenum rated cable. Temperature sensor -40 to 250 °F
C7041J2007	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Twelve (12) foot plenum rated cable with J-Box Style Wiring Enclosure, plenum rated cable, Temperature Sensor -40 to 250 °F
C7041R2000	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Twelve (12) foot J-Box Style Wiring Enclosure, flexible copper element, Temperature Sensor -40 to 250 °F
C7041R2018	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. 24 foot J-Box Style Wiring Enclosure, flexible copper element, Temperature Sensor -40 to 250 °F
C7041F2006	20K Temperature Sensor	Outdoor Air Temperature sensor. Weatherproof enclosure, connects to 1/2 in. conduit. “Lollypop” form factor.

Temperature, Humidity, CO2 Wall Sensors		
Part Number	**Description**	**Detail**
TR40	Sylk Wall Module Sensor	Wall temperature sensor only 32°F – 110°F
TR40-H	Sylk Wall Module Sensor	Wall temperature and humidity sensor 32°F – 110°F; 5-95% RH noncondensing
TR40-CO2	Sylk Wall Module Sensor	Wall temperature and CO2 sensor 32°F – 110°F; 0 – 5,000 PPM
TR40-H-CO2	Sylk Wall Module Sensor	Wall mount, temperature, humidity sensor and CO2 sensor 32°F – 110°F; 5-95% RH; 0 – 5,000 PPM
Pressure, Current Transformer Sensors		
Part Number	**Description**	**Detail**
P7640A1034	Differential Air Pressure Transducer	Required for variable air flow sensing across air filters. Panel Differential Pressure Transmitter, 0-1 in., 0-2.5 in., 0-5 in., 0-10 in. Selectable, 12-30 VDC power, 24 VAC power.
CTP-10-050-VDC-001	Analog Current Sensor	Required for analog proof of fan, compressor, or electric heat operation. Split Core Current Sensor w/ 0 - 10 VDC Output, 0-10/ 0-20 / 0-50 Amps Selectable Ranges
MCSP-A	Digital Current Sensor	Required for digital proof of fan, compressor, or electric heat operation. Split Adjustable 0.70 - 150 Amps 1.00 Amp @ 36 VAC/VDC contact rating

Sylk Sensor Network

What you need to know to install the Sylk sensor network

The Honeywell "Sylk" Network and Sensors
The Honeywell C7400S and TR40, TR40-H, TR40-CO2, TR40-H-CO2 and LCBS Connect wall module are two-wire sensors that attach to a single bus. We call it the Honeywell "Sylk" network.

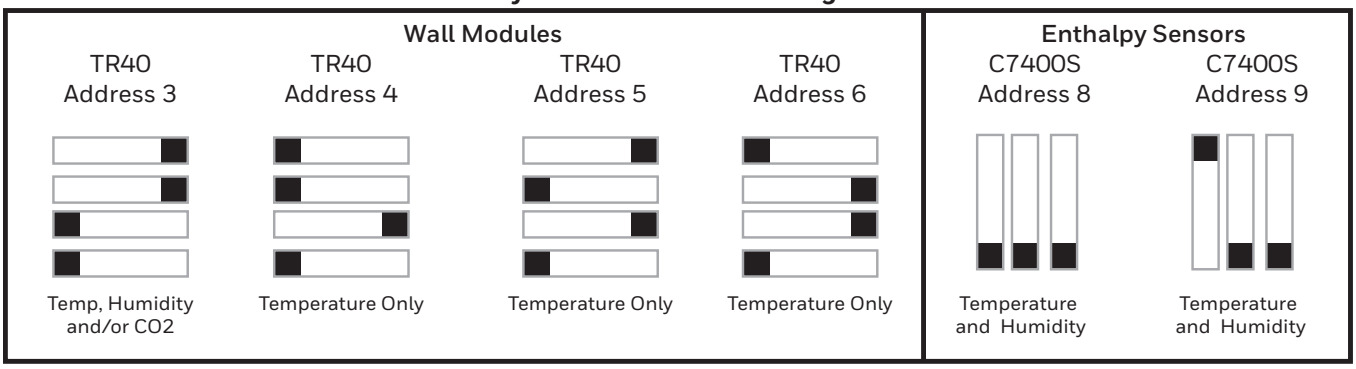
Benefits and details of Sylk network:
- The total length of the Sylk network should not exceed 150 feet. There is nothing you can do about this issue. No additional power supplies can be added. The addition of additional wire capacitance (larger wire AWG), could help extend the length of the network by 20–40 feet.
- It is polarity insensitive. You don't have to connect sensors to "plus" and "minus" consistently.
- It is powered with voltage to power the sensor. No external power supply is required. This leads into a trade-off, simply put the current available to power the sensors is limited. So, please see the table below. This represents the MAXIMUM sensors that can reside on a single Sylk network coming from a single LCBS Connect controller.

Sensor Model Number	Sensor Network Configuration - Maximum
TR40 C7400S	Four TR40, C7400S maximum per Sylk network per LCBS Connect controller. Two C7400S sensors are required to perform differential enthalpy economizer controls.
TR40 TR40-H C7400S TR40-H-CO2 TR40-CO2	One TR40-H, TR40-H-CO2 or TR40-CO2 takes up power of two TR40, C7400S sensors. If you intend to do differential enthalpy control, there is only power for ONE TR40-CO2.

- Sylk sensors must be "addressed" via small switches on the device. If you don't "address" these sensors properly, the sensors WILL NOT WORK properly.

NOTE: If the LCBS Connect wall module stops at the "90% Loading" screen upon power up, there is a Sylk Bus addressing issue. Review the additional Sylk sensor addresses before proceeding.

Sylk Sensor Network Settings



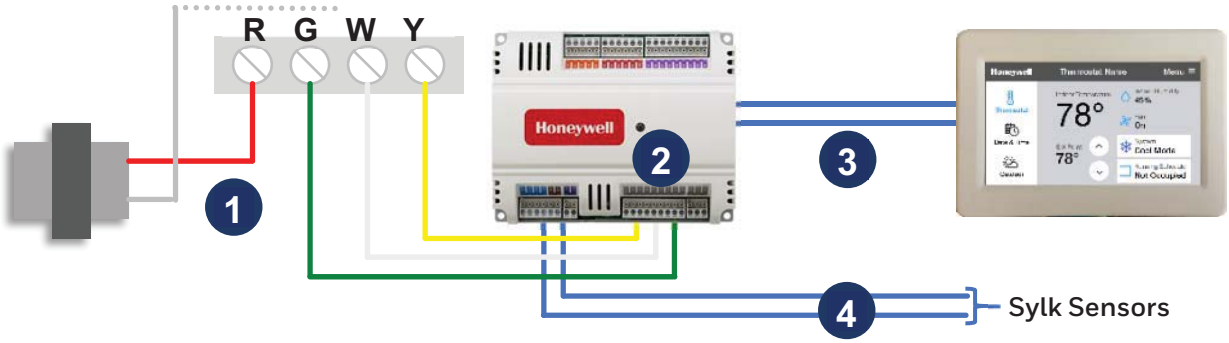
WIRING

Requirements and how to wire the system components to controllers

Description	Wire Description
24 VAC power to controller, actuator, powered devices,	14 AWG 2 to 18 AWG 2. Important to determine potential line loss if long wire run is deployed.
Connection to low voltage system control	24 AWG 5+ to 18 AWG 5+. Terminate Y, G, R, W and multistage terminations to LCBS Connect controller.
Sylk wire. Wall module to controller, sensors	24 AWG 2 to 18 AWG 2. Larger wire size can mitigate length of wire run. Don't exceed 150 foot wire length restriction.
Sensors to controllers	24 AWG 2 to 18 AWG 2. All thermister sensor based sensors, self powered sensors. Use 18 AWG for maximum reliability.
Power sensors to controllers	24 AWG 3 to 18 AWG 3. Sensors requiring DC power need external power supply. Observe LCBS controll power output if selecting other powered sensors.
Network cable	22 AWG 2. Preferred Network IV cable rating. Solid, stranded preferred.

Important. If cable runs through air stream, it must be "plenum rated." Non plenum rated cable can emit noxious, deadly gas into air space.

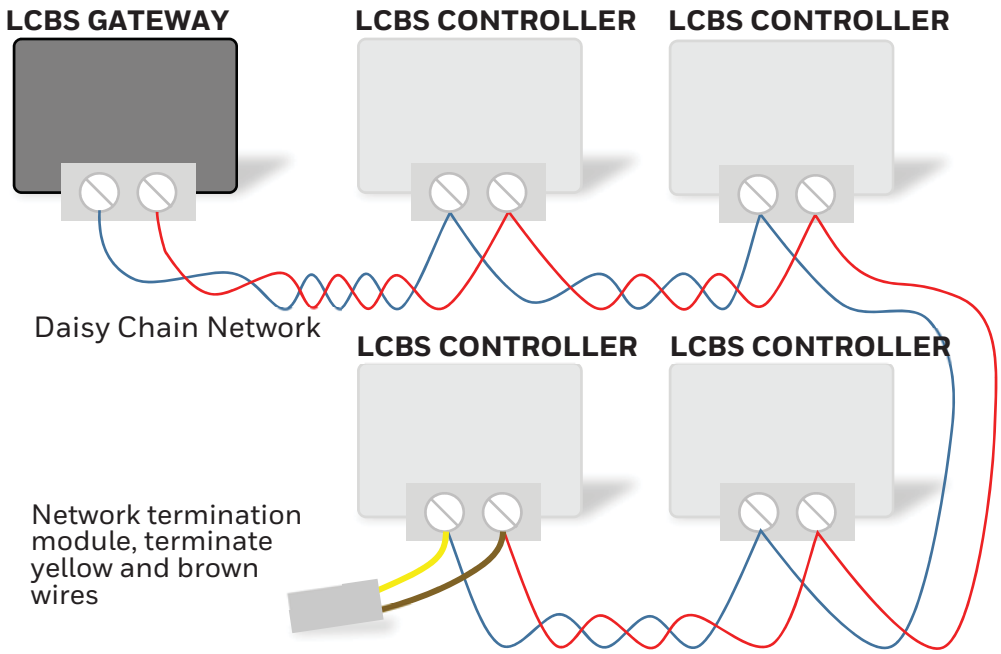
Gateway and controller wiring
Power the controller ❶ with existing 24 VAC from the RTU, heat pump, or split system. Reconnect terminations ❷ to heating, cooling, fan control on LCBS Connect controller. Reuse ❸ two of the existing wires from the wire drop from RTU to thermostat to connect wall module to controller via the S-Bus terminals. Additionally, install new wires, per specification ❹ to "Sylk" bus connection, to install TR40, C7400S Sylk sensors.



Installing the LCBS Controller Network
The LCBS Connect controller network is based on the robust LonWorks™ network. Honeywell adopted this technology in 1988 and has developed core engineering competency creating controls that use this technology, making it a popular choice for contractors. There are a few key things to remember as you develop your installation plan.

While the Echelon FTT-10 technology is quite robust and supports many different topology options, Honeywell recommends standard "daisy chain" wiring, as shown in this guide.

We recommend "single terminated network" approach for LCBS control networks. With our 30 year experience with LON building control networks, most small networks (250 feet in length) will function without the termination module. We recommend that you add this device to keep network message reliable at high at all times. Further, make sure that you wire the termination module correctly, per drawing below. If you don't, controller network failure can occur.



Gateway Installation

The LCBS Connect Gateway takes data from LCBS Connect controllers, via the controller network, and sends that data over the internet to the Honeywell Cloud. Proper planning will make installation of this device very simple.

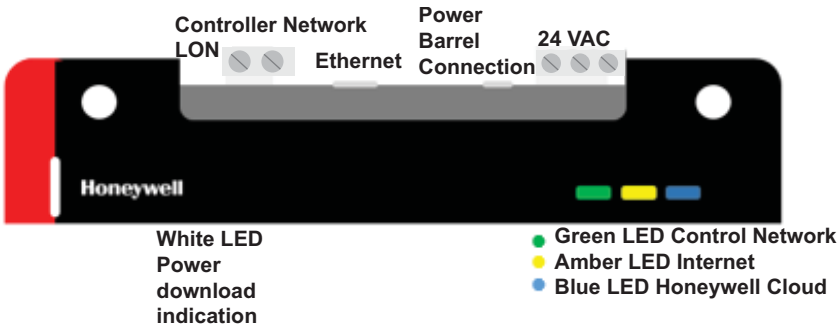
Tips before installing

- Make sure you tell your customer and/or end user business sponsor what you are going to do. In many cases, the customer will express concern that the "IT Manager" will have an issue with the installation of such a device.
- If the customer is concerned, give them the Honeywell white paper "Introduction to LCBS Connect — Information Technology Background". If the customer has questions about this data, call Honeywell customer service at 1-888-793-8188, or your Honeywell Product Management professional.

Physical installation

1. Record the MAC ID before mounting and save it in a safe place. It is on the back of the device and mounting it using installation eyeholes could conceal it.
2. Mount the gateway one of three ways
   a. Using the eyeholes in the corners of the device, screw the gateway into a suitable metal or wood surface. Make sure to record MAC ID before you do so.
   b. Mount the gateway on a standard DIN rail.
   c. Place the gateway on a desktop. The device features rubber mounting feet that will prevent knocking the gateway off a surface.
3. Provide power to the device using the Honeywell power supply (see parts list) or standard 24 VAC power. Device needs 10 VA to be continuously powered.
4. Connect the gateway to the internet via ethernet cable.

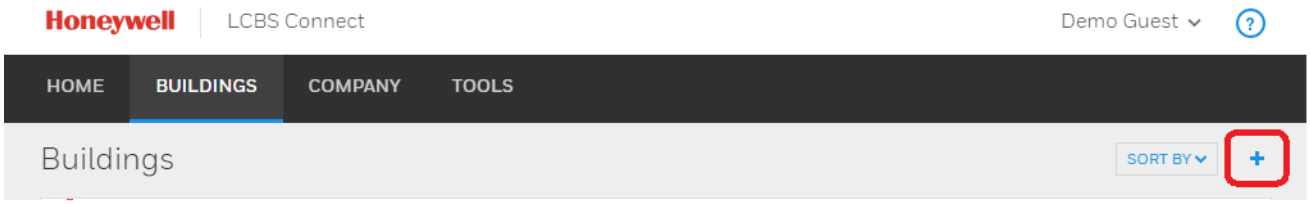
Please refer to gateway specification sheet for specific installation instructions.



Register the Gateway

If you have specific instructions, grab the “Building Registration Process” document. Log onto the LCBS Connect Web UI with the user name and password that you have received sometime in the past. You can’t proceed without this information.

1. Log in to the LCBS Connect web app on any computer, tablet, or smartphone at **lcbs.honeywell.com**
2. Select “BUILDINGS” from the black navigation bar. Select the blue **+** icon.



Add Building

1. Fill in the information about the building.

NOTE: You do not have to assign technicians at this point in time.

2. Select SAVE after completing this task.

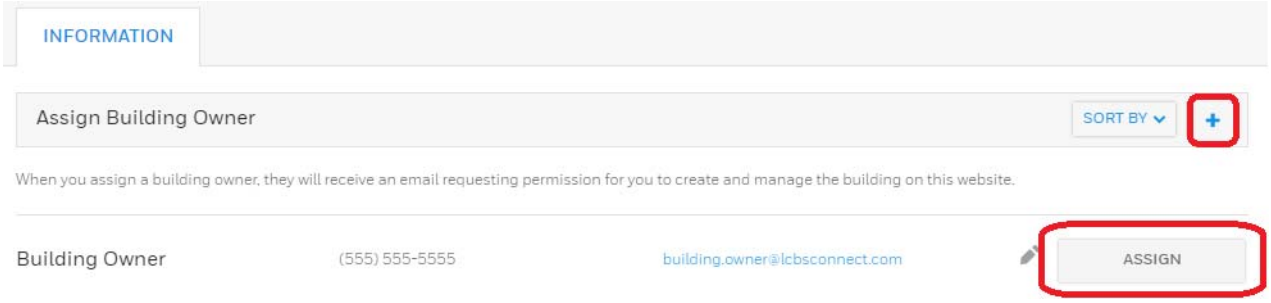
Building Information, Assign Owner

After you have saved the building, the Web UI moves to “Building Information” screen.

1. The interface will show “No Building Owner Assigned.”
2. Select “Assign Owner” button.

Assign Building Owner
After selecting the Assign Owner button, you will see a list of existing building owners.

1. Select the building owner you want by clicking the “Assign” button.
2. If the building owner you wish to assign is not listed, use the **+** button to add them.



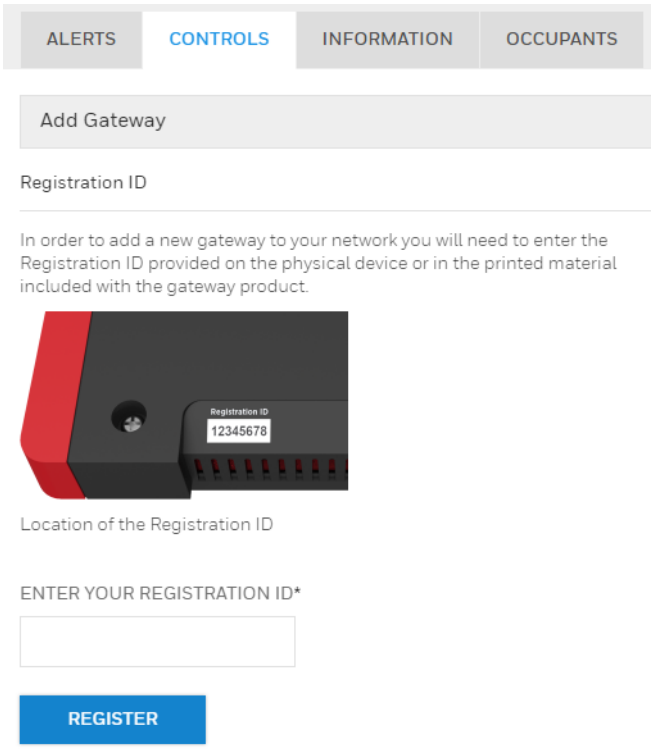
Invitation Sent to Owner
It is essential that you, as your customer’s supplier, let your building owner know that this correspondence is coming to them. An “End User License Agreement” is sent to them for their approval. Once they have done this, you can register the controller.

1. Notify building owner they will be receiving an “End User License Agreement” that **must be accepted** before the gateway registration can be complete.

Register gateway

1. Navigate to the CONTROLS tab of the newly created building.
2. Click the **+** button to add a gateway.
3. Type the eight digit code found on the gateway
4. Wait for device registration confirmation. This may take up to 5 minutes.
5. Observe the gateway directly or call your customer and determine status of the four LEDs. The white, amber, green, and blue LEDs should be on and steadily lit.

- If flashing, consult the gateway documentation “Gateway Installation Instructions,” found in the box, or under the ⓘ icon in the web application.



Controller connections

1. If the controllers have already been connected to the LCBS controller network, they will auto-discover and display without any additional actions.

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31-001330—01 M.S. Rev. 05-17
Printed in United States

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LCBS Connect

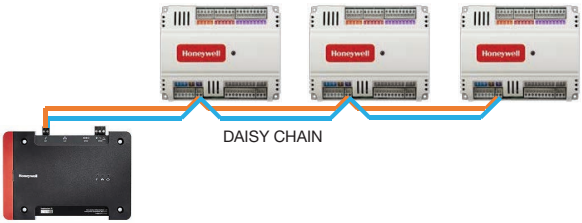
Quick Start Guide

Gateway

Wiring

The LCBS Connect Gateway and Controller use a Free Topology Transceiver (FTT) architecture which supports polarity insensitive and free topology wiring. This allows for any mixture of wiring topologies (Daisy Chain preferred) and simplifies network expansion by eliminating restrictions on wiring routing, splicing and device placement.

The LCBS Connect Gateway can support up to THIRTY Controllers. The local and remote user interfaces will display the number of discovered controllers on the network for easy trouble shooting. The LCBS Connect network is flexible and convenient to install and maintain, but it is important to carefully plan the network layout and create and maintain accurate documentation. For advanced network configurations, including the use of an end-of-line terminator (209541B), refer to 'LonWorks® Bus Wiring User Guide' (74-2865).



Recommended Wire

The LCBS Connect network includes two rules to be met for proper system operation:

1 The distance from each device to all other devices must not exceed the maximum device-to-device distance.

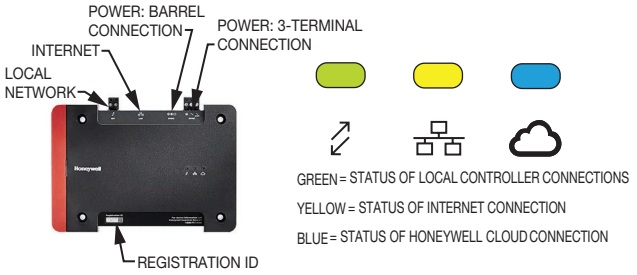
2 The maximum full network wire length is the total amount of wire connected per network segment.

Wire/Cable Type (Unshielded)	AWG	Device-to-Device	Full Network
Honeywell Cable 1125 (Stranded Non-Plenum)	16	1640 feet (500 meters)	1640 feet (500 meters)
Honeywell Cable 1061, 1062, 1063 (Solid/ Stranded Twisted Pair)	22	1300 feet (400 meters)	1640 feet (500 meters)
Honeywell Cable 5078, 5088 (Solid or Stranded, Plenum or Non-Plenum)	24	820 feet (250 meters)	1500 feet (450 meters)

31-00115-01

Connections and LEDs

The LCBS Connect Gateway serves as the main communication device between a building site and the Honeywell Cloud. It has been designed to provide simple, intuitive status indicators, including colored LEDs and icons, to ensure correct connections have been made upon installation.



Description	White	Green	Yellow	Blue
Status	Power/Firmware Update	Controller Network (LON) Connection	Internet Connection	Honeywell Cloud Connection
Solid ON	Gateway powered ON, No firmware updates active	All (previously) discovered controllers are online	Internet connection has been established	Honeywell Cloud connection has been established
OFF	Gateway NOT powered or has failed	All (previously) discovered controllers are offline	Gateway NOT powered or has failed	Gateway connection to the Honeywell Cloud is offline.
Blinking	Gateway firmware update is progress	SOME (previously) discovered controllers are online	Internet connection has NOT been established	Gateway is waiting to be associated to a building

Register at www.lcbs.honeywell.com

Controller

Application

The LCBS Connect RTU Controller is designed to control constant volume air handling units, specifically packaged roof top units (RTU) including heat pumps. It consists of a configurable controller and a wall module which are connected via Sylk™ bus. The controllers are capable of stand alone operation but optimal functional benefits are achieved when connected to the LCBS Connect Honeywell Cloud.

Sylk™ Bus

Sylk is a two wire, polarity insensitive bus that provides both 18 Vdc power and communications between Sylk-enabled devices. Along with the LCBS Connect wall module, the LCBS Connect controller can use UP TO FOUR additional Sylk devices for added control. Each device will have a unique Sylk address (up to 16) and are configured using dip switches on the back of each device.

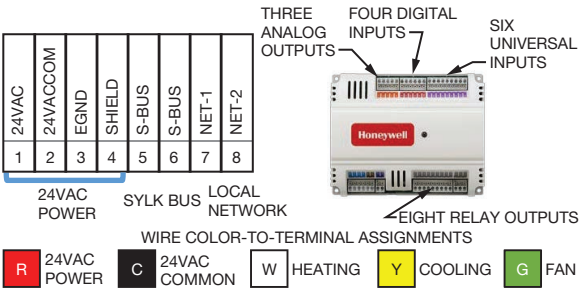
Part Number	Description	Sylk Address(es)
TR40	Sylk Wall Module - Temperature	3, 4, 5, 6
TR40-H	Sylk Wall Module – Temperature, Humidity (Note: Counts as TWO Devices)	3 only
TR40-CO2	Sylk Wall Module – Temperature, CO_2 (Note: Counts as TWO Devices)	3 only
TR40-H-CO2	Sylk Wall Module – Temperature, Humidity, CO_2 (Note: Counts as TWO Devices)	3 only
C7400S1000	Sylk Enthalpy Sensor – Temperature, Humidity	8 (Outdoor Air), 9 (Return Air)

The flexibility of Sylk allows for a number of wiring methods (Daisy Chain, Homerun, etc.). The main consideration is around the maximum distance from a controller to an individual Sylk device based on the wire sized used.

AWG	Single Twisted Pair, Non-Shielded, Stranded or Solid	Standard Thermostat Wire (Non-Twisted), Shielded or Non-Shielded, Stranded or Solid
18-22	400 feet (120 meters)	100 feet (30 meters)
24	300 feet (100 meters)	100 feet (30 meters)

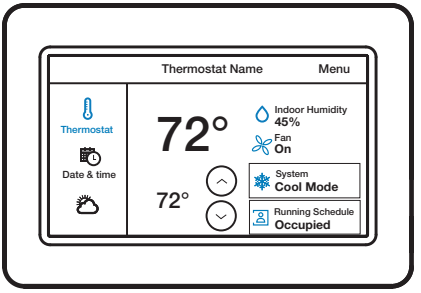
Connections

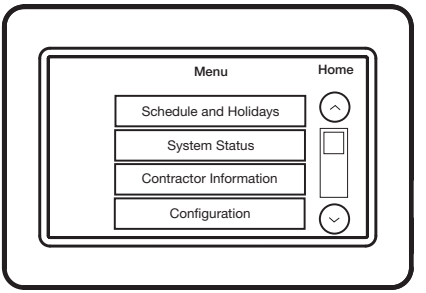
The LCBS Connect controller is a configurable device with options to configure specific inputs and outputs to fit the application needs. It can be configured through the local, wall module display or from the LCBS Connect remote interface when connected to the LCBS Connect gateway.



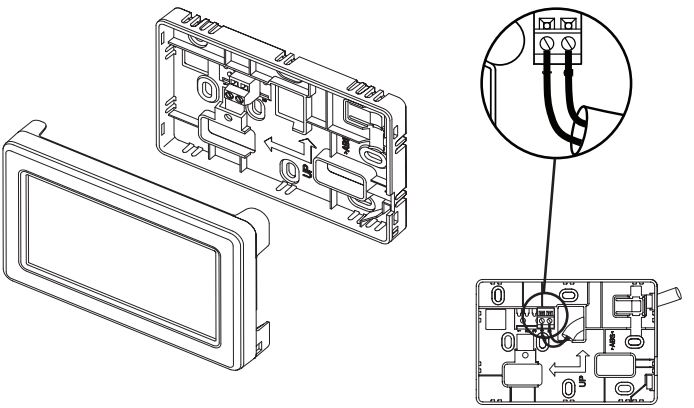
Wall Module

The LCBS Connect wall module is a full color, touchscreen interface that is exclusively compatible with the LCBS Connect controller. The graphic-rich display allows for full configuration of the LCBS controller using an intuitive, menu-driven method.





The wall module gets both its power and communication from the LCBS controller through the Sylk bus. In order to correctly wire the wall module, the front cover needs to be removed to expose the two terminal pins. After replacing an existing thermostat with the new LCBS wall module, consider using the wall plate, 50028399-001, to cover up any previously used mounting holes.



WARNING! Directly applying 24Vac to the wall module may cause damage to the device.

Reference Documents

- LCBS Connect Wall Module Installation Instructions (31-00084)
- LCBS Connect Gateway Installation Instructions (31-00081)
- LCBS Connect Application Manual (31-00118)

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31-00115—01 M.S. 01-17
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Honeywell

LCBS Connect Gateway

LGW1000

INSTALLATION INSTRUCTIONS

APPLICATION

The Honeywell LCBS Connect Gateway serves as the communication device between a building site and the Honeywell Cloud, providing contractors with a way to remotely monitor, control, and configure Honeywell building controllers from Honeywell's LCBS website.

Data is collected from Honeywell sensors and controllers in the building and analyzed for issues. Contractors are notified upon detection of a problem and provided with information that can help diagnose the problem remotely. Honeywell maintains and owns the services provided by the Honeywell Cloud infrastructure.

DIMENSIONS

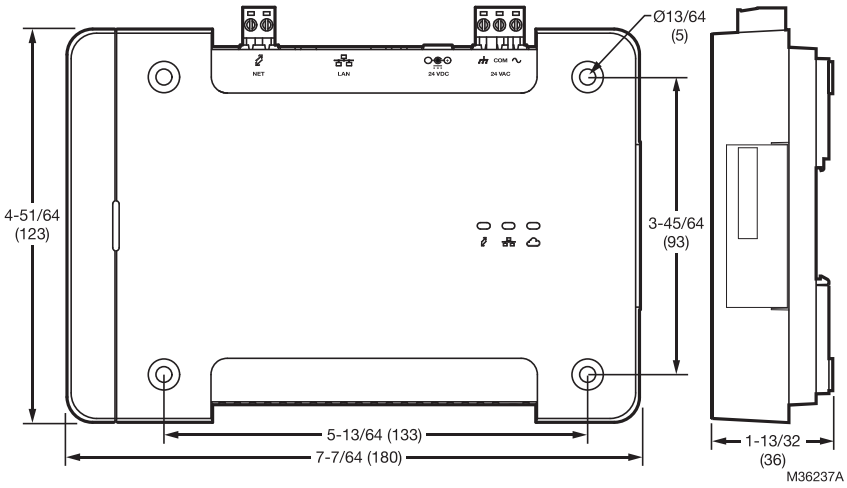

Fig. 1. Dimensions in in. (mm).

31-00081-03

Pre-Installation Checklist

Follow the checklist below to make sure that you are prepared to install the LCBS Connect system in a timely, efficient manner.

1. Work with your customer to determine and arrange for appropriate remote internet access at the customer site. If you need to, contact your local LCBS Connect distributor and review "Honeywell LCBS IT White Paper." Make sure you have the proper tools, components, and cabling to install the gateway.
2. Develop a set of instructions and drawings before going to the jobsite. This will be your work plan. You will know what you need to do, because you know your customer's building. It does make a difference in the steps you install LCBS Connect system components. Having a plan before you get to the jobsite will minimize your installation time. Your Honeywell LCBS Connect distributor can help you generate the pre-installation checklist.
3. Determine gateway installation approach, tabletop or panel. If installing in a control cabinet, connect an appropriately sized (10 VA min.) class 2 transformer to the supplied three terminal connector.

   Note: If the gateway is to share a transformer with other devices in the cabinet, verify that the AC polarity is identical on each device.

   If installing on a tabletop, apply power via the power barrel connector using DC power supply, WPM-8000 or equivalent. Work with your LCBS Connect distributor to make sure you have proper tools, components, and cabling so that you can install the gateway efficiently and effectively.

Installation Steps

1. Your work plan will drive installation process steps. The first thing you should do is install LCBS Connect controllers and make sure they are configured using the LCBS Connect wall module interface. Ensure the LCBS controllers are assigned a proper name using the configuration UI *before* connecting the gateway. This will ensure the gateway is able to send proper names of the controllers to the cloud.
2. Mount the gateway in the desired location following your work plan and guidance from your LCBS Connect distributor.
3. Plug the two wire network cable into the network connector, per your work plan. Follow the quick start wiring guide found in the LCBS controller and wall module pack for network wiring instructions. Use this sequence: connect the gateway to the LON bus and Ethernet before powering up the gateway.
4. Plug the Ethernet cable into the Ethernet jack.
5. Provide power to the gateway. Plug the power cable from the wall transformer into the round barrel connector or through the three terminal connector.

⚠ WARNING

Do not connect both power supplies to the gateway.

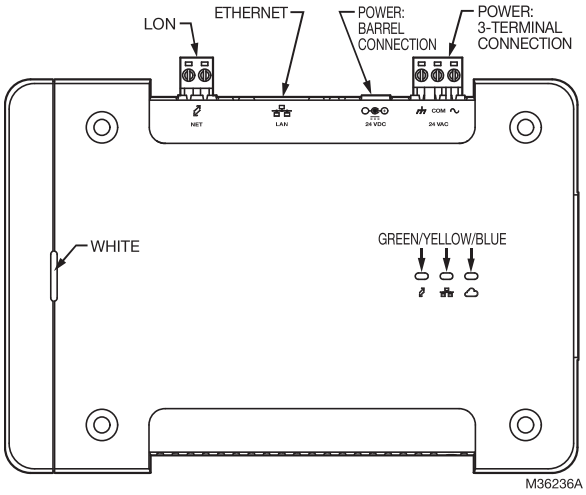

Fig. 2. LCBS Connect Gateway diagram.

6. There are four LEDs on the gateway to convey the status of a specific function as indicated by the adjacent icon (Fig. 2). The behavior of the LEDs will provide troubleshooting guidance when checking the connectivity of your system.
7. The typical behavior of a gateway will be as follows. For complete LED behavior definitions, please see Table 1.
   a. Upon power up, the WHITE LED will first appear with low intensity. Within a few seconds the WHITE LED will be a higher intensity and will remain solid.
   b. After the gateway has powered up, the YELLOW LED will initially blink once a second until a connection to the Internet has been established and then it will go solid.
   c. Once the YELLOW LED has gone solid, the BLUE LED will blink once a second indicating that it is ready to be associated to a building using the Honeywell Cloud. This can only occur if a building has been created and is ready for a gateway's registration ID to be entered. After a successful gateway registration, the BLUE LED will go solid.

   NOTE: Proceeding steps describe the registration process.

   d. The GREEN LED will initially remain off until controllers are installed and wired to the gateway. Once at least one controller is connected, the GREEN LED will go solid. If a controller that was previously connected to the gateway has gone offline and has not been replaced using the Honeywell Cloud Replace function, the GREEN LED will blink once a second.

   NOTE: If the LEDs are not blinking or solid as described, please contact your local Honeywell LCBS Connect distributor technical support desk for assistance, or refer to Table 1 for troubleshooting help.

8. Log-in to your Honeywell LCBS Connect account.

   NOTE: www.lcbs.honeywell.com

9. Add the gateway under a building in the portal.
10. Make sure you enter the correct Registration ID. Registration IDs are case-sensitive.
11. After you have added the gateway under a building account, the gateway will automatically start sending controller data to the cloud. The BLUE LED will be SOLID ON if the gateway is able to send data to Honeywell Cloud.

NETWORKING

- IP allocation requires a DHCP server, provided automatically by most firewall routers.
- Firewall configuration requires port 443 or 5671 (optional).
- Gateway does not work behind an HTTP proxy and may not work behind a transparent proxy, especially if it requires authentication.

Refer to “Honeywell LCBS IT White Paper” for further details.

SPECIFICATIONS

Dimensions: See Fig. 1

ELECTRICAL
Rated Voltage: 20-30 VAC, 50/60 Hz, 10 VA; 24 VDC, 1.25 A
NEMA-2 Class 2 power limited device

ENVIRONMENTAL RATINGS
Operating: 32 F – 120 F (0 C – 50 C)
Shipping and Storage: -40 F – 150 F (-40 C – 66 C)
Relative Humidity: 5% to 95% non-condensing
Enclosure Rating: IP-20, NEMA-1

OPERATION
Power Failure Backup: 24 hours at 32 to 100° F (0 to 38° C), 22 hours at 100 to 122° F (38 to 50° C)

DEVICE CONNECTIONS
Power: 24 VDC Wall Wart or 24 VAC input
Ethernet: One (1) Ethernet interface supporting 10 Base-T and 100 Base-TX
Network: LONworks™

APPROVAL BODIES
CUL, US listed E87741 UL916 energy management equipment subassembly
RoHS compliance: 2011/65/EC and EN 50581:2-12

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.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard (s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Table 1. LEDs and Definitions.

Scenario	Scenario Description	BLUE	YELLOW	GREEN	WHITE
Internet					
1	Gateway can ping Honeywell Cloud	See rows 4-7	On	N/A	On
2	Gateway cannot ping Honeywell Cloud	Off	Blink (1/sec)	N/A	On
Honeywell Cloud					
3	Gateway is ready to be registered but is unable to communicate with the Honeywell Cloud; Internet is NOT working	Off	Blink (1/sec)	N/A	On
4	Gateway is ready to be registered but is unable to communicate with the Honeywell Cloud; Internet is working	Blink (2/sec)	On	N/A	On
5	Gateway is ready to be registered by Honeywell Cloud OR Gateway has been registered but recovering from offline Honeywell Cloud	Blink (1/sec)	On	N/A	On
6	Gateway has been registered and is sending data to Honeywell Cloud	On	On	N/A	On
7	Gateway has been registered but is unable to send data to the Honeywell Cloud; Internet is working	Off	On	N/A	On
8	Gateway has been registered but is unable to send data to the Honeywell Cloud; Internet is NOT working	Off	Blink (1/sec)	N/A	On
9	Re-register button is held down and gateway can send message to Honeywell Cloud	Blink (5/sec)	Previous State	N/A	On
10	Re-register button is held down and gateway cannot send message to Honeywell Cloud	Previous State	Previous State	N/A	On
Power and Firmware					
11	Firmware download in progress	N/A	N/A	N/A	On
12	Firmware installation in progress	N/A	N/A	N/A	Blink (5/sec)
13	Firmware good or installed successfully	N/A	N/A	N/A	On
14	Firmware bad and unrecoverable automatically	N/A	N/A	N/A	Low Intensity
Lon Network					
15	All previously discovered LCBS controllers are NOT communicating	N/A	N/A	Off	On
16	All previously discovered LCBS controllers are communicating	N/A	N/A	On	On
17	Some of the previously discovered LCBS controllers are communicating	N/A	N/A	Blink (2/sec)	On
18	Network adapter issues. May have to replace gateway	N/A	N/A	Blink (1/sec)	On

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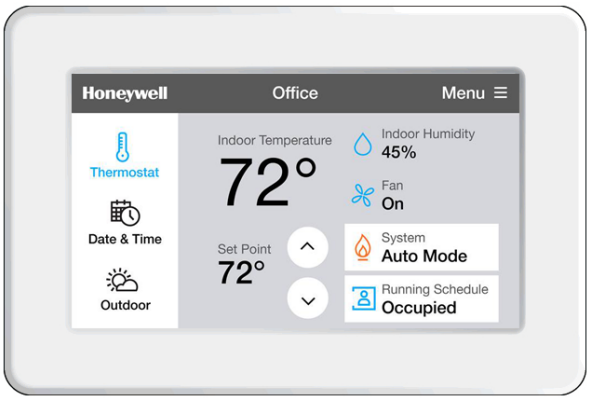
Honeywell

LCBS Connect Wall Module

INSTALLATION INSTRUCTIONS



PRODUCT DESCRIPTION

The LCBS Connect Wall Module is a Sylk bus communicating device which is exclusively compatible with the LCBS Connect controller. It contains integral temperature and humidity sensors to control any given space's comfort. This device enables local controller configuration through an easy-to-use touch screen interface with menu driven selections. The wall module communicates and is powered by the Sylk bus, so no additional wiring is necessary.

Dimensions

The TS120 consists of a back plate and a front cover which contains a circuit board.

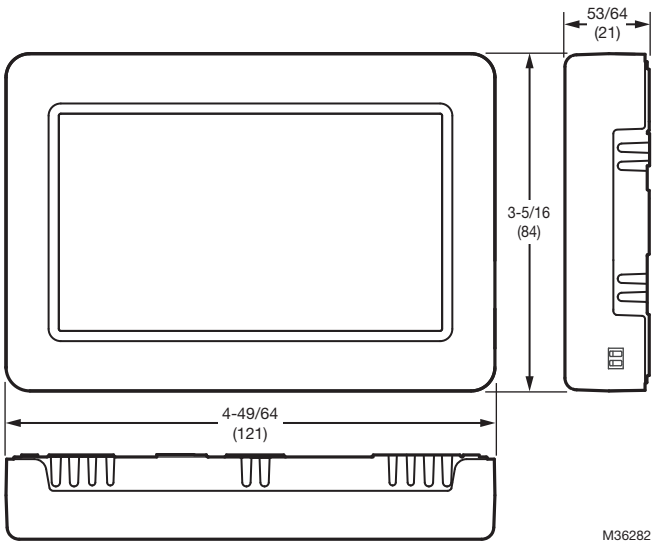


Fig. 1. Dimensions in in. (mm).

INSTALLATION

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check ratings given in instructions and on the product to ensure the product is suitable for the application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

MOUNTING

Mount the wall module on an inside wall approximately 48 in (1.2m) from the floor (or in the specified location) to allow for exposure to the average zone temperature. Do not mount the device on an outside wall, on a wall containing water pipes or near air ducts. Avoid locations that are exposed to discharge air from registers or radiation from appliances, lights or the sun.

Sylk™ Enabled
Easy 2-wire installation

31-00084-01

Do not install the wall module where it can be affected by:
— drafts or dead spots behind doors and in corners.
— hot or cold air from ducts.
— radiant heat from sun or appliances.
— concealed pipes and chimneys.
— unheated (uncooled) areas such as an outside wall behind the thermostat.

WHEN USED TO SENSE ROOM TEMPERATURE
Install the wall module about 4 ft. (1.2m) above the floor in an area with good air circulation at average temperature. (See Fig. 2.) Confirm mounting height meets Americans with Disabilities Act requirements.

WHEN NOT USED TO SENSE ROOM TEMPERATURE
When using the remote-mounted temperature (and humidity) sensor(s) to sense ambient conditions, install the wall module in an area that is accessible for setting and adjusting the temperature and settings.

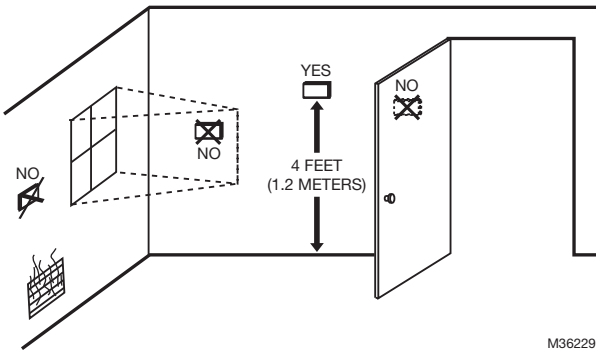


Fig. 2. Typical location of wall module or remote-mounted sensor.

When mounting the wall module to the wall, note the arrows indicating which direction is up, as indicated on the inside of the back plate. The wall module can only be mounted horizontally, so it is important to properly identify a suitable mounting location.

The wall module can be mounted on a wall, on a standard utility conduit box using No. 6 (3.5 mm) screws or on a 60 mm wall outlet box (see Fig. 3). When mounting directly on a wall, use screws appropriate for the wall material. Use a wall plate, 50028399-001, to cover any visible screw holes.

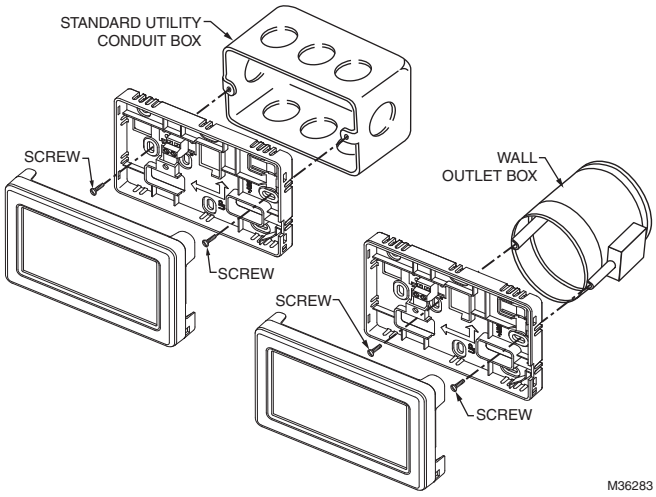


Fig. 3. Mounting the wall module to electrical boxes.

WIRING

The wall module is shipped with the front cover and subbase assembled together. These two parts need to be separated (see Fig. 4) in order to properly wire the device.

There are no field adjustable/replaceable components inside the module.

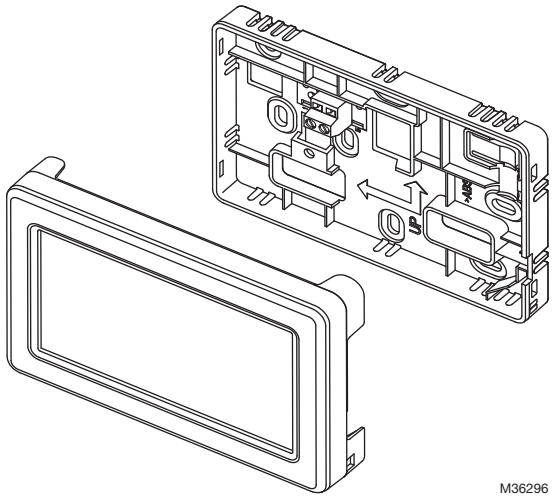


Fig. 4. Separate the front cover from the subbase.

IMPORTANT

All wiring must comply with local electrical codes and ordinances or as specified on wiring diagrams.

⚠ CAUTION
Improper Electrical Contact Hazard
Screw-type terminal blocks are designed to accept no more than one 14AWG (2.5mm sq) conductor.

Wire the terminal block as shown in Fig. 5:

1. For single wires, strip 3/16 in. (5 mm); for multiple wires going into one terminal, strip 1/2 in. (13 mm) insulation from the conductor.
2. Insert the wire in the required terminal location and tighten the screw to complete the termination.
3. Review and verify the terminal connection wiring illustrated in Fig. 5.

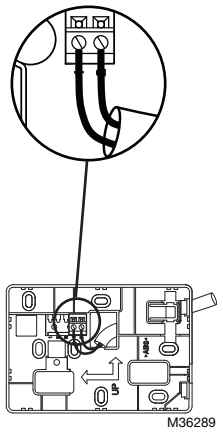


Fig. 5. Connecting wires to the terminal block.

4. See Fig. 6 for wiring multiple Sylk devices.

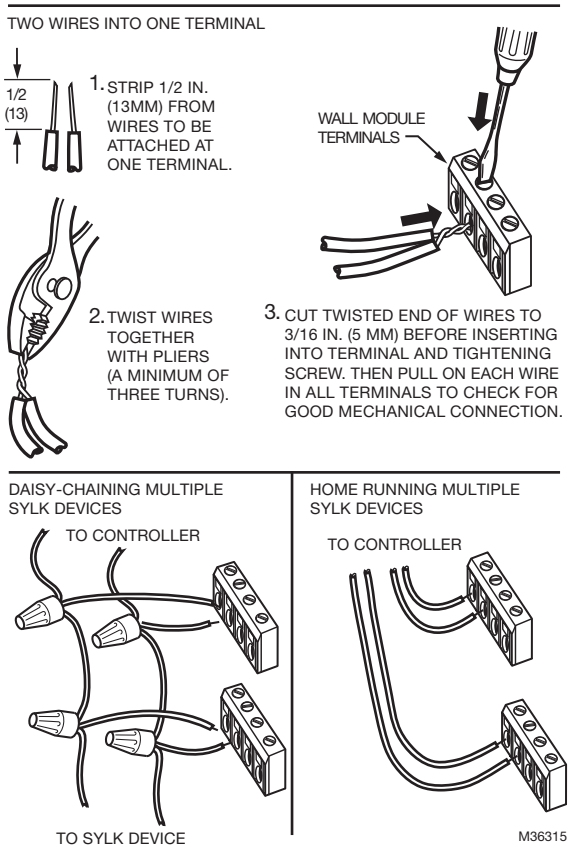


Fig. 6. Options for wiring multiple Sylk devices.

5. When wiring is complete, align the pins from the front cover to the terminal block on the subbase.
6. Firmly push the front cover onto the subbase. If the wall module is powered, a loading screen will be displayed.

Sylk Bus

The wall module communicates with the LCBS Connect controller via Sylk, which is a two-wire, polarity-insensitive bus that provides both 18 Vdc power and communications. This enables a faster and cheaper installation all while minimizing errors. The recommended wire for Sylk is 18-24 AWG (0.82 to 0.20 sq mm) single twisted pair, solid or stranded wire, unshielded for a maximum distance from the controller of 200ft (60m). Standard thermostat wire (non-twisted pair) can be used for runs up to 100ft (30m). See Table 1.

Table 1. Maximun Distance.

Recommended maximum distance from controller to any Sylk device		
Single twisted pair, non-shielded, stranded or solid		Standard thermostat wire, (non-twisted), shielded or non-shielded, stranded or solid
18-22 AWG	24 AWG	18-24 AWG
500 ft (150 m)	400 ft (120 m)	100 ft (30 m)

The wall module is intended to always communicate using Sylk address 1 and is shipped from the factory with this address configured. Other Sylk sensors are compatible with the LCBS Connect controller and wall module but limitations must be observed. Up to FOUR additional Sylk sensors can be used unless a TR40-H, TR40-CO2 or TR40-H-CO2 is used. Then the allowed additional sensors drops to THREE. See Table 2 for a listing of the compatible Sylk sensors.

Compatibility

The LCBS wall module has been designed specifically for the LCBS controller. They are a one-to-one pair and adding an additional LCBS wall module will result in a loss of operation. Connecting an LCBS wall module to another Honeywell controller will also result in the loss of operation for the wall module.

SPECIFICATIONS

Operating Temperature: 32°F to 122°F (0°C to 50°C)

Shipping Temperature: -4°F to 150°F (20°C to 65°C)

Relative Humidity: 5% to 95%, Non-condensing

Related Parts

Parts that are commonly used with the LCBS Connect controller and wall module are shown in Table 2.

Table 2. Compatible Sylk Sensors.

Sylk Device	Description	Sylk Address(s)
YCRL6438SR1000	Controller and Wall Module Pack	N/A
TR40	Sylk Wall Module with Temperature Sensor	3, 4, 5, 6
TR40-H	Sylk Wall Module with Temperature & Humidity Sensors	3 Only
TR40-CO2	Sylk Wall Module with Temperature & CO2 Sensors	3 Only
TR40-H-CO2	Sylk Wall Module with Temperature, Humidity & CO2 Sensors	3 Only
C7400S1000	Sylk Enthalpy Sensor	8, 9
50028399-0001	Wall Plate	N/A

Approvals

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.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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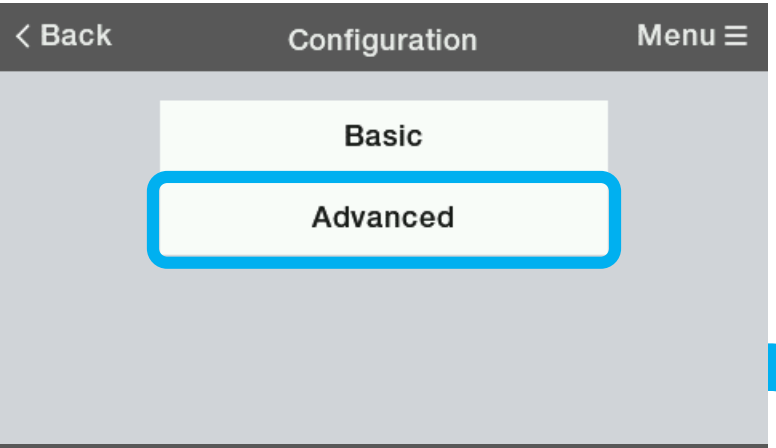
Honeywell

LCBS Connect Wall Module User Guide

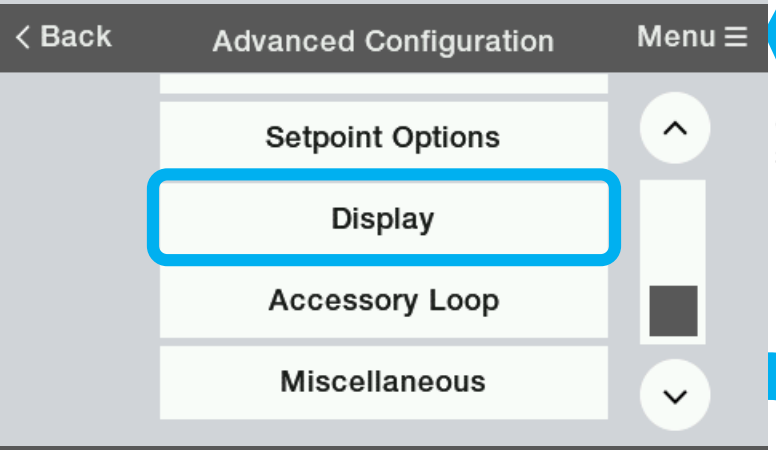
LCBS Connect Simplified View Wall Module Set Up

May 21, 2018

Configuring the new wall module

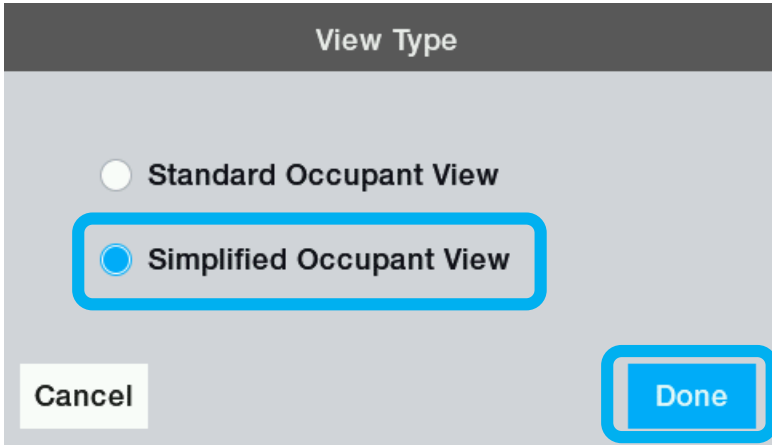


From Configuration Screen, select Advanced Configuration



From Advanced Configuration, select Display

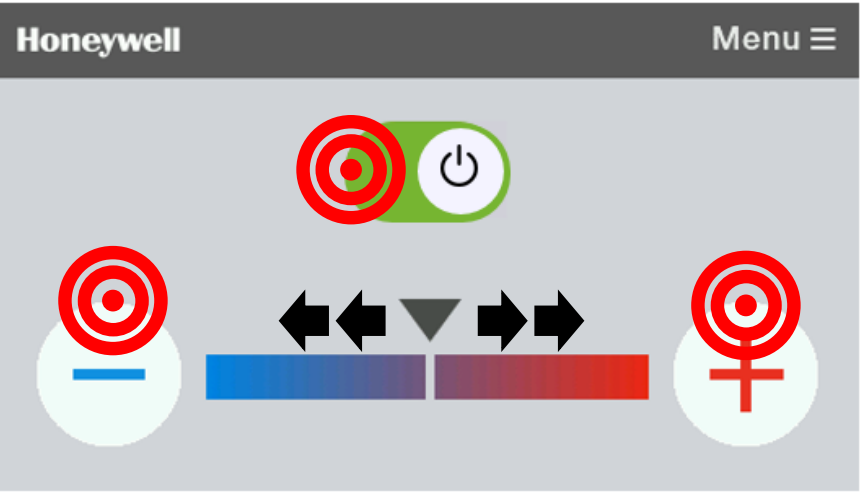
From Display, Occupant View



From View Type, Select Simple Occupant View.

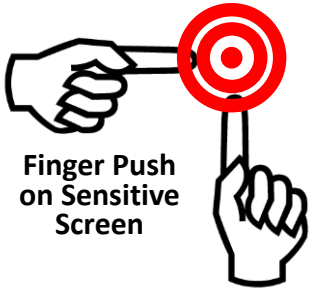
Select Done, go to Menu

Using the new wall module. From Menu, going from occupied to unoccupied (bypass)

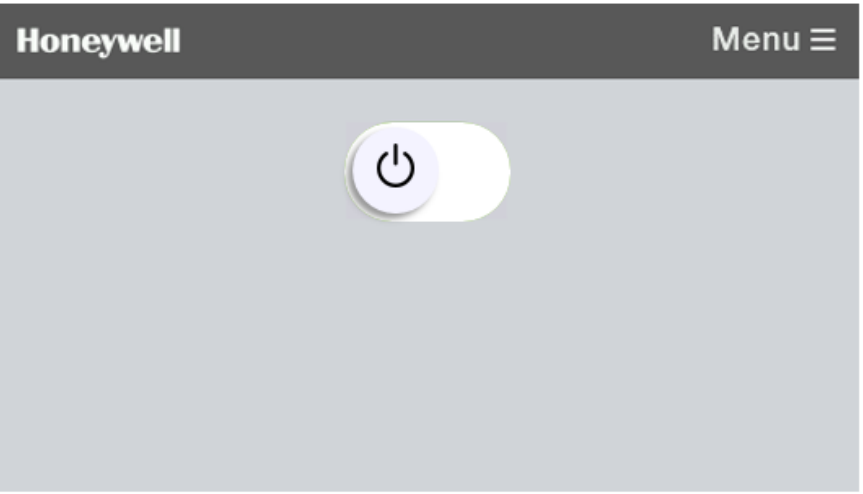


Push on the Green Space to Turn the System Off (to Bypass, Unoccupied) Go to Next Screen

Push on the Red Plus Button to make it Warmer. Push on the Blue Minus Button to make it Cooler

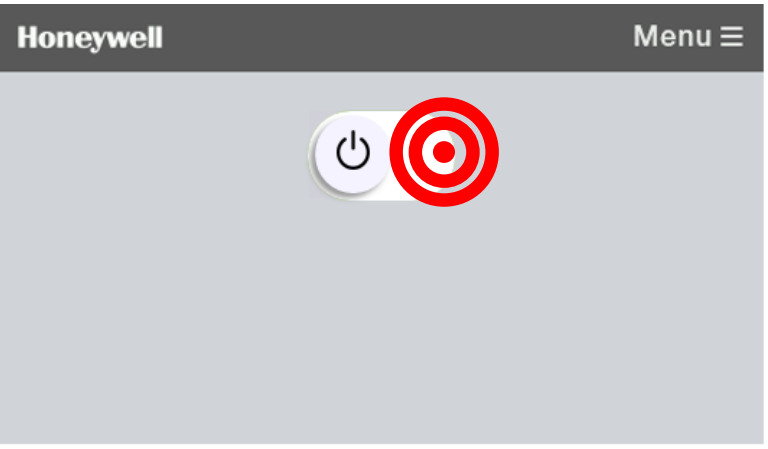


Finger Push on Sensitive Screen

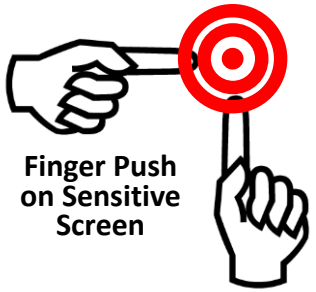


System is in Bypass, Unoccupied

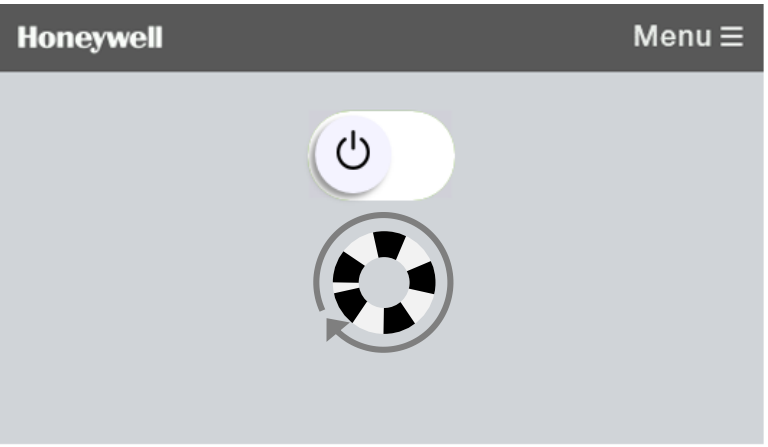
Using the new wall module. Going from Bypass (Unoccupied) to Occupied



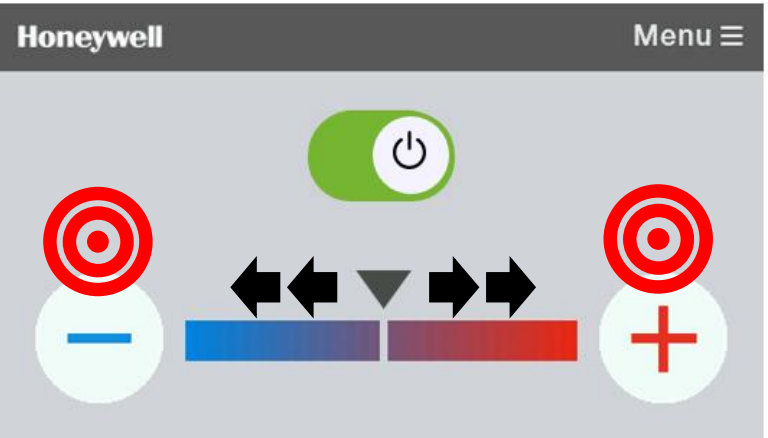
Push on the White Space to Turn the System On (to Occupied) Go to Next Screen



Finger Push on Sensitive Screen

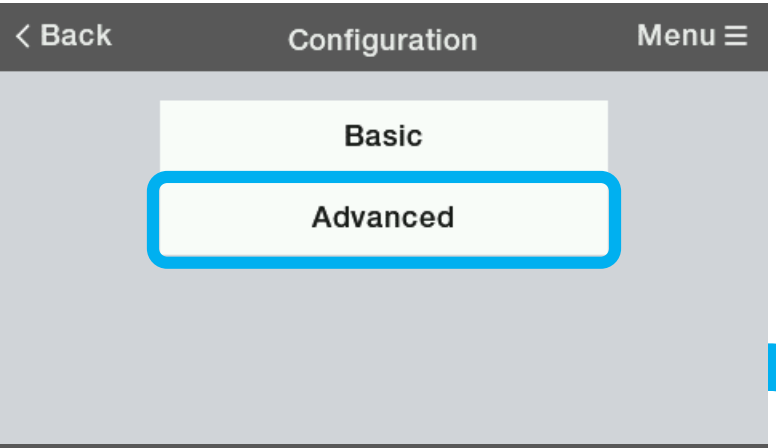


Icon shows up on display. Consider this to be "Please Wait" indication. "Don't Touch Me" Go to Next Screen

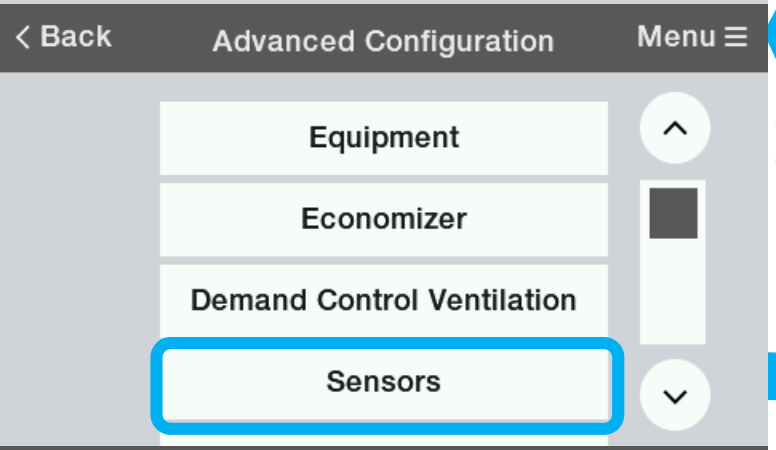


When the System is On, Occupied, the toggle button turns Green. You are now able to change the temperature.

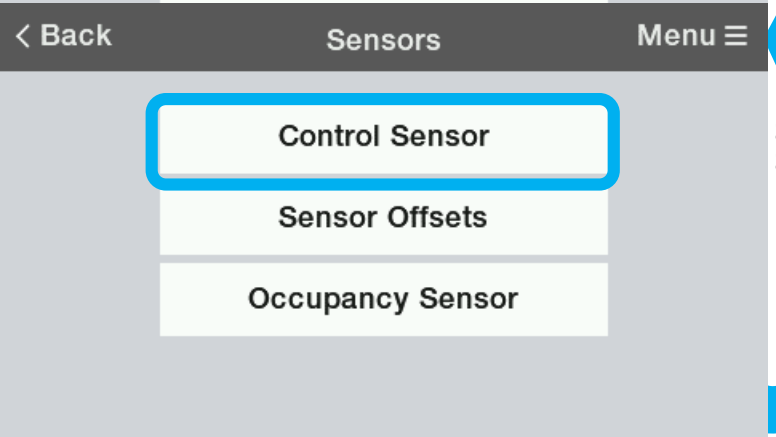
New Control Sensor Options



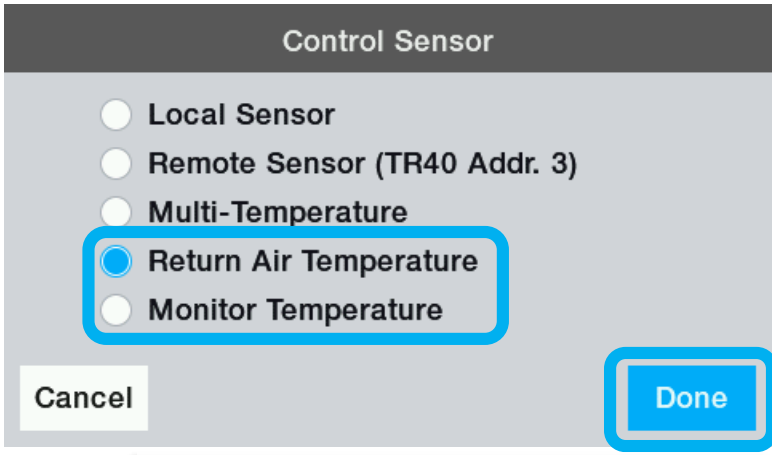
From Configuration Screen, select Advanced Configuration



From Advanced Configuration, select Sensors



From Sensors, Select Control Sensor



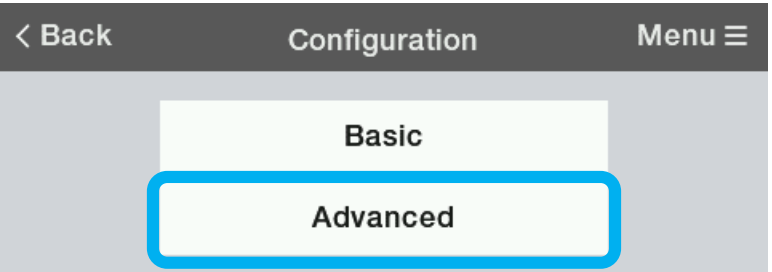
From View Type, Select Simple Occupant View.

Select Done, go to Menu

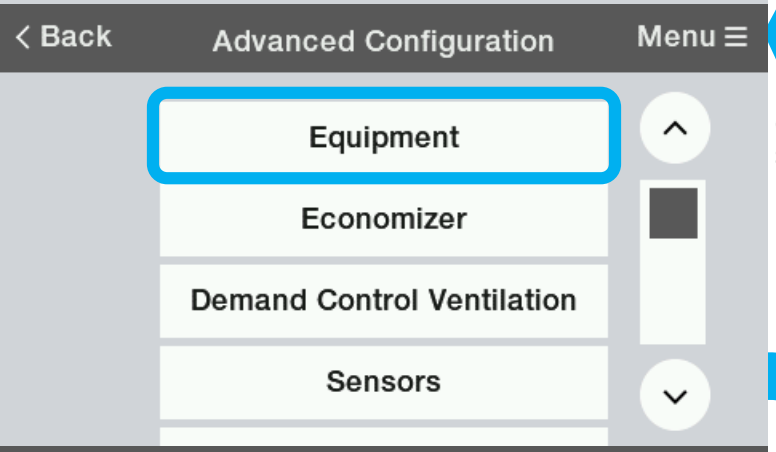
NEW

Up to now, only TR40 sensors could be placed in return air for return air control. Our customers now have the choice to designate a “Return Air Temperature” sensor or “Monitor Temperature” to control space temperature, and not Sylk based sensors! Far more flexible mounting options now available!

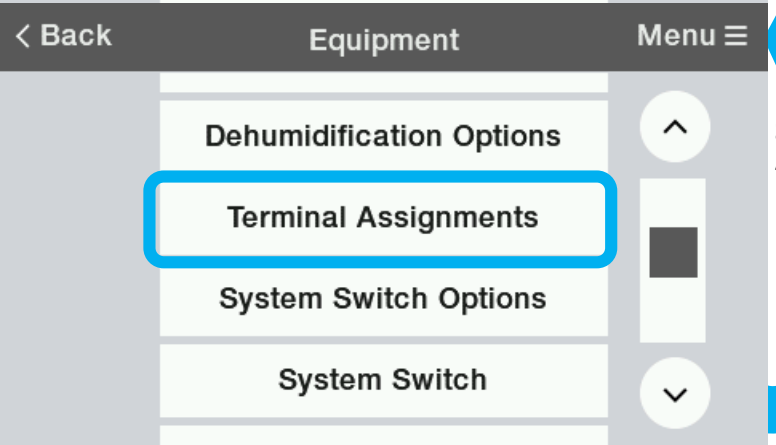
New Monitoring Sensor Options



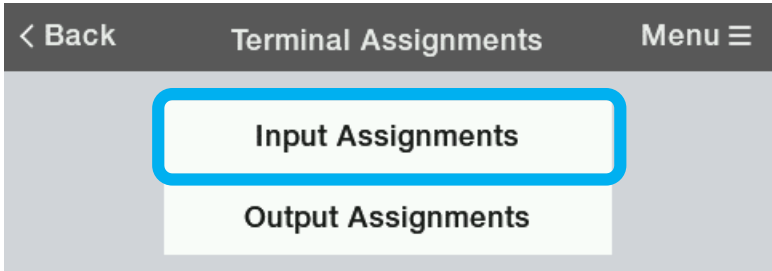
From Configuration Screen, select Advanced Configuration



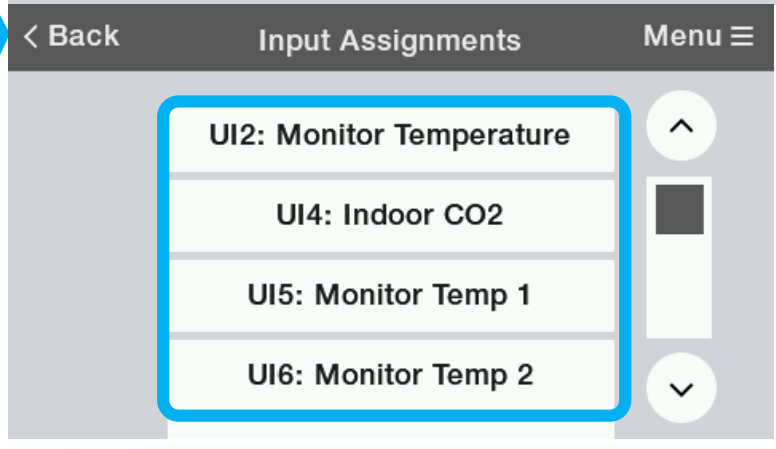
From Advanced Configuration, select Equipment



From Equipment, Select Terminal Assignments



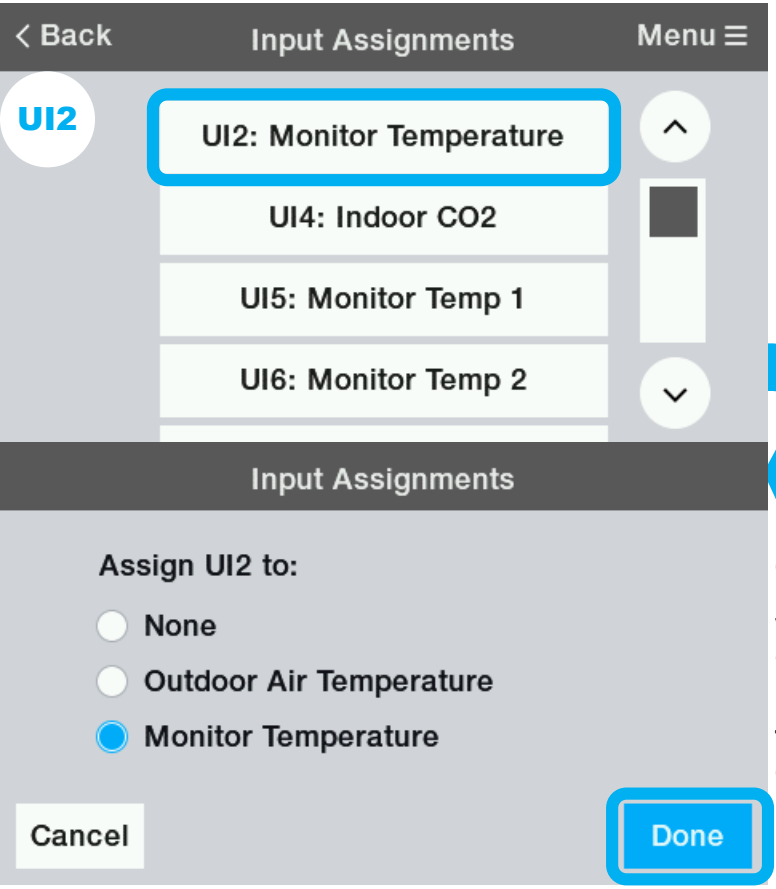
From Terminal Assignments, Select Input Assignments.



Far reaching improvements have been made to using 20K sensors as monitoring points. Up to three (3) 20K can be used per controller to sense temperature, expanding monitoring ability significantly. We've also repurposed UI4 that was previously captured to CO2 sensor use only. These changes will enhance ability to monitor points.

Following, you will see how operators are prevented from making sensor selection errors.

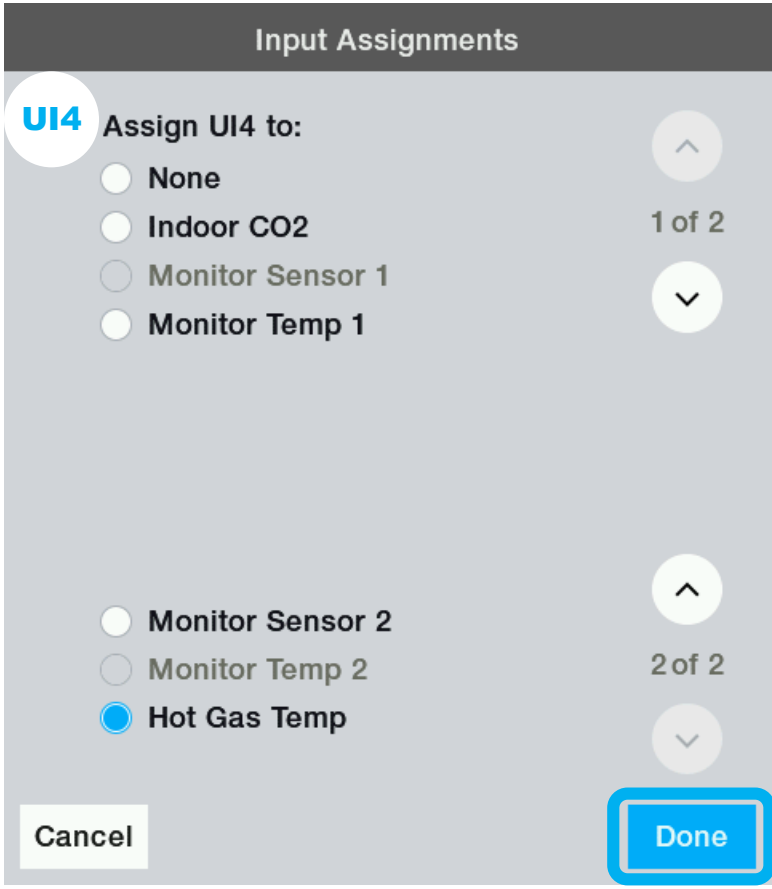
New Monitoring Sensor Options



From Input Assignments Screen, select UI2 Monitor Temperature.

Note: UI2 terminal function HAS NOT CHANGED

UI2 has not changed, but please note that you must supply a Sylk OA sensor if you chose "Monitor Temperature" option.

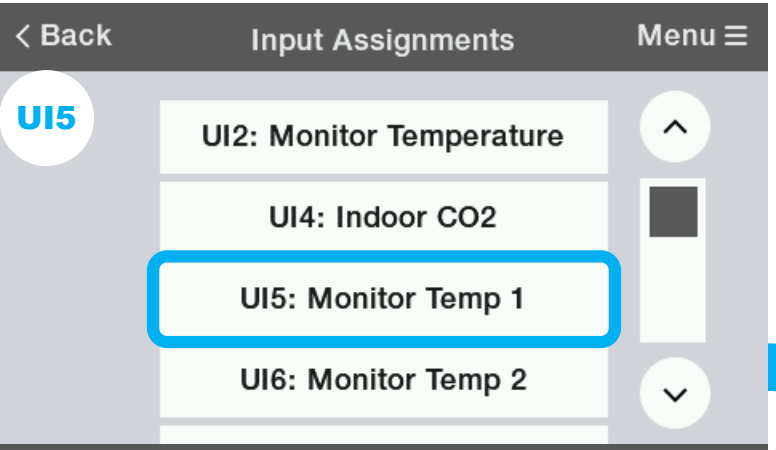


NEW

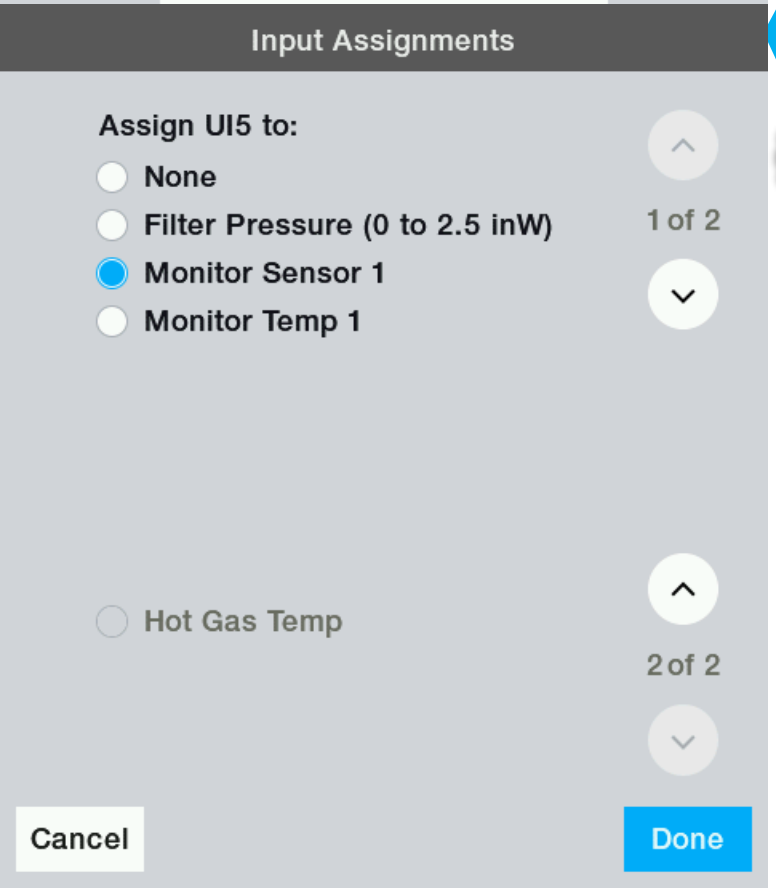
UI4 was only available for CO2 deployment before this update, upgrade. Now, you can select a combination of Monitor Sensors (0-10 VDC) Monitor Temperatures (20K) and "Hot Gas Temp" that is designated for compressor discharge analytic.

Note: As you select these options, they will "disappear" indicating they can't be used any further. This protects the configurer from reusing sensors illegally.

New Monitoring Sensor Options



From Input Assignments Screen, select UI5 Monitor Temperature.

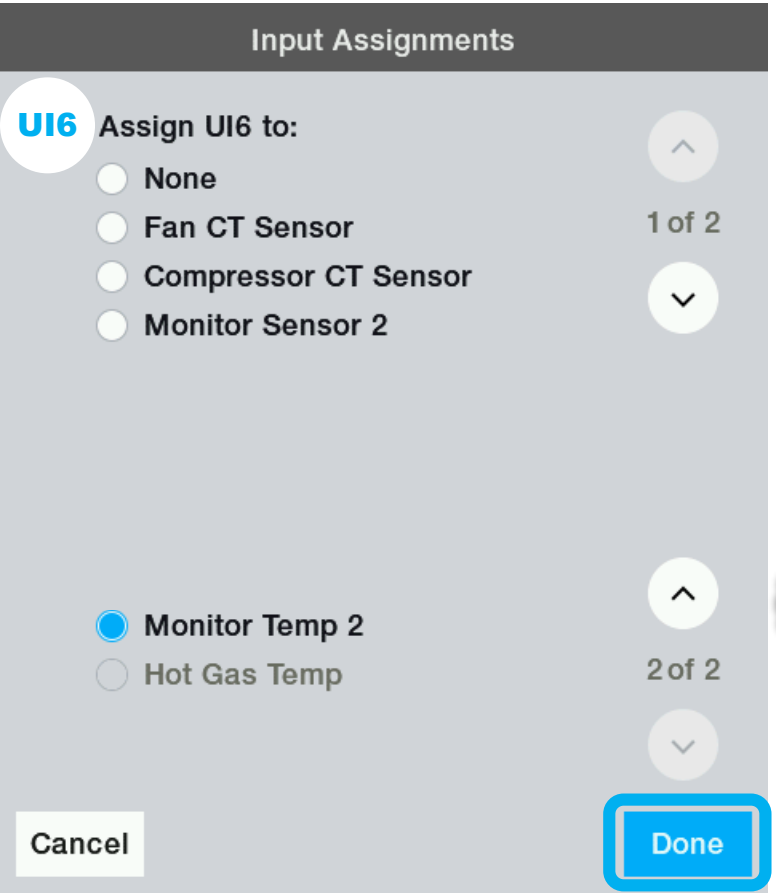


NEW

UI5 is now able to be configured to monitor 20K sensors! Many of you indicated that it was difficult to find 10 VDC temperature transmitters for a competitive price, so we added this capability.

You continue to see how operators are prevented from making sensor selection errors. For example, note that "Hot Gas Temperature" is not available for selection as it has been selected elsewhere.

New Monitoring Sensor Options



From Input Assignments Screen, select UI6 Monitor Temperature.

NEW

UI6 is now also able to be configured to monitor 20K sensors! Many of you indicated that it was difficult to find 10 VDC temperature transmitters for a competitive price, so we added this capability.

You continue to see how operators are prevented from making sensor selection errors. Again, for example, note that "Hot Gas Temperature" is not available for selection as it has been selected elsewhere.

Honeywell

THE POWER OF CONNECTED

LCBS Connect

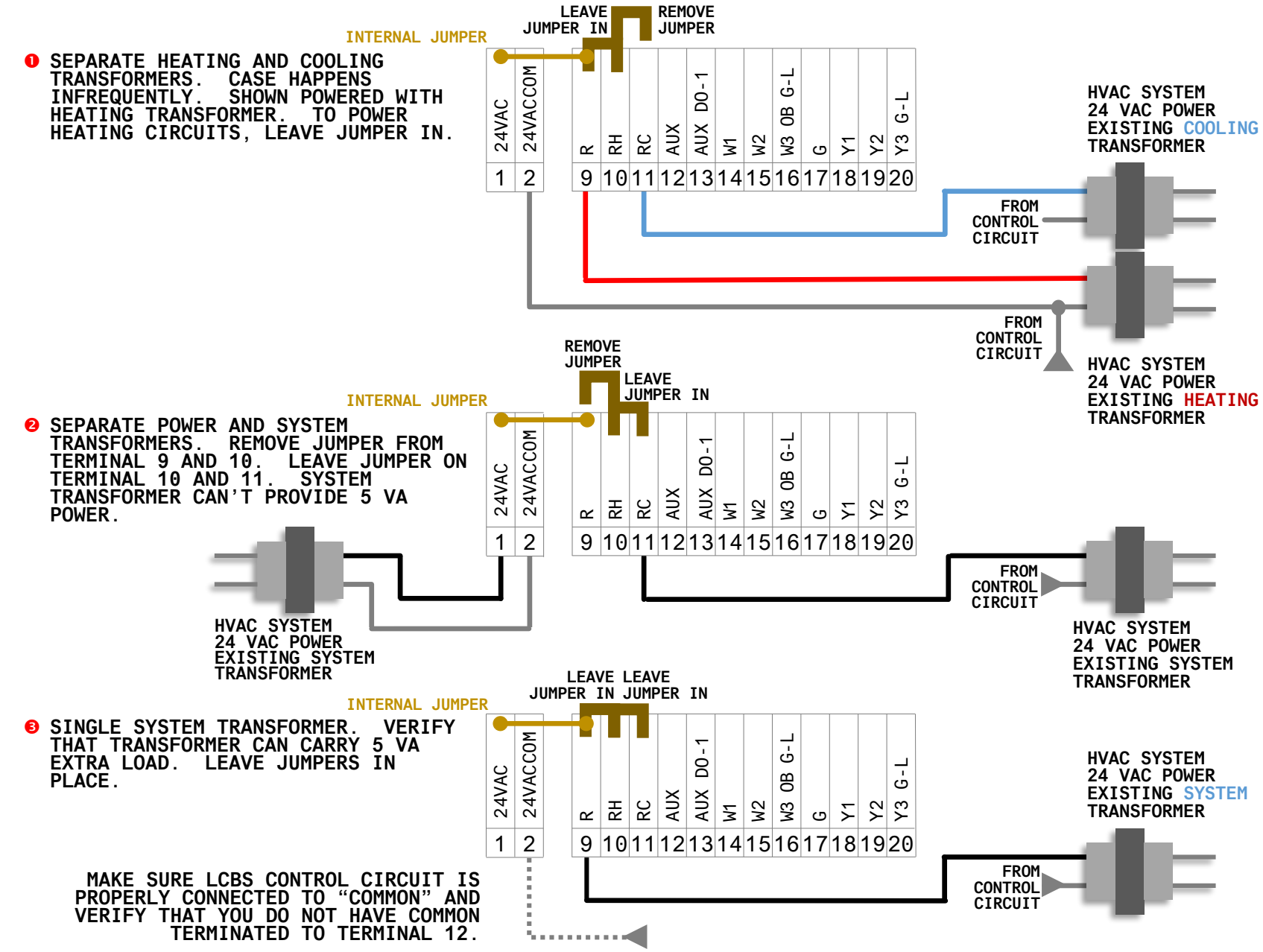
Wiring Diagrams

Updated April 24, 2018

START HERE - POWER THE DEVICES - GENERAL DIAGRAM – POWER

BUILDING NAME		CVAHU RTU NAME		DATE	

NOTE: CONTROLLER HAS INTERNAL JUMPER FROM 1 (24VAC) to 9 (R)
NOTE CHANGE: TERMINAL 12 IS NOT COMMON



❶ SEPARATE HEATING AND COOLING TRANSFORMERS. CASE HAPPENS INFREQUENTLY. SHOWN POWERED WITH HEATING TRANSFORMER. TO POWER HEATING CIRCUITS, LEAVE JUMPER IN.

❷ SEPARATE POWER AND SYSTEM TRANSFORMERS. REMOVE JUMPER FROM TERMINAL 9 AND 10. LEAVE JUMPER ON TERMINAL 10 AND 11. SYSTEM TRANSFORMER CAN'T PROVIDE 5 VA POWER.

❸ SINGLE SYSTEM TRANSFORMER. VERIFY THAT TRANSFORMER CAN CARRY 5 VA EXTRA LOAD. LEAVE JUMPERS IN PLACE.

MAKE SURE LCBS CONTROL CIRCUIT IS PROPERLY CONNECTED TO "COMMON" AND VERIFY THAT YOU DO NOT HAVE COMMON TERMINATED TO TERMINAL 12.

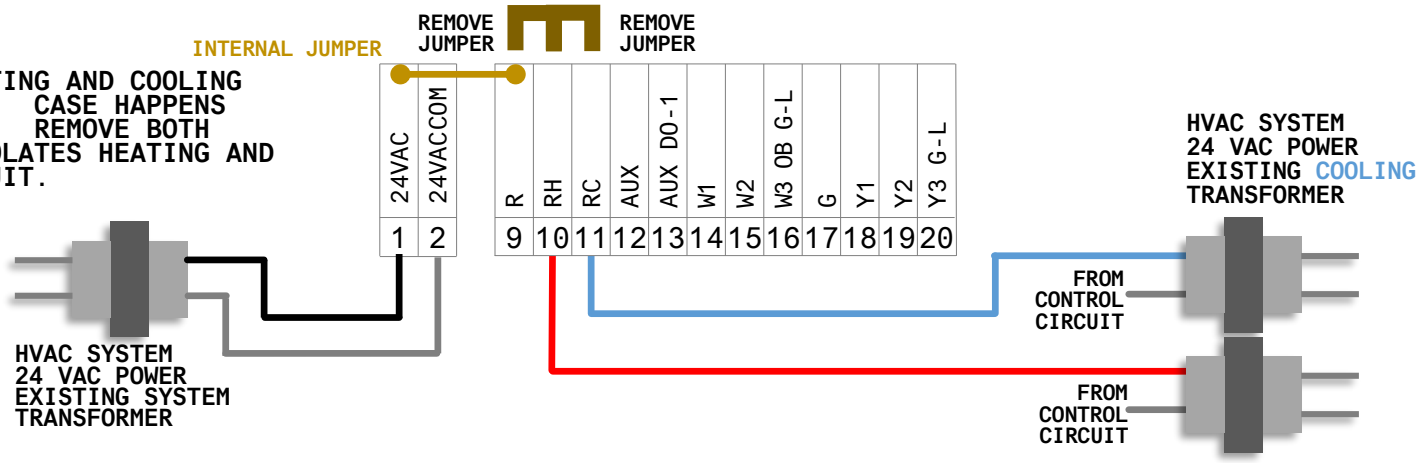
START HERE - POWER THE DEVICES - GENERAL DIAGRAM – POWER

BUILDING NAME		CVAHU RTU NAME		DATE	

NOTE: CONTROLLER HAS INTERNAL JUMPER FROM 1 (24VAC) to 9 (R)
NOTE: TERMINAL 12 IS NOT COMMON

1A

❹ SEPARATE HEATING AND COOLING TRANSFORMERS. CASE HAPPENS INFREQUENTLY. REMOVE BOTH JUMPERS. ISOLATES HEATING AND COOLING CIRCUIT.



START HERE – ACCESSORY DEVICES - CONFIGURABLE INPUT AND OUTPUT ASSIGNMENTS

BUILDING NAME		CVAHU RTU NAME		DATE	

SEE NEW SENSOR SELECTION TABLE PAGE 17 (2)

▶▶▶ DOUBLE CHECK PRESSURE RANGE AND SET ACCCORDINGLY ◀◀◀ (1)

P7640A PRESSURE SENSOR (IN WC,VDC)

USER SELECTED SENSOR 1 (SCALE PER REQUIREMENT)

C7250A OA SENSOR

20K USER SELECTED MONITOR SENSOR

SEE PAGE (4) FOR ACTUAL WIRING

ACCESSORY LOOP

MULTISPEED FAN

P7640A PRESSURE SENSOR (IN WC,VDC)

USER SELECTED SENSOR 2 (SCALE PER REQUIREMENT)

CTP-10-050-VDC-001 FAN, COMPRESSOR CURRENT TRANS (SELF POWERED)

▶▶▶ YOU MUST SCALE CURRENT TRANSFORMERS VIA LCBS CONNECT WALL MODULE TO MATCH SENSED RANGE! ◀◀◀ (2)

LCBS CONTROLLER

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
AO-1	COM	AO-2	AO-3	COM	DI-1	DI-2	COM	DI-3	DI-4	24VDC	UI-1	COM	UI-2	UI-3	COM	UI-4	UI-5	COM	UI-6

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
24VAC	24VACCOM	EGND	SHIELD	S-BUS	S-BUS	NET-1	NET-2	R	RH	RC	AUX	AUX DO-1	W1	W2	W3 OB G-L	G	Y1	Y2	Y3 G-L

FACTORY JUMPER

24 VAC CONTROLLER POWER – ADDITIONAL VA NEEDED TO POWER CONTROLLER, ACCESSORIES

SYLK BUS

LCBS CONTROLLER WALL MODULE

SHOWN POWERED OCCUPANCY, ECONOMIZER, SIMPLE DEHUMID, ACCESSORY LOOP STAGE, ACCESSORY LOOP AUX CONTROL POINT

COOL 3 FAN LOW

HEAT 3 REVERSE VALVE FAN LOW

HVAC SYSTEM 24 VAC POWER EXISTING TRANSFORMER

LCBS CONNECT – INFORMATION

(1) WHEN INSTALLING THE P7640 PRESSURE SENSOR, BE SURE TO SET JUMPERS IN THE DEVICE TO REFLECT APPROPRATE SENSING RANGE.

(2) WHEN INSTALLING CT-10 CURRENT TRANSFORMERS, BE SURE TO SET JUMPERS IN THE DEVICE TO MATCH CURRENT SENSED. FIND CURRENT ON THE RTU MODEL NUMBER PLATE. REMEMBER, YOU ARE SENSING ONLY ONE LEG OF THE FAN OR COMPRESSOR. MAKE SURE TO SET THE APPROPRITE RANGE, SCALE ON THE LCBS CONNECT WALL MODULE. IF YOU FAIL TO DO SO, AMPERAGE WILL READ INCORRECTLY.

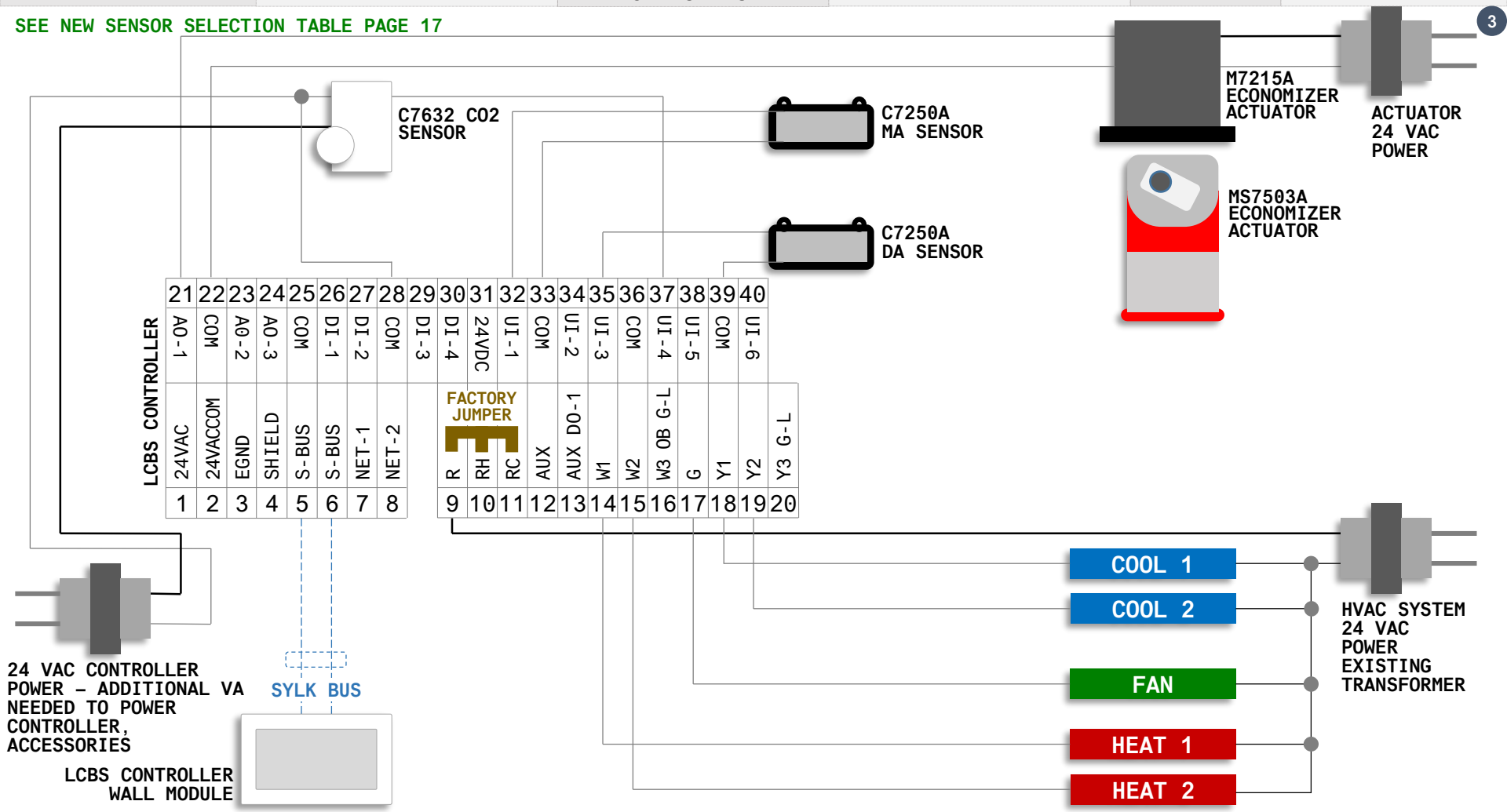
LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

START HERE - FIXED ANALOG INPUT AND DIGITAL OUTPUT ASSIGNMENTS

BUILDING NAME		CVAHU RTU NAME		DATE	

SEE NEW SENSOR SELECTION TABLE PAGE 17

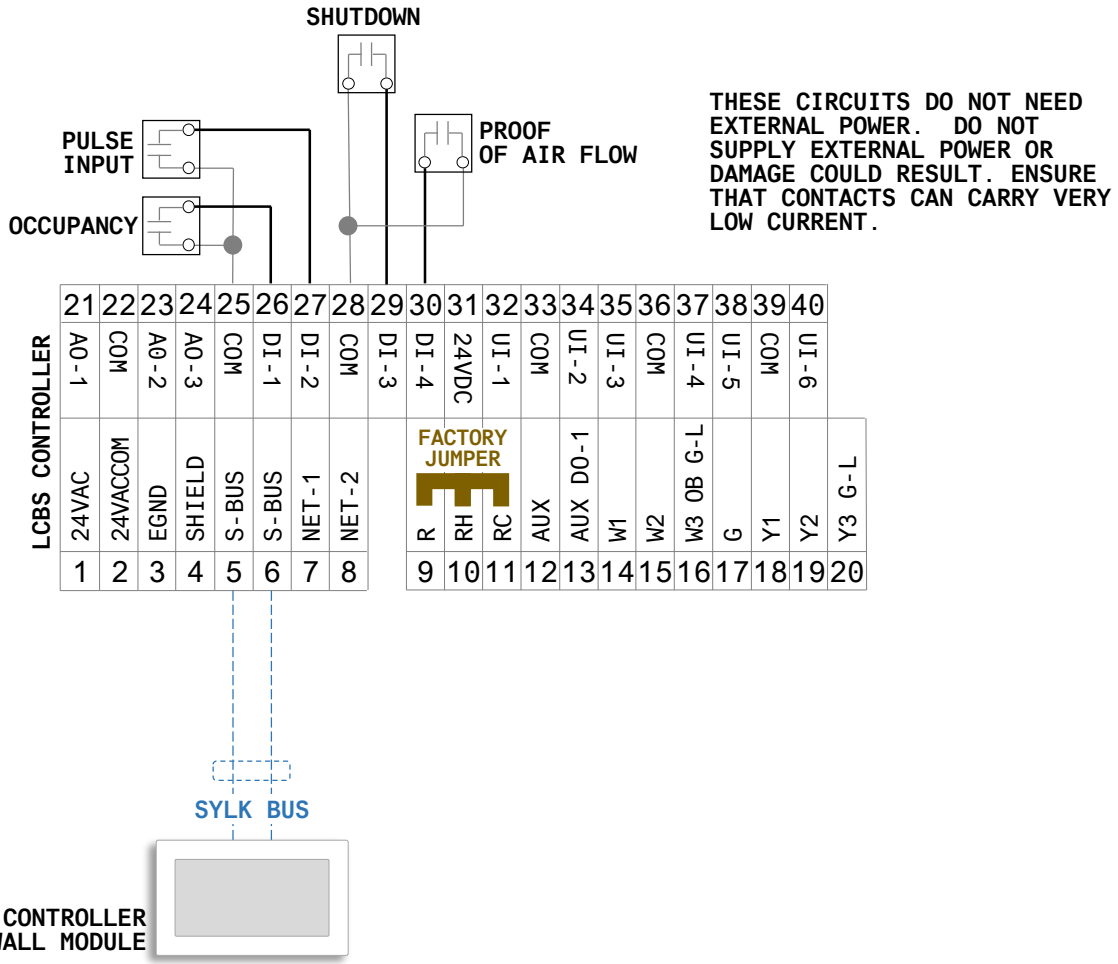


LCBS CONNECT – INFORMATION
THIS IS A GENERAL TEMPLATE THAT INCLUDES ALL FIXED SENSORS AND OUTPUT DEVICES.

LCBS CONNECT – COMPONENTS SHOWN	
OS#	DESCRIPTION

START HERE - FIXED DIGITAL INPUT ASSIGNMENTS

BUILDING NAME		CVAHU RTU NAME		DATE	

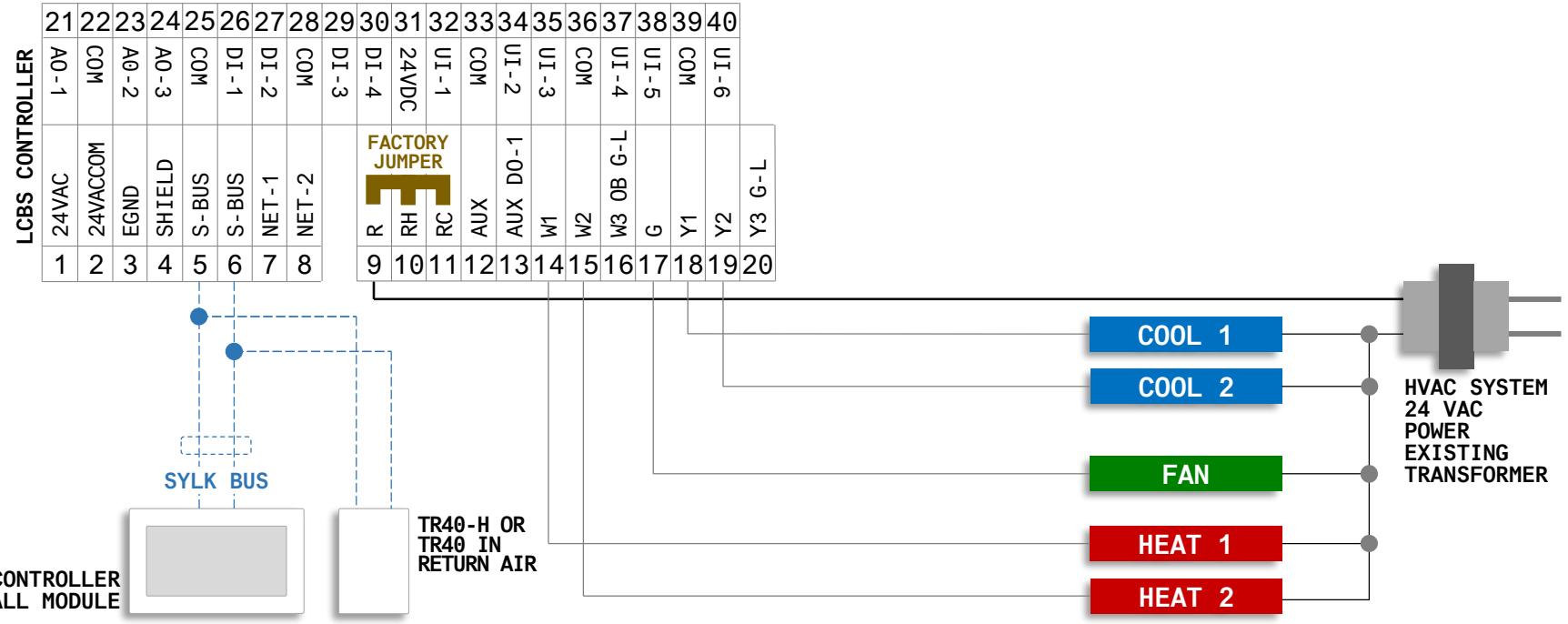


LCBS CONNECT – INFORMATION
THIS IS A GENERAL TEMPLATE THAT INCLUDES DIGITAL INPUT DEVICES

LCBS CONNECT – COMPONENTS SHOWN	
OS#	DESCRIPTION

APPLICATION EXAMPLE 1 – RETURN AIR SENSING WITH STANDARD TWO HEAT TWO COOL CONTROL

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

RETURN AIR SENSING APPLICATION. THE TR40 IS NOT THE MOST DEISRABLE FORM FACTOR TO PUT IN A RETURN AIR DUCT. IT IS POSSIBLE TO PUT ANY TR40 FORM FACTOR IN THE RETURN AIR. NOTE THAT THERE IS A SPECIFIC C7232 CO2 SENSOR THAT IS DESIGNED FOR RETURN AIR USE. IT'S PERFERRED TO USE THIS SKU.

REMOTE TEMPERATURE AND HUMIDITY WILL APPEAR ON THE LCBS CONNECT WALL MODULE!

NO MATTER THE TR40 USED, MAKE SURE THAT IT IS OFFSET FROM RETURN AIR DUCT SHEET METAL. ENSURE THAT AIR CAN "TURBULATE" AROUND THE FORM FACTOR.

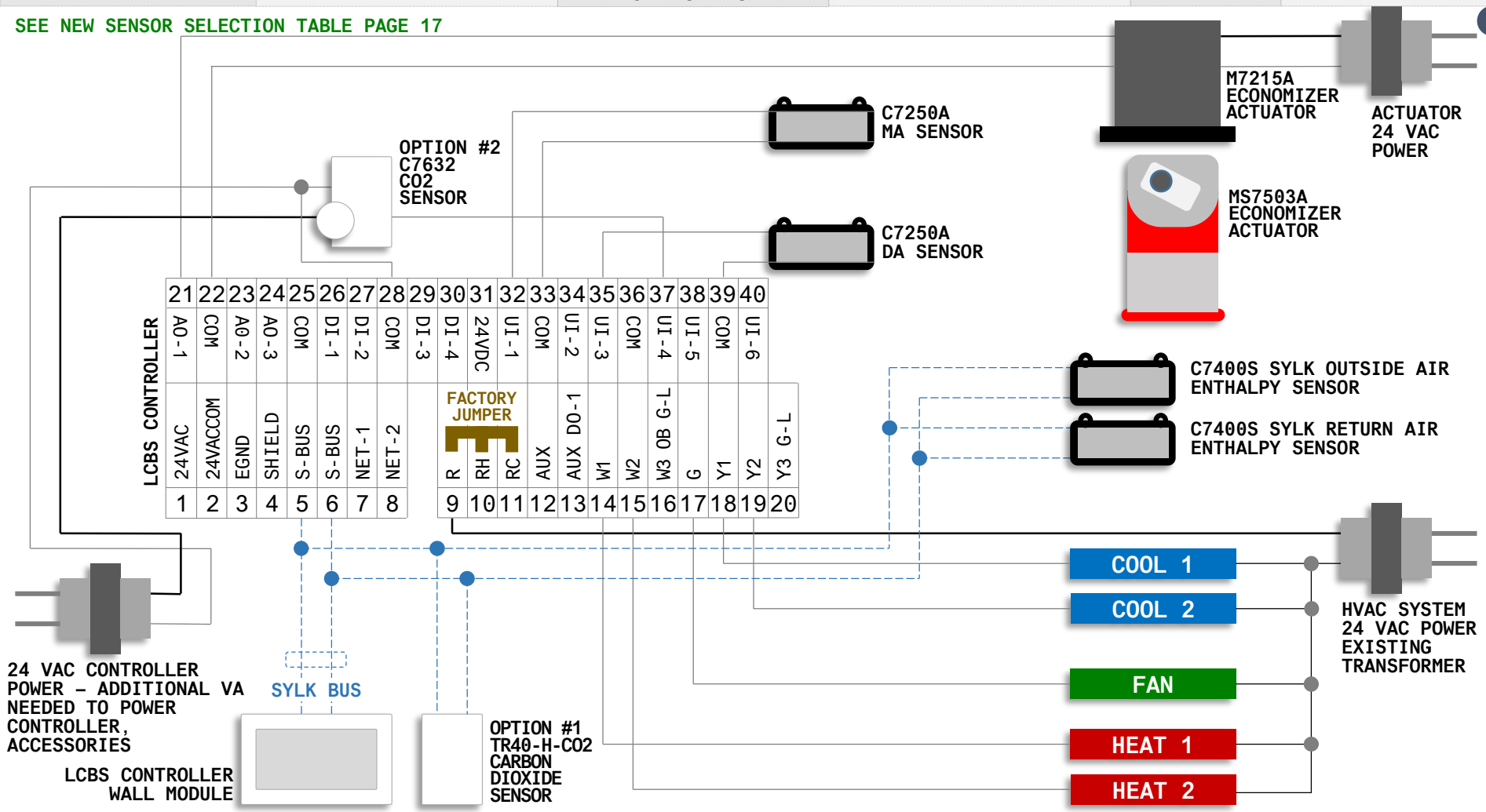
LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 2 - 2H 2C INTEGRATED ECONOMIZER DIFFERENTIAL ENTHALPY AND DEMAND CONTROLLED VENTILATION

BUILDING NAME		CVAHU RTU NAME		DATE	

SEE NEW SENSOR SELECTION TABLE PAGE 17



LCBS CONNECT – INFORMATION

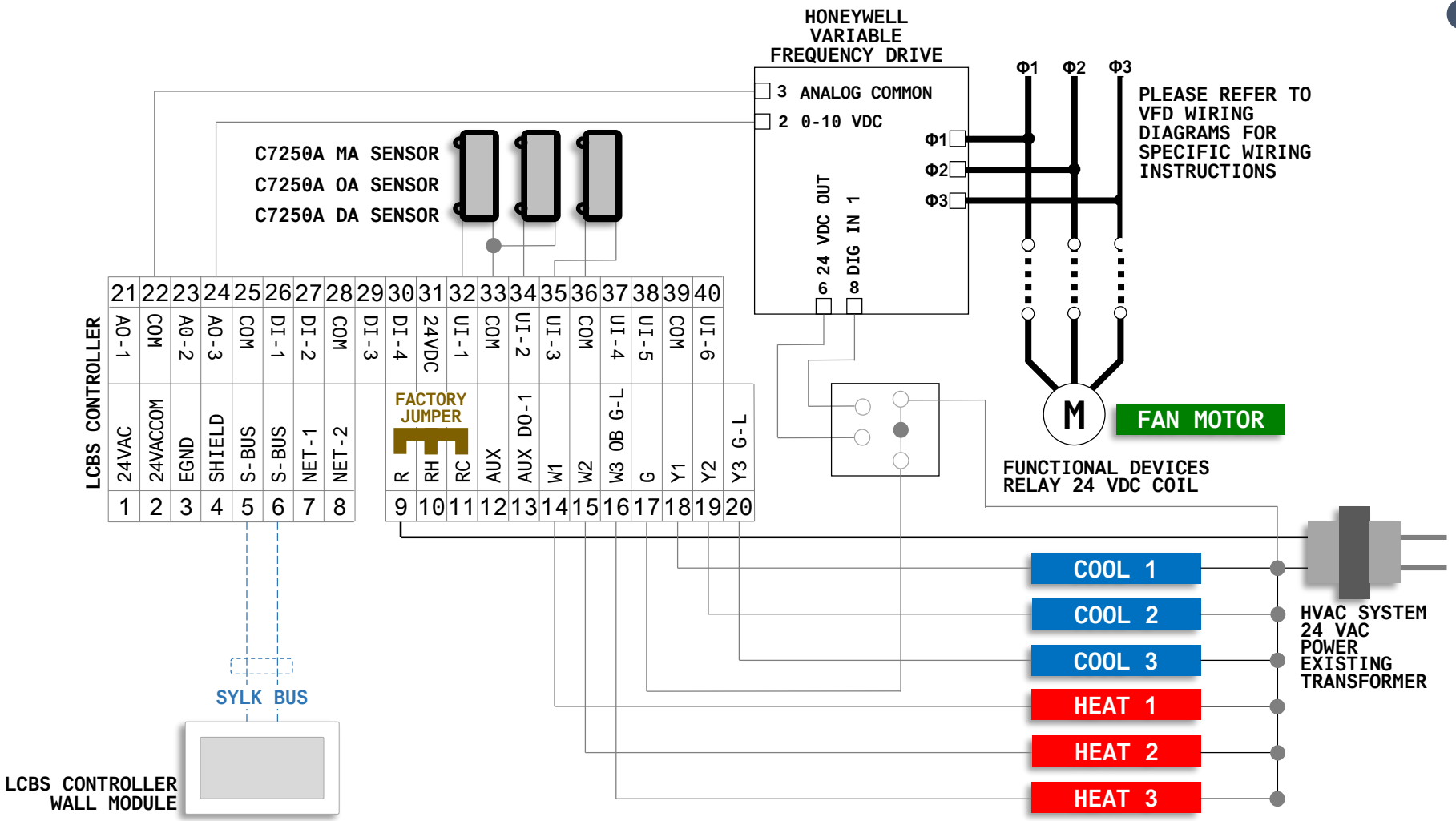
THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF TWO STAGES OF GAS OR ELECTIR HEAT, TWO STAGES OF DIRECT EXPANSION COOLING, AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). THE APPLICATION FEATURES INPUT OF HONEYWELL CO2 SENSOR THAT PROVIDES INPUT TO CO2 SEQUENCE. IF C02 LEVEL IN BUILDING SPACE EXCEEDS SETPOINT, OUTDOOR AIR DAMPER WILL OPEN AND ATTEMPT TO ABATE INDOOR AIR QUALITY ISSUE (SEE APP GUIDE FOR DETAILED SEQUENCE). SETBACK AND ADAPTIVE INTELLIGENT RECOVERY WORKS PER APPLICATION GUIDE. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR HEATING OR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 3 - THREE COOL THREE HEAT MULTISPEED FAN WITH VARIABLE FREQUENCE DRIVE

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

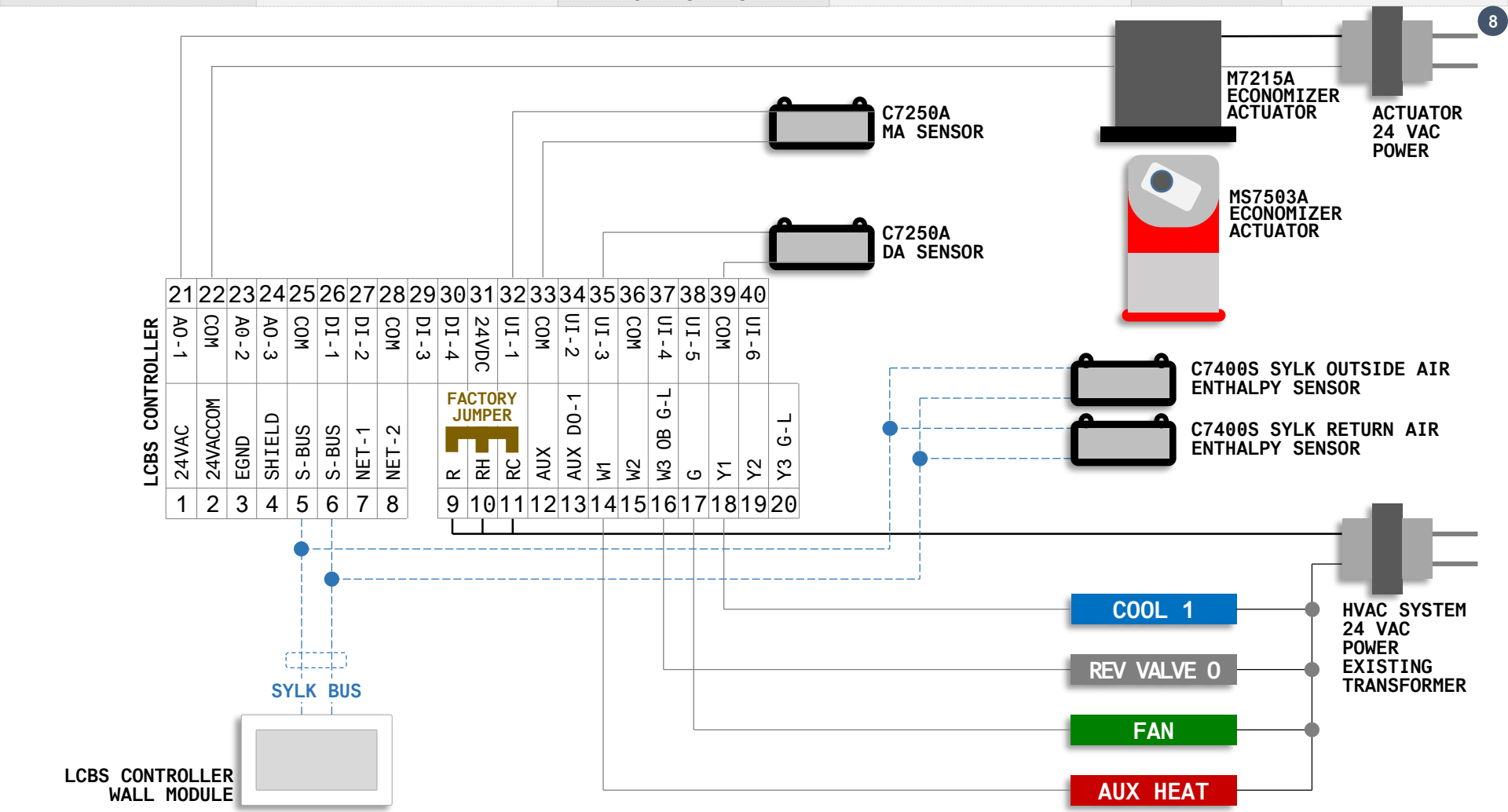
THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF THREE STAGES OF DIRECT EXPANSION COOLING AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). CONFIGURER HAS THE ABILITY TO SET UP SETBACK, SETUP FEATURES THAT WILL ENABLE BUILDING OWNER TO ACHIEVE ENERGY SAVINGS BY REDUCING FAN AND COOLING EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS. ADAPTIVE INTELLIGENT RECOVERY IS ALSO A STANDARD FEATURE. IT PERMITS CONTROLLED OPERATIONAL TRANSITION OF COOLING EQUIPMENT FROM UNOCCUPIED TO OCCUPIED TO 1] GUARD AGAINST EQUIPMENT OVERUSE AND 2] HELP CONTROL POTENTIAL ELECTRICAL SPIKES RESULTING IN DEMAND CONTROL UTILITY CHARGES. MULTISPEED FAN OPTION PERMITS CUSTOMIZED CONTROL OF FAN SPEED AND CAN BE INDEXED TO SPECIFIC MODES. THERE ARE SIX MODES THAT INDIVIDUAL FAN SPEEDS CAN BE COUPLED WITH. SUCCESSFULLY IMPLMEMENTED, COMFORT WITH ENERGY COST AVOIDANCE IS A PROBABLE OUTCOME.

LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 4 - SINGLE STAGE HEAT PUMP ECONOMIZER DIFFERENTIAL ENTHALPY

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

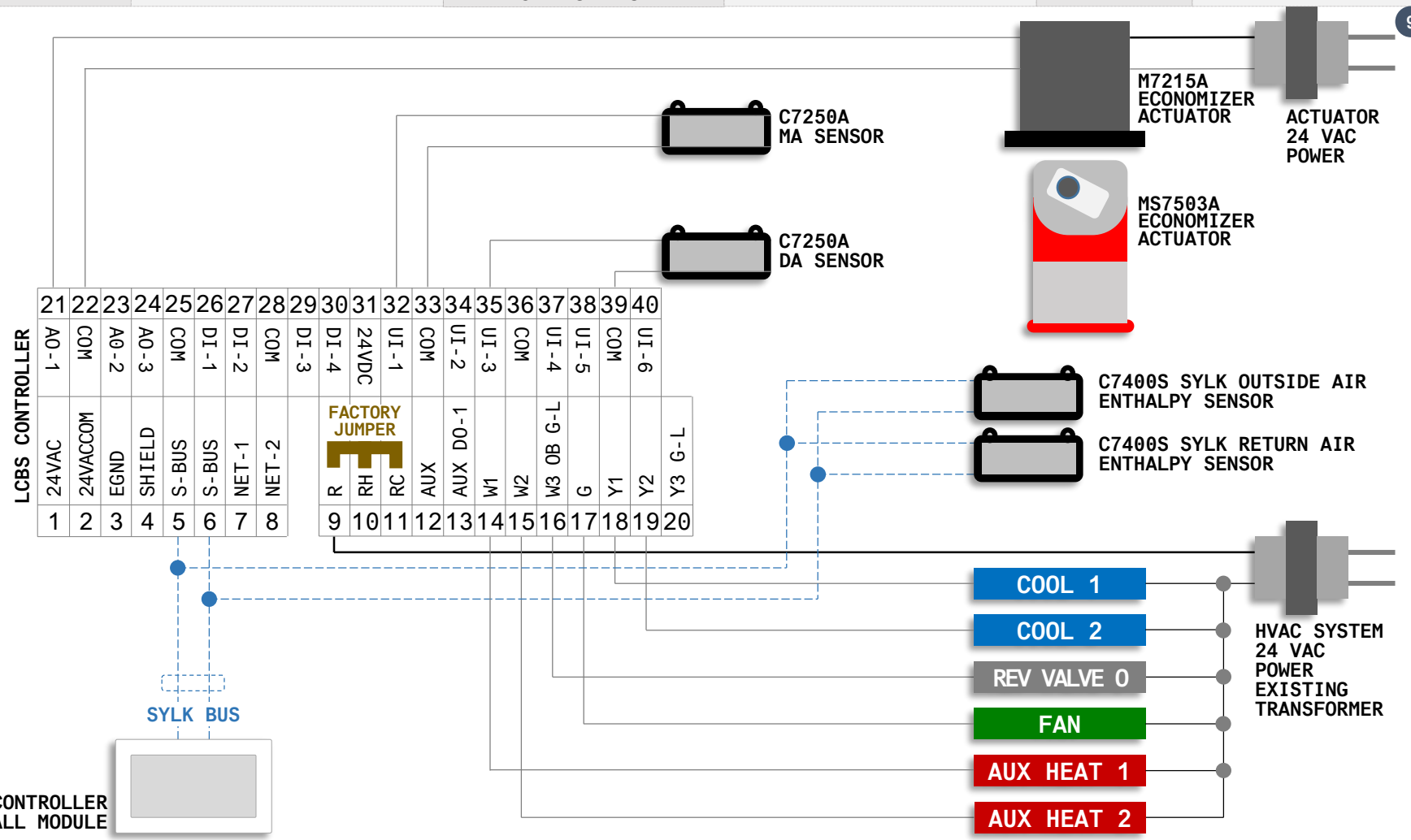
THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF AN AIR TO AIR HEAT PUMP AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). REVERSING VALVE IS ENERGIZED IN COOLING MODE AND INITIATES COOLING CYCLE BASED ON 24 VAC SUPPLIED CONFIGURER HAS THE OPTION TO RUN THE HEAT PUMP IN A "COMFORT MODE" OR "SAVINGS MODE." THE NORMAL MODE WILL OPERATE THE HEAT PUMP AUXILIARY HEAT BASED ON CONFIGURER SELECTED HEATING SETPOINT. IN THE "SAVINGS MODE" THE HEATING SETPOINT IS DEPRESSED SO THAT ELECTRIC, AUXILIARY HEAT OPERATES LESS FREQUENTLY. REFER TO APPLICATION GUIDE TO REFERENCE SETUP, SETBACK OPERATION AS WELL AS ADAPTIVE INTELLIGENT RECOVERY OPERATION. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 5 - TWO STAGE HEAT PUMP TWO STAGE AUXILIARY HEAT ECONOMIZER DIFFERENTIAL ENTHALPY

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

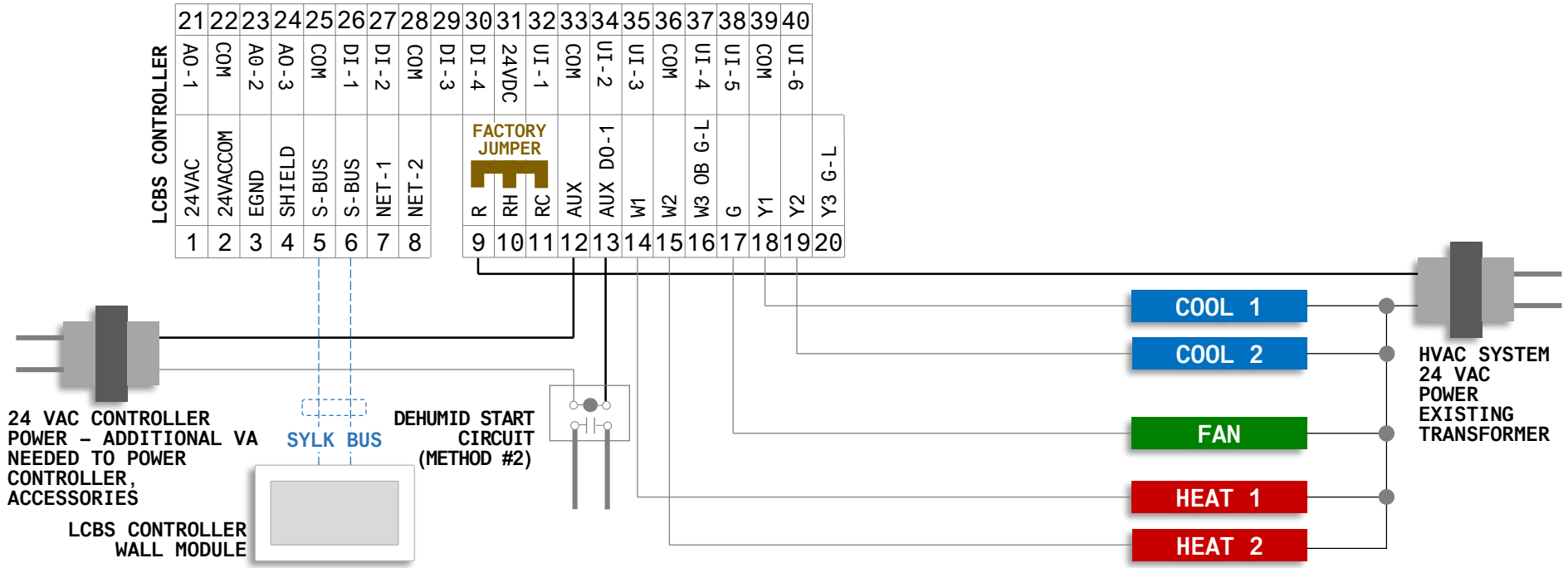
THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF AN AIR TO AIR HEAT PUMP AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). REVERSING VALVE IS ENERGIZED IN COOLING MODE AND INITIATES COOLING CYCLE BASED ON 24 VAC SUPPLIED CONFIGURER HAS THE OPTION TO RUN THE HEAT PUMP IN A "COMFORT MODE" OR "SAVINGS MODE." THE NORMAL MODE WILL OPERATE THE HEAT PUMP AUXILIARY HEAT BASED ON CONFIGURER SELECTED HEATING SETPOINT. IN THE "SAVINGS MODE" THE HEATING SETPOINT IS DEPRESSED SO THAT ELECTRIC, AUXILIARY HEAT OPERATES LESS FREQUENTLY. REFER TO APPLICATION GUIDE TO REFERENCE SETUP, SETBACK OPERATION AS WELL AS ADAPTIVE INTELLIGENT RECOVERY OPERATION. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 6 - DEHUMIDIFICATION - SIMPLE

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

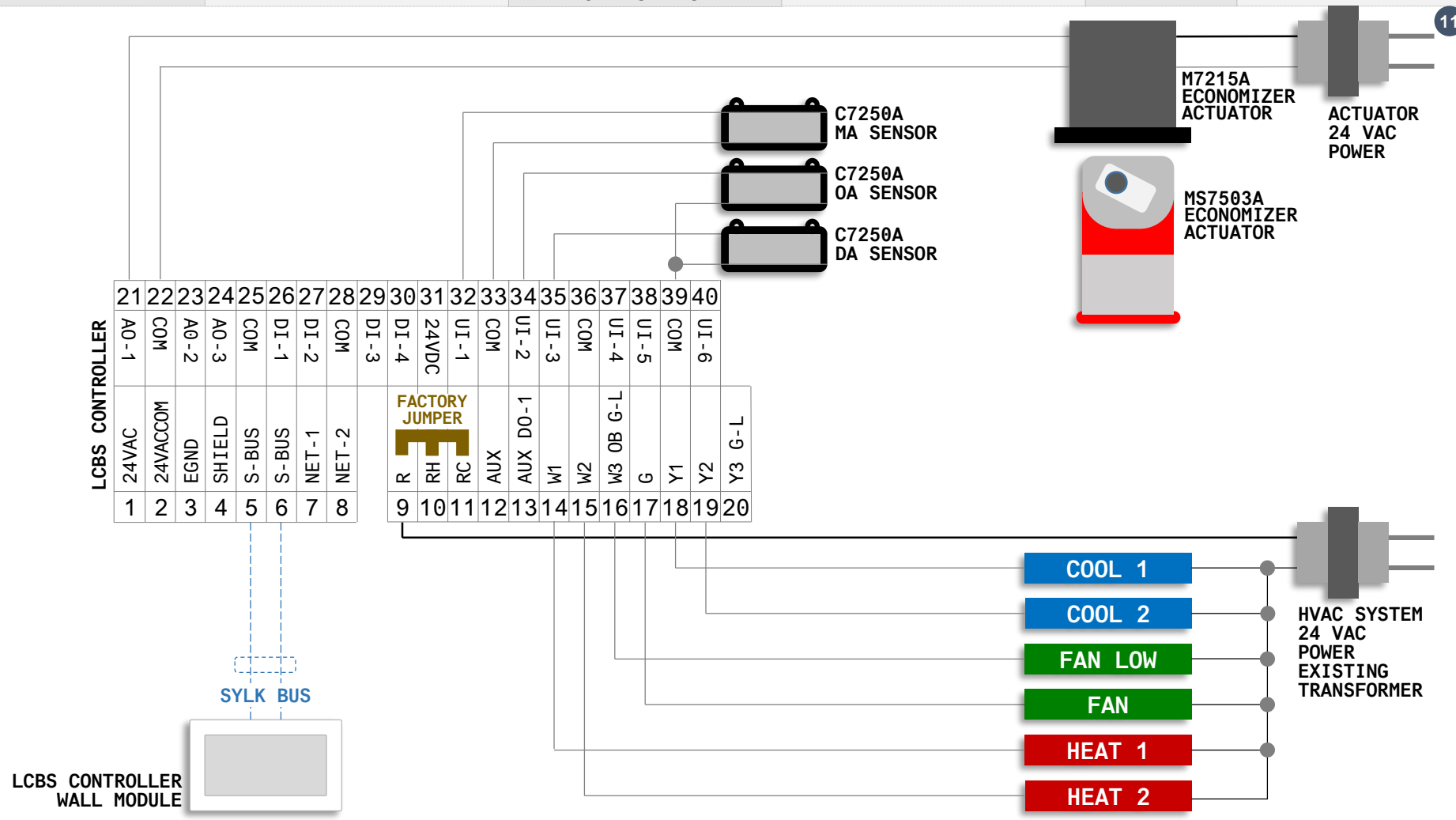
THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF DEHUMIDIFICATION. WE SUPPORT TWO METHODS OF DEHUMIDIFICATION. FIRST, WE PERFORM STANDARD DEHUMIDIFCATION WITH CONNECTED COOLING AND HEATING EQUIPMENT. IF DEHUMIDIFICATION LIMIT IS EXCEEDED AT ANY TIME, OCCUPIED OR UNOCCUPIED TIMING, COOLING AND HEATING IS ENABLED AND OPERATED CONCURRENTLY. HEATING WILL CYCLE TO ATTEMPT TO DEHUMIDIFY. WHEN HYSTERESIS IS OBSERVED AND HUMIDITY FALLS BELOW DEHUMIDIFICATION LIMIT, HEATING AND COOLING ARE CYCLED OFF. IF A CALL FOR COOLING STILL EXISTS, COOLING CONTINUES TO OPERATE BASED ON COOLING SETPOINT. SECOND, AN LCBS CONNECT CONTROLLER OUTPUT CAN BE PROGRAMMED TO CONTROL A DEHUMIDIFICATION UNIT LIKE A DX DEHUMIFIER OR DESSICANT SYSTEM. IF A CALL FOR DEHUMIDIFICATION EXISTS, THE SELECTED SYSTEM OPERATES INDEPENDENTALY OF LCBS CONTROL FUNCTIONS. THE CONFIGURER CAN ALSO SET A “RUN ON TIMER” THAT OPERATES AFTER THE CALL FOR DEHUMIFICATION ABATES, UP TO 15 MINUTES.

LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 7 - TWO SPEED FAN – DISCRETE LOW SPEED AND REGULAR SPEED

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF TWO STAGES OF DIRECT EXPANSION COOLING, HEATING, AND INTEGRATED ECONOMIZER WITH TEMPERATURE LIMIT AND CHANGEOBOER (SEE APP GUIDE FOR DETAILED SEQUENCE). CONFIGURER HAS THE ABILITY TO SET UP SETBACK, SETUP FEATURES THAT WILL ENABLE BUILDING OWNER TO ACHIEVE ENERGY SAVINGS BY REDUCING FAN AND COOLING EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS. ADAPTIVE INTELLIGENT RECOVERY IS ALSO A STANDARD FEATURE. IT PERMITS CONTROLLED OPERATIONAL TRANSITION OF COOLING EQUIPMENT FROM UNOCCUPIED TO OCCUPIED TO 1] GUARD AGAINST EQUIPMENT OVERUSE AND 2] HELP CONTROL POTENTIAL ELECTRICAL SPIKES RESULTING IN DEMAND CONTROL UTILITY CHARGES. MULTISPEED FAN OPTION PERMITS CUSTOMIZED CONTROL OF FAN SPEED AND CAN BE INDEXED TO SPECIFIC MODES. THERE ARE TWO DISCRETE MODES (LOW FAN, REGULARY FAN) THAT CAN BE COUPLED WITH MULTIPLE CONTROL MODES. SUCCESSFULLY IMPLMEMENTED ENERGY COST AVOIDANCE IS A PROBABLY OUTCOME.

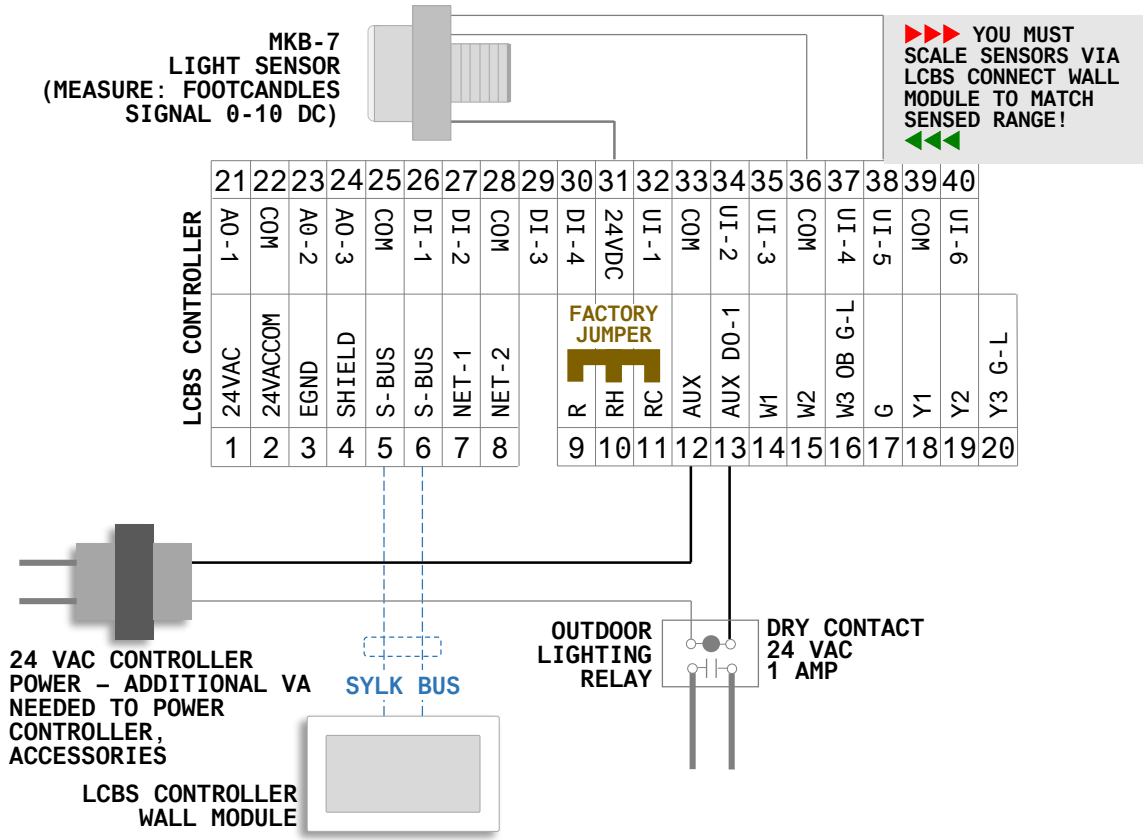
LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 8 - AMBIENT OUTDOOR LIGHTING CONTROL

BUILDING NAME		CVAHU RTU NAME		DATE	

SEE NEW SENSOR SELECTION TABLE PAGE 17



LCBS CONNECT – INFORMATION

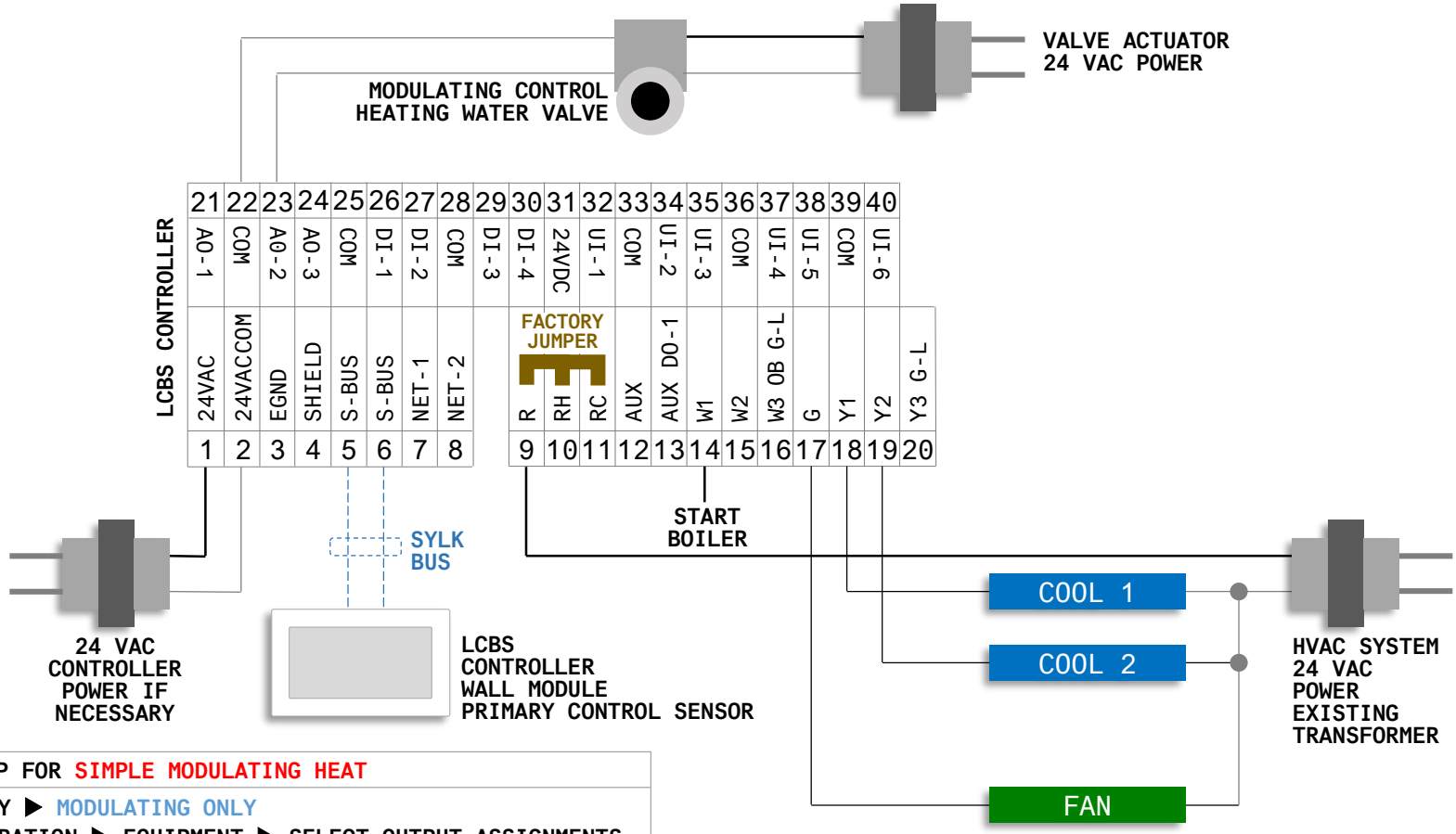
THIS APPLICATION PROVIDES AUTOMATIC CONTROL VIA THE HONEYWELL ACCESSORY LOOP OPTION. IN THIS CASE, WE CONFIGURE A LOOP TO CONTROL A SINGLE STAGE OF OUTDOOR LIGHTING (STAGED ACCESSORY LOOP) THIS IS A REVERSE ACTING LOOP… AS THE MEASURED VALUE INCREASES, THE CONTROL ACTION DECREASES, OR CYCLES OFF (IN THE CASE OF STAGED OUTPUT. LIGHTING LOOP AND MUST BE CONFIGURED AS SUCH. OCCUPIED AND UNOCCUPIED SETPOINTS CAN BE PROVIDED FOR THIS LOOP. THE PRIMARY INPUT SENSOR THAT IS WIRED TO UI-5 NEEDS TO BE CONFIGURED IN “FOOTCANDLES.” THE OCCUPANCY SCHEDULE OPERATES AGAINST THE SCHEDULE SET UP FOR THE PRIMARLY CVAHU, ROOFTOP UNIT, SPLIT SYSTEM. REFER TO APPLICATION NARRATIVE FOR FURTHER INFORMATION ABOUT SET UP AND OPERATION. NOTE! ZERO OUT INTEGRAL TIMING FOR LOOP TO WORK CORRECTLY. FOLLOW SENSOR PROVIDERS INSTALLATION MATERIAL FOR GUIDEANCE TO SET PROPORPORTIONAL, THROTTLING RANGE.

LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPLICATION EXAMPLE 9 - TWO STAGES COOL MODULATING HEAT SIMPLE

BUILDING NAME		CVAHU RTU NAME		DATE	



ACCESSORY LOOP SETUP FOR SIMPLE MODULATING HEAT

1) CONTROL STRATEGY ▶ MODULATING ONLY
2) ADVANCE CONFIGURATION ▶ EQUIPMENT ▶ SELECT OUTPUT ASSIGNMENTS ▶ A02 ▶ ACCESSORY LOOP MODULATING
3) PRIMARY ACCESSORY LOOP SENSOR ▶ TS120 TEMPERATURE
4) PRIMARY ACCESSORY LOOP SETPOINT ▶ EFFECTIVE HEATING SETPOINT
5) RESET SCHEDULE ▶ OPTIONAL
6) DISABLE INPUT LOOP ASSIGNMENT ▶ HEAT STAGE #1
7) SCHEDULED OCCUPANCY ▶ EFFECTIVE OCCUPANCY
8) ACCESSORY LOOP PID ▶ P: 8F I: 1,500 SECONDS
9) LOOP ACTION ▶ REVERSE, HEAT
10) AUXILIARY LOOP ACTION ▶ OPTIONAL
11) ACCESSORY LOOP MINIMUM ON AND OFF TIMES ▶ OPTIONAL

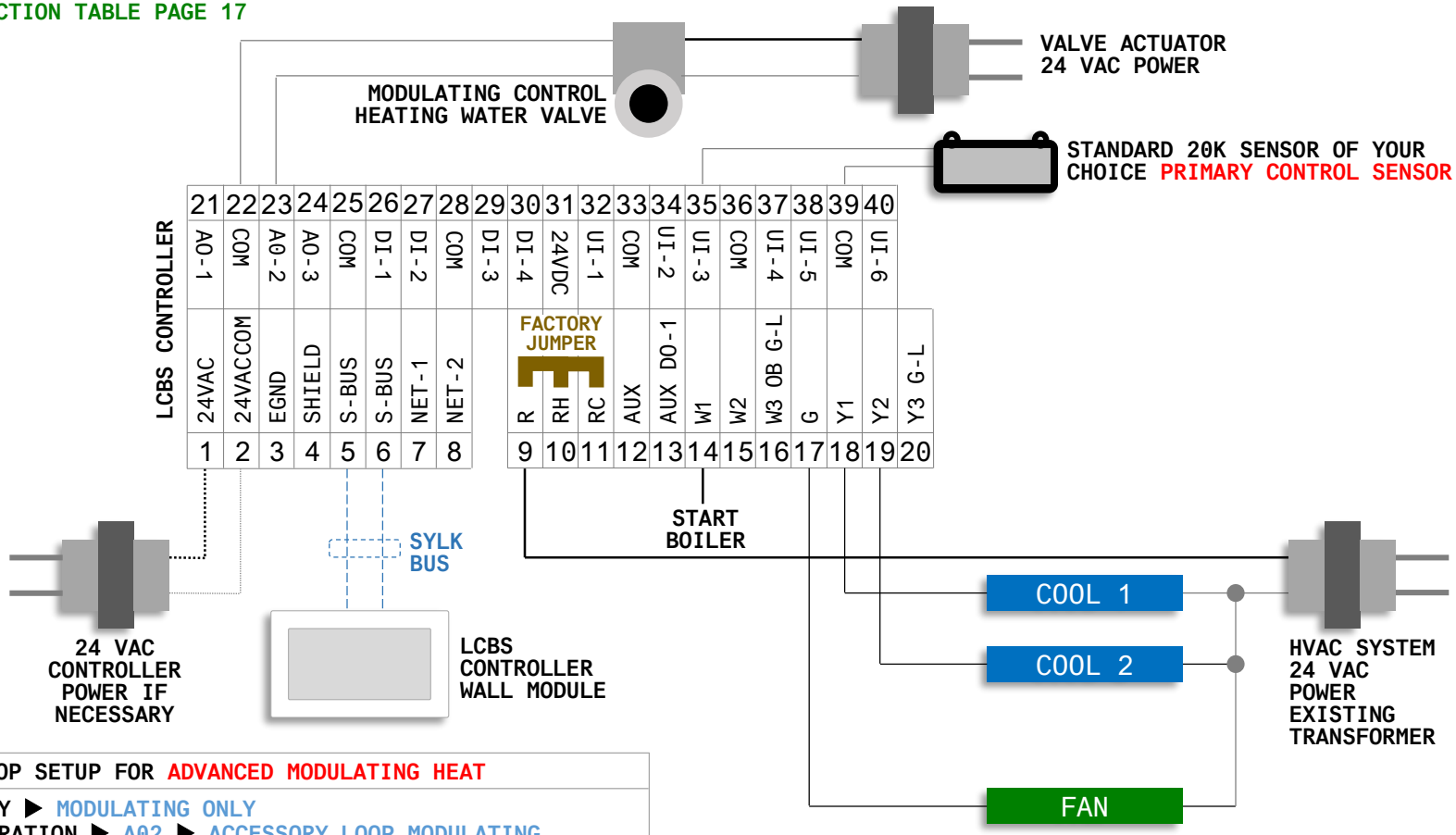
NOTES: ACCESSORY LOOP SETUP FOR STAGED COOLING

1) EQUIPMENT TYPE ▶ CONVENTIONAL STAGED HEAT/COOL
2) EQUIPMENT STAGES ▶ ONE STAGE HEAT TWO STAGE COOL
3) MAKE SURE SPACE TEMPERATURE IS SET AT 72F. SET SPACE COOLING APPROPRIATELY

APPLICATION EXAMPLE 10 - TWO STAGES COOL MODULATING HEAT ADVANCED

BUILDING NAME		CVAHU RTU NAME		DATE	

SEE NEW SENSOR SELECTION TABLE PAGE 17



NOTES: ACCESSORY LOOP SETUP FOR ADVANCED MODULATING HEAT

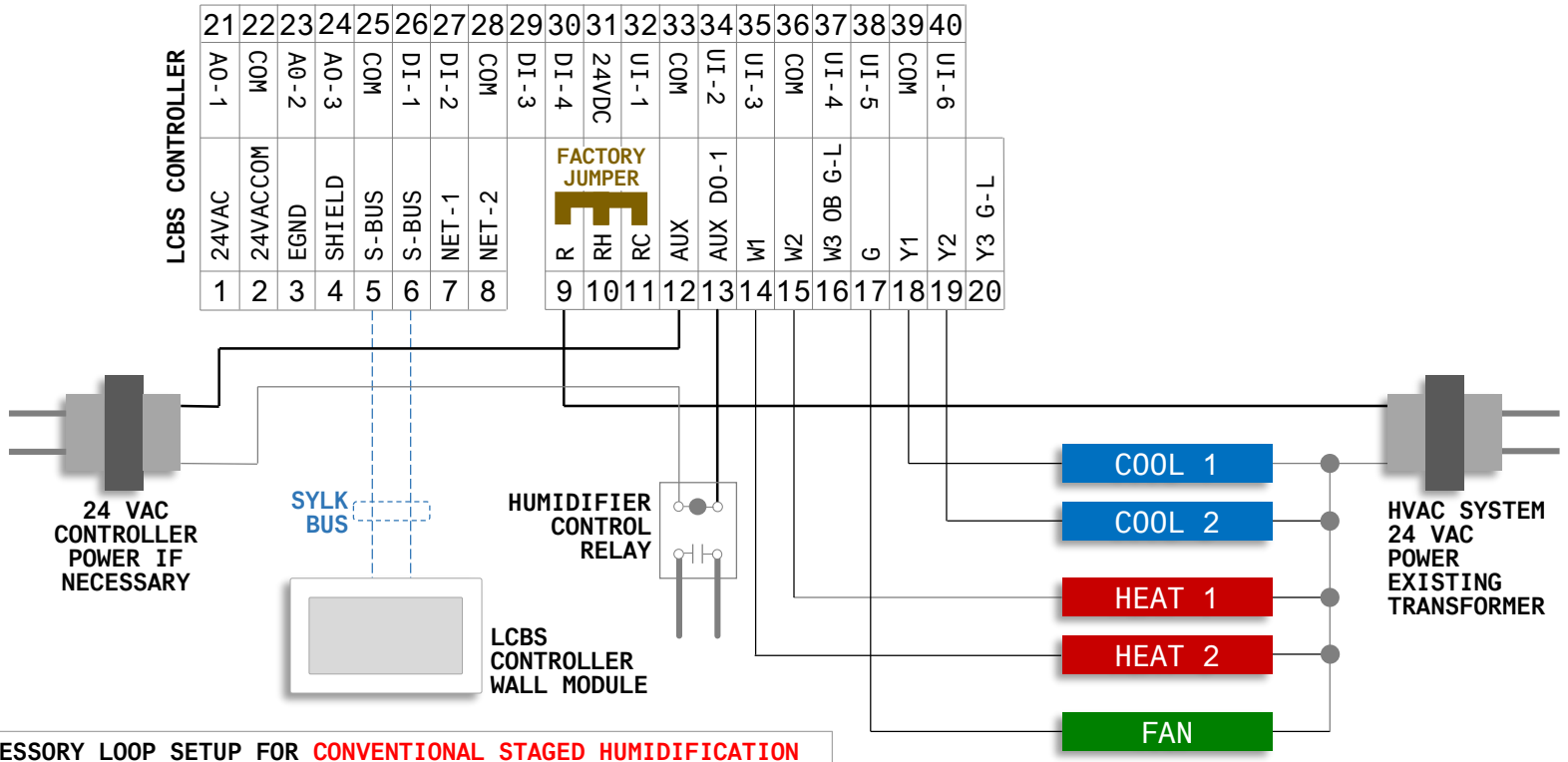
1) CONTROL STRATEGY ▶ MODULATING ONLY
2) ADVANCE CONFIGURATION ▶ A02 ▶ ACCESSORY LOOP MODULATING
3) PRIMARY ACCESSORY LOOP SENSOR ▶ DISCHARGE AIR TEMPERATURE
4) PRIMARY ACCESSORY LOOP SETPOINT ▶ EFFECTIVE HEATING SETPOINT
5) SETPOINT ▶ INTERNAL
6) MAIN SETPOINT ▶ OCCUPIED 68F UNOCC 98F
7) RESET SENSOR ▶ RESET SENSOR MODULATING HEAT OUTPUT
8) RESET SCHEDULE ▶ OFFSET TO MAIN SETPOINT START: 0F END: 30F : START (0%) END (100%)
9) DISABLE INPUT LOOP ASSIGNMENT ▶ HEAT STAGE #1
10) REVERSE DISABLE INPUT ▶ YES
11) SCHEDULED OCCUPANCY ▶ EFFECTIVE OCCUPANCY
12) ACCESSORY LOOP PID ▶ P: 8F I: 1,500 SECONDS
13) LOOP ACTION ▶ REVERSE, HEAT
14) AUXILIARY LOOP ACTION ▶ OPTIONAL
15) ACCESSORY LOOP MINIMUM ON AND OFF TIMES ▶ OPTIONAL

NOTES: ACCESSORY LOOP SETUP FOR STAGED COOLING

1) EQUIPMENT TYPE ▶ CONVENTIONAL STAGED HEAT/COOL
2) EQUIPMENT STAGES ▶ ONE STAGE HEAT TWO STAGE COOL
3) MAKE SURE SPACE TEMPERATURE IS SET AT 72F. SET SPACE COOLING APPROPRIATELY

APPLICATION EXAMPLE 11 – TWO STAGES COOLING TWO STAGES HEATING HUMIDIFICATION – HOT YOGA

BUILDING NAME		CVAHU RTU NAME		DATE	



NOTES: ACCESSORY LOOP SETUP FOR CONVENTIONAL STAGED HUMIDIFICATION

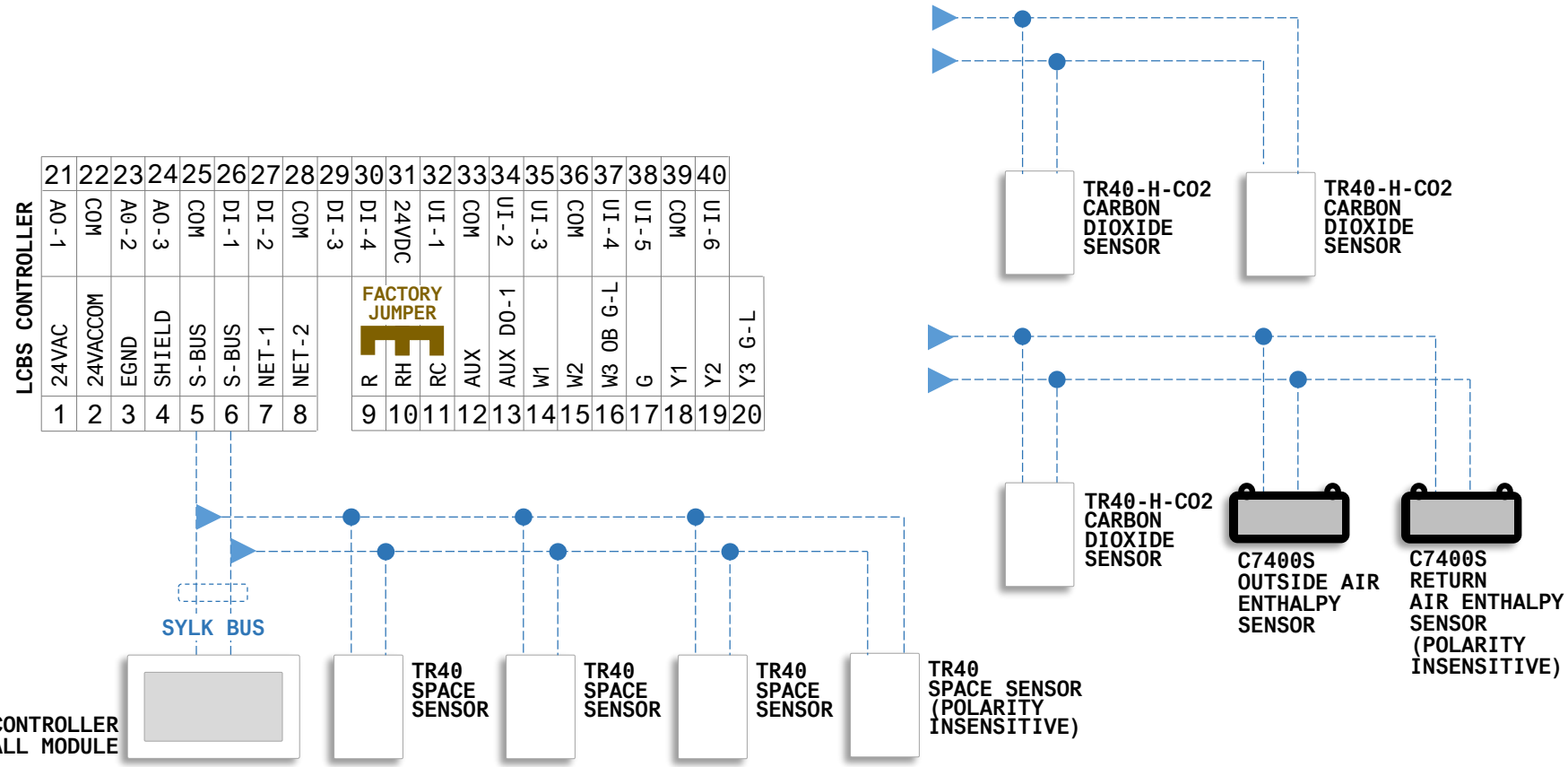
1) CONTROL STRATEGY ▶ MODULATING ONLY
2) ADVANCE CONFIGURATION ▶ EQUIPMENT ▶ SELECT OUTPUT ASSIGNMENTS ▶ D01 ▶ ACCESSORY LOOP STAGE
3) PRIMARY ACCESSORY LOOP SENSOR ▶ INDOOR RELATIVE HUMIDITY
4) PRIMARY ACCESSORY LOOP SETPOINT ▶ INTERNAL 50% RH OCC 20% RH UNOCC
5) RESET SCHEDULE ▶ OPTIONAL
6) DISABLE INPUT LOOP ASSIGNMENT ▶ OPTIONAL
7) SCHEDULED OCCUPANCY ▶ EFFECTIVE OCCUPANCY
8) ACCESSORY LOOP PID ▶ THROTTLING RANGE 5% RH INTEGRAL TIMING 1,500 SECONDS OR LEAVE AS IS
9) LOOP ACTION ▶ DIRECT, HUMIDIFICATION
10) AUXILIARY LOOP ACTION ▶ OPTIONAL
11) ACCESSORY LOOP MINIMUM ON AND OFF TIMES ▶ OPTIONAL

NOTES: ACCESSORY LOOP SETUP FOR STAGED HEATING AND COOLING

1) EQUIPMENT TYPE ▶ CONVENTIONAL STAGED HEAT/COOL
2) EQUIPMENT STAGES ▶ HEATING 0 STAGES COOLING TWO STAGES
3) SETPOINTS ▶ SET HEATING (105F), COOLING OCCUPIED, UNOCCUPIED, STANDBY (OPTIONAL) SETPOINTS.

APPENDIX - "SYLK" SENSORS – ACCEPTABLE CONFIGURATIONS DUE TO "FOUR POWER UNIT" LIMIT

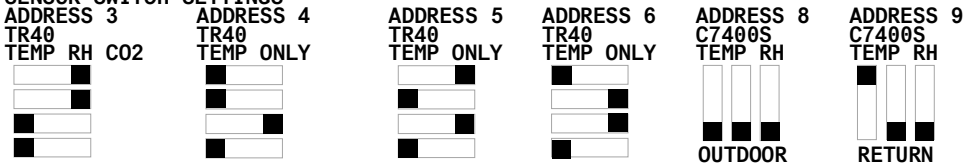
BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

RULES: APPLY DEVICES WITH UP TO FOUR POWER UNITS ON SYLK BUS. POWER UNITS:
TR40 SPACE TEMPERATURE SENSOR: ONE (1) POWER UNIT
TR40-H-CO2 TEMPERATURE HUMIDITY CARBON DIOXIDE SENSOR: TWO (2) POWER UNITS
C7400S TEMPERATURE RELATIVE HUMIDITY SENSOR: ONE (1) POWER UNIT

SENSOR SWITCH SETTINGS



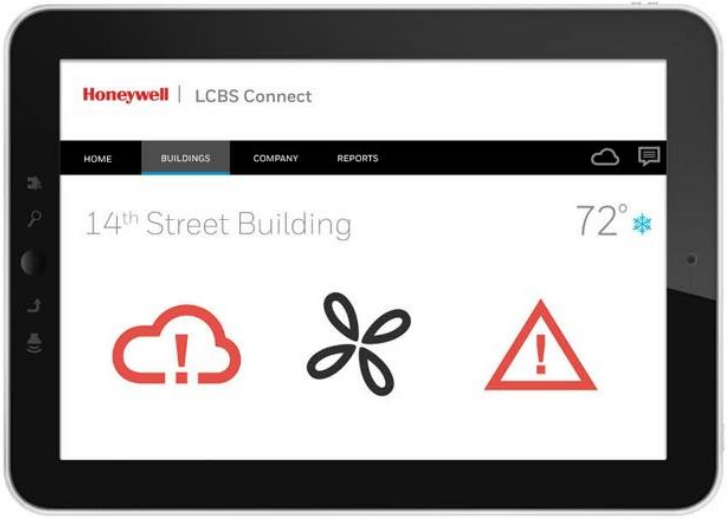
LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION

APPENDIX - MASTER POINTS LIST THOSE IN RED ARE FIXED TO SINGLE INPUT OR OUTPUT DEFINITION	
I/O	NAME OF INPUT OUTPUT POINT(S)
UI1	MIXED AIR SENSOR
UI2	OUTDOOR AIR, USER SELECTED MONITOR POINT (20K)
UI3	DISCHARGE AIR SENSOR
UI4	CO2 SENSOR, MONITOR 1 SENSOR, MONITOR 1 TEMP, MONITOR 2 SENSOR, MONITOR 2 TEMP, COMP DISCH TEMP (HOT GAS)
UI5	FILTER PRESSURE, USER SELECTED MONITOR 1 SENSOR (NEED TO SCALE), MONITOR 1 TEMP, COMP DISCH TEMP (HOT GAS)
UI6	FILTER PRESSURE, COMPRESSOR CURRENT SENSOR, FAN CURRENT SENSOR, MONITOR 2 SENSOR (NEED TO SCALE), MONITOR 2 TEMP, COMP DISCH TEMP (HOT GAS)
DI1	OCCUPANCY, MOTION SENSOR
DI2	PULSE METER
DI3	SHUTDOWN, DIRTY FILTER
DI4	PROOF OF AIRFLOW, USER SELECTED MONITOR SWITCH
AO1	ECONOMIZER ACTUATOR
AO2	ACCESSORY LOOP MODULATING, ACCESSORY LOOP STAGE (NEED RELAY), ACCESSORY LOOP AUX MODULATING
AO3	MULTI-SPEED FAN, ACCESSORY LOOP MODULATING, ACCESSORY LOOP STAGE (NEED RELAY), ACCESSORY LOOP AUX MODULATING
DO1	(DO AUX) OCCUPANCY, ECONOMIZER POWER, SIMPLE DEHUMIFICATION, ACCESSORY LOOP STAGE, ACCESSORY LOOP AUX CONTROL POINT
DO2	HEAT 1
DO3	HEAT 2
DO4	HEAT 3, REVERSING VALVE O OR B, LOW SPEED FAN
DO5	SUPPLY FAN
DO6	COOL 1
DO7	COOL 2
DO8	COOL 3, LOW SPEED FAN

LCBS Connect Solution

How to Set up Alerts



Forms, How to do it

Honeywell Proprietary

May 12, 2017

A

Step A. User Defined Analog Alerts Setup Process

How to Set Up Alerts

HVAC Unit Name	

Select one or more HVAC Units. One is acceptable to start. Set up your own alerts below!

Alert Type	SMS Alert Name	Priority	Point Name	Delay Time	Limit	E-Mail Alert Name	Notes

B

Step B. Pre-Defined Alerts Setup Process

How to Set Up Alerts

HVAC Unit Name	

Select one or more HVAC Units. One is acceptable to start. Set up your own alerts below!

Pre-Defined Alert Name	SMS Alert Text	Priority	Threshold Limit	Delay Time	E-Mail Text

Alert Type: Pre Defined
Pre-Defined Alert: Fan Current, Static Pressure, Digital Input; Proof of Compressor Current; Proof of Heating ΔT, Proof of Cooling ΔT.
Threshold Limit: Digital, 0-2.0 in. wc, 0-10.0 amperes

C

Step C. Select System Defined Alerts Setup Process.

How to Set Up Alerts

HVAC Unit Name	

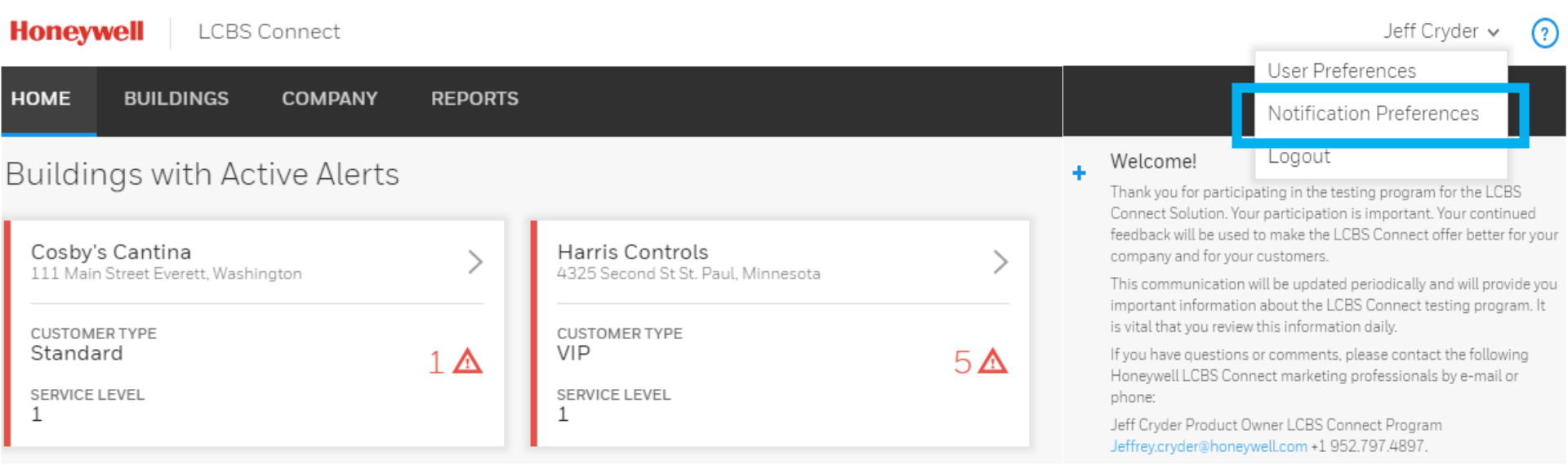
Select one or more HVAC Units. One is acceptable to start. Set up your own alerts below!

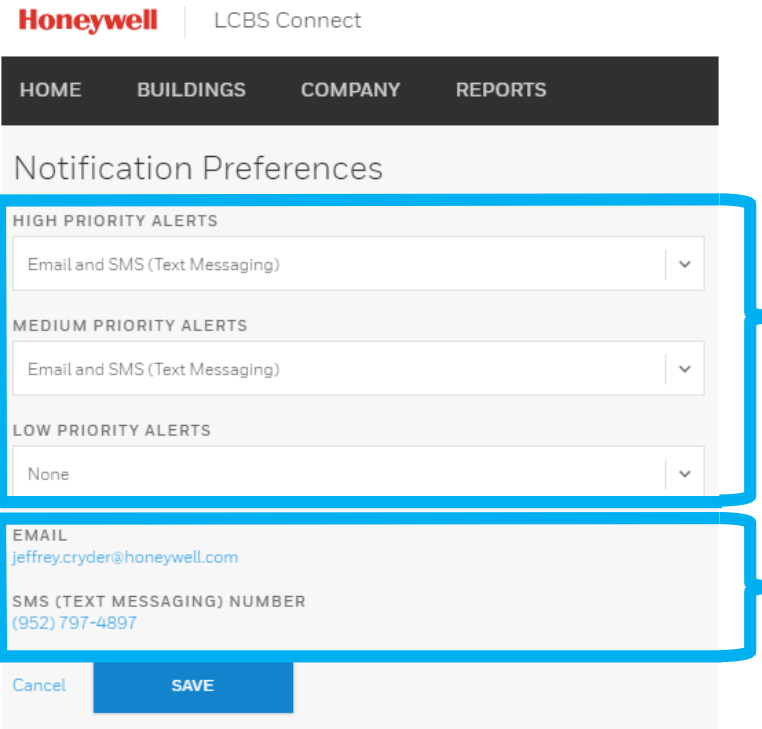
Alert Type	SMS Alert Name	Priority	Name	Delay Time	Limit	E-Mail Alert Name
Offline Alert	Gateway Offline*	H*	System Assigned Gateway Name	10*		
Offline Alert	Controller Offline*	H*	Controller Name	10*		
Offline Alert	Sensor Failure	H*	Pre Assigned Sensor Name	10*		

System Defined Enter Alert Name Enable in Alert List	My Notes

You can't change system define system parameters. You "enable" or leave them "disabled" in alert list.

B Step B. Important Reminder! Before setting up alerts, set your alarm preferences!



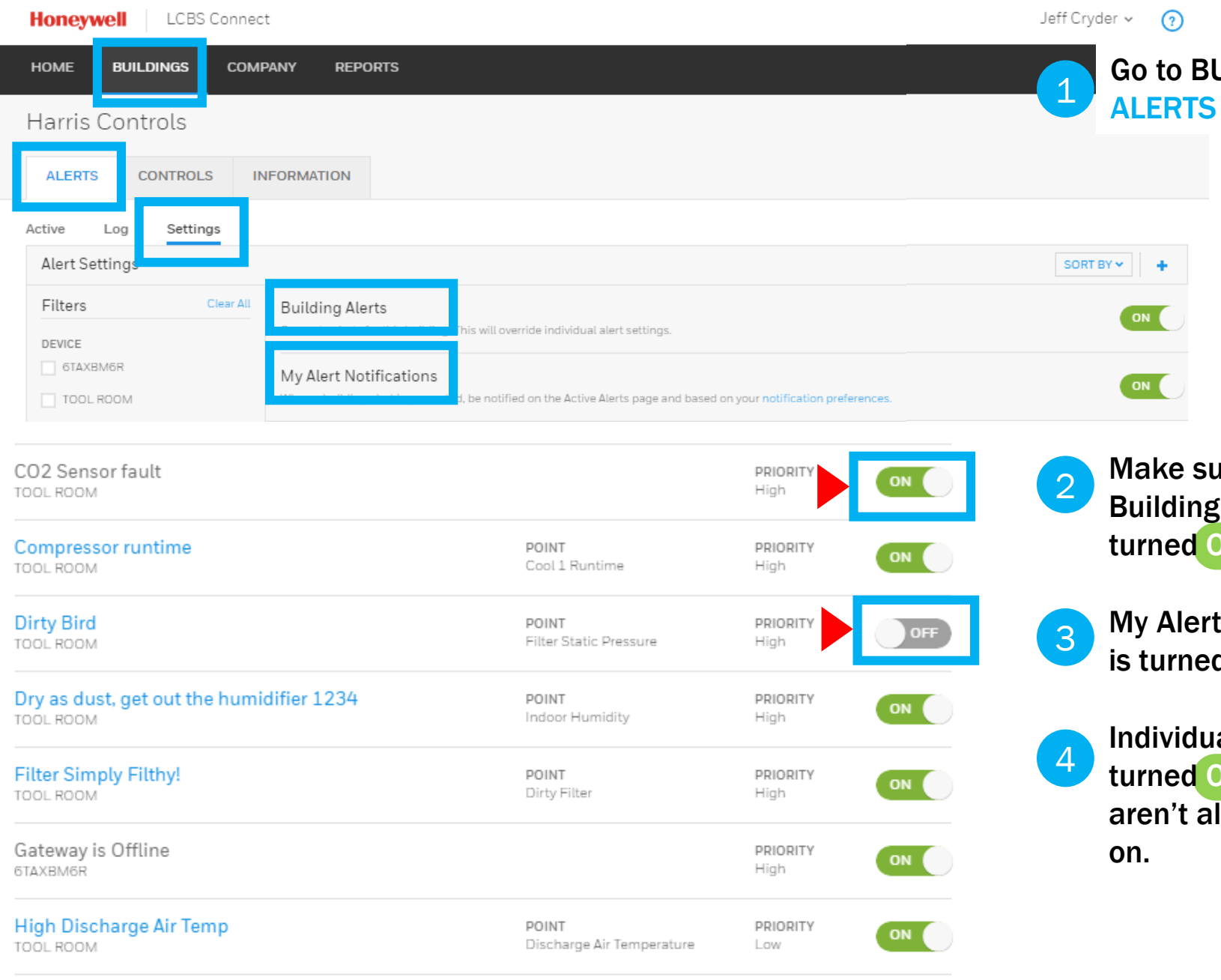


Select SMS messaging and, or
Select E-Mail messaging and, or
Select None for High, Medium, Low Priority Alerting

Add E-Mail Address – Address you want to get alerts at.
Add Cell Phone Number – Telephone you want to get alerts at.

C Step C. Important Reminder! Turn ON building alerts!

How to Set Up Alerts



1 **Go to BUILDINGS > ALERTS > Settings**

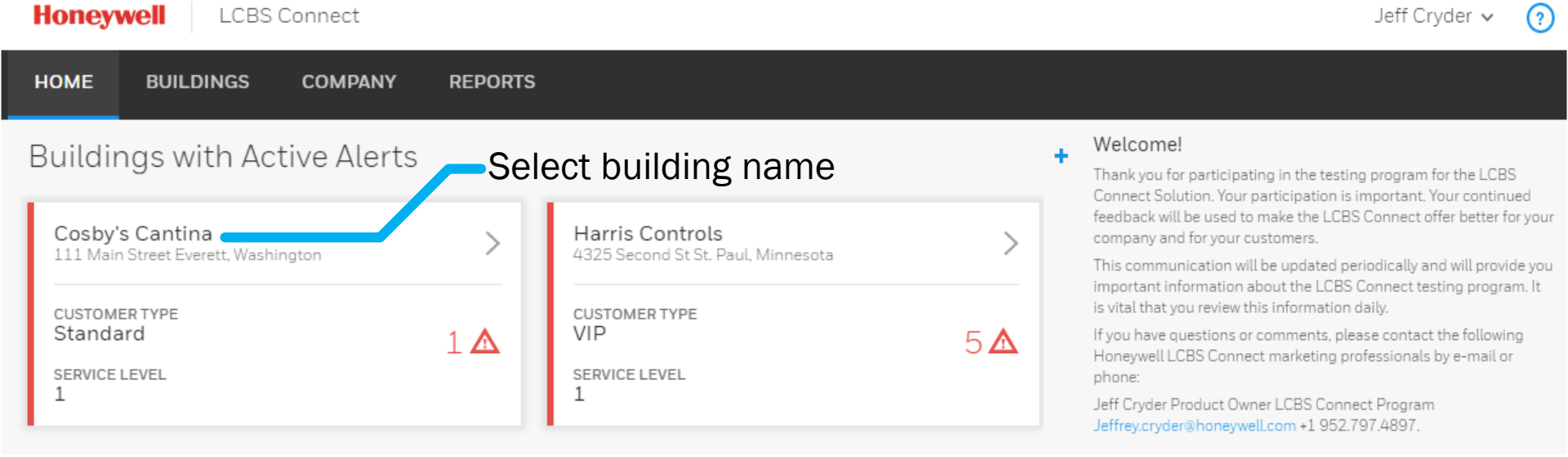
2 **Make sure that Building Alerts are turned ON**

3 **My Alert Notifications is turned ON**

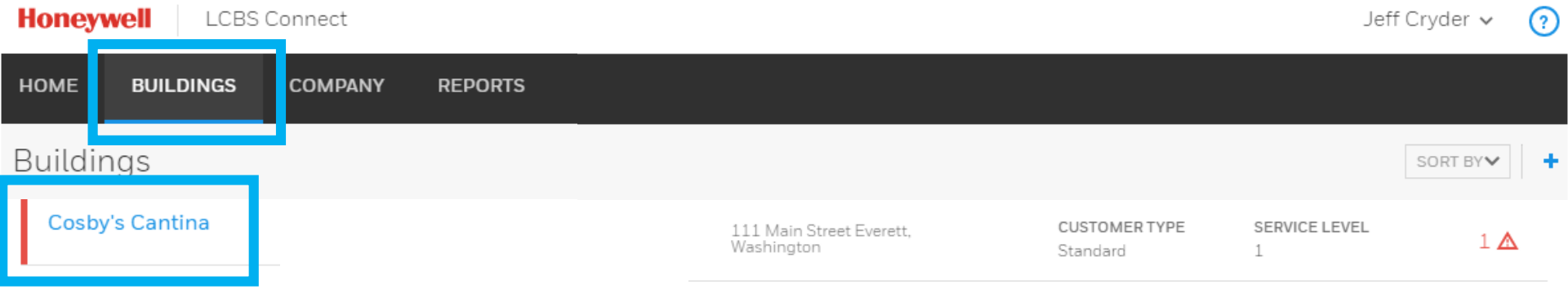
4 **Individual alerts are turned ON if they aren't already turned on.**

How to Set Up Alerts

1 Step 1. Log in.

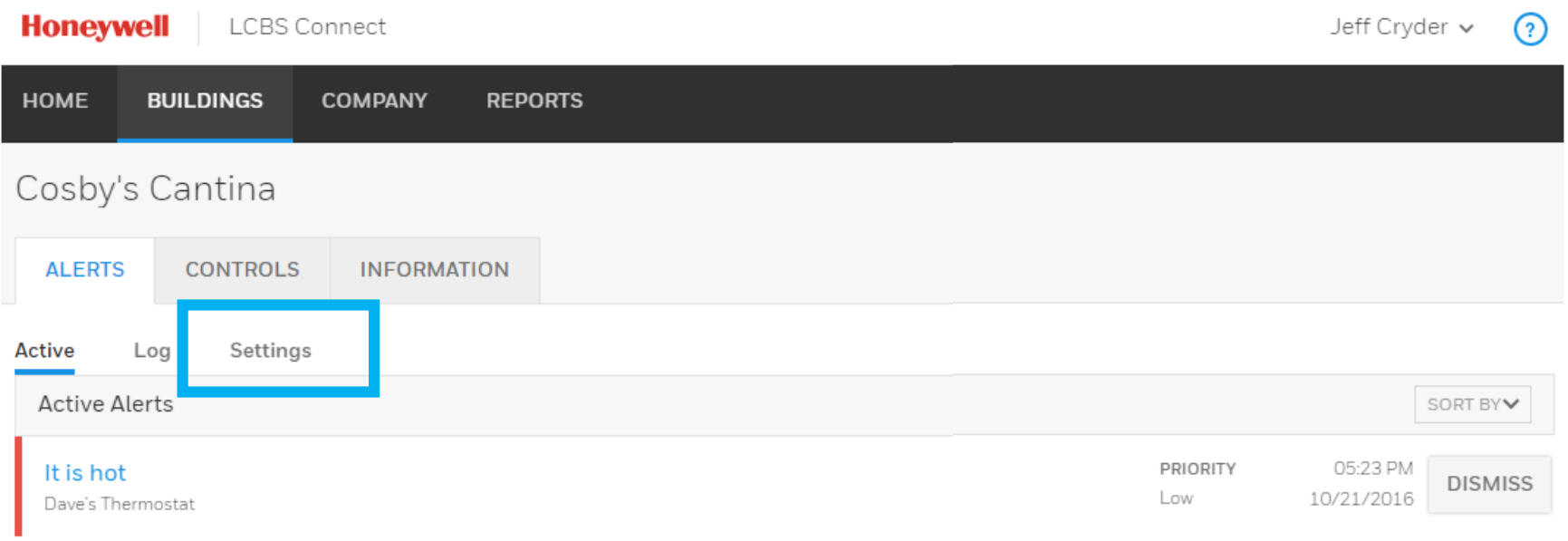


2 Step 2. Select “BUILDINGS” from Menu and then…

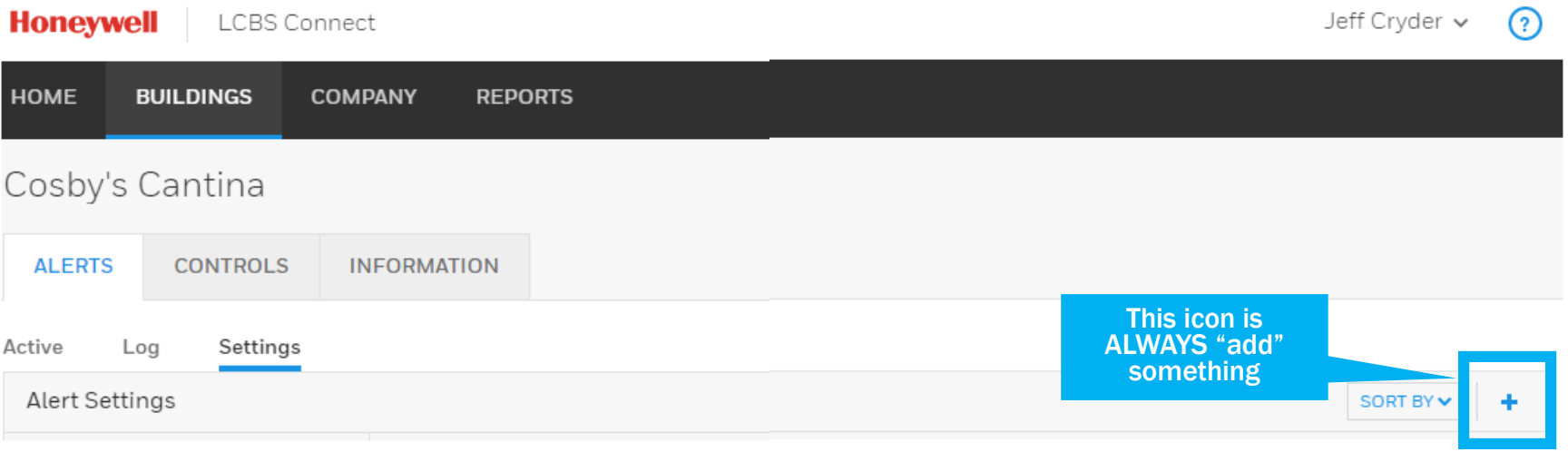


3 Step 3. Select “COSBY’S CANTINA” your building name from Buildings submenu.

4 Step 4. Access Alert Setup

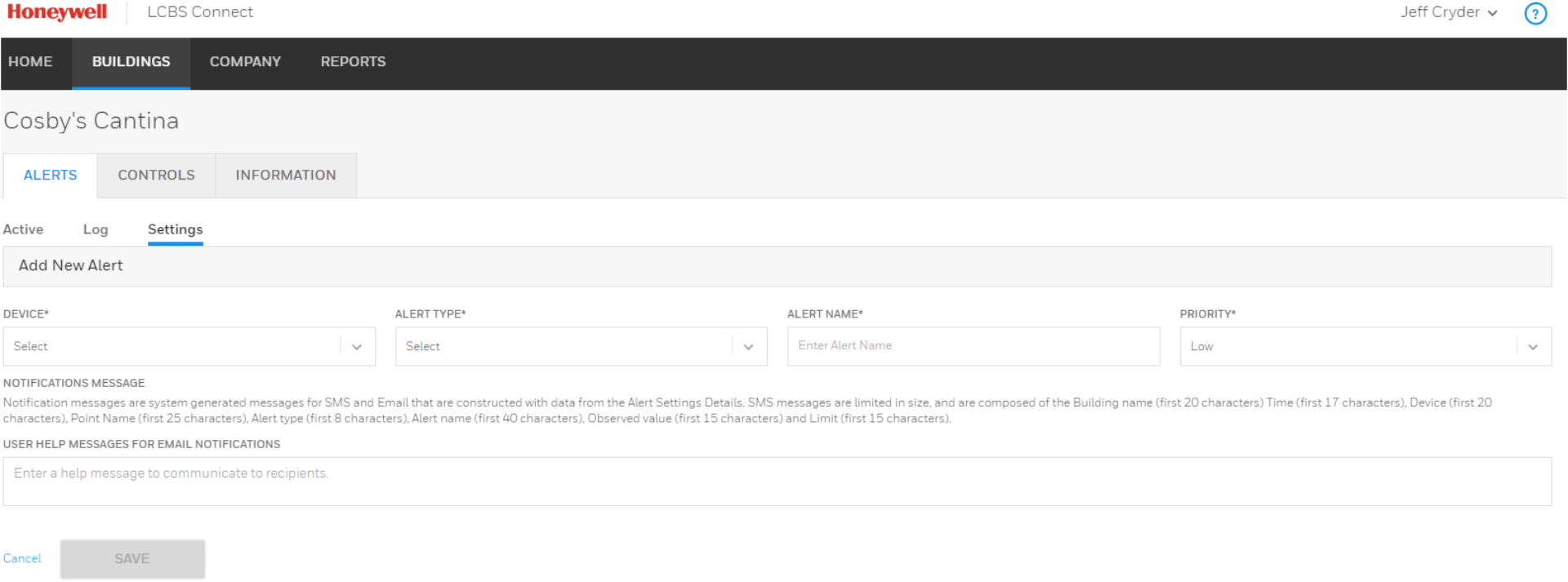


5 Step 5. Move pointer over "+" and Select to set up a new alert

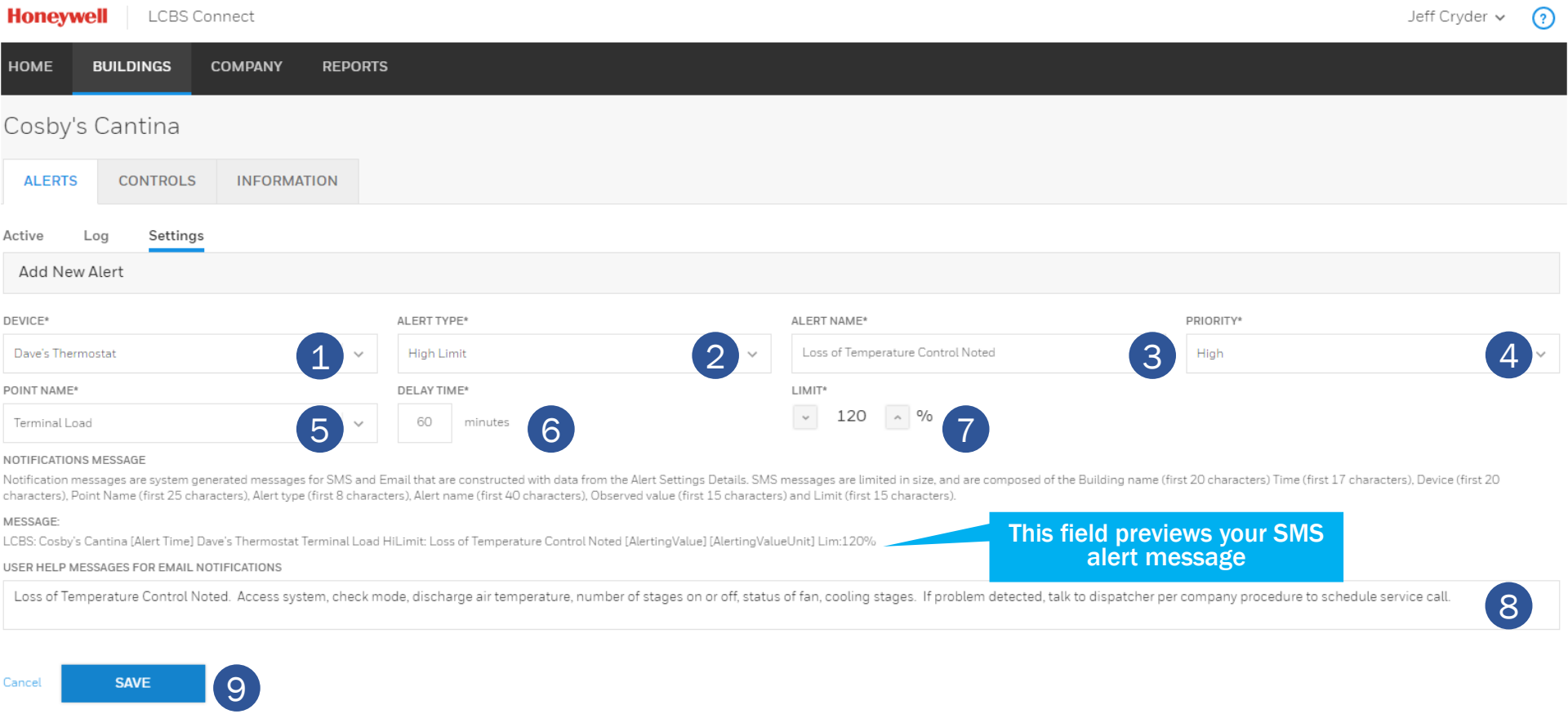


6 Step 6. Add New User Defined Analog Alerts

How to Set Up Alerts

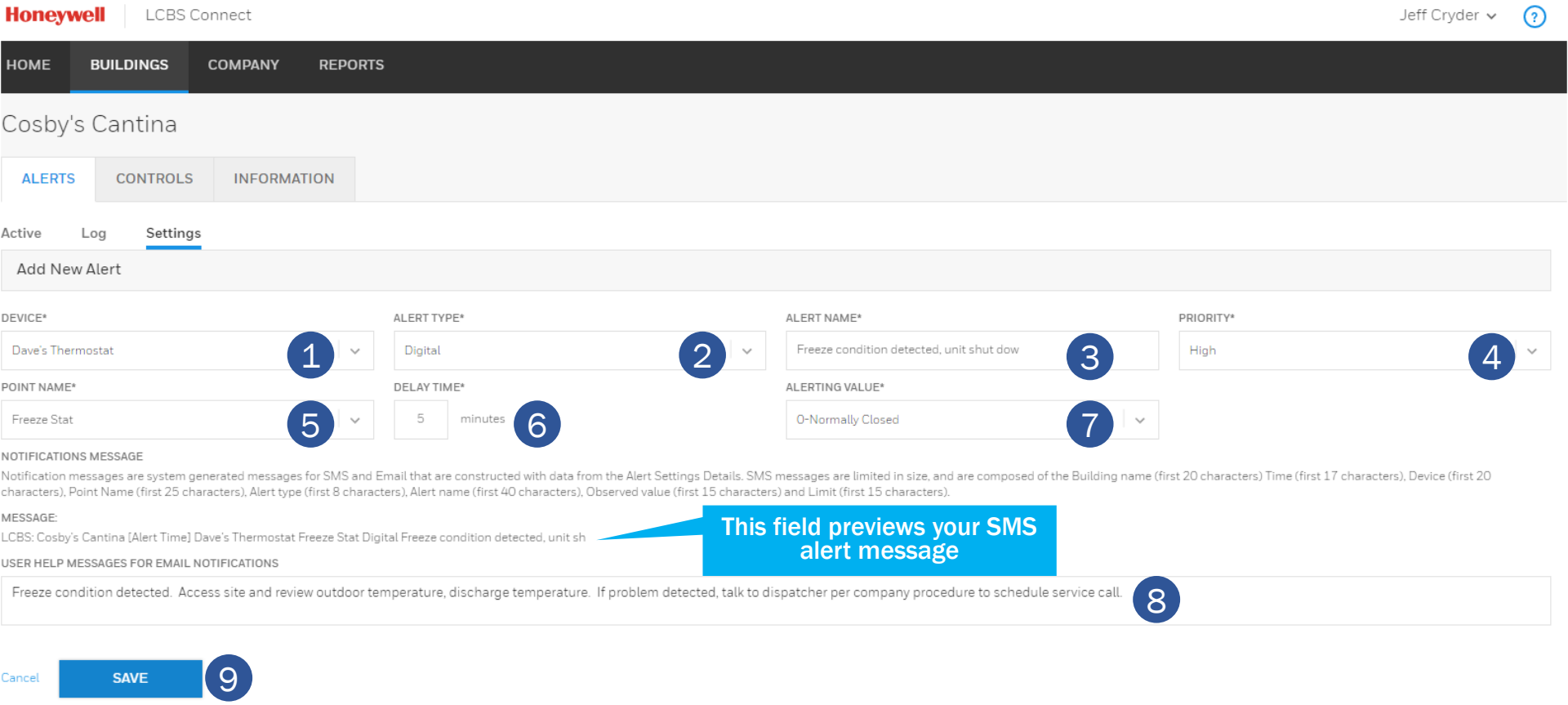


7A Step 7A. Add New Analog Limit Alert



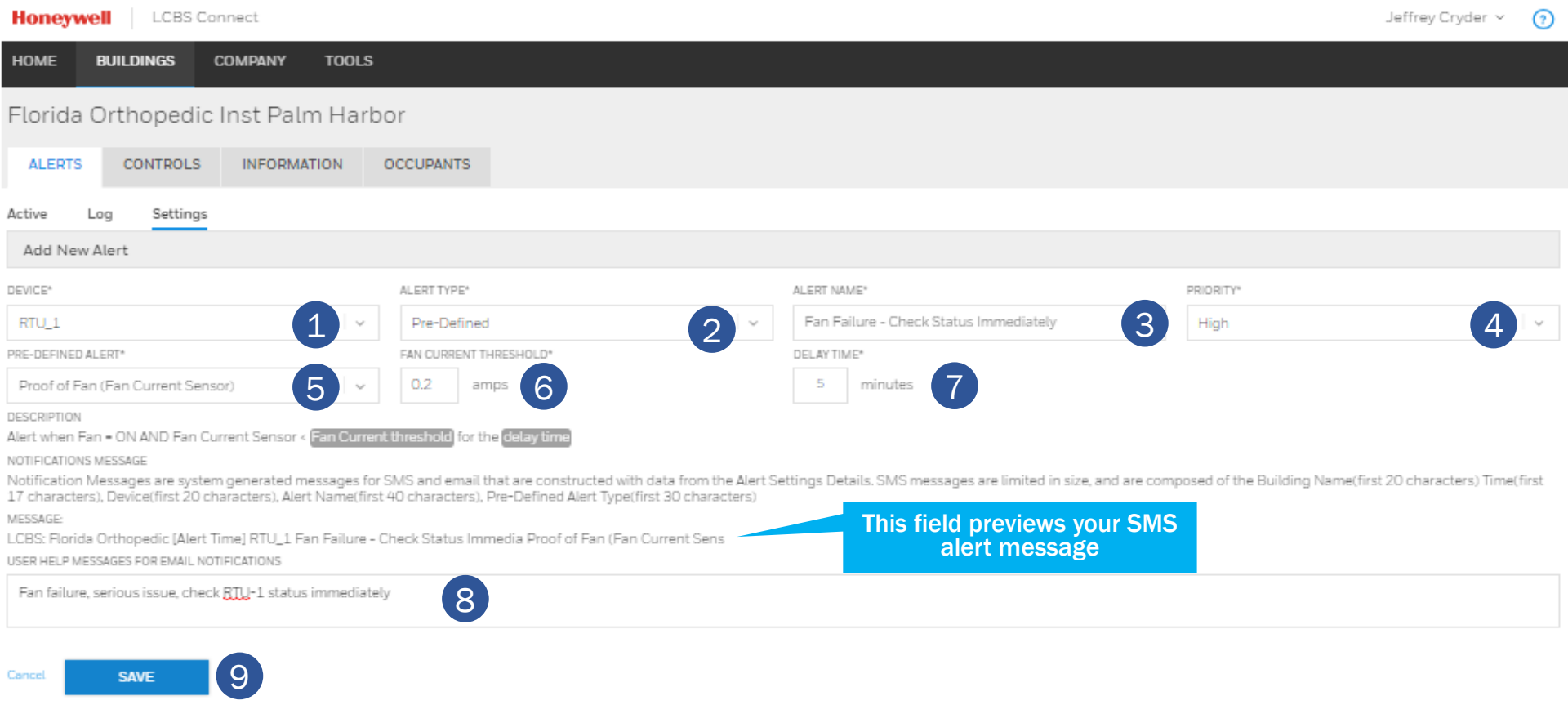
1. From “DEVICE” drop down list box, select the name of the HVAC unit you want to define alerts for.
2. From “ALERT TYPE” list box, select high or low limit.
3. In “ALERT NAME” type up to 40 character message describing alert.
4. From “PRIORITY” list box, select priority level, high medium or low.
5. From “POINT NAME” list box, select name of analog point subject to alert.
6. In “DELAY TIME” input box, enter delay time, hysteresis.
7. In “LIMIT” input box, use up and down buttons to select value to be limited on.
8. In “USER HELP MESSAGE…” enter extended alert message.
9. Select “SAVE” to save your work.

7B Step7B. Add New Digital Limit Alert.



1. From “DEVICE” drop down list box, select HVAC unit
2. From “ALERT TYPE” list box, select digital.
3. In “ALERT NAME” type up to 40 character message describing alert.
4. From “PRIORITY” list box, select priority level, high medium or low.
5. From “POINT NAME” list box, select name of digital point subject to alert.
6. In “DELAY TIME” input box, enter delay time, hysteresis.
7. In “ALERTING VALUE” input box, select the value that will initiate an alert, either “normally open” or “normally closed contact.
8. In “USER HELP MESSAGE…” enter extended alert message.
9. Select “SAVE” to save your work.

7C Step7C. Add Pre Defined Alerts



1. From “DEVICE” drop down list box, select HVAC unit
2. From “ALERT TYPE” list box, select pre-defined.
3. In “ALERT NAME” type up to 40 character message describing alert.
4. From “PRIORITY” list box, select priority level, high medium or low.
5. From “PRE DEFINED ALERT” list box, select name of alerting type to define; fan, compressor, heating, cooling operation.
6. In “FAN CURRENT THRESHOLD” input box, enter amperage limit. For pressure, select inches water column.
7. In “DELAY TIME” input box, input the time delay before alert is recognized.
8. In “USER HELP MESSAGE…” enter extended alert message.
9. Select “SAVE” to save your work.

Honeywell
THE POWER OF CONNECTED | Building

OCCUPANT MANUAL

How to Use the LCBS Connect™ Online Platform

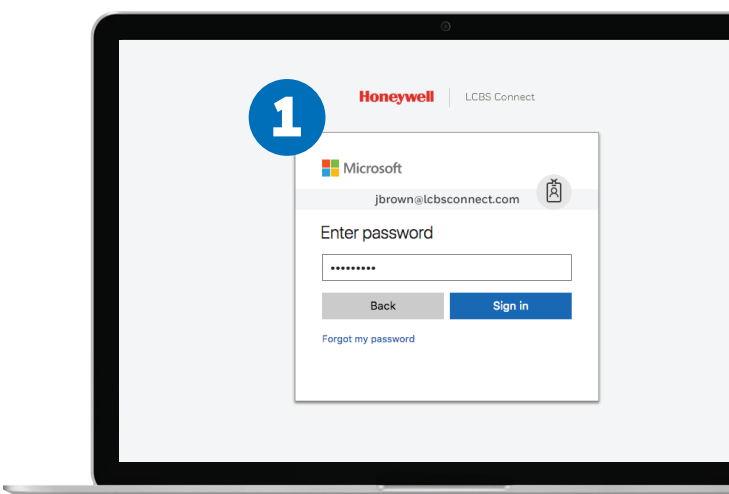
LCBS Connect™

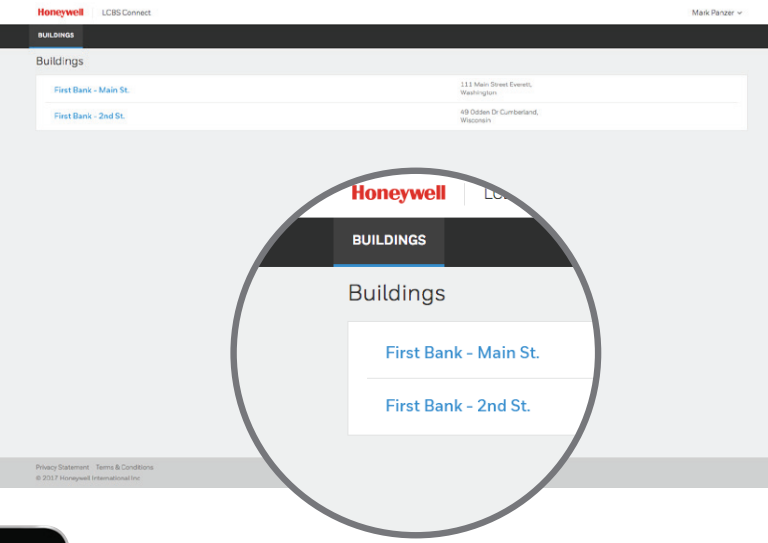
Welcome to LCBS Connect,™ which uses cloud connectivity so your HVAC service provider can monitor your building's systems 24/7 to speed repairs and maintain energy efficiency.

LCBS Connect features a dashboard where you can view and update your building's HVAC information. **To get started,** reference the email invitation you received from your Honeywell LCBS Connect contractor. It should contain a link to begin the setup process as well as a temporary username and password.

If you cannot locate this information, contact your LCBS contractor.

Complete the username and password fields, and then select Sign In. ▼



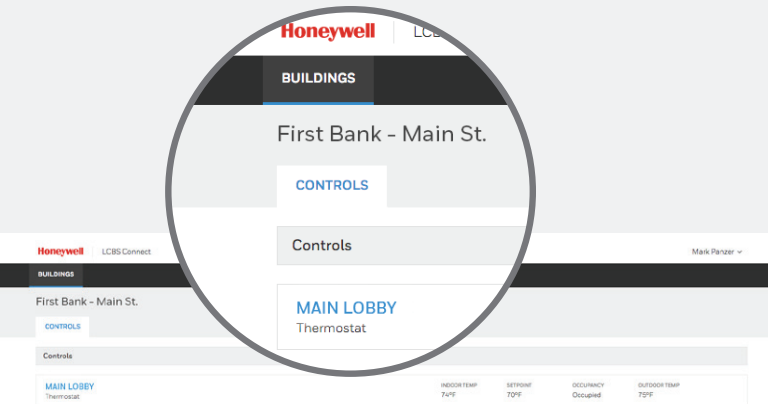


2 After you sign in, all of your buildings will be listed on this page. Select your building.

LCBS Connect uses Cloud-Based Connectivity

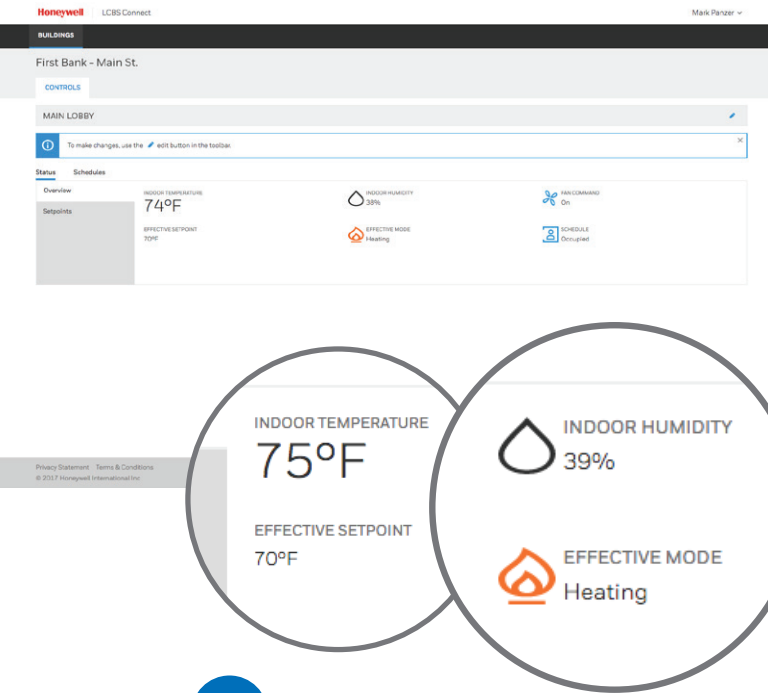
- MOBILE NOTIFICATION
- REMOTE DIAGNOSTICS
- SYSTEM TRENDING
- OPERATIONAL EFFICIENCIES

Building Owners in 2016 saved up to 29% on energy costs using LCBS Connect. Use these tools and you can too!



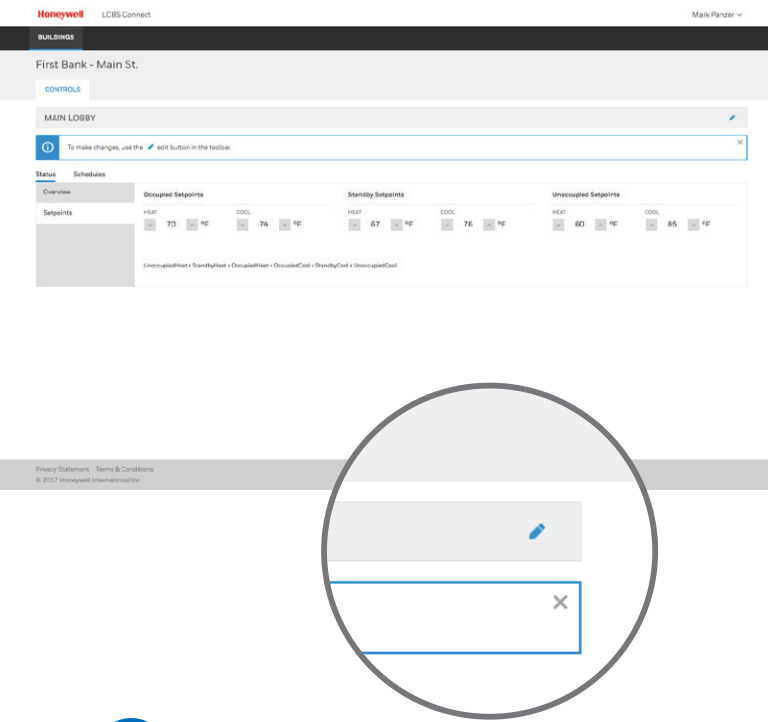
3

Select the HVAC you want to view.



4

View the status, schedule, and setpoints for your building's zone.



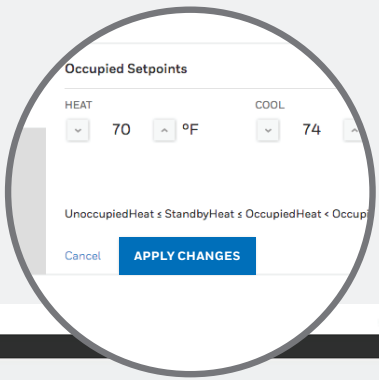
5

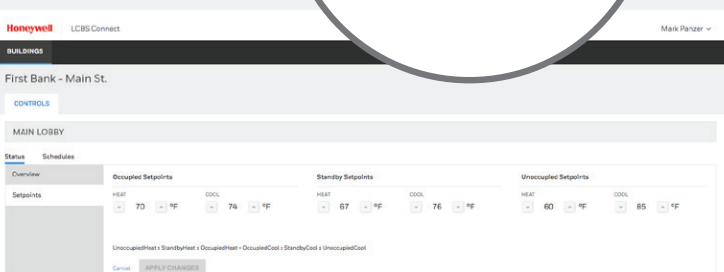
To modify your settings, select the blue edit pencil in the upper right corner. If needed, change the setpoints using the up or down arrows.

6

If you make changes, the Apply Changes button will turn blue. Click that button to save your settings.

The software allows you to go back and cancel at anytime.



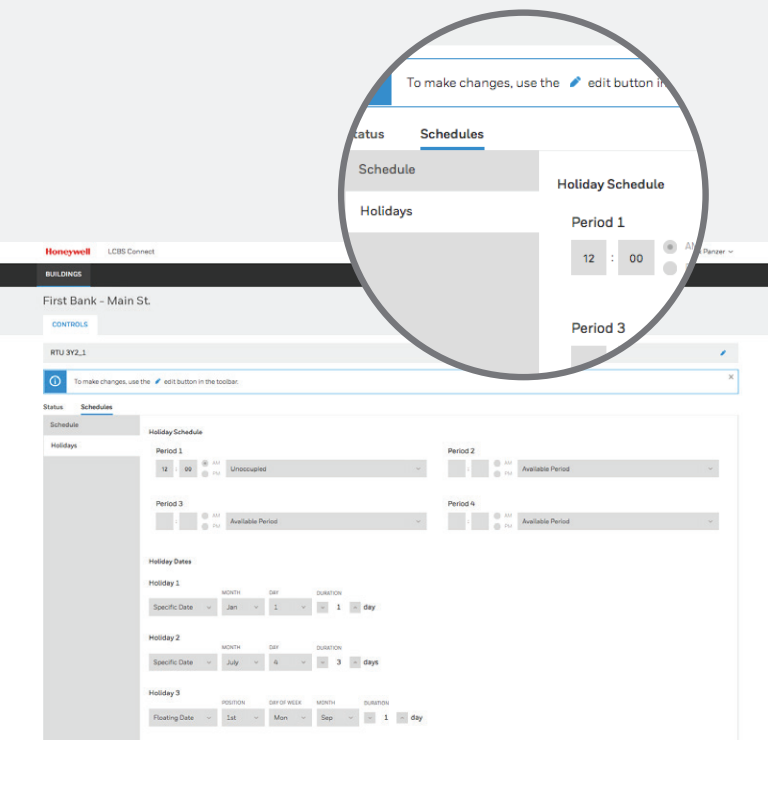


7

Enter your building's HVAC schedule for each day of the week. Click Apply Changes to save your settings. Use the Copy Schedule button to duplicate that day's settings to other days.

8

To save energy and money, input the dates and times your building(s) will be vacant for holidays.



For more information

To learn more about the capabilities of your LCBS Connect system, visit **LCBS.Honeywell.com.**

Honeywell

Home and Building Technologies
715 Peachtree Street NE
Atlanta, GA 30308

01-00093 | PM | 12/17

Honeywell

LCBS Connect End–User Security Guide

TECHNICAL REFERENCE MANUAL

CONTENTS

31-00131-01

INTRODUCTION AND INTENDED AUDIENCE

This manual contains security-related information to guide the contractor, end-user or owner of Honeywell LCBS Connect to plan, install, operate, maintain and decommission it.

It is the responsibility of the contractor, end-user or owner to ensure proper understanding of the information in this manual and ensure proper security of the LCBS Connect System. The information in this manual is intended to provide guidance for the contractor, end-user, or owner on current industry practices; provided, however, it is the responsibility of the contractor, end-user, and owner to ensure the proper and secure installation, operation, maintenance, and decommissioning of the Honeywell LCBS Connect System.

THE LCBS CONNECT SYSTEM IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND. FURTHER, HONEYWELL DOES NOT WARRANT, GUARANTEE, OR MAKE ANY REPRESENTATIONS REGARDING THE USE, OR THE RESULTS OF THE USE OF THE LCBS CONNECT SYSTEM IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, SECURITY, TIMELINESS, OR OTHERWISE. THE ENTIRE RISK AS TO THE RESULTS AND PERFORMANCE OF THE LCBS CONNECT SYSTEM IS ASSUMED BY THE CONTRACTOR, END-USER, AND OWNER. IF THE LCBS CONNECT SYSTEM IS DEFECTIVE OR INOPERATIVE, THE CONTRACTOR, END-USER, AND OWNER, AND NOT HONEYWELL ASSUMES THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. THE CONTRACTOR, END-USER, AND OWNER AGREE TO COMPLY WITH ALL INDUSTRY AND HONEYWELL STANDARDS WITH RESPECT TO CYBERSECURITY. HONEYWELL DISCLAIMS ALL WARRANTIES INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, TITLE AND FITNESS FOR A PARTICULAR PURPOSE.

UNDER NO CIRCUMSTANCES WILL HONEYWELL BE HELD LIABLE FOR ANY HARM RESULTING FROM DOWNLOADING OR ACCESSING ANY INFORMATION OR MATERIAL THROUGH THE LCBS CONNECT SYSTEM, ANY DELAY OR FAILURE IN PERFORMANCE RESULTING DIRECTLY OR INDIRECTLY FROM ACTS OF NATURE, FORCES OR CAUSES BEYOND ITS REASONABLE CONTROL, INCLUDING, BUT NOT LIMITED TO, INTERNET FAILURES, COMPUTER EQUIPMENT FAILURES, TELECOMMUNICATION EQUIPMENT FAILURES, OTHER EQUIPMENT FAILURES, WIRING, INTERNET SERVICE PROVIDERS, MOBILE DEVICE CARRIERS, SATELLITE PROVIDERS, ELECTRICAL POWER FAILURES, SECURITY BREACHES, STRIKES, LABOR DISPUTES, RIOTS, INSURRECTIONS, CIVIL DISTURBANCES, SHORTAGES OF LABOR OR MATERIALS, FIRES, FLOODS, STORMS, EXPLOSIONS, ACTS OF GOD, WAR, GOVERNMENTAL ACTIONS, ORDERS OF DOMESTIC OR FOREIGN COURTS OR TRIBUNALS, NON-PERFORMANCE OF THIRD PARTIES, OR LOSS OF OR FLUCTUATIONS IN HEAT, LIGHT, OR AIR CONDITIONING.

There can be no assurances whatsoever that the LCBS Connect System will protect any individual or his or her property from harm. Appropriate safety precautions must always be taken and experienced installers and operators must be utilized when installing, setting up, operating or maintaining any building systems. Incorrect processes may result in property loss, severe injury, or death. Honeywell assumes no responsibility or liability for any injury or damage to any persons or property resulting from the use of the LCBS Connect System.

SYSTEM OVERVIEW

Fig. 1 is a system diagram of the LCBS Connect system in an example installation in a corporate network.

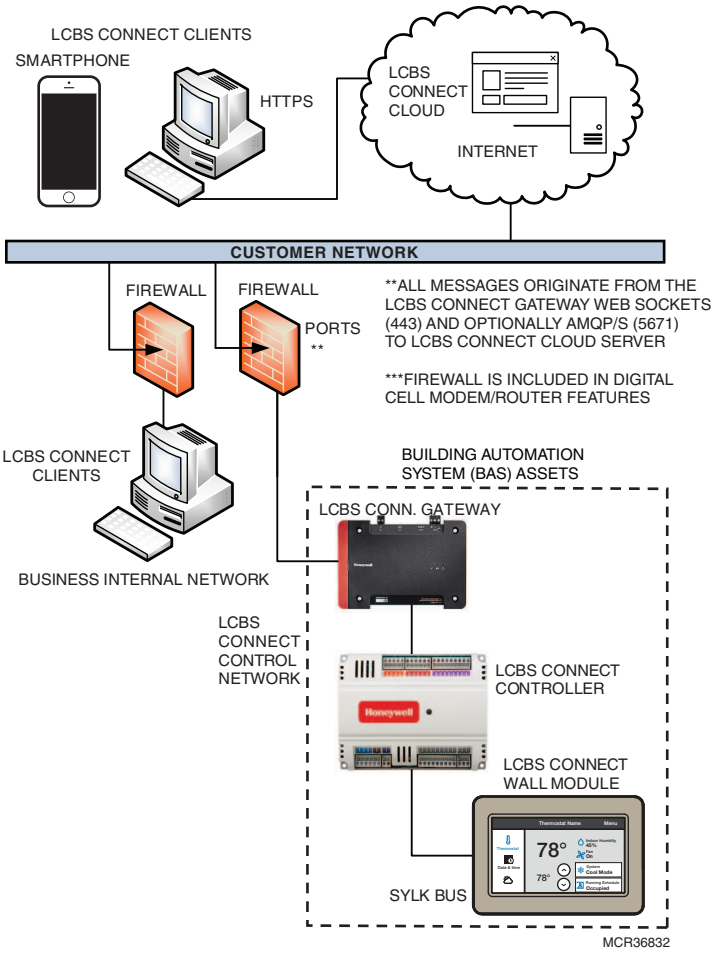


Fig. 1. Example: LCBS Connect system installed in a corporate network.

Fig. 2 is an optional system diagram of the LCBS Connect system for use in the special case that requires a digital broadband provider network for internet access.

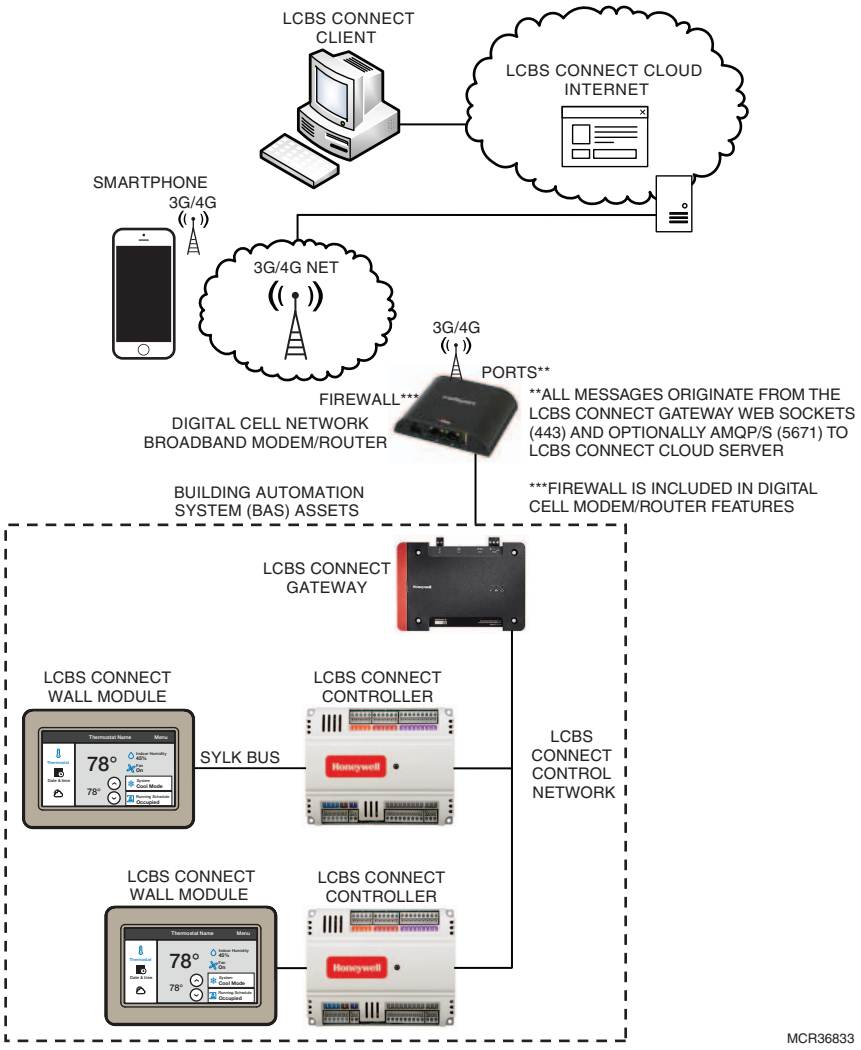


Fig. 2. Example: optional system diagram of LCBS Connect system for use with a digital broadband provider network.

Some key elements of the diagram are:

Internet/Intranet/Customer Network: This is a simplified, logical network representation of all networks outside of the LCBS Connect scope.

The network provides access to the Internet so that the LCBS Connect Gateway can communicate and download operating system updates. It is a requirement for the customer to provide a connection from the gateway to the internet so that the gateway can communicate with the LCBS Connect Cloud.

LCBS Connect is accessed through the Internet through a LCBS Connect client such a PC running a browser, a tablet or a smart phone.

A customer network LCBS Connect client does not access the LCBS Connect gateway directly but will communicate to the LCBS Connect Cloud applications.

LCBS Connect Clients: The user will be able to access their buildings under management through a client browser. The web browser connects securely via HTTP/S to a LCBS Connect Cloud Server. The LCBS Connect Cloud Server is in the Honeywell Cloud which communicates securely to the buildings and LCBS Connect Gateway.

LCBS Connect Cloud: LCBS Connect servers that host the LCBS Connect application which includes remote monitoring, control and other LCBS Connect applications and services.

Firewall: The firewall is used to create the trusted network and prevents unrestricted access to local computers and network resources. The firewall is used to protect the trusted/internal network from unwanted intrusions from the internet. A firewall is typically installed between the facilities network and the general internet.

LCBS Connect Wall Module: A color touch screen wall module interface with integrated temperature and humidity sensor that sends and receives information from the LCBS Connect controller and gateway. The LCBS Connect Wall Module talks to the LCBS Connect controller through the Sylk bus.

LCBS Connect Controller: The physical controller mounted in the Roof top unit.

LCBS Connect Gateway: The device linking the LCBS Connect controllers to the Internet and Honeywell Cloud. The LCBS Connect system will not react to any communication that is not initiated by the gateway. The gateway also connects the LCBS Connect controller through the LCBS Connect control network bus.

Digital Network Broadband Modem/Router/Firewall: An alternative network option in place of an on premise Customer Network. The broadband modem/router provides access to internet without using a customer network using a cellular 3G/4G network.

The cellular network broadband Modem/ Router solution is to facilitate a situation where requirements specify a separate network or there is no other way to get an internet connection to the site.

Access from the control system to the World Wide Web should be clearly justified based on control system operational requirements.

For the LCBS Connect solutions, the AMQP/s and Web Sockets(HTTPS) secure protocols are used for all communications. Communications are initiated from inside the firewall (LCBS Connect Gateway) to a known endpoint (LCBS Connect Cloud).

The secure HTTPS is used within the LCBS Connect Cloud. For example: communications from a LCBS Connect Client Browser to the LCBS Connect Contract portal.

LCBS Connect Network Bus: This is the LONworks communication network between the LCBS Connect gateway and controller and is designated by “Net” on the gateway’s connection labels.

SYSTEM DESIGN AND PLANNING

Physical Security of Components

It is important to have a plan for physical security of system components. It is recommended that the contractor identify the security needs of the building owner and provide guidance for implementation in addition to the requirements of the building owner.

It is recommended that the organization responsible for providing security for network assets be involved in the planning. The Building owner/customer’s IT groups needs to approve and connect the LCBS Connect gateway to the system so that the IT system will work with the LCBS Connect gateway through the corporate network.

Physical security controls, such as a locked cabinet or equipment room that restricts physical access to the LCBS Connect gateway and controllers are necessary to prevent system tampering, power interruption, and other security issues.

Ensure that LCBS Connect components requiring high reliability are protected with secure power sources and emergency power systems. Honeywell recommends strongly that you consider reliable power for the LCBS Connect control system. System reliability is an important security issue and following these requirements and recommendations allows continuous monitoring and ensures HVAC control system reliability.

IT Network

LCBS Connect system requires a connection to the public internet in order to support remote monitoring and operation of the system.

Firewall setup may require coordination with your IT provider staff for network provisioning and testing. Proper coordination and planning with IT staff will result in a secure and fast installation of the LCBS Connect system.

To ensure the cyber safety of your system and data, Honeywell requires you to use a network firewall. Note that the system can functionally operate without the use of a firewall, but it is not safe nor recommended.

Honeywell recommends strongly that you setup the Firewall including ports that are essential to maintaining the designed security protections.

The IT group and contractor need to test communications from the LCBS Connect gateway (using ports 443 and 5671 originating from the gateway to outbound) to the Honeywell Cloud Server. This test can be as simple as plugging the gateway to the wall via power and Ethernet.

Honeywell recommends that network settings be planned and recorded.

IF a static IP address for the gateway is required, then refer to the instructions provided on the LCBS Connect Cloud detailing how to do this via the LCBS Connect wall module advanced configuration screens.

Honeywell strongly recommends that Point of Sale (POS) and other critical business networks be kept separate from the LCBS Connect gateway through network segmentation. Honeywell will not accept any liability if this recommendation is not adhered to.

See additional notes in Appendix 1 on IT network notes.

See additional notes in Appendix 4 for Installation Security Issues

See additional information in Appendix 8 for installation of 3g/4g Data Modem Routers.

LCBS Connect Controller Configuration

LCBS Connect controller configuration information is recommended to be stored in locally accessible backup records for each installation site to allow rapid recovery in case of emergency or internet loss. It is recommended that the contractor keep a record of individual RTU names, configuration, wiring, and setpoints/schedules.

LCBS Connect Communications Bus and Sylk Bus

It is required that physical security access to LCBS Connect communications bus and wall module bus wiring be accomplished by
1) installing wiring in physically inaccessible locations that restricts physical access to the LCBS Connect communications bus
Or
2) installing wire in conduit.

This required physical security access protection is important to prevent security threats to the control system. Failure to protect the LCBS Connect communication bus and Sylk bus can lead to critical security issues. For example, data loss or corruption could result due to not following the required protection for the LCBS Connect communication bus.

See Appendix 2 for Installation Best Practices

LCBS Connect Cloud Application

Access to the LCBS Connect Cloud is granted through the use of secure and unique passwords. Like your bank password, care should be taken to protect user identity. Users invited to participate in LCBS Connect should also be restricted to essential personnel only.

See Appendix 3 for Security Maintenance Tasks

LCBS Connect Clients

Each client for LCBS Connect must be protected as a secure platform. Maintaining a secure client platform will involve OS updates, anti-virus software, and protection of local ports from attacks including spam, phishing, and physical compromise.

See Appendix 4 for Installation security issues

See Appendix 5 for LCBS Connect Client security information

NETWORKS AND FIREWALLS

This section contains information on securely configuring networks and firewalls.

Table 1 describes the ports and processes in a LCBS Connect system. This includes the processes that are part of PC web browsers and network devices such as router.

Table 1. Network ports and firewall settings.

Default Port/ Protocol	Purpose	Device Name	Change from Default	Description	Allow through BAS Firewall?	Note
80/TCP	Access to public web from LCBS Connect network	Network Router / Broadband Cell Router/Browser	Yes	Access to public web from LCBS Connect may be needed if a workstation computer on LCBS Connect network requires access to internet. Incoming port can be blocked.	Incoming port: blocked; Outgoing port possibly open	1
443/TCP	Access to public web from LCBS Connect network and access to LCBS Connect Cloud servers from LCBS Connect Gateway	Network Router/ Broadband Cellular Router	Yes	LCBS Connect Gateway requires access through an outgoing port to LCBS Connect Cloud servers. Incoming ports can be blocked.	Incoming port: blocked; Outgoing port must be open for LCBS Connect Gateway	1
5671/AMQP	Access to LCBS Connect Server	Network Router/ Broadband Cellular Router	Yes	LCBS Connect Gateway requires access through port outgoing to LCBS Connect Cloud servers. Incoming ports can be blocked	Incoming port: blocked; Outgoing port must be open for LCBS Connect Gateway	
NOTES Many users expect that they only need to enter the web address for websites, so if HTTP is enabled, then the web server will automatically redirect the request to HTTPS. If this is desired, then this port must be allowed through the Windows firewall.						

See Appendix 6 for Additional Firewall and Network Intrusion issues

See Appendix 7 for Hardening and Physical Computer Issues

MAINTENANCE

Make sure LCBS Connect clients are running up to date virus software and comply with Corporate PC security standards.

The LCBS Connect gateway is associated with the building during commissioning and should be inspected periodically for connection. If there is no connection, the connection issues should be resolved in a timely manner.

DECOMMISSIONING

The LCBS Connect gateway is associated with the building during commissioning and should be removed after decommissioning. If the LCBS Connect gateway is not decommissioned from the LCBS Connect Cloud, the gateway will appear to work from a remote location like it is in the original building.

LCBS CONNECT INSTALLATION SECURITY CHECKLIST

Job Name:_____

Job Location: _____

Contractor: _____ Date: _____

IT Representative: _____ Date: _____

Complete the following security tasks for your installation.

- ❑ Design a secure installation considering both software and hardware vulnerabilities.
- ❑ Develop a Disaster and Recovery Plan.
- ❑ Develop a Backup and Recovery Strategy.
- ❑ Install, configure, and keep antivirus software updated on LCBS Connect Clients.
- ❑ Keep the LCBS Connect Client devices operating systems updated.
- ❑ Secure access to the LCBS Connect Client's operating system using user accounts.
- ❑ Secure access to LCBS Connect using LCBS Connect Clients individual user accounts.
- ❑ Set up monitoring and logging services to scan for unauthorized access on your LCBS Connect system
- ❑ Securely configure networks and firewalls.
- ❑ Set up network intrusion detection.
- ❑ Secure or eliminate wireless access points.
- ❑ Harden the network system to further safeguard against unauthorized access.
- ❑ Eliminate LCBS Connect Client anonymous logon capabilities.
- ❑ On LCBS Connect Client software, disable the caching of previous logon capabilities.
- ❑ Disable unused subsystems on LCBS Connect Clients. This adds risk to the LCBS Connect system.
- ❑ Deliver all required system information upon delivery to the system owner.
- ❑ Train end-users on security maintenance tasks at system delivery.
- ❑ Assess security risks.

APPENDIX 1 – IT NETWORK NOTES

Businesses with critical Point of Sale infrastructure (POS) or other important assets must use internal network segmentation. Proper network segmentation can be accomplished in a small business with the use of a security gateway or firewall.

Industrial Society of Automation / Industrial Electrotechnical Commission ISA/IEC 62443 Network and system security for industrial-process measurement and control is a recommended security standard that prescribes a clear definition of zones and network segmentation. IEC 62443-Segmentation allows the best control over access and security within an automation network.

NIST Special Publication 800-82 Revision 2: Guide to Industrial Control Systems (ICS) Security is a useful reference for security topics and is available at: http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-82r2.pdf

APPENDIX 2 – INSTALLATION BEST PRACTICES

LCBS Connect Communication Bus
Security of the bus also means that the bus is electrically reliable for communications. It is important the bus is installed with one wire type consistent throughout the whole gateway to controller connection as to eliminate reflections from bus wire impedance mismatches. Shielded wire is not recommended for normal installations. See installation instructions for details.

APPENDIX 3 – SECURITY MAINTENANCE TASKS

It is important to train end-users on documented security maintenance tasks

Disaster Recovery Planning
Creating, implementing, and maintaining a disaster recovery plan is import for the contractor and customer as the system can be restored in the event of a security breach or equipment failure. As a contractor, you may assist in helping the customer develop a plan or provide services to help implement and maintain the plan. The plan needs to ensure clearly documented procedures, document the person or organization responsible, and provide review of the plan during planned maintenance intervals.

Backup and Recovery Strategies
Performing backups of operating data is a risk mitigation task to secure your LCBS Connect system.

Important configuration information may be lost if there are failures due to a natural disaster, hardware or software failure, or computer virus.

Backup strategies should take into account hard drive failures, user errors, and permanent loss of computer connection, virus infection or other problems.

Do not store backup images on the same computer being backed up. If network drives are not available, store backup images to a connected drive using USB.

Configure your backup software to do full backup's weekly and incremental backups nightly to lower the load and performance impact of backup activities. Ensure that the data was backup up correctly after the backup is complete.

APPENDIX 4 – INSTALLATION SECURITY ISSUES

This section contains security issues and information on security issues related to each individual installation step for LCBS Connect.

Table 2. Installation Security Issues.

Step ID	Name	Security issues and information
1a	Plan, install, test Internet access with IT	Ensure physical and network security is in place and access to necessary ports is restricted. Router and firewall setting must be specified and tested. If a digital cellular broadband network is used, additional security accounts must be managed by the network provider. The signal strength at the installation location should be established with a test 3G/4G Router using the planned data plan provider in the actual installation location. The signal strength should be at or exceed 3 bars at the modem/router for greater than 95% of a day. Planning for maximum reliability may require an external antenna be mounted on the roof and connected to the Digital broadband router.
1b	Install LCBS Connect gateway in a physically secure location with power, network, controller communication bus	Ensure physical and network security is in place and access to necessary ports is restricted as necessary.
2a	Review power and I/O specifications for controller	Ensure physical and network security is in place and access to power, Sylk bus, I/O wires, and controller network wires are restricted.
2b	Mount controllers, wire power/sensors and plan power	
2c	Controller bus wiring planning and installation	
2d	Mount, wire LCBS Connect wall module	Ensure physical and network security is in place and access to power, Sylk bus, I/O wires, and controller network wires are restricted.
2e	Perform initial setup from LCBS Connect wall module – at least password MUST be completed	It is important to create controller name, create secure, unique password, and configure RTU locally to ensure security. If the controller already has a password, ensure that it has been set by the contractor per specification.
3a	Unplug IT LAN network connection to gateway. Power the gateway and diagnose local controller communications using lights on gateway. Troubleshoot local controller communication using wall module status screen and gateway lights. Solid green light indicates good communications to controller.	Ensure physical and network security is in place and access to power, network, Sylk bus, and controller network wires are restricted.
3b	Connect gateway to network and diagnose network gateway lights. Blinking Blue light will occur meaning the gateway is ready to be registered.	
4a	Honeywell creates distributor	Ensure password protection of distributor account. Ensure security of distributor password.
4b	Honeywell creates Contractor.	Ensure password protection of contractor account. Ensure security of distributor password.
4c	Honeywell links contractor to a designated distributor.	
4d	Honeywell invites distributor	

Table 2. Installation Security Issues.

Step ID	Name	Security issues and information
4e	Distributor accepts the invitation. Distributor now has username and temporary password. First login will request change to the temporary password.	Ensure secure email account and secure email platform app and OS.
4f	Distributor invites contractor.	
4g	Contractor accepts the invitation. Contractor now has username and temporary password. First login will request change to the temporary password.	Ensure secure email account and secure email platform app and OS.
4h	Contractor creates building and specifies a building owner. Contractor request access from building owner. Building owner accepts request. Now contractor can add and register gateway.	Ensure secure email account and secure email platform app and OS.
4i	(optional) Distributor invites additional users to help manage system	Ensure secure email account and secure email platform app and OS.
4j	(optional) Contractor invites additional users to help manage system	Ensure secure email account and secure email platform app and OS.
4k	Connect gateway to network and diagnose network gateway lights. Solid Blue light now indicates a registered gateway associated with a building communicating to the cloud.	Ensure physical security to gateway and communication bus.
4l	Additional configuration of controller occurs from cloud	Ensure audit log of changes. Ensure secure password of users.
4m	Contractor can access configurations, alerts and analytics via web page or receive text messages/email.	Authenticate users. Audit Logs of changes.
5a	Access to the wall module day-to-day operations has limited privilege. Contractor has more features available via password on wall module	Ensure wall module password is secure and not shared. Change wall module passwords as needed.
5b	Supported web browsers are Chrome, Firefox, Edge, Safari. User is responsible for maintaining password security and maintaining Platform security updates to OS, LCBS Connect application, and password security.	Ensure password protection of distributor, contractor, building owner and all delegates account. Ensure security of all password.
6	Gateway firmware is pushed remotely on scheduled intervals	Schedule regular audits to verify unused accounts are deleted. Automated password resets and complexity verification.
7	Cloud system security issues	Schedule regular audits to verify unused accounts are deleted.
8	Obsoleted users	Schedule regular audits to verify unused accounts are deleted.
9	Validate security	Regular tests of network security are performed and corrective action taken.
10	Disaster recovery plan created to allow system restoration after a security breach or equipment failure.	Plan tested and in place that allows for rapid recovery from security breach or equipment failure.
11	Backup of configuration information	Information of configuration must be documented and available to ensure risk mitigation for securing LCBS Connect.
12	Software and operating system security	Ensure up to date Virus protection, Virus signature file updates, and active antivirus scanning automation. Service packs and security updates to browser application and operating system.

APPENDIX 5– LCBS CONNECT CLIENT SECURITY INFORMATION

Software and Operating System Security

This section includes information to installing and configuring non-LCBS Connect software and the operating system.

Virus Protection
Although some modern threats can bypass even the best antivirus checks, antivirus software is still an essential element of a comprehensive security strategy.

Installing Antivirus Software
Install antivirus software on every computer in the network, including the LCBS Connect primary workstation,

LCBS Connect client workstations, and devices used for web browser access.

After installing antivirus software, check the Event Logs and ensure no errors are reported.

If the system starts experiencing failures, the inability to read or write files, the logs show deadlock errors, or the system shows any other unusual behavior, disable the antivirus software to see if the failures continue.

Note that some antivirus software may need to be completely uninstalled in order to be disabled.

Ensure Frequent Updates to Antivirus Signature Files
It is important to update antivirus signature files frequently by subscribing to the updates of your antivirus software vendor(s) and leveraging enterprise antivirus policies and practices when available. Since new viruses are released every day, the system will remain vulnerable to attack if the signature files are not updated at the same rate. Where it is not practical to perform updates daily, monitor reputable web sites that publish information about new virus attacks so that the system can be isolated if a specific threat appears.

Receipt of new signature files generally requires Internet access so that the files can be downloaded from the antivirus software vendor. If possible, set up servers for the controlled distribution of antivirus signature files.

Configuring Active Antivirus Scanning
Adopting an active virus scanning strategy as on-access scanning provides the best real-time protection for your system. Configure the virus scanner to run on-demand scans during regular, scheduled maintenance to catch any malicious files or programs which may be dormant on the computer.

Configure both on-access and on-demand scanning to:
- Scan the boot sectors of all disks.
- Move infected files to a quarantine directory and notify the user that an infected file was found.

Allow the user to clean up the infection.

Regularly review virus scan reports as part of the active scanning strategy.

Tuning Antivirus Scanning for System Performance
When formulating your virus scanning strategy you must take into account the potential impact on critical system resources. For example, if the LCBS Connect workstation is experiencing problems due to low system resources, you may need to:
- Ensure that antivirus software only runs when system resources on the computer are adequate to meet system needs.
- Limit system resources that are used by antivirus software during scanning.

To find the proper balance between browser workstation performance and virus protection you need to make configuration choices such as disabling scanning on reading of files and changing the default process-based scanning to per-process scanning. Do not automatically schedule full system scans, as this can result in severe degradation of performance, which could impact the ability of operators to respond to an incident.

Service Packs and Security Updates
An important part of the overall security strategy is to ensure that the operating system is kept up-to-date with the latest patches and updates. Before turning the system over to the customer, ensure that you have:
- Installed the latest supported web browser version.
- Updated Windows to the latest service pack supported by LCBS Connect (this information is available on the LCBS Connect web site or by contacting Technical Support).
- Configured Windows Update to automatically check for updates.

For the LCBS Connect primary workstation, discuss with the customer about how to automatically or manually apply updates. The customer may opt to install them manually in order to control when the LCBS Connect primary workstation gets rebooted. For client workstation computers, updates should be installed automatically.

User Accounts

Securing Access to the Operating System
LCBS Connect does not use Windows user accounts for application security; Windows user accounts are used to secure access to the operating system and still provide a very valuable layer of protection. Ensure that only authorized users have access to computers.

Windows User Accounts and Passwords
Access is gained to the Windows operating system by logging onto the computer using a user account name and password. This is true for both local and remote terminal services access. Because user accounts may be well known or easily guessed within an organization, the password becomes the prime vehicle for authentication. User account and password policies are therefore important security measures.

User and Password Policies and Settings
Since users are not authenticated using Windows, configure LCBS Connect so that each user has a unique login name and password. Ensure that when an employee, or any other user with permanent or temporary access,

leaves the organization or no longer needs access, their user accounts are disabled. For example, when a subcontractor is on the job working on the LCBS Connect HVAC system, they are given access to the system. Monitor their access while the work is in progress and then disable their credentials once the work is complete. In addition, because LCBS Connect software is available using a browser, ensure that the LCBS Connect user account is also disabled.

Follow Windows user and password policies to secure access to the operating system running LCBS Connect. As a general rule:
- Review user accounts on a regular basis.
- Disable or delete all unused accounts.
- Disable all anonymous accounts
- Disable all guest accounts.

Configure password policies so that Windows account passwords are difficult to guess and they are changed often. The following settings are suggested:
- Maximum password age set to 45 to 90 days – this forces the choice of a new password after this time. Configure the setting for the Administrator account shorter than a normal system user. A maximum of 30 days is recommended.
- Minimum password age set to 1 to 5 days— this prevents cycling passwords too rapidly
- Minimum password length set to 11 characters – This improves encryption and makes guessing harder. Using several words to form a phrase can make a stronger password that is also easier for the user to remember. For example, “My dog Fido has 50 fleas!” is a much stronger password, and much easier to remember, than “X$9d8oc-@Ek”
- Enforce password history set to 24 passwords remembered – This prevents reuse of the same password too quickly.
- Password must meet complexity requirements set to enabled improves encryption and makes guessing harder. Suggest requiring at least three of the following: Uppercase Character, Lowercase Character, Number, and Special Character
- Store passwords using reversible encryption set to disabled – this prevents passwords from being stored in (the equivalent of) clear-text.
- Account lockout threshold set to 5 invalid logon attempts – this prevents continual password guessing by disabling an account after the specified number of attempts. Consider disabling account lockout for operator (or other user) accounts where denial of service or loss of view would be detrimental to safety or the continued operation of the facility.
- Account lockout duration set to 30 minutes – this specifies the period of time during which a user will not be able to log on following an account lockout. (Note that the administrator can re-enable the account before the expiration of the specified lockout period.)
- Reset account lockout counter after 29 minutes --- this sets the time before the account lockout is reset to zero. For example, with the account lockout set at 10, and the lockout counter set at 29 minutes, lockout will occur if there are 10 invalid logon attempts within 29 minutes. Note that the lockout counter must be less than the lockout duration.

Service and Primary Workstation Accounts
Run Windows services and PC browser required by LCBS Connect under an account with the lowest possible set of privileges. The following classes of accounts are suggested in order of preference:
- Local service accounts.
- Local accounts with minimum rights.
- Domain accounts with minimum rights.
- The Network Service account.
- Local or domain user accounts belonging to the Local Administrators group.
- The local system account.

Monitoring and Logging

System Monitoring
Diligent system monitoring will help guard your system against unauthorized access. However, there is always the possibility that an attacker will succeed in circumventing all the safeguards and compromise the system. If this happens, it is important to discover the breach and prevent further damage as rapidly as possible. The earlier a system breach is detected and the more evidence that is captured, then the less damage is likely to occur and the greater the chances of identifying the intruder.

Setting Up and Analyzing Windows Audit Logs
Enable the auditing of your file system and registry access. If you suspect that the system is being misused, then Windows auditing provides a useful tool to track who did what and when. Once Windows auditing is enabled, review the Windows audit logs frequently and take action if unexpected activity is seen.

Restricting Access to Event Logs
By default, anonymous accounts and guest accounts can view Windows Event Logs when logged in to a Windows computer. Restrict this access on the LCBS Connect primary workstation, because the system, application, and security logs may contain sensitive information about the system and its operations.

IMPORTANT

Back up your system and then back up the registry hive before making any modifications in the Windows registry. If a mistake occurs, you can then recover by reverting back to the backup of the hive—or worse case, revert back to the system backup—to recover and minimize downtime.

⚠ CAUTION

Possible Equipment Damage

Mistakes made while editing the Windows registry can cause serious issues with your computer. Follow these steps precisely. If you make a mistake you cannot fix, restore your backup and start over.

To restrict access to administrators and system accounts only on Windows machines:
1. Choose Start > Run to open the Run window.
2. Type regedit and then click OK.
3. Expand the HKEY_LOCAL_MACHINE tree until you open the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EventLog registry key.
4. Select the Security sub key.

5. Right-click in the right window and then choose New > DWORD Value to create a new registry value.
6. Name the new value RestrictGuestAccess.
7. Right-click RestrictGuestAccess and then select Modify.
8. Type 1 in the RestrictGuestAccess value data field and then click OK.
9. Repeat steps 5 through 8 for the Application and System sub keys.
10. Close the Registry editor.

APPENDIX 6– FIREWALL AND NETWORK INTRUSION ISSUES.

Configuring the Windows Firewall on Windows PCs Running the Web Browser
The Windows firewall provides another layer of protection and must always be enabled. When the firewall is on, it will reject any incoming connections by default. Exceptions must be put into the firewall to allow incoming connections to succeed. By default, the LCBS Connect uses the designated browser and does not automatically configure the Windows firewall. If not manually configured, on first usage the Windows firewall will prompt the user to add a firewall exception. Use the following configuration settings:

- The firewall is on.
- The firewall is on for all network locations (Home or work, Public, or Domain).
- The firewall is on for all network connections.
- The firewall is blocking all inbound connections except those that you previously specified.

Detecting Network Intrusion
Network Intrusion Detection Systems (NIDS) can take many forms. NIDS can be a dedicated server on the same network branch, freeware software available under GNU or similar licenses (most of these are aimed at UNIX systems), or commercial products aimed specifically at Windows systems.

The purpose of NIDS is to scan incoming network packets and look for unusual traffic or for specific malformed packets known to be associated with attacks. If anomalies are found, NIDS take action such as raising alerts or even disconnecting the computer from the network. The latter is a dangerous option which causes its own denial of service while preventing damage to the system by closing network ports, and so on.

Most firewalls, switches, and routers have reporting capabilities that can report various levels of events varying from debugging to emergency failure. These reports can be viewed using telnet, collected by a central logging server, or emailed to an administrator. For example, the Cisco PIX firewall and Catalyst 4500 switches can be configured to send selected levels of events to a central syslog server where further analysis can occur and significant events can be detected.

Syslog servers are common on UNIX systems, and third-party syslog services are available for Windows. They vary in functionality and cost, from freeware, which simply writes to a log file, to sophisticated NIDS that analyze the logs in detail. As well as being able to control the level of severity of events, the PIX firewall allows the suppression of individual messages. This can significantly reduce clutter and also provide some ability to recognize common attack signatures and then raise the appropriate alarms.

When you configure network event logs, maintain a balance between collecting too many events (and missing something important) and filling storage disks and deleting information (which is subsequently needed for an intrusion investigation).

Other forms of intrusion detection will search event logs looking for unusual events, or will compare the current file system to a known good image. Be careful when running such tools to prevent them from using too many resources and interfering with the control system.

Wireless Access Points
Follow these guidelines when setting up and configuring a wireless network:

- Do not use the default Service Set Identifier (SSID); configure a unique SSID.
- Disable SSID broadcast.
- Use Wi-Fi Protected Access II (WPA2-Personal) or (WPA2-Enterprise) encryption. Wired Equivalent Privacy (WEP) is not sufficiently secure.
- Use the correct class of network equipment. For example, do not use home or small office equipment for large enterprise jobs.
- Change the default administrator password.
- Ensure access points are running the latest firmware.
- Physically secure access point devices.
- Use a separate access point for public, non-secured access, such as WiFi for guests or customers.
- When feasible, enable media address control (MAC) filtering and enter the MAC addresses for all the wireless devices.

APPENDIX 7 – HARDENING AND COMPUTER ISSUES

Hardening
Hardening involves taking additional actions to make it more difficult to obtain unauthorized access or to circumvent security mechanisms.

Physical Computer
Implement additional steps to harden computers against unauthorized access:

- If computers with DVD drives are readily accessible, fit locks or remove the DVD drives. Disable unused USB ports to prevent USB drives or other uncontrolled devices from being connected to the system. Such devices may be used to introduce a virus or other malware. Also disable or physically protect the power button to prevent unauthorized use.
- Set the BIOS to boot only from the operating system's root partition/drive.
- Set a BIOS password (ensure that this does not prevent automatic startup).
- Remove the floppy and CD/DVD drives from the computer.
- Disable USB ports and other ports capable of being used for memory sticks and other portable storage devices.

- Prevent drives, like the DVD drive, from being visible to Microsoft Windows Explorer by using the group policy.
- See Using Group Policy Objects to hide specified drives at http://support.microsoft.com/kb/231289 for more information.
- Note, however, that hiding the drives in Windows Explorer does not prevent those drives from being accessed using a command prompt.

Operating System
Many additional configuration options can be applied to harden the operating system against threats.

The following recommendations apply to desktop security policy settings:
- Configure Windows to display a warning against unauthorized use of the computer.
- You can configure computers to display a message when someone logs on. A typical message would be “It is an offense to continue without proper authorization.” Historically, legal prosecutions of intruders have failed because no such warning was displayed. The banner can be defined using Group Policy or the local registry.
- Use Group Policy (if the computer is part of a Windows domain) or the local registry to: Hide the last user name on the logon window. By default, the Logon dialog box displays the name of the last user to log on. This saves time if the same user is logging on again.

APPENDIX 8 – 3G/4G DATA MODEM/ ROUTER INSTALLATION

If a 3G/4G Data Modem/Router is to be used instead of the corporate LAN, configuration and password information needs to be planned and documented.

The signal strength at the installation location should be established with a test 3G/4G Router using the wireless provider in the actual installation location. The signal strength should be at or exceed 3 bars at Modem/Router for greater than 95% of a day.

Maximum reliability of 3G/4G Data Modem/Router may require an external antenna be located outside and connected to the Digital broadband router.

Home and Building Technologies

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31-00131—01 M.S. 05-17
Printed in United States

Honeywell

LCBS Connect Solution

APPLICATION MANUAL

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31-00118EFS-01

INTRODUCTION

The LCBS Connect Solution features controllers that support multiple CVAHU applications, including rooftop units, split systems and air to air heat pumps and a new Gateway that permits controller data to be sent from individual CHAHU controllers via the internet to the new LCBS Connect Cloud. The new Honeywell Cloud capability gives our control system users unprecedented access to data remotely via standard smart phones, tablets, and personal computers. Honeywell also performs data analysis, called “analytics,” that will permit service contractors and building owners to effectively and efficiently manage HVAC assets. Here are a few specific features of the new LCBS Connect solution.

- **Occupancy Control.** Daily and holiday schedules are available to ensure that building occupants, employees, and visitors are comfortable when they are in the building and that owners achieve maximum energy savings when no one is occupying the building. Honeywell patented Adaptive Intelligent Recovery monitors outdoor and indoor climate conditions to ensure comfortable conditions when building occupants arrive.
- **Advanced Sensing.** Supports multiple space temperature sensors (Up to five) for effective temperature value (Average, Minimum, Maximum, and Smart) and options for return air sensing. Supports space and return air temperature, humidity, and CO2 sensing.
- **Heating and Cooling Control.** Provides three stages of heating and cooling for conventional equipment and up to three compressor stages for air to air heat pumps. LCBS Connect heat pump controllers support up to two (2) stages of auxiliary heat.
- **Economizer Control.** Supports nine different economizer strategies that address all climatological zones in North America.
- **Dehumidification Control.** Three (3) dehumidification strategies for dehumidification control are supported. First, if the equipment is capable, a reheat mode can be programmed to provide precise dehumidification operation. Second, dehumidification equipment can be controlled through a direct LCBS Connect output to provide dehumidification. Third, extended minimum cooling runtime can be selected supporting the dehumidification process.

- **Accessory Loop, Multispeed Fan Control.** Each LCBS Connect controller provides the ability to configure custom control loops to control other equipment including exhaust fans, exhaust pressurization loops, cabinet unit heaters, blower coils, and outdoor lighting circuits based on ambient light level. These loops are called "Accessory Loops." LCBS Controllers also provide unprecedented control of CVAHU fans that we call Multispeed Fan. This feature not only ensures building occupant comfort, but when applied properly, results in energy cost avoidance to building owners.
- **Honeywell Cloud Based Remote Control and Service Analytics... A New Honeywell Feature!** Data is sent securely from a building site via the internet to the Honeywell Cloud where extensive analysis is performed. The output of this analysis is useful information that will allow service contractors to do service more efficiently and effectively and retain valuable service contracts.

Background

The LCBS Connect system provides comprehensive control options for constant volume air handling units (CVAHU). In addition to heating, air conditioning, dehumidification, and ventilation applications, critical data from LCBS Connect controllers is collected, stored, and analyzed in the Honeywell Cloud. The data can be used for logging, sophisticated graphic display, advanced service alerting and "big data" analytics. Honeywell data scientists and engineers are relying on hundreds of years of control and service experience to write analytics that will help service contractors assist building owners to predict and prevent service issues from occurring, resulting in superior equipment uptime and extended HVAC equipment life. These analytics run in the cloud 24 hours a day, 365 days a year.

Honeywell has an incomparable industry reputation for providing precise temperature control, superior remote and local operator interface experience. With the addition of cloud based data collection and data analytics, Honeywell steps to the front again.

The primary focus for LCBS Connect is control of CVAHU rooftop units and split systems. Over 60% of commercial buildings in North America are heated and cooled by CVAHU packaged and split systems. The average age of this HVAC equipment is approximately eight (8) to 10 years. Due to lack of appropriate service, many suffer from operational problems including temperature, pressure, humidity sensing devices that are out of calibration, refrigeration circuits improperly under and overcharged for a variety of reasons, economizer ventilation cycles that have ceased to function, air flow systems improperly sized delivering substandard air flow, and thermostats in common buildings that "fight" each other due to improper occupant intervention.

LCBS Connect. Extending HVAC Equipment Life

The average estimated life of packaged constant volume air handling systems is about 17-25 years, depending on where the system is located. At eight (8) years, these systems are ripe for 1] restorative service and 2] re-control for reasons listed above. With service contractor assistance, a user of these systems can delay capital appropriation and expenditure by up to five (5) years by restoring these units to initial, "as built" specified operation. Restored equipment operates less resulting in lower energy costs. Ongoing maintenance costs are reduced as "tuned up" equipment operates efficiently and effectively. After this work is done, Honeywell offers LCBS Connect Cloud Services that will help HVAC service contractors keep HVAC equipment operating in a highly efficient manner and delivering extended equipment life.

What you will learn by reading this document

Each section consists of three (3) sections. First, "theory and operation" includes a short description about why we do what we do and how it works. Second, a more complete description of "how it works" is provided. Third, wiring diagrams are provided to demonstrate how an installer wires up the application. Technically, this is in the "appendix" of this document.

Controls in Small Commercial Buildings

In commercial buildings, it is essential that heating and air conditioning systems operate in a properly configured, automatic manner. In a small commercial building, HVAC operational experts are often HVAC service contractor specialists or by a few subject matter experts within the building. Additionally, control performed in a small commercial buildings is typically more complex than in a residential dwelling. Heating, cooling, fan operation, ventilation, indoor air quality, dehumidification, and various other functions can all operate successfully in a small commercial building but due to economics, we can't count on an experienced controls experts to be present to troubleshoot building controls problems.

Herein lies a point of concern for servicing contractors and building owners as we strive to effectively control small commercial buildings. Honeywell and our contractor business partners need to provide basic local control for building owners. The more power and authority that building occupants have is desirable, but can also lead to undesirable system operation, particularly higher energy use and HVAC equipment wear and tear. It is important that Honeywell LCBS Connect contractors to educate building owners about key control requirements.

Here is a typical case of how control systems are designed to work and how building occupant's well intentioned efforts can cause facility operational problems.

Typical CVAHU systems observe a control operation strategy called "automatic heating and cooling changeover." This operation ensures that mandatory, building code compliant heating, cooling, and ventilation occurs in a commercial building. If the system permits, a building occupant can change this operational to "cooling" or "heating" only. A well intentioned building occupant may simply be hot or cold and may change settings to achieve personal comfort.

This action is not without consequences. If this setting is erroneously left in the "cooling" or "heating" position, when climate changes, mechanical heating and cooling is locked out. This will lead to an inevitable service call at 1] will cost the building owner hundreds of dollars due to service contractor interaction or 2] a service contractor who can't bill for the call due to service contractor type.

Enter LCBS Connect

A contractor that has adopted LCBS Connect will have remote access to the customer's site and will allow remote remediation of the problem and will save a truck roll to the customer's site. Providing local access to building occupants should be weighed and discussed carefully with the building owner and those paying for maintenance and utility bills.

AUTOMATIC BUILDING SCHEDULES

Automatic Occupancy Control Theory and Operation

For building owners and operators, we assume two basic things: indoor commercial building environments need to be heated, cooled, and ventilated for human health and comfort during the time humans occupy a building. There are important secondary issues relating to occupancy including management and protection of assets during periods when humans don't occupy building spaces including protection of plants, precious artwork, plumbing, paper products, and wall and floor coverings. Excessive heat, cooling, and humidity conditions can cause damage to building.

Ensuring that building space is conditioned to make sure building occupants are comfortable is quite different than making sure that it is warm or cool enough to protect plumbing from freezing and from wall paper and paint from peeling off the wall. In general, the energy required to operate systems to provide human comfort is 2-5X the cost to protect assets in a building without humans present.

How does occupancy methodology work?

LCBS Connect allows HVAC service contractor and customers to develop schedules via LCBS Connect tools including local operator interface or remote cloud based tool to match building occupancy schedules. These schedules can be also be set to accommodate occurrence of special events and holidays.

To ensure that proper comfort conditions are achieved by desired occupancy, Honeywell has developed an algorithm to meet these needs. Honeywell's answer to this recovery process is called "Adaptive Intelligent Recovery™" Implementing this correctly will require knowledge by the HVAC professional regarding the rate at which the HVAC system can provide restorative heat injection (heating), heat removal (cooling) in a building space. This recovery algorithm also keeps HVAC systems from starting suddenly and creating an excessive electrical in-rush that can result in undesirable utility demand control charges. The payoff to getting this "right" is huge. We want to keep building occupants and patrons comfortable and control energy usage and associated costs. Honeywell Adaptive Intelligent Recovery permits us to meet this requirement.

LCBS Connect controllers also have the ability to control temperature to "standby" set points. This set point technique is typically applied to building spaces that are randomly and infrequently occupied. A good example of the application of the standby set point is for an office or meeting room. The standby heating set point is always set the same or slightly below the standard occupied set point and the standard cooling set point is always set the same or slightly above the standard occupied set point. If the space temperature is being controlled at the standby set point, it is assumed that the building space being controlled is unoccupied. The benefit of using the standby strategy is twofold... 1] to make sure that building occupants are comfortable when they enter randomly occupied spaces and 2] reduce energy usage by altering HVAC control and reducing ventilation when building occupants aren't in the randomly occupied building space. The transition of standby set points from "standby" to "occupied" is typically initiated by a "motion sensor" detecting occupancy in the building space. Likewise, if the motion sensor does not detect motion, the set point is transitioned from "standby" to "unoccupied."

In order to comply with building codes, during scheduled "occupied" periods, the supply fan will run 100% on. Why? Most prevailing building codes require "continuous fresh air ventilation" and a specific requirement of fresh air, outdoor air based on an aggregate CFM per hour or CFM per person in the building space. Without going into detail, it is literally

impossible to provide minimum fresh air ventilation without supply fan moving air. During "standby" and "unoccupied" periods, the supply fan operates in conjunction with a call for heating or cooling and ventilation is disabled, as we assume that people are not in the building space.

LCBS Connect users can permit the supply fan to run only on a call for heating or cooling during "occupied" periods, but it is discouraged and defies prevailing the building ventilation code. Further, cycling the fan on a call for heating or cooling can degrade the life of the fan motor, fan belts, and associated fan accessories.

LCBS Connect controllers have the ability to control local equipment based on an eight (8) day scheduling strategy, seven days of the week featuring four events per day and a "holiday" schedule featuring four events per day.

Let's get into some specific details.

There are four (4) programmable events that are available for each event.

- **Occupied.** This indicates the beginning of a time period, associated with an "on" condition or observance of "occupied" set points when building occupant typically occupy building zones.
- **Unoccupied.** This indicates the beginning of a time period, associated with an "off" condition or observance of "unoccupied" set points when building occupants typically leave the building.
- **Standby.** This indicates the beginning of a time period, associated with observance of "standby" set points, were ventilation and fan are controlled conforming to unoccupied control behavior. Using "standby" set points and process can result in energy savings during traditional occupied hours. During the standby period, if an occupancy sensor is assigned to the controlled zone, and it detects people in the controlled zone, occupied set points and occupied ventilation practice is observed. If this occupancy sensor does not detect movement, unoccupied set points and ventilation practice is observed. **Tip: Use standby set points in infrequently occupied building zones including meeting rooms and break rooms.**
- **Available.** This is a fourth condition indicating that a change of event state can be programmed, configured, executed. This is also referred to as "un-configured."

How it works

Date and Time is available for each LCBS Connect controller. Each LCBS controller can support for events. For example, assume that I open my store at 7:00 AM and close it at 7:00 PM Monday through Friday. My store is open at 7:00 AM and closes at 1:00 PM on Saturday. I'm closed on Sunday. Find constructed table of required schedules below:

Table 1.

DAY	EVENT 1		EVENT 2		EVENT 3		EVENT 4	
	EVENT TYPE	TIME	EVENT TYPE	TIME	EVENT TYPE	TIME	EVENT TYPE	TIME
MONDAY	OCCUPIED	7:00AM	UNOCCUPIED	7:00PM	AVAILABLE		AVAILABLE	
TUESDAY	OCCUPIED	7:00AM	UNOCCUPIED	7:00PM	AVAILABLE		AVAILABLE	
WEDNESDAY	OCCUPIED	7:00AM	UNOCCUPIED	7:00PM	AVAILABLE		AVAILABLE	
THURSDAY	OCCUPIED	7:00AM	UNOCCUPIED	7:00PM	AVAILABLE		AVAILABLE	
FRIDAY	OCCUPIED	7:00AM	UNOCCUPIED	7:00PM	AVAILABLE		AVAILABLE	
SATURDAY	OCCUPIED	7:00AM	UNOCCUPIED	7:00PM	AVAILABLE		AVAILABLE	
SUNDAY	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE				

Scheduling Summary

LCBS Connect controllers have a default schedule built into them. The LCBS Connect controller will work when you pull them out of the box. The default schedule is 6:00 AM to 6:00 PM Monday through Sunday. If you want to set up different occupancy schedules, it's a good idea to refer to appropriate documentation form in your support package, print it out, and write out the schedules you want to implement. Go to LCBS Connect wall module or LCBS Connect Remote User Interface and program desired times.

Scheduling a Holiday

LCBS Connect controllers support the following holiday scenarios for one event schedule. This will be improved in the future, particularly when we implement "Cloud Based Scheduling":

Date specific: A good example of this is July 4 for our national holiday and December 25 for Christmas. This could be obvious, but isn't intended to be insulting to the reader. July 4th never changes as a date, but the day of week does.

Day specific: A good example of this is Thanksgiving. This date is always on the last Thursday of the month of November. Thursday, as the day we celebrate American Thanksgiving, never changes, but the date does.

Extended date: Establish a specific day or date. The ability to extend this holiday any number of days is offered. For example, if we celebrate Thanksgiving and our establishment will be closed on the day following Thanksgiving, enter two (2) days in the proper configuration field.

Holiday Scheduling Summary

LCBS Connect controllers do NOT have a default holiday schedule built into them. If you want to set up different occupancy schedules on various holiday dates and times, please do so. Go to LCBS Connect wall module or LCBS Connect Remote User Interface and program desired times.

HEATING, HEAT PUMP CONTROL

Heating Theory and Operation

There are two key theoretical objectives for heating. First, we have an objective to keep building occupants comfortable by providing heat during heating seasons during periods when occupants occupy buildings. Second, we need to keep building assets warm enough so that no building damage occurs to valuable assets, particularly when it's very cold outdoors. LCBS Connect controllers are designed so they don't operate heating system in an inefficient manner, on in a manner where damage occurs to the heating systems. Some examples to protect heating equipment are minimum on and off times for gas and electric heating elements and heat exchangers, high limit heating controls, and lockout based on low sensed ambient or outdoor air temperature.

Basic Gas and Electric Heating

There are two basic systemic direct heating methods that LCBS Connect supports; standard staged heating that features natural gas heat exchangers and staged electric heat that typically include electric duct heaters. For gas heating option, LCBS Connect can either be set to energize supply fan operation on a call for heating directly or the supply fan can be controlled by a fan and limit device. The latter is quite common with gas heating systems. We support control of three stages of heat, three stages of cool. Further, electric heat can typically be cycled more frequently and aggressively than gas heat. LCBS Connect accounts for both methods and all settings.

Air to Air Heat Pump

In North America, there are areas where natural gas is not available or where electrical energy is relatively inexpensive. This makes Air to Air Heat Pumps financially and operationally viable. The air to air heat pump features mechanics and electronics that reverse the refrigeration cycle in an air conditioning unit and pumps warm refrigerant into the evaporator coil to provide heat. Another heat pump that we find in North America is the "water source" or "geothermal" heat pump. The Air to Air Heat Pump is a widely used solution that spans residential and commercial applications in North America and is the focus of this release. We will be able to control Water Source Heat Pumps and associated boiler and cooling tower plans in the 2.0 release of LCBS Connect.

A standard method of controlling the flow of refrigerant in a heat pump system is by controlling the position of the "reversing valve." There are two prevalent methods are 1] energizing the reversing valve on a call for cooling and 2] energizing the reversing value of a call for heating. For the former, the terminal designation on the low voltage terminal strip on the heat pump is "O" and for heating, "B." **Please note!** There is a third method of heat pump control, popularized by Carrier and Carrier brands. This method features standard Y1 and W1 cooling and heating control with the reversing valve internally controlled. It may be necessary to adjust heating minimum on times to protect heating compressor cycle.

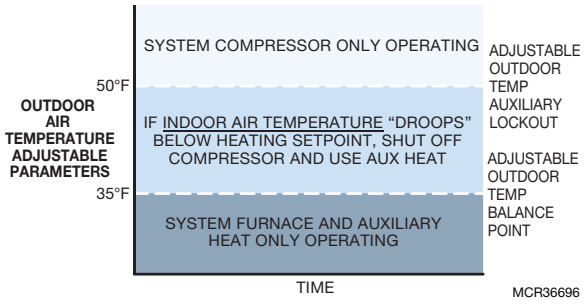


Fig. 1.

Depending on the geographical location of our customer's building and of an air to air heat pump, electric auxiliary heat may be required. In northern United States, if a heat pump compressor is not protected with a compressor heater, the compressor must be locked out to prevent damage to it and electric heat must be used to heat building space. The latter can be expensive, thus we provide adjustable settings to attempt to help contractors and building owners avoid excessive electricity use. The LCBS Controller has an adjustable outdoor air limit sensor that can lockout heat pump compressor if outdoor air temperature falls below an adjustable level. Given this potential extraordinary expense, we've developed several techniques to attempt to reduce the cost of operation of electric heat. Honeywell provides an option to operate electric heat in a standard manner; this concentrates on traditional comfort. It's called the "comfort" mode. Look for this as you configure your air to air heat pump; it's a selectable option. If the building owner can tell their employees, staff to have a sweater ready on very cold days, Honeywell offers the "savings" mode. This automatically depresses the heating set point and results in electric heat cycling less, maintaining a lower heating set point.

Droop, Comfort and Saving Heat Pump Mode

What is "droop?" Simply put, it's a temperature value that "droops" below standard occupied or unoccupied heating set point. Heat pumps do a super job of heating as long as it's not too cold outdoors. As we've described a few times, sometimes the pump just loses the battle to provide adequate heating. When this happens, the LCBS Connect control system supplements the compressor and begins using "fossil fuel" heating, typically electric strip heaters. So, standard heat pump cycle is designed to terminate heat pump usage below established outdoor air temperature where the efficiency is less than electric or gas heat.

Here's a summary of the "Comfort" and "Savings" mode:

"COMFORT" MODE	**"SAVINGS" MODE**
Depending on outdoor limits set, the compressor, the compressor acting in unison with auxiliary heat, or auxiliary heat operates to maintain heating setpoint.	If "savings" mode is selected and if auxiliary heat is not locked out, the heating sepoint is depressed by "x" degrees. this minimimzes the use of auxiliary heat and avoids energy cost.
COMMENTS. BENEFITS, SHORTCOMINGS	
Comfort is our prevailing concern for our employees, guests, and patrons.	Pushes pump operation thus saves energy. the more aggressive the "savings" setpoint is, the more likely that building zones will become cold. take care to select parameters properly.

Discharge Air Temperature High Limit Control

While heating, it is possible that discharge air temperature may increase beyond an unacceptable limit. To avoid this, the LCBS Connect controller features discharge air temperature high limit control. When discharge air temperature increases above the discharge air high limit set point, the heating equipment is controlled to maintain the discharge air temperature to the set point. Let's assume that the discharge air set point is 120°F. If the discharge air temperature increases above 120°F then the heating equipment is cycled off. When it falls back below the limit minus the switching differential, it will be allowed to cycle back on. **Please note: Your HVAC unit will feature a high limit heating control. Ensure that the LCBS Connect setting is HIGHER than that of the unit being controlled.**

Heating Summary

LCBS Connect controllers have a wide array of heating options. As with most functions, if you are commissioning a simple single heat conventional system, the LCBS Controller will work "out of the box." It will be designed to work at 68°F occupied setting and 62°F unoccupied setting. You will have access to changing proportional band, integral gain, and derivative gain if you wish. It is **HIGHLY RECOMMENDED that you DON'T alter these parameters** unless a Honeywell LCBS Connect support professional tells you to do so. You will need to make some basic changes to the device if you are commissioning a heat pump. There are a number of options described in this document that will allow you to alter basic heat pump operation; most are provided so that the heat pump operates in an **efficient manner**. It is recommended that you don't change preconfigured parameters.

COOLING, DEHUMIDIFICATION, ECONOMIZER CONTROL

Cooling Theory and Operation

There are two key operational objectives for cooling. First, we have an objective to keep building occupants comfortable during assumed cooling seasons during periods when occupants occupy buildings. A close following objective is to keep building assets cool and dehumidified enough so that no building damage occurs when it's very warm and humid outdoors. LCBS Connect controllers need to protect cooling systems so they don't operate in an inefficient manner, on in a manner where damage occurs to the cooling systems. Some typical examples to protect cooling equipment are

minimum on and off times for compressor operation and lockouts based on low sensed ambient or outdoor air temperature. Freeze stat operation protects HVAC system from being damaged as systems are cycled off if system freezing conditions are detected.

Cooling Operation

LCBS Connect controllers support control of compressor stages and DX refrigeration circuits. Up to three stages of cooling can be controlled by LCBS Connect controllers. There is a freeze stat sensor control input that monitors potential freezing temperatures and serves as a low limit. The sensor is typically mounted against the cooling coil and protects it from freezing, resulting in coil damage and can also make sure that unheated outdoor compressors aren't "slugged." The LCBS Connect controller shuts off the supply fan, the compressor and closes the outdoor air damper if a frozen coil condition is detected. Also the discharge air sensor utilizes a control tactic called a "low limit", where if the discharge air temperature falls below the low limit, compressor stages will be turned off until the condition goes away or all stages are off.

Dehumidification

Dehumidification Theory and Operation

Dehumidification is an important part of control operation in many parts of the United States. High humidity can result in two major problems. First, high relative humidity can result in uncomfortable conditions for building occupants. Second, relative humidity is destructive to architectural elements like carpeting, wallpaper, paint, and art work.

How does LCBS Connect dehumidification work?

Three (3) dehumidification strategies for dehumidification control are supported. First, cooling and heating can be programmed to operate in a reheat sequence to provide precise dehumidification operation. Second, dehumidification equipment can be controlled through a direct LCBS Connect output to provide dehumidification. Third, extended cooling extended runtime can be selected that can enhance and augment the dehumidification process. These are described in detail below.

Method #1. Cooling On, Cycle Heating

The reheat dehumidification control algorithm works only when system in in cooling mode. The call for dehumidification occurs as a result of humidity level rising above the dehumidification limit. If cooling is not operating, it becomes energized. A single stage of heating is energized in conjunction with the call for dehumidification. When humidity drops below set point less differential, hysteresis, the heating stage is cycled off and cooling cycles off. If a call for cooling continues, cooling remains on and cycles per temperature control algorithm. Method #1 can be augmented with Method #3, described below.

NOTE: It's important to observe the configuration of heating and cooling coils in the constant volume that you intend to apply the dehumidification algorithm. The heating coil must be downstream of the supply fan and cooling coil for the dehumidification algorithm to work properly.

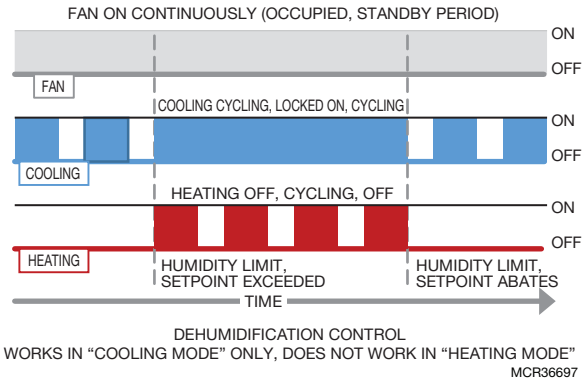


Fig. 2.

Method #2: Simple Humidification

In the "simple dehumidification method," the algorithm simply senses space or return air humidity and energizes a designated digital output until the call for dehumidification abates. Method #2 can be augmented with Method #3, described below.

Method #3: Dehumidification extended cooling minimum run time

This alternate dehumidification sequence works in conjunction with the dehumidification strategy described above. If there is a call for dehumidification and there is also a call for cooling, the DX refrigeration will continue to operate and functionally runs for specified time. We are ensuring that a cooling stage is on long enough so that it reaches a cold enough temperature to remove moisture. This will cause fewer compressor cycles of longer duration, which may result in slightly larger temperature swings around the set point.

Cooling and Dehumidification Summary

LCBS Connect controllers have numerous cooling and dehumidification options as described in this section. If you are commissioning a simple single cool conventional system, the LCBS Controller will work "out of the box." It will be designed to work at 76°F occupied setting and 82°F unoccupied set point setting. You will have access to changing proportional band, integral gain, and derivative gain if you wish. It is HIGHLY RECOMMENDED that you DON'T alter these parameters unless a Honeywell LCBS Connect support professional tells you to do so. You will need to make some basic changes to the device if you are commissioning a dehumidification loop. There are a number of options described in this document that will allow you to alter basic dehumidification operation. Do not change preconfigured parameters unless you discuss this with an LCBS Connect support professional.

FRESH AIR ECONOMIZER CONTROL

Theory and Operation Economizer

There are two key operational objectives for economizer. First, we have an objective to keep building occupants alert, healthy, and safe by making sure that fresh outdoor air is continually provided to the building space. Technically, this is referred to as "ventilation." In the North American geography, there are many areas that cool, dry outdoor air can be used to cool building spaces and augment the mechanical cooling process. This apparatus, system, collection of sheet metal and controls is called an "economizer system. "

Economizer Function

Three high level strategies are supported by LCBS Connect to address control economizer functions.

- **None.** First, for units that do not feature integrated economizer at all, LCBS connect offers a "none" selection. There are some parts of North America that allow make up air to be provided to building spaces in an alternate manner; not using the economizer apparatus. Please refer to ASHRAE Standard 90.1 - 2010 Section 6.5.1 or to your local building code for ventilation and economizer codes. This choice would also be used for systems that aren't connected to a fresh air, ventilation function, like many commercial split systems.
- **Enable Economizer Function.** Second, there are hundreds of thousands of economizers that are "controlled" by a stand-alone collection of economizer controls, typically provided by Honeywell for the last 20 years through companies like MicroMetl, Cambridgeport, and Canfab to name a few. The resulting control sequence is super simple. If there is a call for cooling via a thermostat of contractor and building owner's choice and the economizer control system indicates that outdoor air is cool and dry enough, the economizer controls operate, providing as much as 100% outdoor air to cool the building space. If outdoor air becomes unacceptably warm, the electronic thermostat takes over control and controls mechanical cooling. Lastly, a time of day signal is provided to the economizer control system so that the outdoor air damper is able to close 100% to avoid equipment damage and potential excessive energy use.
- **Integrated Economizer.** The third strategy that is supported is full control of the economizer function by the LCBS Connect controller. If this option is suggested, you have also enabled the LCBS Connect controller to perform "Demand Controlled Ventilation (DCV)." DCV will be described in the next section. This is clearly the preferred selection. This results in optimum comfort for customers and can also result in efficient operation, supporting cost avoidance for building owners. Service contractors also benefit from full Cloud based remote control of the economizer function, allowing him or her to troubleshoot the economizer from the ground, rooftop unit, or their service truck.

General Economizer Operation

We refer to the economizer section of a rooftop in many ways. When we refer to the "economizer damper," we're typically referring to the combination of outside air damper and return air damper. In our area of interest in the light commercial marketplace and more specifically, 3 to 25 ton CVAHU units, the outside air damper system is typically operated by an actuator directly coupled to mechanical linkages and to dampers. The outdoor air damper is normally closed and return air damper is normally open. For most installations, the outdoor air damper is interlocked mechanically to the return air damper. The outdoor air actuator is almost exclusively a "spring return device" that is designed to "spring closed" in event of a loss of control signal power failure. The spring return apparatus in an actuator is provided to combat the potential damage to HVAC coils, compressors, and to building plumbing.

Minimum Ventilation

Let's examine the minimum ventilation requirement first. The notion of minimum ventilation is now driven by building codes and is tied to providing "fresh air" to building dwellers. The code typically provides a guideline that is driven by number of people in a building space, multiplied by CFM per person. This is further mitigated by the operation going in the building, but that's simply too complex for this paper.

A Simple Example

We are retrofitting the controls on a five (5) ton rooftop unit in a commercial application. We are assuming that there will be an average of 20 people in the space served by this unit. Our local code dictates that we need to provide 5 CFM of "fresh air" per person to the building occupants. Our customer would like to make sure there is a rich supply of fresh air in their building space, so we'll increase this to 10 CFM per hour. Simply put, this requires us to ventilate the building space at a rate of 200 CFM per hour. The rooftop unit that we've installed has the capability to supply 2,000 CFM air per hour and further, has the capability to ventilate our space at that rate. In conclusion, we need to ventilate the space at a maximum rate of 200 CFM per hour. Divide 200 CFM by 2,000 CFM and we'll need to provide minimum ventilation rate of 10%. Don't panic! Hysteresis that occurs from damper and actuator linkage, plus the relatively poor accuracy of OEM dampers will make it easy for you to estimate 10% damper position. Use the LCBS Connect service mode to help you set the 10% air flow target.

Naturally, when folks leave the building at the end of the day, we aren't required to provide any fresh air and we close the outdoor air dampers, shut off the system fan and operate at "unoccupied set points" that result in customer energy cost avoidance.

Enable Economizer Function

There are literally millions of economizers installed in North America that are integrated through a simple integration to a time of day signal and call for cooling.

How it works. A digital "enable economize" signal must be configured on the LCBS Connect controller. Again, typically this "dry" digital output can be used to carry 24 VAC to a packaged economizer system. By definition, during building unoccupied schedule, the contact is open, disabling the economizer. This typically allows a spring return actuator to close to 100% position.

⚠ NOTICE

Opportunity to upgrade your customer's system and provide trusted advisor service! Using the "integrated" techniques described above, you will be able to 1] improve economizer operation 2] provide full remote access of settings, configuration information, 3] permit access to interesting and useful graphics, trending, and service mode capability and 4] enable full Title 24, economizer analytics that will allow you to provide heroic service to key service customers.

Honeywell Integrated Economizer Control Described

In addition to making sure that fresh air is provided to building occupants, the economizer function consists of two more basic control loops. **First is a "mixed air control loop."** This is a direct acting control loop that is enabled by a call for cooling and positions an outdoor air damper actuator based on mixed air temperature and set point. **Second is a changeover or "high limit" control function.** In our industry, these terms are sometimes used interchangeably. This control loop senses outdoor air temperature, or outdoor air temperature and humidity (enthalpy). If this loop senses high temperature or high enthalpy, the control system drives the outdoor air damper actuator to minimum position. The high limit controls make sure that warm or moist air is prohibited from getting into the building space.

There is another changeover strategy that is associated with the economizer function called "differential" control. On a call for cooling, if the system return air sensor senses a temperature less than the system outdoor air sensor, and a call for cooling exists, **the economizer is disabled.** The test is simple... if there is a call for cooling and return air is cooler than outdoor air, I'm going to use return air to provide "free cooling." Likewise, on a call for cooling, if the outdoor air temperature is less that the return air temperature, **the system economizer continues to be enabled.** This is called "differential temperature changeover." There is an equivalent "differential enthalpy changeover" described in this document. Applied properly, differential control can provide substantial customer energy cost avoidance.

NOTICE

Some economizer strategies are not applicable for all climates in the United States. ASHRAE Standard 90.1 - 2010 Table 6.5.1.1.3 A describes what economizer strategies should be used in various climate regions in the United States. For example, the fixed enthalpy economizer strategy **is not permitted** in U.S. climate zones 1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, and 8 and fixed dry bulb and differential dry bulb economizer strategy **is not permitted** in U.S. climate zones 1a, 2a, 3a, and 4a.

Honeywell Integrated Economizer Control, Climate Zones, Getting Tactical!

If outdoor air is cool enough, our integrated economizer system begins to control our outdoor air actuator to attempts to control to mixed air set point. The control is mitigated by a throttling range set point.

WARNING

Unless you are instructed to do so by your Honeywell or LCBS Connect control system distributor, you should NEVER have to change mixed air set point and throttling range. Over 8M of the control systems we've provided to the HVAC industry have these set points "hard coded" in the devices with literally no complaints, callbacks, or service interventions.

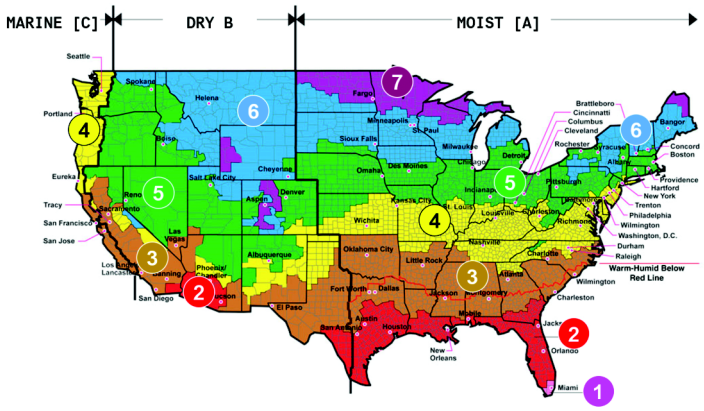


Fig. 3.

Pacific Northwest National Laboratory & Oak Ridge National Laboratory August 2010
http://www1.eere.energy.gov/buildings/publications/pdfs/building_america/ba_climateguide_7_1.pdf

Table 2.

ASHRAE 90.1 PERMISSABLE ECONOMIZER CONTROL TYPES, HIGH LIMIT, CHAGEOVER OPTIONS		
CONTROL TYPE	ALLOWED IN CLIMATE ZONES	HIGH LIMIT, CHANGEOVER SETPOINT
FIXED DRY BULB TEMP	1B, 2B,3B,3C,4B,4C,5B,5C,6B,7,8	OUTDOOR AIR TEMP > 75°F
	5A, 6A	OUTDOOR AIR TEMP > 70°F
	1A,2A,3A,4A	OUTDOOR AIR TEMP > 65°F
DIFFERENTIAL DRY BULB TEMP	1B, 2B, 3B, 3C, 4B, 4C, 5B,5C,6B,7,8	OUTDOOR AIR TEMP > RETURN AIR TEMP
FIXED ENTHALPY WITH FIXED DRY BULB TEMP	ALL	OUTDOOR AIR ENTHALPY > 28 BTU/LB OR OUTDOOR AIR TEMP > 75°F
DIFFERENTIAL ENTHALPY WITH FIXED DRY	ALL	OUTDOOR AIR ENTHALPY > RETURN AIR ENTHALPY OR OUTDOOR AIR TEMP > 75°F

When the mixed air control system has captured all the cooling value from outdoor air it can, the system will begin to augment that call for cooling with mechanical cooling. An integrated low limit is also offered.

Honeywell Integrated Economizer Control – High Limit and Changeover Strategies

North America features widely different climates. ASHRAE and other code bodies recognize this fact and provide control guidance. These organizations drive application and use of economizer systems regionally. These different climate zones drive different economizer application practices. For example, air in Honolulu and Miami is far hotter, higher dew point and has almost no capability to be used to augment the HVAC cooling process.

NOTICE

As a service contractor, you probably know what your customer's needs are. Continue to set controls how you see fit. We haven't seen any building code or ASHRAE police roaming any U.S. streets, yet!

The information below describes the use of the following economizer strategies.

Strategy 1: Differential Enthalpy with Fixed Dry Bulb Temperature Limit

This technique can be used in all ASHRAE climate zones. Successfully applied, excellent energy savings can accrue to building owners. LCBS Connect remote services alerting and analytics can help you fine tune settings to maximize customer energy savings and maintain comfort.

How does it work? If there is a call for cooling and return air enthalpy is less than outdoor air enthalpy and the outdoor air temperature is below high limit, changeover set point, RETURN air will be used to cool your customer's building. If there is a call for cooling and return air enthalpy is GREATER than outdoor air enthalpy and the outdoor air temperature is below high limit, changeover set point, OUTDOOR air will be used to cool your customer's building.

Enthalpy hysteresis is adjustable to make sure that you don't experience excessive enabling and disabling of the economizer cycle potentially overusing the economizer actuator. It is advised that you don't change this value unless you talk to a Honeywell distributor or customer support professional.

Strategy 2: Outdoor Air Enthalpy

This technique can be used in all climate zones. HVAC professionals like this method as it's relatively simple to deploy. As with all economizer limit and changeover strategies, LCBS Connect remote services alerting and analytics can help you fine tune setting to maximize customer energy savings and maintain comfort. There is an ASHRAE prescriptive value suggestion at 28 LB/BTU changeover. Many folks find this a bit warm and could result in customer, client comfort issues.

How does it work? If there is a call for cooling and outdoor air enthalpy is less than outdoor air enthalpy set point and the outdoor air temperature is below high limit, changeover set point, outdoor air will be used to attempt to cool your customer's building.

Again, enthalpy hysteresis is adjustable to make sure that you don't experience excessive enabling and disabling of the economizer cycle potentially overusing the economizer actuator. It is advised that you don't change this value unless you talk to a Honeywell distributor or customer support professional.

Strategy 3: Differential Temperature

This technique is suggested to be used in zones 1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, and 8. See map on page 16. HVAC professionals like this method as it's relatively simple to deploy and understand. As with all economizer limit and changeover strategies, LCBS Connect remote services alerting and analytics can help you fine tune setting to maximize customer energy savings and maintain comfort.

How does it work? If there is a call for cooling and outdoor air temperature is less than return air temperature and the outdoor air temperature is below high limit, changeover set point, outdoor air will be used to attempt to cool your customer's building. If there is a call for cooling and outdoor air temperature is GREATER than return air temperature and the outdoor air temperature is below high limit, changeover set point, RETURN air will be used to attempt to cool your customer's building.

Temperature hysteresis is adjustable to make sure that you don't experience excessive enabling and disabling of the economizer cycle potentially overusing the economizer actuator. It is advised that you don't change this value unless you talk to a Honeywell distributor or customer support professional.

Strategy 4: Outdoor Temperature

This technique is suggested to be used in zones 1A, 2A, 3A, 4A, 5A, 6A, 1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, and 8. See map on page 16.

HVAC professionals like this method as it's probably the simplest strategy to deploy and understand. This technique was widely used before humidity sensing technology became cost effective. As with all economizer limit and changeover strategies, LCBS Connect remote services alerting and analytics can help you fine tune setting to maximize customer energy savings and maintain comfort.

How does it work? If there is a call for cooling and outdoor air temperature is less than outdoor air temperature is below high limit, changeover set point, outdoor air will be used to cool your customer's building.

Temperature hysteresis is adjustable to make sure that you don't experience excessive enabling and disabling of the economizer cycle potentially overusing the economizer actuator. It is advised that you don't change this value unless you talk to a Honeywell distributor or customer support professional.

Low Limit Temperature Override Control

HVAC coil protection is offered as a feature as part of integrated economizer control. Please note that this feature does not work with the "simple" digital input, digital output economizer control sequence described above.

How it works. The low limit control overrides the economizer damper position to prevent the economizer control sensor, mixed air temperature or discharge air temperature from falling below the low temperature override limit by closing the economizer, outdoor air damper. The low limit temperature override control is disabled when DCV is enabled as heating will allow to cycle on.

Freeze Stat Operation

The capability to apply and install an electromechanical freeze stat as an ultimate redundant control is available. Simply select freeze stat function by configuring the appropriate digital input on the LCBS Connect controller. A freeze stat contact must be installed and an output from the device needs to be terminated to the LCBS controller. If the freeze stat is configured and the LCBS Connect controller input is closed, the CVAHU system will be shut down. **The freeze stat function can also be used to shut down the CVAHU system for smoke or fire alert, alarm.**

Economizer Control Summary

LCBS Connect controllers feature an "ASHRAE Complete" range of economizer control, changeover, and high limit options. If you are attempting to commission a "direct drive" economizer system, read this description carefully. LCBS Connect remote services will be a great help to you as you fine tune economizer control.

ADVANCED TEMPERATURE CONTROL FUNDAMENTALS

If you would like to learn how to "fine tune" control loops, you may want to take some time to learn about more advanced control fundamentals. This will also be important for you if you chose to construct "Accessory Loops" as part of your control business. Please read the following about proportional, integral, and derivative control operation. Contact your Honeywell LCBS Connect professional for assistance.

Proportional Control and the Concept of Differential and Throttling Range

Let's start with basic control. Feedback control uses the "error", defined as the sensed value minus the set point, to determine how to drive the output. Proportional Control commands the output as a direct proportion of the current error. This is typically configured with a "Proportional Band" or a "Throttling Range" that defines the value of the error that will result in the control output going to 100%. These terms are typical when we are describing modulating output. If we are driving a digital output, the difference that is observed between the controlled load being energized and de-energized is typically referred to as Differential.

So, if we are driving a modulating output, then the output is set to the percent calculated from the ratio of the error to the Throttling Range (TR, e.g. if the error is ½ the TR, the output would be 50%, and if the error is equal to the TR then it would be 100%).

Proportional Control

Proportional control is the function that determines the output setting required to meet the load conditions.

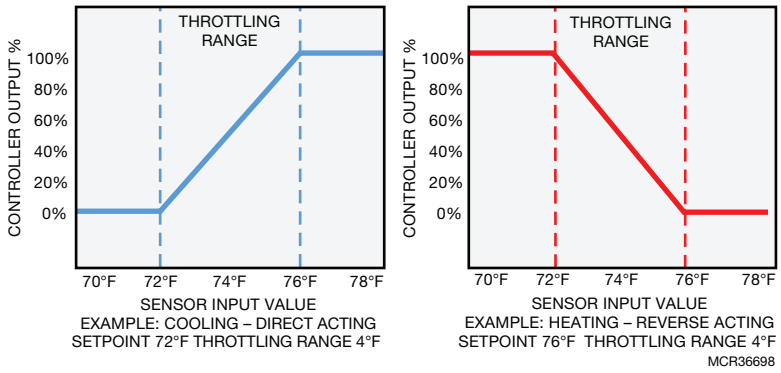


Fig. 4.

A direct acting control loop is one where the output increases as the input sensor value rises above the set point. A reverse acting control loop is one where the output increases as the input falls below the set point. Direct or reverse acting should be selected based on the application requirements with the consideration that set point is the "no load" value of the measured variable and with 0% output the energy input should be the closed or off. The physical outputs can be configured to match the controlled devices (normally open, normally closed, energized on, energized off, etc.).

APPLICATION EXAMPLES			
DIRECT ACTING. CONTROL DEVICE INCREASES AS MEASURED VALUE INCREASES		REVERSE ACTING. CONTROLLED DEVICE DECREASES AND MEASURED VALUE INCREASES	
COOLING	STATIC PRESSURE	HEATING	LIGHTING
DEHUMIDIFICATION	CHILLED WATER PUMP	HUMIDIFICATION	STATIC PRESSURE
MIXED AIR	CONDENSER WATER PUMP	HOT WATER PUMP	

The proportional calculation determines proportional error (Ep). Proportional error is the deviation from set point of the sensed medium (input sensor) divided by the throttling range expressed in units of the input sensor. The set point is the value of the input sensor at which the control loop is satisfied. When the input sensor value is at set point there is no proportional error and the output is 0%. The throttling range is the amount of change in the sensed medium required to drive the output from 0 to 100%. By definition, in proportional control the input value must deviate from set point to initiate a change in the output.

Selected Throttling Range must be narrow enough to provide good control without becoming unstable. The throttling range is determined by a number of factors such as the control application, the response time to the equipment being controlled, and the control algorithm being used. The narrower (smaller) the throttling range, the more precise the control and the wider (larger) the throttling range, the more stable the control. The objective is setting the throttling range to achieve the optimum balance between precision and stability.

Set point and Differential Refresher – On Off, Digital Control

The following is a refresher course for you and describes the relationship between set point and differential for heating and cooling. These settings are typically programmed for each control loop and each on off output.

In heating mode, the differential is below the set point. The output relay de-energizes when the temperature rises to the set point. As the temperature drops to the set point minus the differential, the relay energizes. You will also see this referred to as "direct acting," where increased control action is in direct relationship to increased temperature value.

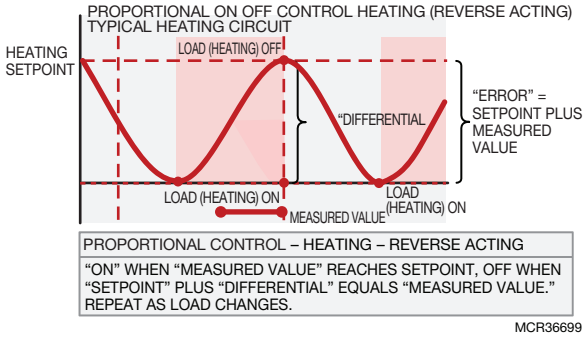


Fig. 5.

In cooling mode, the differential is above the set point. The output relay de-energizes when the temperature falls to the set point. As the temperature rises to the set point plus the differential, the relay energizes. You will also see this referred to as "reverse acting, where increased control action is in direct relationship to reduced temperature value.

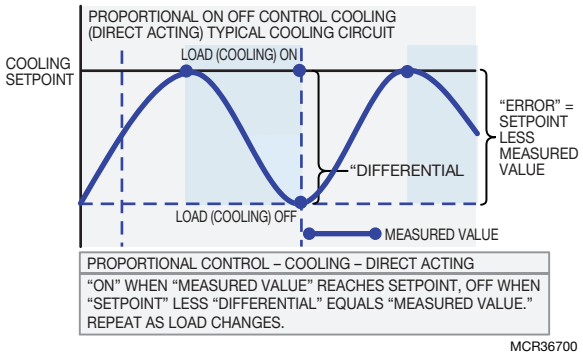


Fig. 6.

Integral Action Primer and Refresher Course for Some

The purpose of the integral function is to eliminate the offset inherent in proportional control, in other words, integral control functions to hold the input sensor value at set point.

The integral function is a function of proportional error and time.

When the proportional error is greater than 0 the integral error will be calculated and added to proportional error to determine the control loop output. The integral error is cumulative and will continue to increase as long as the proportional error is greater than 0. The increase in the output signal will drive the controlled device further open and the controlled medium will be brought closer to set point. While the proportional error is reduced, the integral error will continue to increase until the proportional error is eliminated.

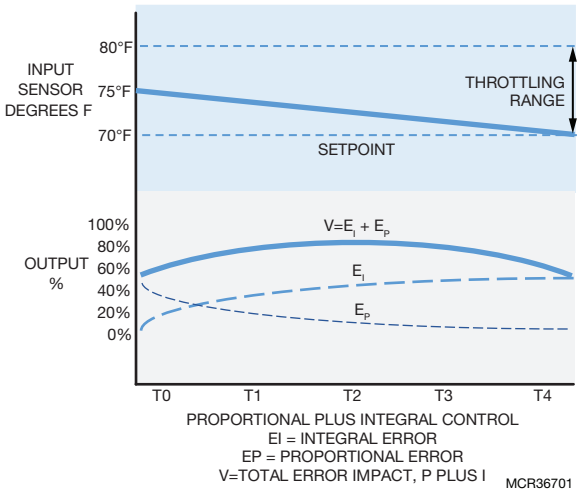


Fig. 7.

When the proportional error equals 0 the calculated integral error is 0 and no change is made to the output.

When the proportional error is less than 0 the integral error is calculated as a negative value resulting in decrease in the integral error.

The integral time value is set in seconds based on the lag time of the controlled process. A slow process such as space temperature control requires a long integral time (600 seconds or more) while a fast process such as static pressure control requires a short integral time. An integral time value of 0 (default) eliminates implementation the integral function.

P+I control can decrease stability of a control loop. Stability of the control loop is a balance of the throttling range and the integral time. If a P+I control loop is unstable it is necessary to increase the throttling range and/or increase the integral time. In general, the throttling range required for P+I control is greater than that for proportional only.

⚠ NOTICE

A bit of good news. Honeywell has utilized "proportional plus integral control" in analog and digital temperature control devices for residential and commercial customers **for 40 years. LCBS Connect controllers are preconfigured with proper settings as they have been for 40 years.** You simply don't have to do a thing to take advantage of this sophisticated control.

If you decide to use LCBS Connect controller "accessory loop" function, you may want to ask your Honeywell LCBS Connect distributor for a hand. If you decide to control something other than temperature with the accessory loop function, you may need to provide integration timing factor. For example, if you want to control outdoor lights, the integration feature doesn't add to the quality of control and the integration timer should be set to zero (0). Simple set point and differential are the only parameters that need to be set.

Do You Want to Know More about Integral Control?

As a starting point, the LCBS Connect controller uses the dependent gains form of the PID equation. This means that you specify an integral time and the actual integration gain is dependent on the Throttling Range (TR). Specifically the integral time is the time in seconds that it should take for the integration result to be 100% if the error is held constant at the TR. For room control integral time typically ranges from 1,000 to 2,500 seconds given the standard throttling range used. Note that the LCBS Connect controller integral gain for the thermostat function is predefined for optimal performance and should generally not be changed! The purpose of integral action is to reduce the offset from set point during steady state control that can be experienced using proportional only control. Again, as general information, control action is impacted by throttling range selection and adjustment. It's a good idea to adjust the throttling range first before making any adjustment to integral time. It's a good idea to adjust throttling range to be as wide as possible because this will provide the most stable control. Remember that the integral will eliminate the steady state error so you do not need to have a small throttling range to have accurate control. Integral action allows for controlling to set point even with a wide throttling range.

Derivative Control

Proportional-integral-derivative (PID) control adds the derivative function to PI control. The derivative function opposes any change and is proportional to the rate of change. The more quickly the control point (actual sensed temperature) changes, the more corrective action the PID system provides. The higher the derivative setting, the greater the effect. In LCBS Connect controllers, the derivative default value is factory set to zero resulting in no control. **It is strongly recommended that the derivative remain at zero (0) unless you have a very good reason to adjust it.** Derivative control is not needed in the vast majority of HVAC applications.

DEMAND CONTROLLED VENTILATION

Theory and Operation Demand Controlled Ventilation (DCV).

As energy costs increased in the last half of the 20th century, coupled with the cost of providing ventilation to building spaces during height and depth of winter and summer, ventilation codes have been altered. It is acceptable to supply ventilation at a rate equivalent to the number of building occupants as opposed to a fixed minimum ventilation rate of outdoor air actuator and dampers.

DCV Operation

As energy consumption continues to be a driving part the economics to operate HVAC systems, we continue to support HVAC strategies that will allow systems to dynamically "decrease" fresh air ventilation rates if there are a few occupants in a building space. Unfortunately, many building owners and operators have figured this out and have purposefully restricted fresh air ventilation flow to building occupants. Incorrectly executed, this can result in sluggish behavior and illness directly caused by stale, recirculated air.

Without writing an HVAC physics paper, scientists have determined that the presence of carbon dioxide gas is proportional to oxygen content in air due to human respiration. Fact is that the "primary function (of human respiration) is to obtain oxygen for use by body's cells and eliminate carbon dioxide that cells produce." The less content of carbon dioxide in the air, the less presence of human respiration (and humans) exists. This makes people drowsy, ill, and worse.

Find levels and associated human impact of CO2 in confined building spaces provided by "Engineering Tool Box:"

SITUATION	CO2 PPM LEVELS
NORMAL OUTDOOR AIR PPM LEVEL	350-450 PPM
ACCEPTABLE PPM LEVEL	<600 PPM
COMPLAINTS OF DISCOMFORT, ODORS BY BUILDING OCCUPANTS	600-1,000 PPM
ASHRAE AND OSHA STANDARD, EXPECTATION	1,000 PPM
GENERAL DROWSINESS	1,000-2,500 PPM
ADVERSE HEALTH EFFECTS EXPECTED	2,500-5,000 PPM
MAXIMUM ALLOWED CONCENTRATION WITHIN AN EIGHT (8) HOUR WORKING PERIOD	5,000 PPM

Source: http://www.engineeringtoolbox.com/

The Honeywell LCBS Connect control can reduce ventilation in a building space with feedback from a CO2 sensor. As you can see from the table above, it is desirable to keep interior building space CO2 levels at 1,000 PPM or below during building occupancy periods. If sensed CO2 level falls, it is acceptable to reduce outdoor air damper minimum position and still conform to building code. The LCBS Connect controller will reduce outdoor air damper position until sensed CO2 begins to rise. Again, if it is very cold or very warm outdoors, reducing outdoor air position can save substantial negative energy consumption and associated cost outlay.

First "law" of ventilation

The bigger the rate is, the more my energy bills will be. The more extreme the climate, the more damaging high rates of ventilation are. So, what if I only have five (5) people in my building, instead of 20? I only need to provide 50 CFM of fresh air to the building. As a building owner I could do two things. First, if I could control to this lower level and I could 1] provide appropriate fresh air to my building guests and 2] save a bunch of energy dollars by backing off ventilation rate. Demand Controlled Ventilation (DCV) unlocks the promise of dynamically provide lower ventilation rates automatically and delivering benefits described above.

How do we do this?

Do I count folks as they come in and out of the controlled building space? There are a few promising technologies that could "count people," but they simply aren't economical now. The preferred method to sense guest's presence in an enclosed space is the detection of CO2 gas and associated sensing technology. Because this isn't a science lesson, we'll be humane. Simply put, human beings breathe in oxygen and as our body processes oxygen and the other things we consume, we "exhaust" and exhale CO2. CO2 is far from fatal if continually ingested by the human body, but it does make us sleepy, grumpy, and less attentive. Again, not a science lesson, but we also refer to CO2 as a "trace gas." What is this? Consider carbon dioxide and "proxy" for other nasty stuff in building environment. Simply put, there are other noxious by products floating in the air including VOCs (outgassed from carpeting, paint, cleaning solutions) and bugs that float around from folks coughing and sneezing. Just to be clear, when we refer to "cold and flu season," *one of the contributing factors of this phenomenon is bad building ventilation*.

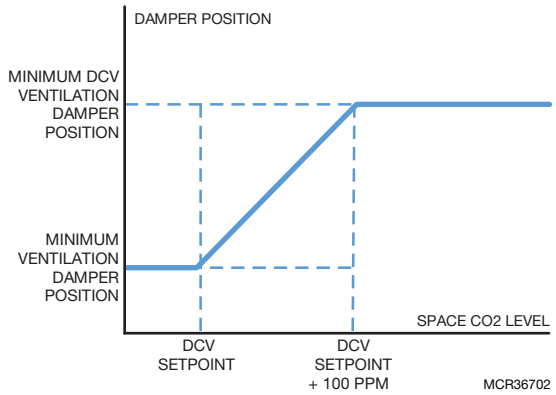


Fig. 8.

Providing good ventilation is important. Let's go back to the theory and operation of DCV. During building occupancy, we continuously and dynamically sense CO2. If the level of CO2 is lower than our selected threshold, or "limit," we control rate of ventilation at the "minimum ventilation damper position" level. Theoretically, this is a position that will provide fresh air to estimated building occupant population as we've discussed before.

Let's add a factoid here. HVAC "scientists" suggest that at 800 PPM building CO2, bad things start happening to the human being as we've shown. This becomes a typical and suggested setting to monitor and control carbon dioxide content in our building space. Our automatic control system begins to reset minimum ventilation rates from our "minimum ventilation damper position" level to our "minimum DCV ventilation damper position." This reset will dynamically continue based on sensed carbon dioxide PPM level in the space.

Demand Controlled Ventilation Summary

LCBS Connect controllers can provide mitigation strategy based on the increase of CO2 as a "trace gas" indicating the fouling of oxygenated air. As described, this results in "woozy" building occupants and can also lead to illness as described in this document. As with previous control loops, there are many values that you can alter that will make your DCV strategy work well or work badly. It is essential that you understand 1] what DCV techniques you and your company likes to use and 2] what the prevailing building code, ventilation standard is for your area.

ADAPTIVE INTELLIGENT RECOVERY

Adaptive Intelligent Recovery is a Honeywell is a patented feature that when properly applied 1] ensures comfort for building occupants at occupancy even after equipment has been controlled at a higher (cooling) or lower (heating) temperature after hours 2] gradually ramps set points up or down (heating or cooling) reducing wear and tear on equipment and 3] reduces the likelihood of all equipment cycling at the same time that could result in undesirable high electrical demand.

LCBS Connect controllers use Adaptive Intelligent Recovery to gradually and dynamically transition temperature setpoints from unoccupied to occupied, standby to occupied, and unoccupied to standby operation. The concept of Adaptive Intelligent Recovery is to gradually increase or decrease (heating, cooling) the set point from the unoccupied or standby set point, to the standby or occupied set point over a period of time to match the recovery capability of the mechanical system, providing benefits listed above.

The **minimum ramp rate** assures that the occupied temperature will be met at the appropriate scheduled occupied time without overheating or overcooling condition space. If the equipment is oversized or the call for mechanical cooling or heating is not too severe, the equipment is cycled appropriately to achieve occupied set point in a timely manner. The beneficial outcome is gradual, responsible operation of equipment that ultimately saves energy, reduces wear and tear on equipment, and ensures comfort conditions by occupancy.

Similarly, the **maximum ramp rate** assures that the occupied temperature will be met at the appropriate scheduled occupied. In this case, it's probably very hot, very cold outside or some type of excessive load exists in the building space. Maximum ramping is probably associated with observation and realization of local heating or cooling "design conditions." As with minimum ramping, the beneficial outcome is the same including responsible operation of equipment that reduces wear and tear on equipment and ensures comfort by occupancy.

NOTICE

Work with your Honeywell customer service or Honeywell LCBS Connect distributor professional for advice for constructing parameters properly to ensure successful Adaptive Intelligent Recovery deployment.

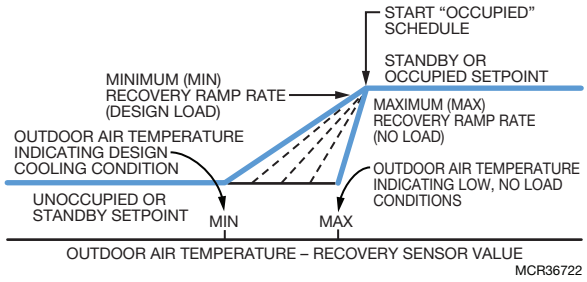


Fig. 9.

Table 3.

SETPOINT NAME	DESCRIPTION
MINIMUM RECOVERY SENSOR VALUE	THE VALUE OF THE RECOVERY SENSOR (TYPICALLY OUTSIDE AIR AT LOCAL DESIGN TEMPERATURE) AT WHICH THE MINIMUM RECOVERY RAMP OCCURS.
MAXIMUM RECOVERY SENSOR VALUE	THE VALUE OF THE RECOVERY SENSOR (TYPICALLY OUTSIDE AIR AT NO LOAD TEMPERATURE) AT WHICH THE MAXIMUM RECOVERY RAMP OCCURS.
MINIMUM RECOVERY RATE	THE RECOVERY RATE FOR THE MECHANICAL SYSTEM (TYPICALLY HEATING OR COOLING) AT DESIGN CONDITIONS (USUALLY THE OUTSIDE AIR TEMPERATURE). THIS MINIMUM RATE OF RECOVERY TAKES THE MAXIMUM TIME TO GET TO THE NEW OCCUPIED OR STANDBY SETPOINT.
MAXIMUM RECOVERY RATE	THE RECOVERY RATE FOR THE MECHANICAL SYSTEM (TYPICALLY HEATING OR COOLING) AT NO LOAD CONDITIONS (USUALLY THE OUTSIDE AIR TEMPERATURE AT WHICH HEATING OR COOLING IS NO LONGER NEEDED). THIS MAXIMUM RATE OF RECOVERY TAKES THE MINIMUM TIME TO GET TO THE NEW OCCUPIED OR STANDBY SETPOINT.

NOTE: When used with Adaptive Intelligent Recovery, minimum and maximum apply to the rate of recovery expressed in degrees per hour. The smallest amount of recovery in one hour is minimum recovery. The most recovery in one hour is maximum recovery. For example, a heating plant can be sized for a recovery of 3°F per hour, at 0°F outside air temperature and a recovery of 8°F per hour at 55°F. The minimum recovery rate is 3°F per hour and the maximum recovery rate is 8°F per hour.

Adaptive Intelligent Recovery™ Summary

You will need to understand how your equipment is sized in relationship to heating and cooling load in the middle of summer and winter and during transitional climate season. It is absolutely essential that you understand concepts in diagram above so that you can commission an effective recovery strategy. Use LCBS Connect remote troubleshooting tools to help you set appropriate Adaptive Intelligent Recovery settings.

MULTISPEED FAN

Multispeed Fan Theory and Operation. Almost 80% of the commercial heating and air conditioning systems in North America feature a one speed, single speed fan. Rising energy costs, accompanied by increasing HVAC mechanical system expertise and technology have given rise to the concept to alter the speed of a supply fan during occupied building hours. A typical HVAC system is sized for regional, geographic "design conditions" at a certain rate of compliance. For example, in Birmingham, Alabama, find metrological design facts of interest:

				HEATING DB °F			**COOLING DB/MCWB °F/°F**		
					DB	**WB**	**DB**	**WB**	
STATION	**LAT**	**LON**	**ELEV**	**99.6%***	**99.0%***	**99.6%***	**99.0%***	**99.6%***	**99.0%***
BIRMINGHAM MUNICIPAL AIRPORT	33.56N	86.75W	630	19.6	24.0	95.0	75.1	92.6	74.9

*Exceeds parameter, criteria N% of observed climatological condition.

As you know, commercial HVAC equipment is sized to operate at its full capacity limit at some percent level of design, local climate condition. In Birmingham, an HVAC unit operates at full capacity when it's equal or above 95°F dry bulb and 75.1°F wet bulb outdoor temperature, further at the 99.0% design level. Specifically, this means that 99% of the time, the HVAC unit operates at a LOWER load level. Bottom line, there is plenty of opportunity to mitigate, reduce air flow, thus reduce operational supply fan speed. As you know, this is one of the basic tenets of "variable air flow" design and there is no reason why we can't deploy load reduction principles to constant volume air handling units.

Multispeed Fan Operation

Honeywell LCBS Connect controller offers a variety of control strategies to control fan speed. Industry sources have shown that varying supply fan speed can result in substantial energy and O&M savings by engaging the technique.

There are three basic ways that we can achieve this applying LCBS Connect control system. First, a traditional belt drive single-speed motor controlled by a variable frequency drive (VFD) can be used, second, a two-speed motor with two sets of preset motor windings, and lastly a direct-drive motor (PSC or ECM) controlled by relays or a digital control system.

Two speed motor

The two-winding, two-speed motor is the simplest of the three options that the LCBS Connect controller can control. The motor will have two sets of windings; this motor is typically provided by an HVAC OEM or by a motor supplier directly. One set is energized for one discrete speed and the other set energized for the second discrete speed. If you encounter a motor like this, it is already wired to control the two discrete speeds with LCBS Connect controller. Again, note that the speeds are probably unchangeable in the field.

VFD application

The LCBS Controller sends a control signal to a VFD that changes frequency and the speed of the supply fan motor. LCBS Controller supports up to six discrete speeds. Each of the speeds can be assigned to a specific control "mode," like "ventilation, stage 1 cooling, stage 2 - 3 cooling, stage 1 heating," and so on. Please note that if you are considering retrofit of a motor, that motor bearings are able to support operation at less than the 60 Hz design speed. Cost of VFDs have decreased over the years, they are efficient, and they can be preprogrammed to specific speeds. Because of their electrical construction, VFDs can gradually increase supply fan speed, providing supply fan "soft start." This avoids starting jolts that create excess noise and mechanical wear on the system.

Direct drive "ECM" motor

A direct-drive motor can received a control signal from the LCBS Controller that will change the supply fan motor speed. You will find that these are typically low horsepower applications, usually found is system less than five (5) tons. You will find that the direct-drive motor takes up no additional space in the base rooftop and can be field configured through the LCBS Controller.

LCBS Connect can perform all currently accepted multispeed supply fan strategies. If you encounter an ECM type supply fan motor or two speed, two winding fan, we can control it. For retrofit application, it is our recommendation that the application of a VFD makes most sense. It provides ultimate ability to alter supply fan motor speed and provides soft start operation for the fan motor. Make sure you are conscious of application of a VFD with the motor you are attempting to control.

Honeywell LCBS offers two basic multispeed control options. They are:

- **Two speed, discrete fan control.**
- **Multispeed variable-constant fan control, up to six stages of fan.**

Two Speed Discrete Fan Control

In a two-speed discrete fan supply strategy, the fan **SPEEDS** must be able to be operated and controlled in a discrete manner. Specifically, there are two outputs on the LCBS Connect controller that controls "Fan Low Speed" and "Fan High Speed." The two-winding, two-speed motor is the simplest of the three options that the LCBS Connect controller can control. The motor will have two sets of windings. One set of windings is energized for one discrete speed and the other set is energized for the second speed. If you encounter a motor like this, it is probably already wired to control the two discrete speeds to existing control system.

NOTES:

1. Speeds are probably unchangeable in the field as they are "hardwired" by the motor manufacturer.
2. If you are replacing a control system with the LCBS Connect controller, the HVAC system may "hide" the complexity of control of the two speed fan and actually allow the service contractor to apply a standard staged heating, staged cooling, fan with two speed logic performed on the line voltage side of the control system. A typical way a fan is controlled on a 3 - 25 ton constant volume air handling unit is low speed as follows that DOES NOT require two speed control interface and just a simple R,G,W,Y thermostat. Please refer to this sequence to understand this point:

Table 4.

OCCUPANCY CONDITION	LOW VOLTAGE INTERFACE, WHAT THE EXISTING THERMOSTAT DOES	HOW SYSTEM IS CONTROLLED, LINE VOLTAGE
UNOCCUPIED	NO CONTROL SYSTEM VOLTAGE, NO CALL FOR HEATING OR COOLING.	CONTROL SYSTEM FEATURES A TIMING FUNCTION TO TURN OFF 24 VAC.
TRANSITION FROM UNOCCUPIED TO OCCUPIED	NO CONTROL SYSTEM VOLTAGE, FAN CIRCUIT (G) ENERGIZED W (CALL FOR HEAT) Y (CALL FOR COOL).	24 VAC TOGGLES FROM OFF TO ON, Y AND W CYCLE WITH LOW SPEED FAN WINDING.
OCCUPIED, NO CALL FOR COOLING	CONTROL SYSTEM VOLTAGE PRESENT, FAN CIRCUIT (G) ENERGIZED.	24 VAC ON, PROVIDES VOLTAGE TO ECONOMIZER AND LOW SPEED FAN WINDING.
OCCUPIED, CALL FOR COOLING	CONTROL SYSTEM VOLTAGE PRESENT, Y (CALL FOR COOLING) FAN CIRCUIT ENERGIZED.	24 VAC ON, PROVIDES VOLTAGE TO ECONOMIZER AND HIGH SPEED FAN WINDING.
OCCUPIED, CALL FOR HEATING	CONTROL SYSTEM VOLTAGE PRESENT, W (CALL FOR HEATING) FAN CIRCUIT ENERGIZED.	24 VAC ON, PROVIDES VOLTAGE TO ECONOMIZER AND HIGH SPEED FAN WINDING.

⚠ WARNING

If the constant volume control system controls a system as shown above, do NOT use the two fan speed logic provided by LCBS controller.

Two Speed and Multispeed VFD Application

The LCBS Controller sends a control signal (0-10 VDC) to a VFD that changes frequency and the speed of the supply fan motor.

NOTES:

1. Consult with VFD manufacturer to ensure that the supply fan motor in your constant volume air handling unit is able to be controlled by the VFD. As time goes on, older technology motors in typical 3 - 25 constant volume air handling units become ever less applied, but care must be taken retrofitting motors.
2. While changing the speed of a fan motor can yield excellent energy savings, the service contractor must take care to ensure that reduced air flow is substantial to dissipate heat or cool load across the heat exchanger. If airflow is dropped to severely, damage to heating or cooling equipment can occur, not to mention reduced comfort conditions.

As mentioned above, cost of VFDs have decreased over the years, they are efficient, and they can be preprogrammed to specific speeds. Because of their electrical construction, VFDs can gradually increase supply fan speed, providing supply fan "soft start." This avoids starting jolts that create excess noise and mechanical wear on the system

Electronic Direct Drive Motor (ECM, et al.) A direct-drive motor can received a control signal from the LCBS Controller that will change the supply fan motor speed. You will find that these are typically low horsepower applications, usually found is system less than five (5) tons. You will find that the direct-drive motor takes up no additional space in the base rooftop and can be field configured through the LCBS Controller.

LCBS Connect can perform all currently accepted multispeed supply fan strategies. If you encounter an ECM type supply fan motor or two speed, two winding fan, we can control it. For retrofit application, it is our recommendation that the application of a VFD makes most sense. It provides ultimate ability to alter supply fan motor speed and provides soft start operation for the fan motor. Make sure you are conscious of application of a VFD with the motor you are attempting to control.

How it Works VFD Application and Direct Drive "ECM" Motor

The LCBS Connect controller offers some groundbreaking control technology to take advantage of ever lower costs of variable frequency drives. The Honeywell approach permits the applier to assign any fan speed to any heating, cooling, ventilation mode. The following table shows the options for VFD control.

Table 5.

CONTROL CONDITION ENCOUNTERED, MODES	DESCRIPTION	UP TO SIX FAN SPEED CHOICES
VENTILATION MODE	NO CALL FOR HEATING, COOLING DURING OCCUPANCY	40-100%.
SINGLE STAGE HEATING	CALL FOR ONE STAGE OF HEATING	40-100%.
MULTIPLE STAGE HEATING	CALL FOR ONE, TWO, THREE STAGES HEATING	40-100%.
SINGLE STAGE COOLING	CALL FOR ONE STAGE OF HEATING	40-100%.
MULTIPLE STAGE COOLING	CALL FOR ONE, TWO, THREE STAGES HEATING	40-100%.
OTHER MODE	DESCRIBE, DEFINE ANOTHER MODE	40-100%.

Example of VFD Fan Control

Let's assume that I want to reduce fan speed during single stage of heat and ventilation mode at the same low rate 40%. I want to reduce fan speed during first stage cool to 60%. I want the fan to run at 80% for multistage heat and cool HVAC modes. Please refer to the diagram below to describe how we want the system supply fan will work.

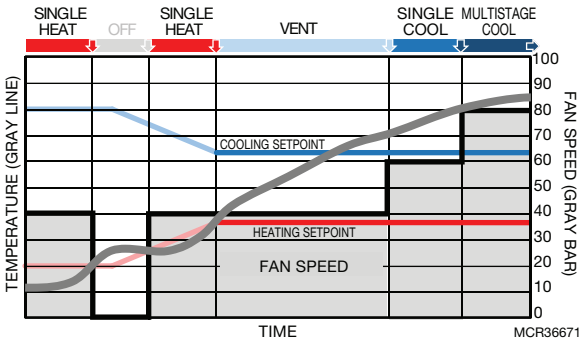


Fig. 10.

Following the diagram from left to right, just above and to the left, note that if there is a call for "unoccupied heat," the fan cycles on with the call for single stage heat, per single heat mode at 40%. When the call for heat abates, the fan cycles off during "unoccupied" period. During Intelligent Recovery, call for heat occurs again and fan is energized to 40% speed, per "single heat" mode. When system enters "occupied mode," fan speed is programmed for 40% and fan runs at this level. We assuming that economizer carries the cooling load within "vent mode" and fan continues to run at 40%. We have a call for mechanical cooling. When first stage of cooling is energized, fan runs at 60%. The call for cooling continues and second state of cooling is energized. Per "multistage cooling" mode requirement, fan runs at 80%.

Without "multispeed fan" and variable frequency drive application, the fan operates as shown, to your left. The "yellow area" indicates energy saving potential by running the fan with the Honeywell LCBS Connect controller algorithm.

Wow!

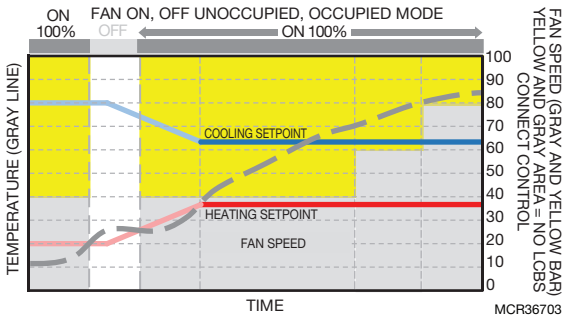


Fig. 11.

Multispeed Fan Summary

Please take the time to understand the physics of the fan(s) you intend to control; wire them up properly and determine how you are going to control them. It is essential that you read and understand the theory and operation of the multispeed fan options and how you intend to control them. It is absolutely essential that you understand concepts shown above so that you can commission an effective fan control strategy. Contact your Honeywell LCBS Connect sales and support professional for assistance.

THEORY AND OPERATION ACCESSORY LOOPS

One of the key differences between residential and commercial applications is the presence of HVAC equipment, along with commercial constant volume air handling units, rooftop units, and split systems. Vestibules, entry ways have unit heaters, perimeter zones have electric and hot water radiant heaters, stock and storage rooms have unit heaters. All of these HVAC types can be controlled by the LCBS Connect controllers. Lighting and refrigeration systems can also be controlled by Accessory Loops. As long as we pay careful attention to HVAC and electrical physics of controlled loads, we can do a great job of controlling most HVAC and other ancillary heating, cooling, and lighting loads.

How do Accessory Loops work?

For all intents and purposes, if you understand and can define inputs and outputs do in the control sequence, you will be able to duplicate it with an LCBS Connect accessory loop. Two common examples that will demonstrate the use of LCBS Connect accessory loops will be described. First will be a simple blower fan and gas heater, typically found in warehouses, loading docks, stocking areas. Second will be a photocell loop that is commonly applied to turn outdoor lighting on and off based on outdoor ambient light level.

Example

Heating Blower Coil

Assume that a heating blower coil is in a loading dock and that the dock is open from 6 AM in the morning to midnight. Because this is a heating blower coil, our primary requirements during occupancy would be 1] the comfort of the loading dock employees and 2] good even temperature control. During unoccupied times from midnight to 6 AM, out primary requirement is keeping pipes, product, and equipment from freezing in the loading dock, warehouse area.

Setting up the application

First, a sensor should be selected in the controlled space proximate to the blower coil. The desired control set point range should be considered in the selection process. Let's assume that we want to control the temperature in the loading dock at 65°F during occupancy and we want to control the temperature in the loading dock during unoccupied time at 40°F. It is desirable to ensure that blower coil is not over cycled, so choose the type to be a Staged Thermostat that will ensure standard cycling behavior. Further we will configure, the PID action to be reverse acting (heating). This drives the selection of the right room, space, zone sensor, type and action. We'll pick the TR40 sensing only device that has a range from 32°F to 110°F. Secondly, we need to determine how to operate the control circuit to energize and reenergize the blower coil fan and the gas or electric heating circuit. We need to examine the rating of the on-board relay on the LCBS Connect controller. After brief investigation, we find that we can control a 1.0 A circuit at 24 VAC. This stated, we can probably interrupt a low voltage control circuit directly or provide a line voltage relay with a low voltage relay coil.

NOTE: If you are controlling a line voltage load (110 VAC+) you need to provide a relay with an appropriate low voltage coil to control the control load.

Example **Outdoor Ambient Lighting**

The application is the control of outdoor lighting loads, using a sensor in the outdoors, measuring light level of outdoor ambient light, typically "foot-candles," and turning external lighting on and off. To be clear, external light circuits will be turned on as outdoor ambient light level decreases and off as light level increases. This loop will remained enabled 24 hours a day to permit external lights to be on in the event of dark, gloomy days and will be on to enhance safe condition outside our building.

Setting up the application

To control outdoor ambient lighting, several basics need to be considered. First, an outdoor rated ambient lighting sensor must be selected. These devices typically feature physical rating and mounting kit that will permit outdoor use. It is important to follow instructions relating to how the sensor is "aimed" at the light source. Second, the control output of these sensors need to match LCBS Connect controller rating; 0-10 VDC should be selected. Finally, these systems need DC power. Make sure the 20 VDC power supply from LCBS Connect controller has enough current to power the sensor. This is particularly critical if you've applied more than one sensor per LCBS Controller that needs power. Next, we need to determine how to operate the lighting circuit to turn lighting load on and off. As with the previous application, we need to examine the rating of the on-board relay on the LCBS Connect controller. As we now know, we find that we can control a 1.0 Amp control circuit at 24 VAC. If our customer is using a circuit breaker panel (highly risky, poor practice, dangerous) or line volt switches to turn lighting on and off, one or more low voltage coil relays with appropriately sized line voltage relay contacts will be required. For this application we will choose type as "Staged Conventional" and the PID action to be "Indirect".

In summary, Accessory Loop control provides a creative way to automatically control a wide variety of electric consuming equipment in a commercial building.

Accessory Loops Summary

You will need to clearly understand are going to control a "controlled device," how it is going to act in response to a change in the measured value, and what you want the output to be. Further, if you are using custom sensors, you need to know how the media you are monitoring responds to the media. The Accessory Loop is debatably one of the most clever and capable control strategy that we supply with LCBS Connect controllers, but it take commensurate planning. So, if you going to deploy a "roll your own" temperature, humidity, pressure, lighting strategy, you will need to go to print them out, and write out the settings and parameters you want to implement. Go to LCBS Connect wall module or LCBS Connect Remote User Interface and input desired values. It is absolutely essential that you understand concepts that are presented above so that you can commission an effective "accessory loop" strategy.

SERVICE ALERTING THEORY AND FUNDAMENTALS

As fuel costs have increased in the last half of the 20th Century and the first part of the 21st Century, coupled with the cost of providing professional service to our HVAC service customers, the use of remote services to inform service providers of improper HVAC operation has become more and more popular. Building owners also realize that faced with the challenge of keeping their employees, patrons, and guests comfortable coupled with rising energy costs that it's simply good business to employ HVAC service contractors who use remote technology to oversee and service their buildings. As ubiquitous remote technology including processing capability and storage grow and are enhanced, Honeywell has harnessed "LCBS Connect Cloud Technology" and discovered a way to analyze data extracted from HVAC systems in light commercial buildings and create meaningful service information. This information can be used by service providers to predict and prevent HVAC system failures and can also be used to provide evidence of how failures were addressed and repaired. This leads to the service contractor's goal to become their customer's "trusted advisor."

At a basic level, the concept of service alerting can be applied to individual sensed temperature, humidity, and pressure sensors. If sensed values become suspect, the Honeywell LCBS Controller provides processing data in The Cloud that results in a service alert. This capability has existed for years and years, since the advent of 300 baud modems. What the advent of the Honeywell Cloud has provided is ability to provide:

- Highly customized methods of sending English language messages to appropriate service technicians and to common internet based communication devices, including smart phones, tablets, and laptop computers.
- Ability to log large amount of expertly summarized data that will allow service technicians to view and print data they want to see it, in a highly consumable, attractive manner. This permits service contractors to provide "before" and "after" objective, real data to their service clients.
- Data rules that will avoid "alert rains" resulting in data overload for recipients. This ranges from ability of service technicians to set clear and cogent boundaries, hysteresis values to a Honeywell exclusive feature that reduces duplicate incoming information from The Cloud that could potentially create stress for service dispatchers and technicians.
- The ability to perform multivariable analysis based on streaming and historical data to allow us to predict and diagnose specific HVAC anomalies, including Title 24 economizer and ventilation analysis.

How does service alerting work?

The service provider can select any analog sensor to provide alert information. Further, alerts are provided for all sensors attached to the system that fail by short or open conditions. Alerts are also propagated if controllers fail and if the system gateway fails. Analog alerting is described below, followed by these other cases. During the selection of these sensing options, it's important to understand why alerting is necessary and what we are prepared to do if an alert is triggered. This drives very specific documentation that we will prepare to address and alert.

NOTE: We don't necessarily need to alert on every analog point, in fact, setting up copious alerts that are poorly conceived, can cause more problem than good. Our recommendation is to start with a few, carefully selected alerts with very specific, viable requirements and expected outcomes.

First, consider some key service failures, events, key personnel that can impact how you perform against your service contract objectives. Who is signing your checks for your service agreement? Who needs to be kept comfortable at your customer's place of business? What is the impact to them if comfort conditions aren't provided? How old is the equipment that you service? Did you just perform some repairs on equipment that you need to "keep an eye on," that you suspect may fail? After you have this discussion with you and your staff, it would be good to write your thoughts down on accompanying form. Your Distributor or Honeywell sales professional is available to help you as well.

Here are some examples shown below that will help you with develop your own meaningful alerts.

Terminal Load, Zone Demand Alert

This is one of many analytics that will tell a service contractor if heating and cooling equipment is matching zone, space demand. A high terminal load, zone demand reading at 130% (max 162%) or above indicates that mechanical cooling is not matching zone, building heat exchange demand. Likewise, a low terminal load, zone demand of -130% (min -162%) or lower indicates that mechanical or electric heating is not matching zone, building heat exchange demand.

Your story

You have a maintenance contract with your customer to monitor heating and cooling efficiency. If you receive and alert for 120% for cooling or -120% for heating, you are beginning to lose capacity for some reason. This could be a result of heat exchangers that are getting dirty and losing efficiency. This could also be a result of a malfunctioning economizer, a loss of refrigerant charge, a dirty condenser or failed condenser fan. This is your opportunity to address this issue before it gets "out of control" status. Think about this one... if you get this alert during the Fall or Spring season before requirement for heating or cooling gets more substantial, you better do something about it before it gets very cold or very warm.

NOTICE

Design considerations. You should apply terminal load, zone demand alerts at 125% or -125% for cooling and heating respectively. When a system reaches this level, temperature control becomes impaired. Create a custom message and make sure that your service technician gets a custom e-mail message and an SMS message. The messaging could result in some well timed service.

Space Humidity Alert

Space humidity levels are usually a good sign that cooling systems that you observe and service are not performing properly.

Your story

Your service a client that is putting off replacement of a 20 year old rooftop unit. You've done everything you can to keep the unit operating. Your customer knows that the unit is on it "last legs" and that they want to put off the decision to replace the unit until next year; the next cooling season.

You have observed that the unit isn't holding a proper refrigerant charge and that further, the unit does a poor job of dehumidification as the equipment has aged. When you serviced the unit last time, you found that the dry bulb temperature is being maintained properly, but space humidity was pretty high. So, based on this, you've decided to monitor the unit and have picked space humidity as one of the points you will monitor. This is a great choice because humidity is included in the standard LCBS Connect controller wall module.

NOTICE

Design considerations. You have determined that it will get uncomfortable in the space when relative humidity exceeds 50%. This will drive the selection of the "alert limit." Further, you want to make sure that you don't have excessive alert activity, so you should set alert hysteresis at 15 minutes. This means that the humidity level needs to exceed 50% for 15 minutes or longer. If the humidity level rises above 50% and then fall below 50%, the timer is reset. You can further create a custom message and make sure that your best service technician gets a custom e-mail message and an SMS message. The messaging could result in the sale of a replacement rooftop unit by your company as you are armed with objective supporting data logs.

Space Zone Carbon Dioxide Level Alert

High CO2 levels indicate that ventilation systems are operating properly.

Your story

Your service client has noted perceived comfort issues and "stale air" in a major conference center, served by a rooftop unit you service. You've installed a demand control ventilation control strategy for the rooftop unit, but one of the employees in your customer's firm likes to change damper settings because he thinks it saves the boss energy. Your customer, the boss, doesn't know that her employee is messing with the rooftop unit that you service, but you are going to catch him!

NOTICE

Design considerations. You have determined that it will gets "stale" in the space when CO2 level exceeds approximately 600 PPM CO2. As with the humidity example above, this drives the selection of the "alert limit." Further, you want to make sure that you don't have excessive alert activity, so you should set alert hysteresis at 10 minutes. This means that the CO2 level needs to exceed 600 PPM for 10 minutes or longer. If the carbon dioxide rises above 600 PPM and then fall below 600 PPM, the timer is reset. You can further create a custom message and make sure that your best service technician gets a custom e-mail message and an SMS message indicating that a CO2 level alert has occurred. Again, you can further create a custom message and make sure that your best service technician gets a custom e-mail message and an SMS message. By definition, this technician will be prepared to address the mischievous employee!

Differential Pressure Alerting, Filter Loading

High differential static pressure indicates that system filter is loaded and that filter needs to be replaced.

Your story

You have a maintenance contract with your customer to replace air filters. Your contract indicates that you replace the filters four times a year. You intend to improve you service response to change filters when they need to, rather than to do it on a fixed time basis. You will save truck rolls to service sites and you will make sure that your customer's equipment is operating at peak efficiency.

NOTICE

Design considerations. You have determined that standard pressure drop across a clean evaporator coil and filter is about 0.70 inches of water column. You've also determined by your filter and equipment manufacturer's technical literature and advice that filters start to load with negative system consequences at about 0.75 inches of water column. As with the humidity example above, this drives the selection of the "alert limit." Further, you want to make sure that you don't have excessive alert activity, so you should set alert hysteresis at 120 minutes. This means that the static pressure level needs to exceed 0.75 inches of water column for 120 minutes or longer. You can create a custom message and make sure that your best service technician gets a custom e-mail message and an SMS message indicating that a static pressure alert has occurred. This would present an opportunity to reference the model number for filter media. You could also set a "pre alert" so that you have warning to order filter media and schedule a service call.

ALERTING DETAILS

The following alerts can be activated for the "Alpha Version" of LCBS Connect. This description indicates what the alert is, how the alert can be used, and what the application benefits are for the alert.

Each Alert can be set up to send messages to service contractor owners, service managers, dispatchers, and technicians via SMS to Droid and IOS devices. A customized message can be set up in SMS environment, not to exceed 40 characters. Customized messages can be set up in e-mail format with limitless message format.

Table 6.

SENSOR NAME	DIGITAL ALERTS	HI LIMIT ALERTS	LOW LIMIT ALERTS	SENSOR FAIL ALERT	DESCRIPTION AND USE CASES
DIRTY FILTER DIGITAL	●				INDICATES THE STATE OF THE DIRTY FILTER DIGITAL INPUT. THIS IS A DIGITAL SIGNAL AND COUNTS ON SERVICE CONTRACTOR SELECTING A DIGITAL FLOW SWITCH THAT MEASURES ENTERING AND LEAVING AIR ACROSS AIR FILTER.
PROOF OF AIRFLOW DIGITAL	●				INDICATES THE CURRENT STATE OF THE FAN STATUS DIGITAL INPUT. THIS IS A DIGITAL SIGNAL AND COUNTS ON SERVICE CONTRACTOR SELECTING A DIGITAL FLOW SWITCH THAT MEASURES ENTERING AND LEAVING AIR ACROSS THE SUPPLY FAN.
FREEZE STAT	●				INDICATES THE STATE OF THE FREEZE STAT DIGITAL INPUT. ALSO CALLED COIL FREEZE. IF THIS CONDITION IS DETECTED, LCBS CONTROLLER LOGIC WILL SHUT OFF SUPPLY FAN.
USER CONFIGURED INPUT	●				MONITOR SWITCH: INDICATES THE STATE OF THE MONITOR SWITCH DIGITAL INPUT. UP TO CONFIGURER'S IMAGINATION AND ALERTING REQUIREMENTS.
RETURN AIR ENTHALPY		●		●	RETURN AIR ENTHALPY. THIS CAN BE OF INTEREST TO SERVICE CONTRACTORS WHO MAY NEED TO TROUBLESHOOT DIFFERENTIAL ECONOMIZER ISSUES. ALSO CAN BE OF INTEREST TROUBLESHOOTING COOLING ISSUES.
RETURN AIR HUMIDITY		●		●	RETURN AIR RELATIVE HUMIDITY (RH). THIS CAN BE OF INTEREST TROUBLESHOOTING COOLING ISSUES.
RETURN AIR TEMPERATURE		●		●	RETURN AIR TEMPERATURE. ALWAYS INTERESTING COMPARING RETURN AIR TEMPERATURE TO ROOM TEMPERATURE. SHOULD BE ROUGHLY THE SAME ON ONLY SLIGHTLY OFFSET.
INDOOR CO2		●		●	SPACE CO2 IF DEMAND CONTROLLED VENTILATION APPLIED, THIS IS AN INTERSTING POINT TO ALERT.
TERMINAL LOAD, ZONE DEMAND	●				THIS VERSITLE VALUE INDICATES TRUE HEAT LOAD IN A SPACE. IT TELLS THE SERVICE CONTRACTOR IF COOLING AND HEATING SYSTEMS ARE MEETING BUILDING LOAD. IF THIS PARAMETER GETS OUT OF CONTROL (130+ COOLING, 130- HEATING; +162 MAX,-162 MIN) SYSTEMS ARE NOT PERFORMING PROPERLY.

Table 6.

SENSOR NAME	DIGITAL ALERTS	HI LIMIT ALERTS	LOW LIMIT ALERTS	SENSOR FAIL ALERT	DESCRIPTION AND USE CASES
INDOOR HUMIDITY		●		●	RETURN AIR RELATIVE HUMIDITY (RH). THIS CAN BE OF INTEREST TROUBLESHOOTING COOLING ISSUES. USE "TERMINAL LOAD, ZONE DEMAND" ALERTING FIRST.
INDOOR TEMPERATURE		●	●	●	SPACE TEMPERATURE. CAN BE INTERESTING TROUBLESHOOTING HEATING AND COOLING ISSUES. USE "TERMINAL LOAD, ZONE DEMAND" ALERTING FIRST.
COMPRESSOR CURRENT TRANSFORMER SENSOR		●		●	INDICATES COMPRESSOR CURRENT IN AMPS WHEN THE INPUT UI6 IS CONFIGURED TO MEASURE COMPRESSOR CURRENT
DISCHARGE AIR TEMPERATURE		●	●	●	DISCHARGE AIR TEMPERATURE IS A FAVORITE DIAGNOSTIC TOOL BY MANY HAVE SERVICE CONTRACTORS. IT IS EASY TO TELL IF THERE IS A LOW AND DEGRADING DELTA T ACROSS A COOLING COIL THAT THERE IS SOMETHING WRONG WITH COOLING SYSTEMS. CONSIDER ZONE DEMAND AND LOW LIMIT FIRST.
FAN CURRENT TRANSFORMER SENSOR		●		●	INDICATES FAN CURRENT IN AMPS WHEN THE INPUT UI6 IS CONFIGURED TO MEASURE FAN CURRENT. USEFUL TO MONITOR RELATIVE LOAD OF FAN. ALSO CAN BE USED TO DETECT HARD START OF THE LOAD, I.E. EXCESSIVE AMP DRAW.
FILTER STATIC PRESSURE		●	●	●	INDICATES THE PRESSURE DROP ACROSS THE FILTER WHEN THE INPUT UI5 IS CONFIGURED TO MEASURE FILTER PRESSURE. THIS INPUT CAN BE USED TO MONITOR AND MEASURE FILTER STATIC, FILTER LOAD. LIMIT CAN BE SET TO INDICATE WITH FILTER USE BECOMES INEFFECTIVE.
MIXED AIR TEMPERATURE		●	●	●	MIXED AIR TEMPERATURE IS A USEFUL ALERTING POINT TO SERVICE ECONOMIZER USE. THIS SENSOR IS ALSO "ENTERING SYSTEM TEMPERATURE." AND IS NECESSARY FOR MOST UPCOMING HEATING AND COOLING ANALYTICS. CONSIDER LOW LIMIT FIRST.
OUTDOOR AIR ENTHALPY		●			OUTDOOR AIR ENTHALPY CAN BE USED TO TROUBLESHOOT ECONOMIZER ISSUES.
OUTDOOR AIR HUMIDITY		●		●	OUTDOOR AIR RELATIVE HUMIDITY (RH) CAN BE USED TO TROUBLESHOOT ECONOIMZER ISSUES.
OUTDOOR TEMPERATURE		●	●	●	OUTDOOR AIR TEMPERATURE CAN BE USED TO TROUBLESHOOT ECONOMIZER ISSUES.
MONITOR SENSOR 1		●	●	●	WHEN THE INPUT UI5 IS CONFIGURED TO "MONITOR SENSOR", THIS INDICATES THE VALUE READ BY THE SENSOR. THIS IS A 0-10 VDC SENSOR.
MONITOR SENSOR 2		●	●	●	WHEN THE INPUT UI6 IS CONFIGURED TO "MONITOR SENSOR", THIS INDICATES THE VALUE READ BY THE SENSOR. THIS IS A 0-10 VDC SENSOR.
MONITOR TEMPERATURE		●	●	●	WHEN THE INPUT UI2 IS CONFIGURED TO "MONITOR TEMPERATURE", THIS INDICATES THE VALUE READ BY THE SENSOR. THIS IS A TEMP SENSOR

Table 6.

SENSOR NAME	DIGITAL ALERTS	HI LIMIT ALERTS	LOW LIMIT ALERTS	SENSOR FAIL ALERT	DESCRIPTION AND USE CASES
SYLK ADDRESS 3 CO2		●		●	TR40 REMOTE WALL MODULE CO2, SYLK BUS ADDRESS 3. SAME BENEFITS AS DIRECT WIRED CO2 SENSOR, EXCEPT NO POWER SUPPLY REQUIRED.
SYLK ADDRESS 3 HUMIDITY		●		●	TR40 REMOTE WALL MODULE HUMIDITY, SYLK BUS ADDRESS 3. SAME BENEFITS AS SPACE HUMIDITY.
SYLK ADDRESS 3 TEMPERATURE		●	●	●	TEMPERATURE MEASURED BY TR40 REMOTE WALL MODULE AT SYLK BUS ADDRESS 3. SAME BENEFITS AS SPACE TEMPERATURE.
SYLK ADDRESS 4 TEMPERATURE		●	●	●	TEMPERATURE MEASURED BY TR40 REMOTE WALL MODULE AT SYLK BUS ADDRESS 4.
SYLK ADDRESS 5 TEMPERATURE		●	●	●	TEMPERATURE MEASURED BY TR40 REMOTE WALL MODULE AT SYLK BUS ADDRESS 5.
SYLK ADDRESS 6 TEMPERATURE		●	●	●	TEMPERATURE MEASURED BY TR40 REMOTE WALL MODULE AT SYLK BUS ADDRESS 6.
SYLK ADDRESS 8 HUMIDITY		●		●	OUTDOOR AIR RELATIVE HUMIDITY MEASURED BY C7400S SENSOR AT SYLK BUS ADDRESS 8.SAME BENEFITS AS SPACE RELATIVE HUMIDITY.
SYLK ADDRESS 8 TEMPERATURE		●	●	●	OUTDOOR AIR TEMPERATURE MEASURED BY C7400S SENSOR AT SYLK BUS ADDRESS 8.
SYLK ADDRESS 9 RELATIVE HUMIDITY		●		●	OUTDOOR AIR RELATIVE HUMIDITY MEASURED BY C7400S SENSOR AT SYLK BUS ADDRESS 9.
SYLK ADDRESS 9 TEMPERATURE		●	●	●	OUTDOOR AIR TEMPERATURE MEASURED BY C7400S SENSOR AT SYLK BUS ADDRESS 9.
LOCAL TS120 SENSOR RELATIVE HUMIDITY		●		●	TS120 WALL MODULE RELATIVE HUMIDITY
LOCAL TS120 SENSOR TEMPERATURE		●	●	●	TS120 WALL MODULE TEMPERATURE

Service Alerting Summary

An immense amount of flexibility is offered with Honeywell Service Alerting capability. A good deal of your personal imagination coupled with your service objectives will make the Service Alerting option pay big dividends for your company. You may want to brainstorm some of your service issues with your service department and try a few things to see what will make your service operation really productive.

NOTE: You CAN NOT access alerting setup, values and parameters from the LCBS Connect wall module. You can only set up, change and access alert messages via LCBS Connect Remote User Interface, your techs tablets, phones, and laptops!

APPENDIX, WIRING DIAGRAMS

1. Master Points List – Configurable and Fixed Function Points

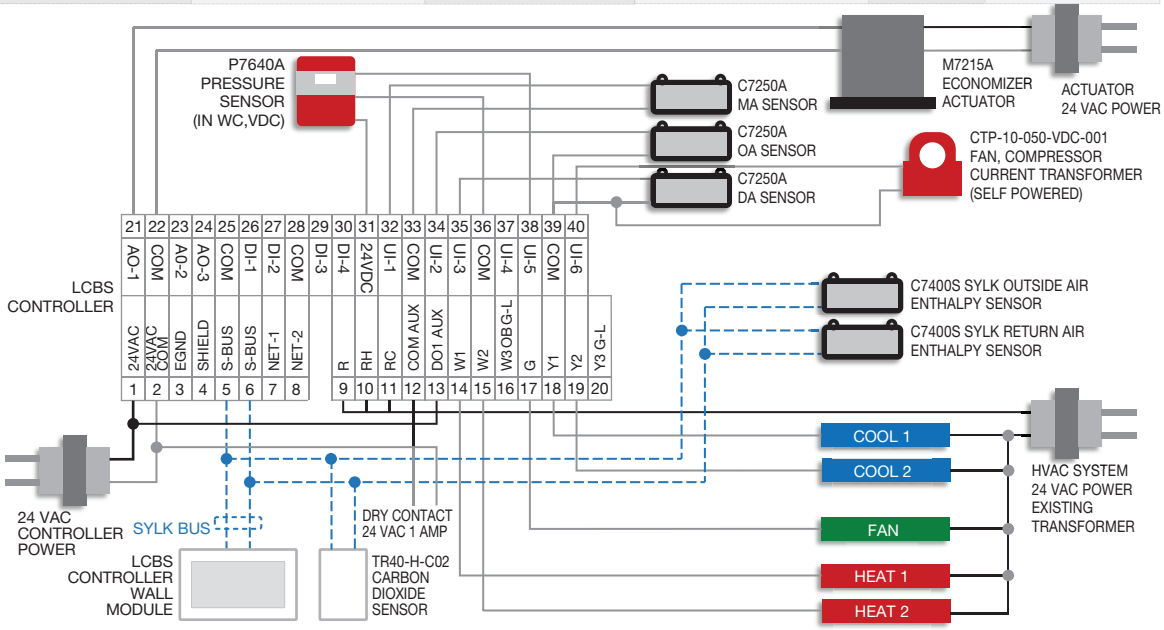
MASTER POINTS LIST THOSE IN RED ARE FIXED TO SINGLE INPUT OR OUTPUT DEFINITION	
I/O	NAME OF INPUT OUTPUT POINT(S)
UI1	MIXED AIR SENSOR
UI2	OUTDOOR AIR, USER SELECTED MONITOR POINT (20K)
UI3	DISCHARGE AIR SENSOR
UI4	CO2 SENSOR
UI5	FILTER PRESSURE, USER SELECTED MONITOR SENSOR 1 (NEED TO SCALE)
UI6	FILTER PRESSURE, COMPRESSOR CURRENT SENSOR, FAN CURRENT SENSOR, USER SELECTED MONITOR SENSOR 2 (NEED TO SCALE)
DI1	OCCUPANCY, MOTION SENSOR
DI2	PULSE METER
DI3	FREEZE STAT, DIRTY FILTER
DI4	PROOF OF AIRFLOW, USER SELECTED MONITOR SWITCH
AO1	ECONOMIZER ACTUATOR
AO2	ACCESSORY LOOP MODULATING, ACCESSORY LOOP STAGE (NEED RELAY), ACCESSORY LOOP AUX MODULATING
AO3	MULTI -SPEED FAN, ACCESSORY LOOP MODULATING, ACCESSORY LOOP STAGE (NEED RELAY), ACCESSORY LOOP AUX MODULATING
DO1	OCCUPANCY, ECONOMIZER POWER, SIMPLE DEHUMIFICATION, ACCESSORY LOOP STAGE, ACCESSORY LOOP AUX CONTROL POINT
DO2	HEAT 1
DO3	HEAT 2
DO4	HEAT 3, REVERSING VALVE O OR B, LOW SPEED FAN
DO5	SUPPLY FAN
DO6	COOL 1
DO7	COOL 2
DO8	COOL 3, LOW SPEED FAN

MCR36706

2. Master Application Inventory – All Wiring Diagrams

MASTER APPLICATION INVENTORY

BUILDING NAME		CVAHU RTU NAME		DATE	

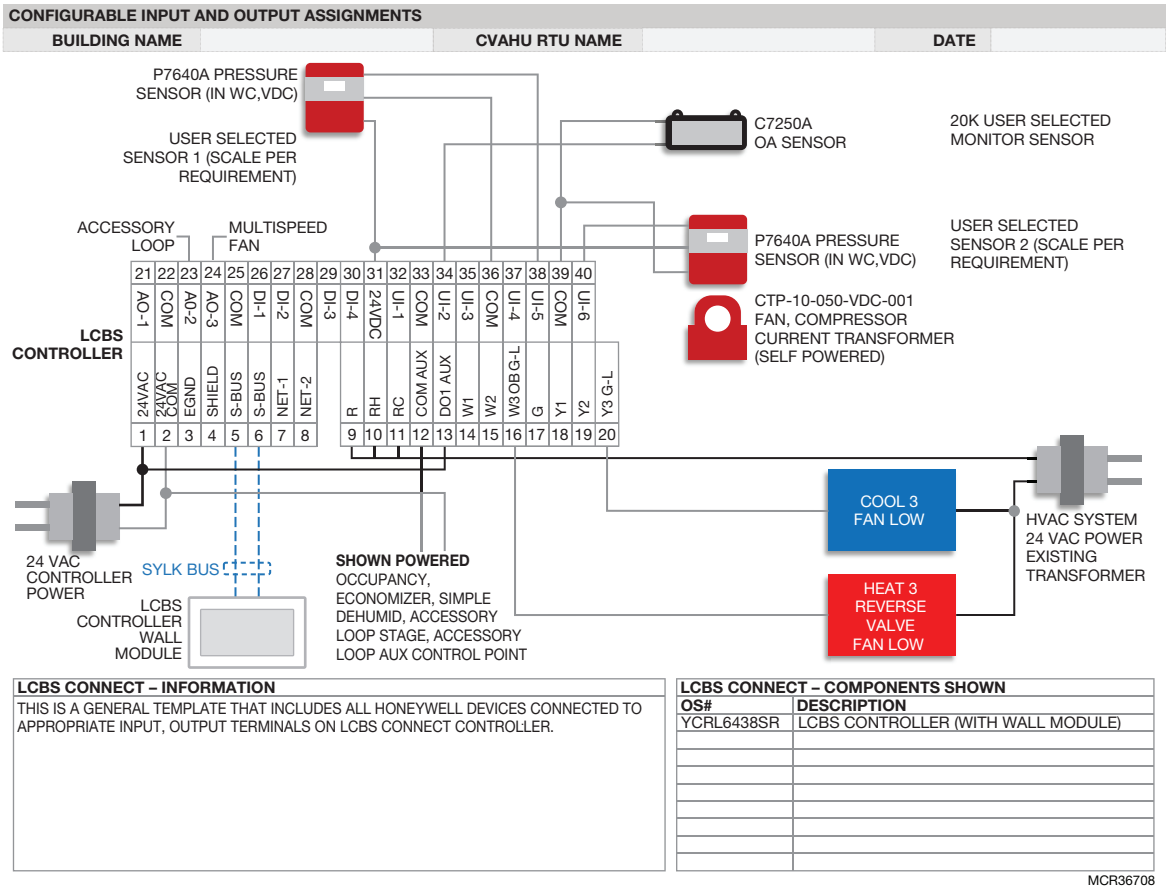


LCBS CONNECT – INFORMATION
THIS IS A GENERAL TEMPLATE THAT INCLUDES ALL HONEYWELL DEVICES CONNECTED TO APPROPRIATE INPUT, OUTPUT TERMINALS ON LCBS CONNECT CONTROLLER.

LCBS CONNECT – COMPONENTS SHOWN	
OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)

MCR36707

3. Configurable Input and Output Assignments Wiring Diagram

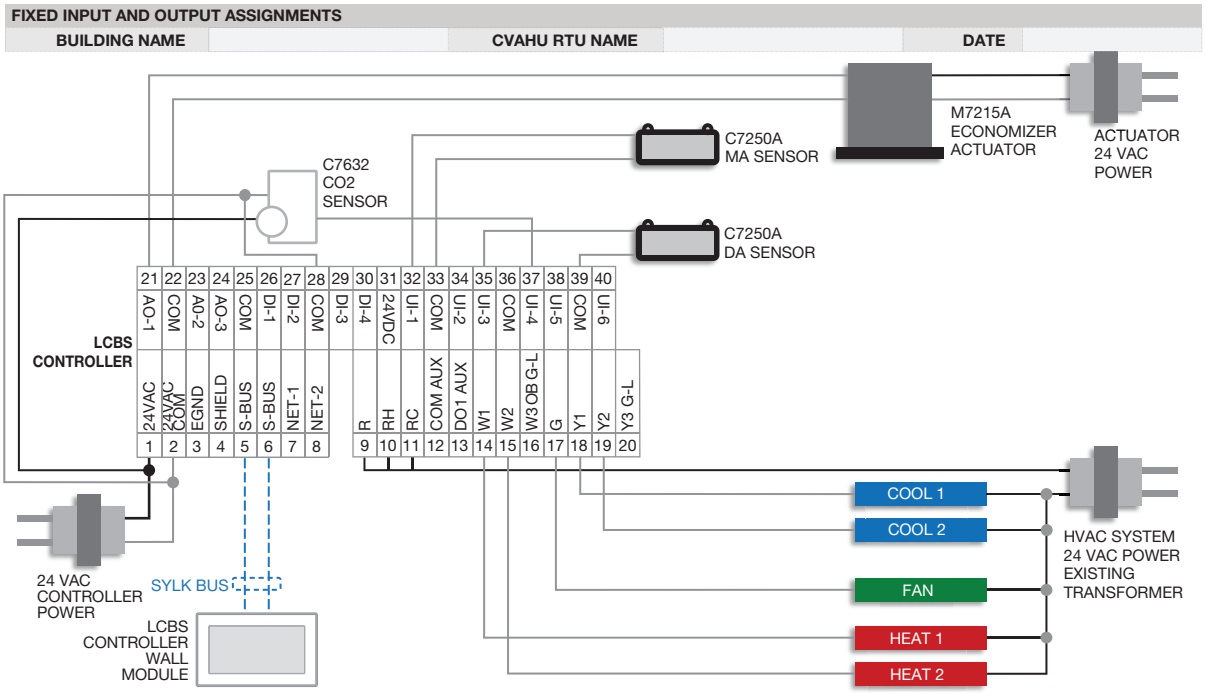


LCBS CONNECT – INFORMATION
THIS IS A GENERAL TEMPLATE THAT INCLUDES ALL HONEYWELL DEVICES CONNECTED TO APPROPRIATE INPUT, OUTPUT TERMINALS ON LCBS CONNECT CONTROLLER.

LCBS CONNECT – COMPONENTS SHOWN	
OS#	**DESCRIPTION**
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)

MCR36708

4. Fixed Input and Output Assignments Wiring Diagram



LCBS CONNECT – INFORMATION
THIS IS A GENERAL TEMPLATE THAT INCLUDES ALL HONEYWELL DEVICES.

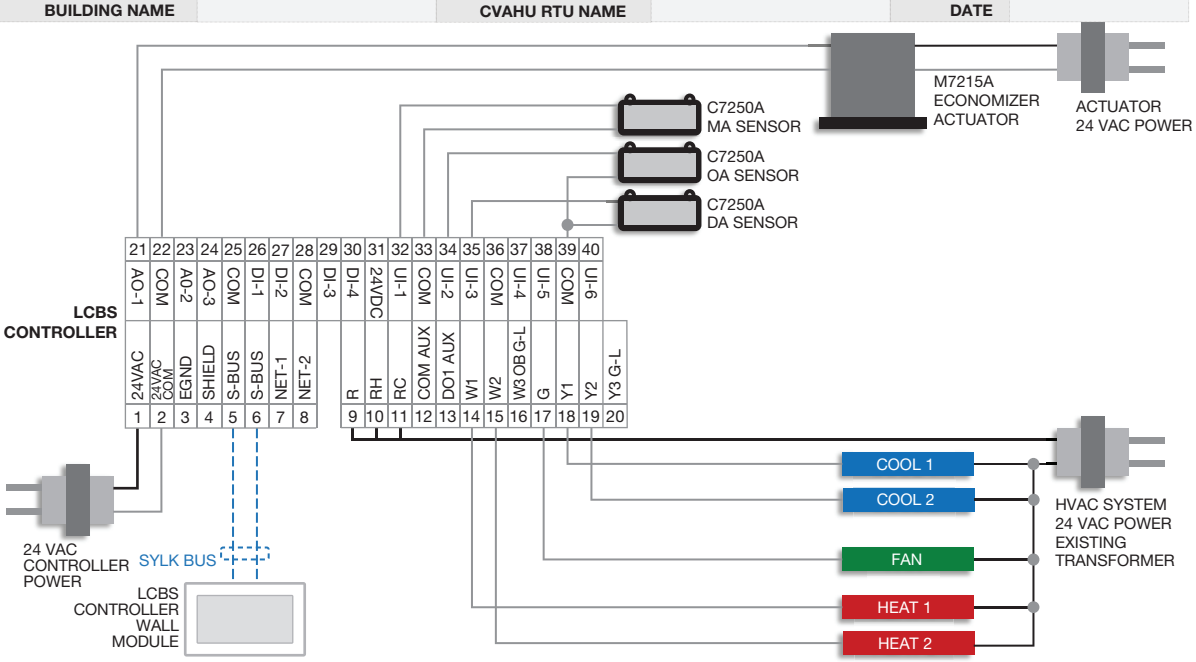
LCBS CONNECT – COMPONENTS SHOWN	
OS#	**DESCRIPTION**
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)

MCR36709

5. Two Heat Two Cool Integrated Economizer Single Temperature Changeover Limit

TWO HEAT TWO COOL INTEGRATED ECONOMIZER DRYBULB CHANGEOVER

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

EXAMPLE OF SEQUENCE OF OPERATION. THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF TWO STAGES OF GAS OR ELECTIR HEAT, TWO STAGES OF DIRECT EXPANSION COOLING, AND INTEGRATED ECONOMIZER WITH DRY BULB ECONOMIZER CHANGEOVER, HIGH LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). CONFIGURER HAS THE ABILITY TO SET UP SETBACK, SETUP FEATURES THAT WILL ENABLE BUILDING OWNER TO ACHIEVE ENERGY SAVINGS BY REDUCING EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS. ADAPTIVE INTELLIGENT RECOVERY ISALSO A STANDARD FEATURE. IT PERMITS CONTROLLED OPERATIONAL TRANSITION OF HEATINGAND COOLING EQUIPMENT FROM UNOCCUPIED TO OCCUPIED TO 1] GUARD AGAINST EQUIPMENT OVERUSE AND 2] HELP CONTROL POTENTIAL ELECTRICAL SPIKES RESULTING IN DEMAND CONTROL UTILITY CHARGES. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR HEATING OR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

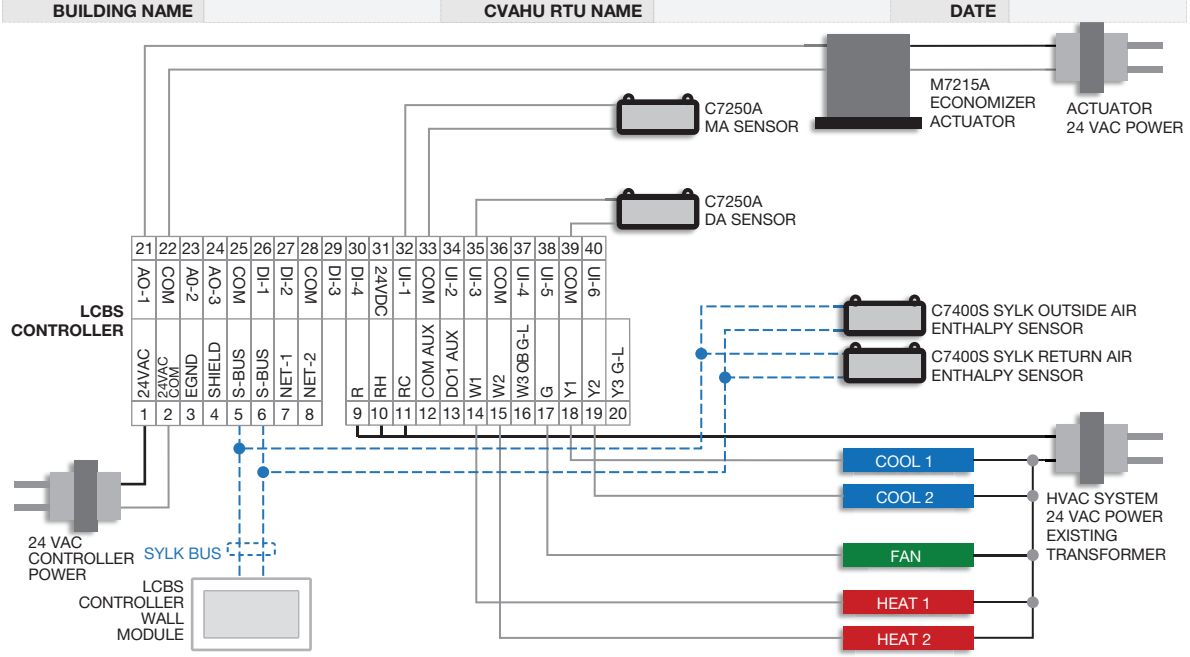
OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	OUTDOOR AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40A	TRANSFORMER (SIZE APPROPRIATELY)

MCR36710

6. Two Heat Two Cool Integrated Economizer Differential Enthalpy Changeover and Temperature Limit

TWO HEAT TWO COOL INTEGRATED ECONOMIZER DIFFERENTIAL ENTHALPY

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF TWO STAGES OF GAS OR ELECTIR HEAT, TWO STAGES OF DIRECT EXPANSION COOLING, AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR HIGH LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). CONFIGURER HAS THE ABILITY TO SET UP SETBACK, SETUP FEATURES THAT WILL ENABLE BUILDING OWNER TO ACHIEVE ENERGY SAVINGS BY REDUCING EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS. ADAPTIVE INTELLIGENT RECOVERY IS ALSO A STANDARD FEATURE. IT PERMITS CONTROLLED OPERATIONAL TRANSITION OF HEATING AND COOLING EQUIPMENT FROM UNOCCUPIED TO OCCUPIED TO 1] GUARD AGAINST EQUIPMENT OVERUSE AND 2] HELP CONTROL POTENTIAL ELECTRICAL SPIKES RESULTING IN DEMAND CONTROL UTILITY CHARGES. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR HEATING OR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

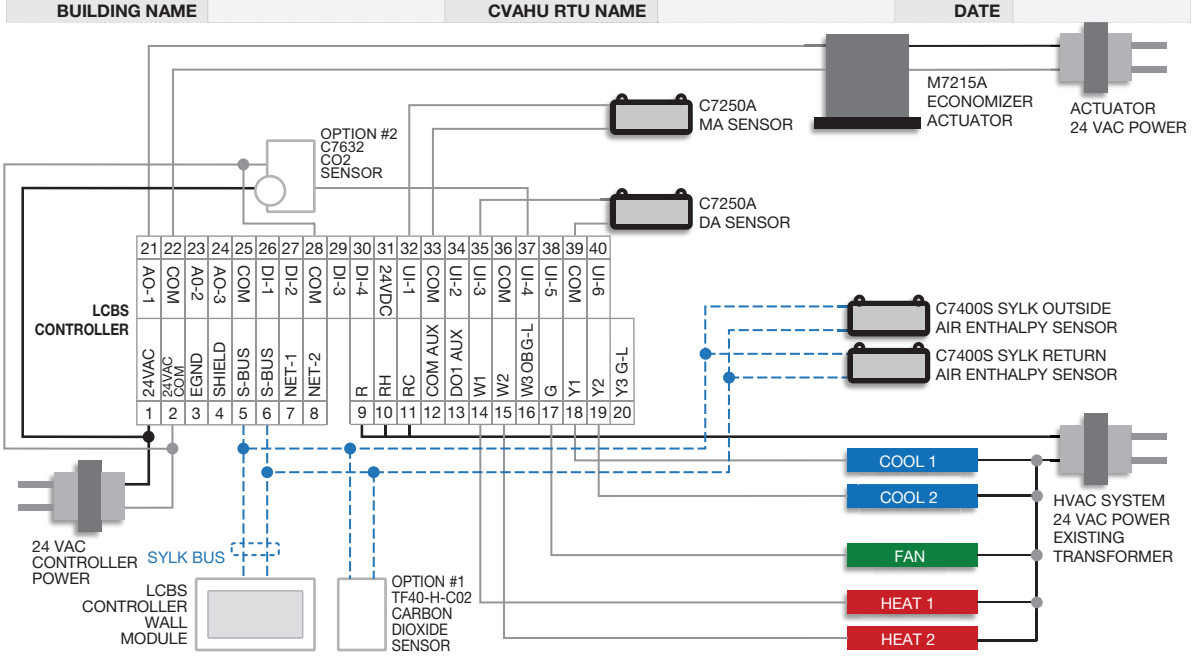
OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	OUTDOOR AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40A	TRANSFORMER (SIZE APPROPRIATELY)

MCR36713

7. Two Heat Two Cool Integrated Economizer Differential Enthalpy Changeover and Temperature Limit and Demand Controlled Ventilation

2H 2C INTEGRATED ECONOMIZER DIFFERENTIAL ENTHALPY AND DEMAND CONTROLLED VENTILATION

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF TWO STAGES OF GAS OR ELECTIR HEAT, TWO STAGES OF DIRECT EXPANSION COOLING, AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR HIGH LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). THE APPLICATION FEATURES INPUT OF HONEYWELL CO2 SENSOR THAT PROVIDES INPUT TO CO2 SEQUENCE. IF C02 LEVEL IN BUILDING SPACE EXCEEDS SETPOINT, OUTDOOR AIR DAMPER WILL OPEN AND ATTEMPT TO ABATE INDOOR AIR QUALITY ISSUE (SEE APP GUIDE FOR DETAILED SEQUENCE). SETBACK AND ADAPTIVE INTELLIGENT RECOVERY WORKS PER APPLICATION GUIDE. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR HEATING OR COOLING DURING UNOCCUPIED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

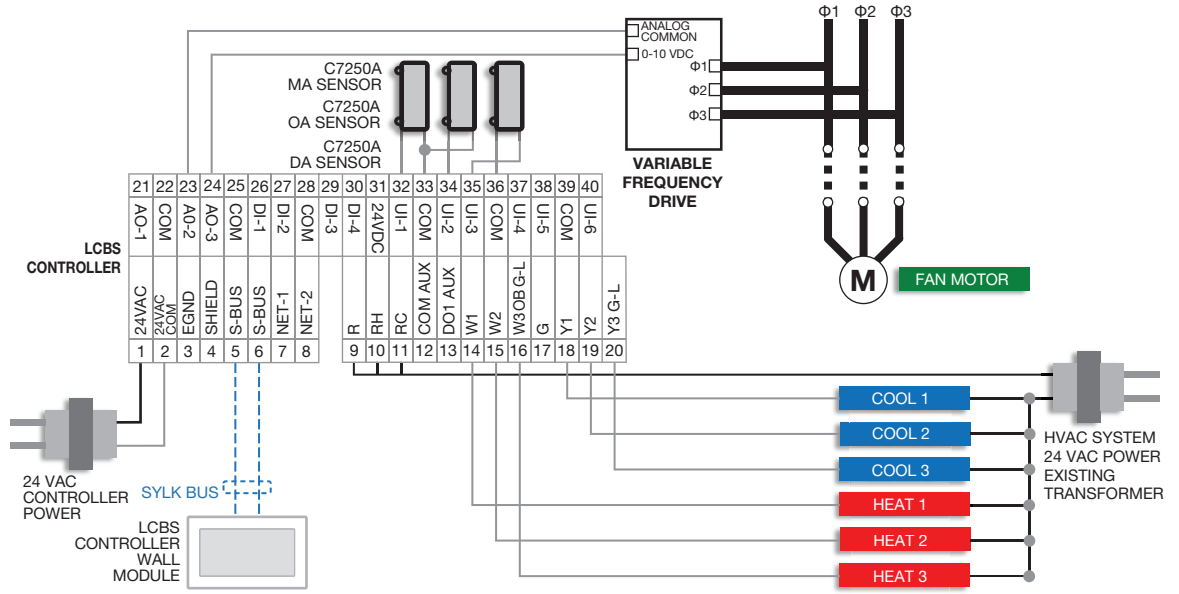
OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
C7400S	RETURN AIR ENTHALPY SENSOR
C7400S	OUTDOOR AIR ENTHALPY SENSOR
M7215A	ECONOMIZER ACTUATOR
TR40-H-C02	CARBON DIOXIDE AIR SENSOR
AT40	TRANSFORMER(S)

MCR36714

8. Three Heat Three Cool Multispeed Fan with Variable Frequency Drive

THREE COOL THREE HEAT MULTISPEED FAN WITH VARIABLE FREQUENCE DRIVE

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF THREE STAGES OF DIRECT EXPANSION COOLING AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). CONFIGURER HAS THE ABILITY TO SET UP SETBACK, SETUP FEATURES THAT WILL ENABLE BUILDING OWNER TO ACHIEVE ENERGY SAVINGS BY REDUCING FAN AND COOLING EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS. ADAPTIVE INTELLIGENT RECOVERY IS ALSO A STANDARD FEATURE. IT PERMITS CONTROLLED OPERATIONAL TRANSITION OF COOLING EQUIPMENT FROM UNOCCUPIED TO OCCUPIED TO 1] GUARD AGAINST EQUIPMENT OVERUSE AND 2] HELP CONTROL POTENTIAL ELECTRICAL SPIKES RESULTING IN DEMAND CONTROL UTILITY CHARGES. MULTISPEED FAN OPTION PERMITS CUSTOMIZED CONTROL OF FAN SPEED AND CAN BE INDEXED TO SPECIFIC MODES. THERE ARE SIX MODES THAT INDIVIDUAL FAN SPEEDS CAN BE COUPLED WITH. SUCCESSFULLY IMPLMEMENTED, COMFORT WITH ENERGY COST AVOIDANCE IS A PROBABLE OUTCOME.

LCBS CONNECT – COMPONENTS SHOWN

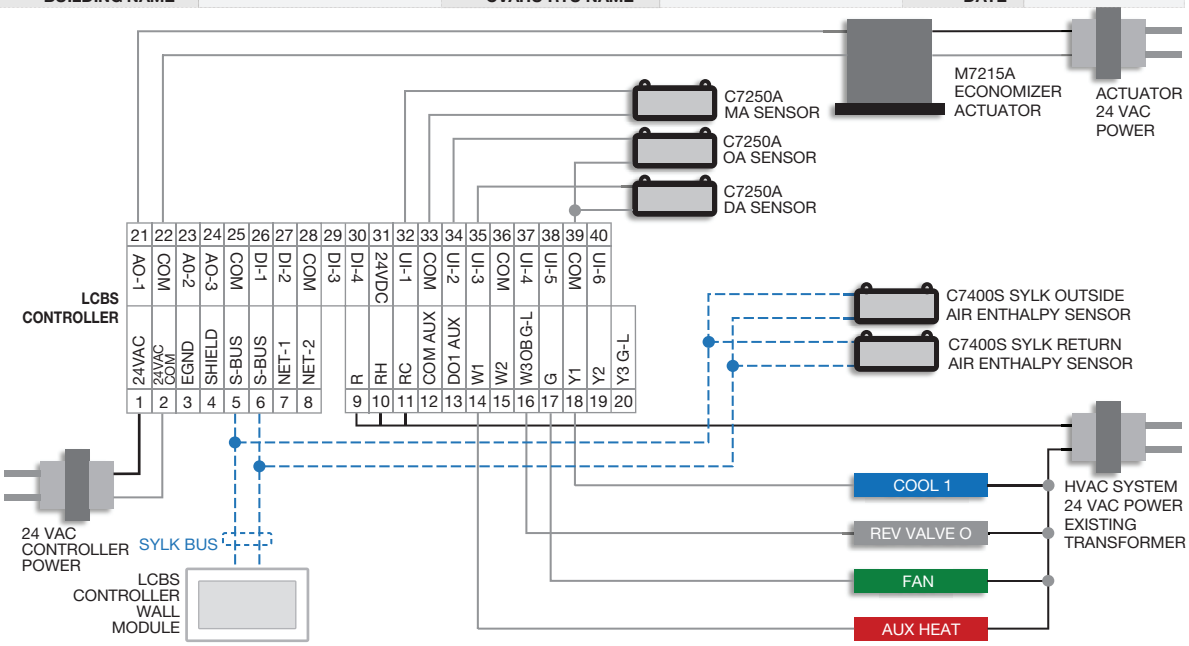
OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
C7400S	RETURN AIR ENTHALPY SENSOR
C7400S	OUTDOOR AIR ENTHALPY SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40	TRANSFORMER(S)

MCR36715

9. Single Stage Heat Pump with Economizer Differential Enthalpy Changeover and Temperature Limit

SINGLE STAGE HEAT PUMP ECONOMIZER DIFFERENTIAL ENTHALPY

BUILDING NAME		CVAHU RTU NAME		DATE	



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF AN AIR TO AIR HEAT PUMP AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). REVERSING VALVE IS ENERGIZED IN COOLING MODE AND INITIATES COOLING CYCLE BASED ON 24 VAC SUPPLIED CONFIGURER HAS THE OPTION TO RUN THE HEAT PUMP IN A "COMFORT MODE" OR "SAVINGS MODE." THE NORMAL MODE WILL OPERATE THE HEAT PUMP AUXILIARY HEAT BASED ON CONFIGURER SELECTED HEATING SETPOINT. IN THE "SAVINGS MODE" THE HEATING SETPOINT IS DEPRESSED SO THAT ELECTRIC, AUXILIARY HEAT OPERATES LESS FREQUENTLY. REFER TO APPLICATION GUIDE TO REFERENCE SETUP, SETBACK OPERATION AS WELL AS ADAPTIVE INTELLIGENT RECOVERY OPERATION. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

LCBS CONNECT – COMPONENTS SHOWN

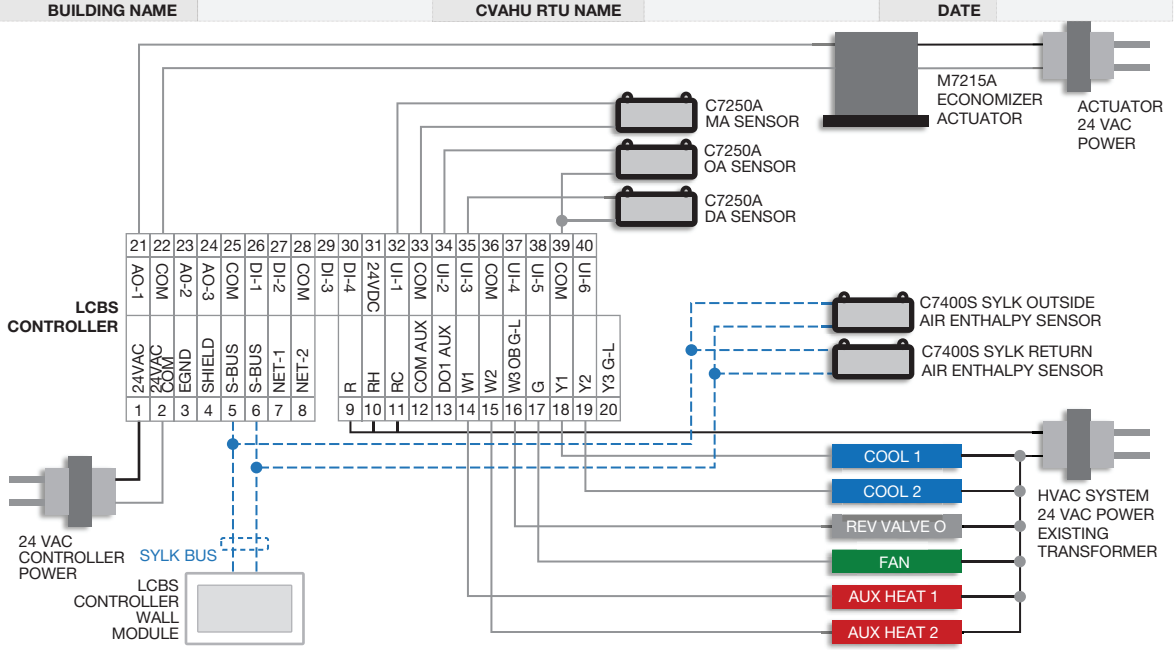
OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
C7400S	RETURN AIR ENTHALPY SENSOR
C7400S	OUTDOOR AIR ENTHALPY SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40	TRANSFORMER(S)

MCR36716

10. Two Stage Heat Pump with Economizer Differential Enthalpy Changeover and Temperature Limit

TWO STAGE HEAT PUMP TWO STAGE AUXILIARY HEAT ECONOMIZER DIFFERENTIAL ENTHALPY

BUILDING NAME	CVAHU RTU NAME	DATE



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF AN AIR TO AIR HEAT PUMP AND INTEGRATED ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL AND HIGH TEMPERATURE LIMIT (SEE APP GUIDE FOR DETAILED SEQUENCE). REVERSING VALVE IS ENERGIZED IN COOLING MODE AND INITIATES COOLING CYCLE BASED ON 24 VAC SUPPLIED CONFIGURER HAS THE OPTION TO RUN THE HEAT PUMP IN A "COMFORT MODE" OR "SAVINGS MODE." THE NORMAL MODE WILL OPERATE THE HEAT PUMP AUXILIARY HEAT BASED ON CONFIGURER SELECTED HEATING SETPOINT. IN THE "SAVINGS MODE" THE HEATING SETPOINT IS DEPRESSED SO THAT ELECTRIC, AUXILIARY HEAT OPERATES LESS FREQUENTLY. REFER TO APPLICATION GUIDE TO REFERENCE SETUP, SETBACK OPERATION AS WELL AS ADAPTIVE INTELLIGENT RECOVERY OPERATION. SYSTEM SUPPLY FAN AUTOMATICALLY OPERATES IN A CONTINUOUS MANNER DURING OCCUPIED PERIODS AND CYCLES ON A CALL FOR COOLING DURING UNOCCUIPED PERIODS TO MEET THE NEED OF PREVAILING BUILDING CODES.

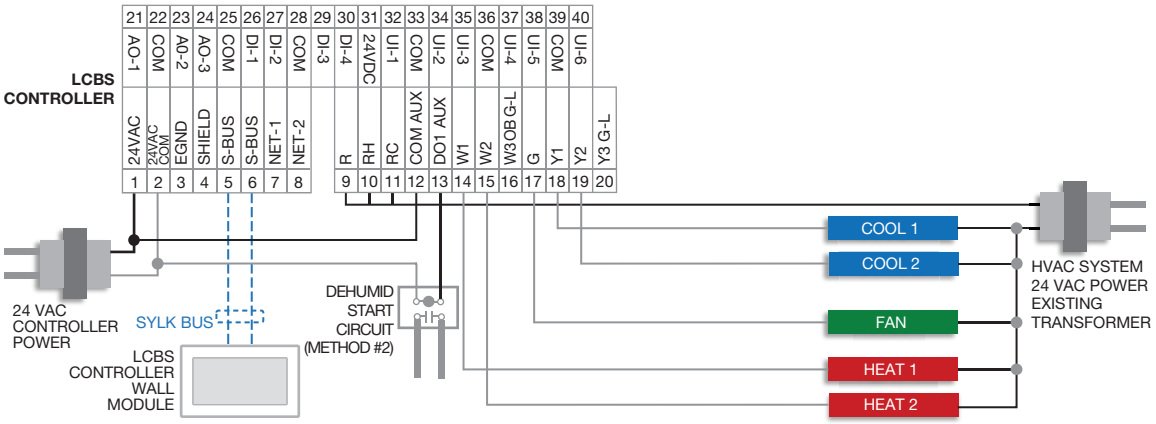
LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
C7400S	RETURN AIR ENTHALPY SENSOR
C7400S	OUTDOOR AIR ENTHALPY SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40	TRANSFORMER(S)

MCR36717

11. Simple Dehumidification

DEHUMIDIFICATION – SIMPLE					
BUILDING NAME		**CVAHU RTU NAME**		**DATE**	

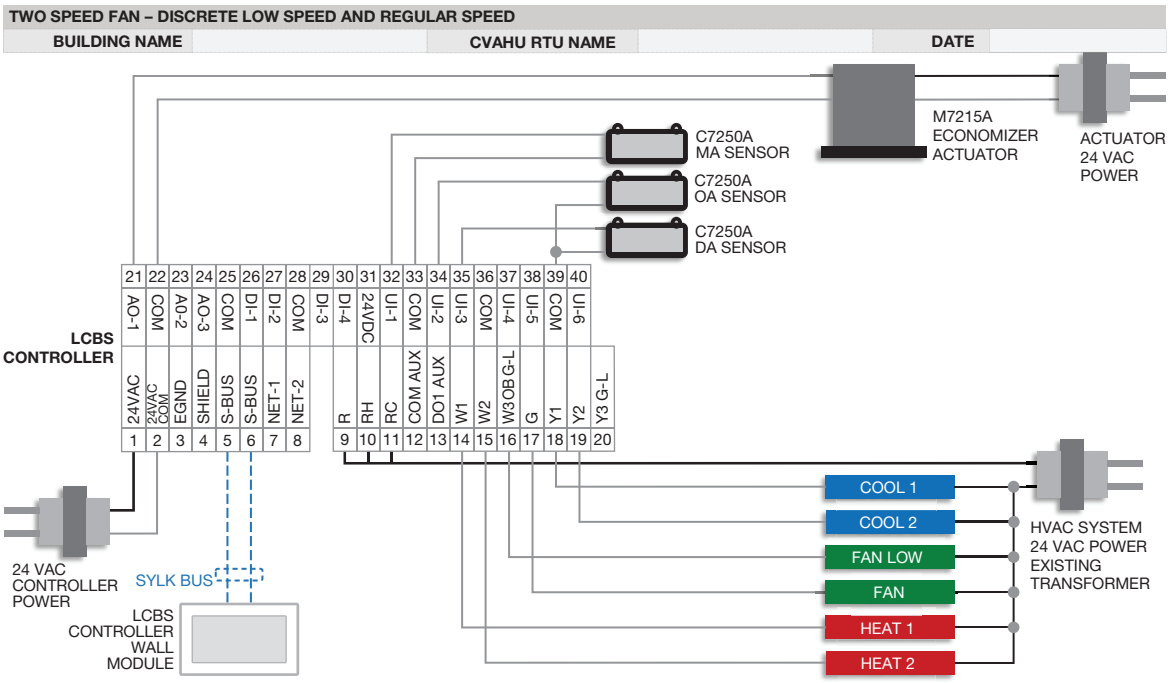


LCBS CONNECT – INFORMATION
THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF DEHUMIDIFICATION. WE SUPPORT TWO METHODS OF DEHUMIDIFICATION. FIRST, WE PERFORM STANDARD DEHUMIDIFCATION WITH CONNECTED COOLING AND HEATING EQUIPMENT. IF DEHUMIDIFICATION LIMIT IS EXCEEDED AT ANY TIME, OCCUPIED OR UNOCCUPIED TIMING, COOLING AND HEATING IS ENABLED AND OPERATED CONCURRENTLY. HEATING WILL CYCLE TO ATTEMPT TO DEHUMIDIFY. WHEN HYSTERESIS IS OBSERVED AND HUMIDITY FALLS BELOW DEHUMIDIFICATION LIMIT, HEATING AND COOLING ARE CYCLED OFF. IF A CALL FOR COOLING STILL EXISTS, COOLING CONTINUES TO OPERATE BASED ON COOLING SETPOINT. SECOND, AN LCBS CONNECT CONTROLLER OUTPUT CAN BE PROGRAMMED TO CONTROL A DEHUMIDIFICATION UNIT LIKE A DX DEHUMIFIER OR DESSICANT SYSTEM. IF A CALL FOR DEHUMIDIFICATION EXISTS, THE SELECTED SYSTEM OPERATES INDEPENDENTALY OF LCBS CONTROL FUNCTIONS. THE CONFIGURER CAN ALSO SET A “RUN ON TIMER” THAT OPERATES AFTER THE CALL FOR DEHUMIFICATION ABATES, UP TO 15 MINUTES.

LCBS CONNECT – COMPONENTS SHOWN	
OS#	**DESCRIPTION**
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
C7400S	RETURN AIR ENTHALPY SENSOR
C7400S	OUTDOOR AIR ENTHALPY SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40	TRANSFORMER(S)

MCR36718

12. Two Speed Fan with Discrete Fan Outputs Two Heat and Two Cool



LCBS CONNECT – INFORMATION

THIS APPLICATION PROVIDES AUTOMATIC CONTROL OF TWO STAGES OF DIRECT EXPANSION COOLING, HEATING, AND INTEGRATED ECONOMIZER WITH TEMPERATURE LIMIT AND CHANGEOBOER (SEE APP GUIDE FOR DETAILED SEQUENCE). CONFIGURER HAS THE ABILITY TO SET UP SETBACK, SETUP FEATURES THAT WILL ENABLE BUILDING OWNER TO ACHIEVE ENERGY SAVINGS BY REDUCING FAN AND COOLING EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS. ADAPTIVE INTELLIGENT RECOVERY IS ALSO A STANDARD FEATURE. IT PERMITS CONTROLLED OPERATIONAL TRANSITION OF COOLING EQUIPMENT FROM UNOCCUPIED TO OCCUPIED TO 1] GUARD AGAINST EQUIPMENT OVERUSE AND 2] HELP CONTROL POTENTIAL ELECTRICAL SPIKES RESULTING IN DEMAND CONTROL UTILITY CHARGES. MULTISPEED FAN OPTION PERMITS CUSTOMIZED CONTROL OF FAN SPEED AND CAN BE INDEXED TO SPECIFIC MODES. THERE ARE TWO DISCRETE MODES (LOW FAN, REGULARY FAN) THAT CAN BE COUPLED WITH MULTIPLE CONTROL MODES. SUCCESSFULLY IMPLMEMENTED ENERGY COST AVOIDANCE IS A PROBABLY OUTCOME.

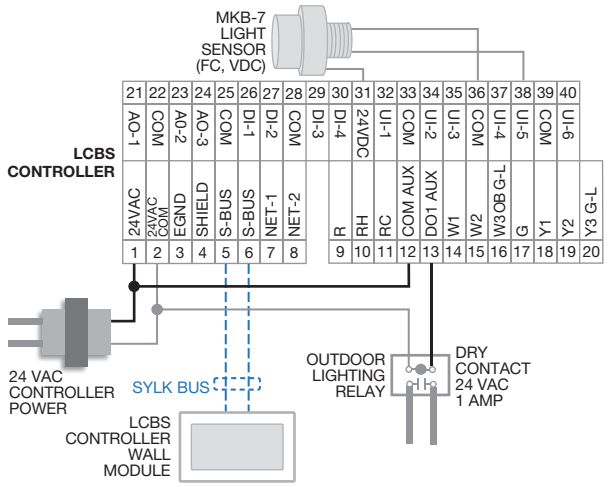
LCBS CONNECT – COMPONENTS SHOWN

OS#	DESCRIPTION
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
C7250A	MIXED AIR SENSOR
C7250A	DISCHARGE AIR SENSOR
C7250A	OUTDOOR AIR SENSOR
M7215A	ECONOMIZER ACTUATOR
AT40	TRANSFORMER(S)

MCR36719

13. Outdoor Ambient Lighting Control with Photo sensor Input to Control Outdoor Light Level

AMBIENT OUTDOOR LIGHTING CONTROL USING ACCESSORY LOOP					
BUILDING NAME		**CVAHU RTU NAME**		**DATE**	



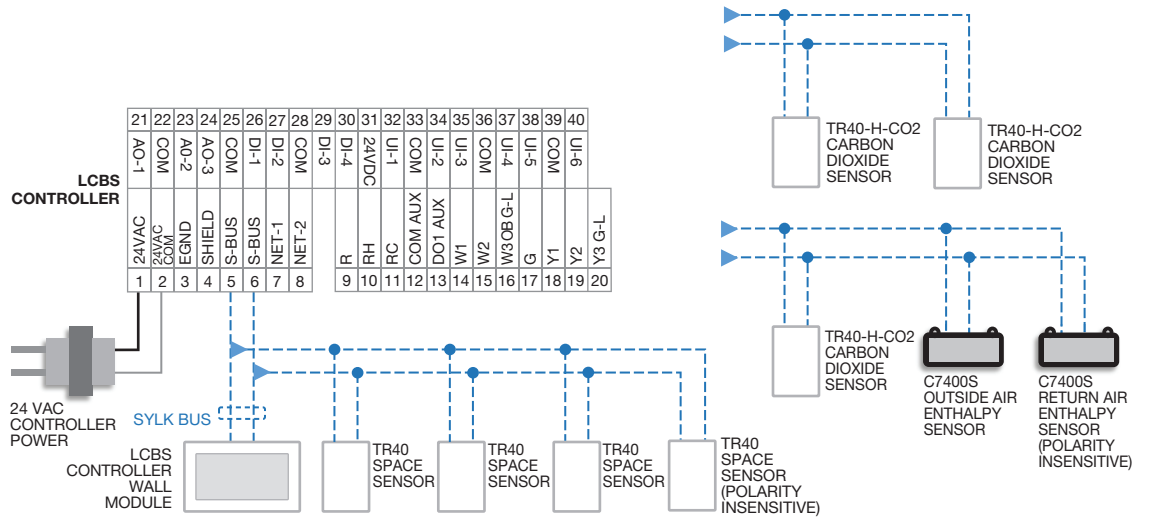
LCBS CONNECT – INFORMATION
THIS APPLICATION PROVIDES AUTOMATIC CONTROL VIA THE HONEYWELL ACCESSORY LOOP OPTION. IN THIS CASE, WE CONFIGURE A LOOP TO CONTROL A SINGLE STAGE OF OUTDOOR LIGHTING (STAGED ACCESSORY LOOP) THIS IS A REVERSE ACTING LOOP… AS THE MEASURED VALUE INCREASES, THE CONTROL ACTION DECREASES, OR CYCLES OFF (IN THE CASE OF STAGED OUTPUT. LIGHTING LOOP AND MUST BE CONFIGURED AS SUCH. OCCUPIED AND UNOCCUPIED SETPOINTS CAN BE PROVIDED FOR THIS LOOP. THE PRIMARY INPUT SENSOR THAT IS WIRED TO UI-5 NEEDS TO BE CONFIGURED IN "FOOTCANDLES." THE OCCUPANCY SCHEDULE OPERATES AGAINST THE SCHEDULE SET UP FOR THE PRIMARLY CVAHU, ROOFTOP UNIT, SPLIT SYSTEM. REFER TO APPLICATION NARRATIVE FOR FURTHER INFORMATION ABOUT SET UP AND OPERATION. NOTE! ZERO OUT INTEGRAL TIMING FOR LOOP TO WORK CORRECTLY. FOLLOW SENSOR PROVIDERS INSTALLATION MATERIAL FOR GUIDEANCE TO SET PROPORPORTIONAL, THROTTLING RANGE.

LCBS CONNECT – COMPONENTS SHOWN	
OS#	**DESCRIPTION**
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)
MKB-Y	OUTDOOR AMBIENT LIGHT SENSOR (BY OTHERS)

MCR36720

14. Sylk Sensor Installation Relating to LCBS Connect Controller

"SYLK" SENSORS – ACCEPTABLE CONFIGURATIONS DUE TO "FOUR POWER UNIT" LIMIT					
BUILDING NAME		**CVAHU RTU NAME**		**DATE**	



LCBS CONNECT – INFORMATION

RULES: APPLY DEVICES WITH UP TO FOUR POWER UNITS ON SYLK BUS. POWER UNITS:
TR40 SPACE TEMPERATURE SENSOR: ONE (1) POWER UNIT
TR40-H-CO2 TEMPERATURE HUMIDITY CARBON DIOXIDE SENSOR: TWO (2) POWER UNITS
C7400S TEMPERATURE RELATIVE HUMIDITY SENSOR: ONE (1) POWER UNIT

SENSOR SWITCH SETTINGS

LCBS CONNECT – COMPONENTS SHOWN	
OS#	**DESCRIPTION**
YCRL6438SR	LCBS CONTROLLER (WITH WALL MODULE)

MCR36721

Home and Building Technologies

In the U.S.:

Honeywell

1985 Douglas Drive North

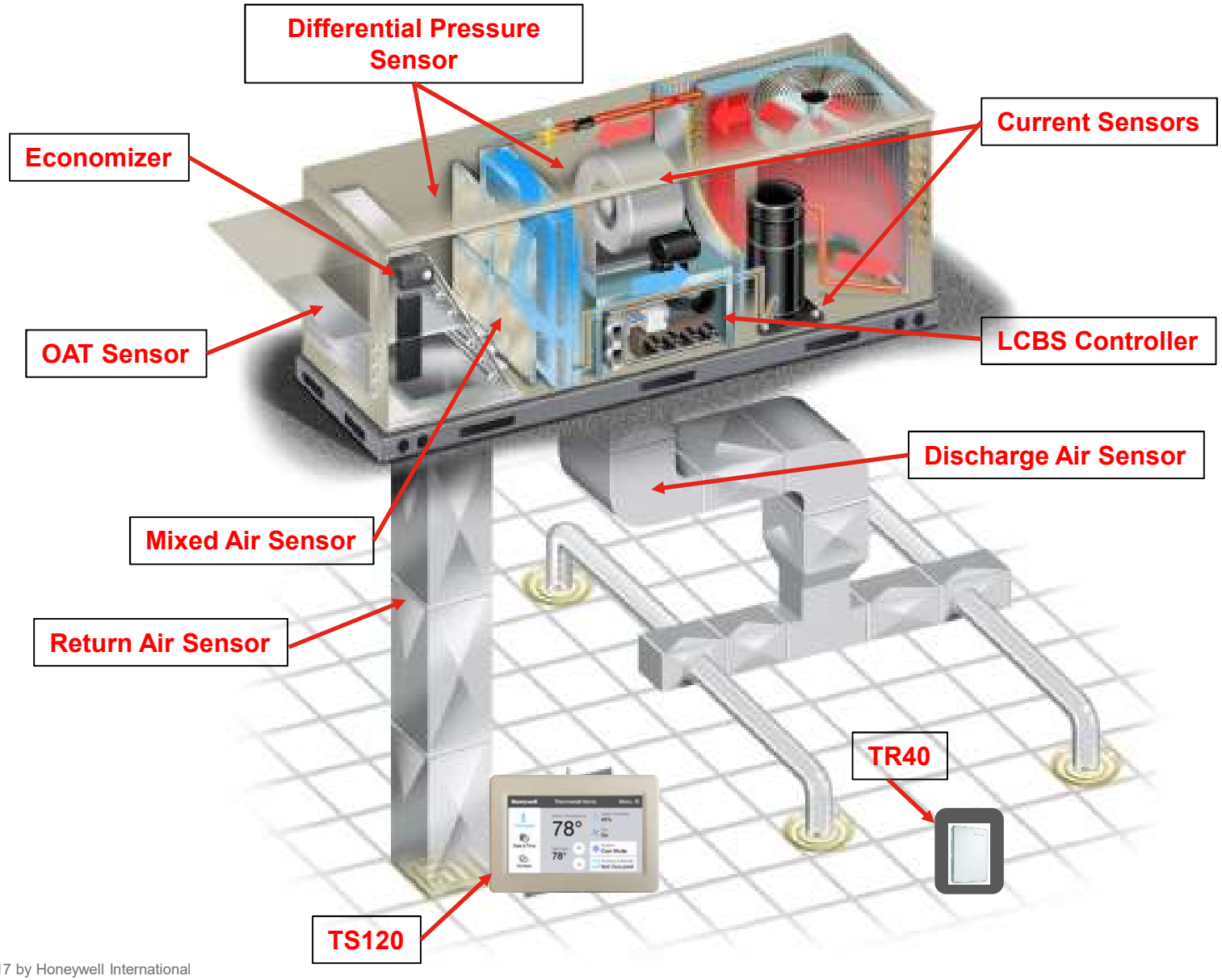
Golden Valley, MN 55422-3992

customer.honeywell.com

Honeywell

31-00118EFS—01 M.S. 02-17
Printed in United States

Equipment Type and Sensors



Honeywell

Honeywell LCBS Connect

Bill of Materials

March 11, 2018

Bill of Materials

A list of material and controls that you need to develop a complete system

A single LCBS Connect controller and wall module are necessary to provide control of a standard constant volume air handling unit. Two devices are provided in a box and are "matched" to operate together. A 24 VAC power supply (5 VA) is required to power the LCBS Connect control system. In most cases this power is available from the constant volume air handling unit, in the low voltage control panel of the HVAC system.

An optional LCBS Connect gateway enables remote communication from LCBS Connect controllers on building control network to communicate with the Honeywell LCBS Connect Cloud. Either native 24 VAC power is required with a standard transformer (10 VA) or the WPM-8000 "wall wart" is required.

Basic Controller. Select One for Each RTU, Split System, Heat Pump		
Part Number	**Function, Description**	**Detail**
YCRL6438SR1000	LCBS Controller, Wall Module Package. This is the base, mandatory requirement to start LCBS Connect site installation.	LCBS Controller and Wall Module, Matched Pair. This is the mandatory, set of product required to start your customers LCBS Connect system. Wiring needed to power device, to connect low voltage control, and drop from HVAC unit to wall module.
50007298-001	5.0" X 6.875" Wall Trim Ring	Arctive White. Use trim ring to cover wall scars from the removal of previous controls.
50022893-001	5.75 X 7.375 Wall Trim Rign	
Data to Cloud. Select One for Each 30 Controllers		
Part Number	**Part Number**	**Detail**
LGW1000	Gateway. This device is needed to collect site data and deposit the data in the Cloud for downstream processing and retrieval.	The LGW1000 needs a 24 VAC power supply OR the WPM-8000 transformer (plugs into 120 VAC handy box). Connect LCBS Controller network to the Gateway Connect RJ45 connector from customer switch, router to the Gateway.
WPM-8000	Gateway power supply, "wall wart"	Power supply, provides 24 VDC power to gateway.
Network Termination. One per Network		
Part Number	**Description**	**Detail**
209541B FTT	Network Termination Module.	This device is used to bias LCBS Connect controller network. One device is typically used to bias network. This is described in "Network construction" Look at diagram attached to this document. Install this device as shown ONLY!
Economizer. One per Constant Volume Air Handling System		
Part Number	**Description**	**Detail**
M7215A1008	Economizer Actuator, Foot Mount… the Black Motor	Replace actuator if over ten years old. This actuator form factor is typically in place in about 80% of installed actuators in North America. Technical Specification: 25 lb-in, SR Black Motor, 2 - 10 VDC control, 24 VAC power 8 VA
MS7503A2030	Economizer Actuator, Direct Coupled	Functional replacement for the Black Motor. Need crank arm kit. Technical Specification: 24 lb-in, SR Direct Coupled Actuator, 2 - 10 VDC Control, 24VAC Power 6 VA
-AND- STRN-CRK-01	Crank Arm Kit for Direct Coupled Actuator	Order with MS7503A2030 to Replace M7215A or M7215B Actuator

Economizer Discharge, Mixed, Return Air, Duct Sensors		
Part Number	**Description**	**Detail**
C7400S1000	Duct Mount Temperature, Humidity Sensor. Sensor network is called the "Sylk" Network.	Required for LCBS Connect economizer control. Each device as one humidity and one temperature sensor. Two (2) required for Differential Enthalpy control. Grey plastic enclosure, must use Duct Mount offset.
C7250A1001	20K Duct Mount, Outdoor Temperature Sensor. Grey enclosure form factor.	This form factor is NOT RECOMMENDED for mixed air sensing. Grey plastic enclosure, use Duct Mount Kit
50053060-001	Duct Mount Sensor Offset bracket	Required where C7400S and C7250A1001 are mounted to keep sensing device in air stream.

Economizer Discharge, Mixed, Return Air, Duct Sensors		
Part Number	**Part Number**	**Part Number**
C7041B2005/U	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Six (6) inch stainless steel probe with J-Box style mounting bracket. Temperature sensor –40°F - 250°F.
C7770A1040/U	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Six (6) inch stainless steel proble with six (6) foot plenum rated cable. Mounting flange. Temperature sensor 40°F - 250°F.
C7041B2013/U	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Twelve (12) inch stailess steel probe J-Box style mounting bracket. Temperature sensor -40°F - 250°F
C7041J2007	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Twelve (12) foot plenum rated cable with J-Box Style Wiring Enclosure, plenum rated cable, Temperature Sensor -40°F - 250°F
C7041R2000	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. Twelve (12) foot copper element with J-Box Style Wiring Enclosure. Temperature Sensor -40°F - 250°F.
C7041R2018	20K Temperature Sensor	Duct, Mixed, Coil Temperature Sensor. 24 foot J-Box Style Wiring Enclosure, flexible copper element, Temperature Sensor -40°F - 250°F.
C7031F2006	20K Temperature Sensor	Outdoor Air Temperature sensor. Weatherproof enclosure, connects to ½" conduit. "Lollypop" form factor.
Temperature, Humidity, CO2 Wall Sensors		
Part Number	**Description**	**Detail**
TR40	Sylk Wall Module Sensor	Wall temperature sensor only 32°F – 110°F
TR40-H	Sylk Wall Module Sensor	Wall temperature and humidity sensor 32°F – 110°F; 5-95% RH noncondensing
TR40-CO2	Sylk Wall Module Sensor	Wall temperature and CO2 sensor 32°F – 110°F; 0 – 5,000 PPM
TR40-H-CO2	Sylk Wall Module Sensor	Wall mount, temperature, humidity sensor and CO2 sensor 32°F – 110°F; 5-95% RH; 0 – 5,000 PPM

Pressure, Current Transformer Sensors		
Part Number	**Part Number**	**Part Number**
P7640A1034	Differential Air Pressure Transducer	Required for variable air flow sensing across air filters. Panel Differential Pressure Transmitter, 0-1", 0-2.5", 0-5", 0-10" Selectable, 12-30 VDC power, 24 VAC power.
CTP-10-050-VDC-001	Analog Current Sensor	Required for analog proof of fan, compressor, or electric heat operation. Split Core Current Sensor w/ 0-10 VDC Output, 0-10/0-20/0-50 Amps
MCSP-A	Digital Current Sensor	Required for digital proof of fan, compressor, or electric heat operation. Split Adjustable 0.70 - 150 Amps 1.00 Amp @ 36 VAC/VDC contact rating

Sensor Selection Guide

Honeywell

Sensing for Building Applications

Honeywell's complete line of sensor's cover all necessary control applications and mounting options, making Honeywell your best sensor source.

Temperature Sensors

You can count on Honeywell temperature sensors for the latest technology, accurate performance and reliability. Honeywell temperature sensors feature solid-state components and are impervious to dust and dirt. They cover a variety of applications that will fit your needs from averaging, immersion and outdoor sensors to duct-mount, wall mount and strap-on sensors.

Humidity Sensors

Highly accurate, stable humidity transducers designed for use with HVAC controllers, thermostats and direct digital controllers, Honeywell humidity sensors feature a ceramic technology that's affected by condensation. Applications include room comfort, rooftop units, air handlers, air conditioning and anywhere relative humidity is tightly controlled.

Dew Point Sensors

Suitable for mounting on flat and round surfaces, the Honeywell dew point sensor is used to regulate cooling performance, switch cooling systems ON and OFF, and signal if the temperature is approaching the dew point.

CO_2 Sensors

The Honeywell CO2 sensor includes state-of-the-art non-dispersive infrared (NDIR) technology plus a corrosion-free-designed sensing chamber that provides accurate and stable CO2 readings for years, avoiding costly and inconvenient re-calibration. A patented gold-plated sensing chamber eliminates a primary source of dirt. Paired with a Honeywell economizer, the Honeywell CO2 sensor can triple year-round savings over "cooling only" economizing. The sensor is used in demand control ventilation applications to maintain acceptable levels of CO2 in the space.

Current Sensors And Switches

Honeywell current switches can detect whether current is flowing and then transmit the status to a building management system, DDC or PLC controller. Honeywell current transmitters measure the level of operating current and can be used to monitor equipment or drive other equipment with a modulating output. Both current switches and transmitters can be used to detect a motor failure, belt loss or slippage, or a mechanical failure to help prevent further damage and reduce downtime. Because Honeywell current sensors are rated at up to 250 amps, you can meet high-amp applications without the need for a transformer. And Honeywell offers current switches with a very low trip point of 0.20 amps.

Enthalpy Sensors

Honeywell enthalpy sensors are used with Honeywell economizer logic modules to permit the use of outdoor air as the first stage of cooling in HVAC systems. The long-lasting solid-state sensing elements are accurate and stable over time. Maximum economizer savings are achieved when two enthalpy sensors are connected to one economizer logic module for differential enthalpy changeover control.

Differential Pressure Sensors

All Honeywell differential pressure sensors offer field selectable 4-20 mA, 0-5 Vdc and 0-10 Vdc outputs, uni- and bi-directional outputs, push button and digital inputs to zero the output, and configurable pressure ranges. Use P7640 dry media sensors in applications where you want measure extremely low pressure, such as clean rooms, hospitals, fume hoods and computer rooms. Use the PWT Series to monitor and control pump differential pressure, chiller/boiler differential pressure drop and CW/HW system differential pressure.

Specify Honeywell Sensors And Save

Honeywell sensors have always been competitively priced, and today Honeywell sensors continue to be one of the industry's best values. Add in the fact that their ease-of-installation increases your productivity and you'll see that Honeywell sensors are the smart, cost-effective choice.

H7655B, H7625B, H7635B

C7600B, H7655A

Electronic Humidity Sensors, 0-100% RH (some with temperature sensors)

Part Number	Output Signal	RH Accuracy	Mounting & Application	Voltage Supply	Temp Sensor	Use With	Insertion Length
H7625A1008	Selectable 4-20mA, 0-10Vdc, or 0-5 Vdc	2%	Wall	18-36 Vdc or 24 VAC	20K ohm at 77° F	T7350, H775, XL50, XFC, W750B/C, W7753, W7760A/C, W7761	
H7625A2010				18-40 VDC/18-28 VAC			
H7635A2012		3%					
H7625B1006		2%	Duct				7.5" - "B" model only
H7625B2006							
H7635B2018		3%					
H7635C2105			Outdoor				
H7655A1001	0-10 Vdc	5%	Wall	16-40 VDC/16-30 VAC	None	Any controller that accepts 0-10 Vdc input	
H7655B2014	Selectable 4-20mA, 0-10Vdc, or 0-5 Vdc	5%	Duct	18-40 VDC/18-28 VAC	20K ohm at 77° F	T7350, H775, XL50, XFC, W750B/C, W7753, W7760A/C, W7761	
C7600A1002	4-20 mA inversely proportional	5% between 30~70% RH	Duct	12-40 VDC	None	W7600	N/A
C7600A2008	4-20 mA		anywhere where it is exposed to freely circulating air	N/A		W7600 or controller requiring 4-20 mA reverse acting input	N/A
C7600B2008	2-10 Vdc	+/- 5 between 30-70% RH +/- 7 between 10-90% RH	Wall	16-40 VDC/16-30 VAC		H775 that accepts 2-10 Vdc output	N/A
C7600C1008	4-20 mA	5% between 30~70% RH	Duct	N/A		T775U	N/A
C7600C2001			anywhere where it is exposed to freely circulating air	N/A		W7600 or controller requiring 4-20 mA reverse acting input	N/A

HSS-DPS

Dew Point Sensors

Part Number	Output	Switch	Hysteresis
HSS-DPS	Potential-free relay with changeover	RH>90% ± 3% contact open RH < 90% ± 3% closed	5% RH

C7232A

C7232B

Carbon Dioxide (CO_2) Sensors

Part Number	Output Signal	Display Screen	Honeywell Logo	Mounting	CO_2 Range (accuracy)
C7232A1008	0/2 to 10 Vdc or 0/4 to 20 mA w/ one adjustable SPST relay output	Yes	Yes	Wall	0 to 2,000 ppm adjustable, +/- 30 ppm +/- 2% of reading at normal temperature and pressure
C7232A1016		No	Yes		
C7232A1024		Yes	No		
C7232A1032		No	No		
C7232B1006		Yes	Yes	Duct (8" insertion length)	
C7232B1014		No	Yes		
C7232B1022		Yes	No		
C7232B1030		No	No		
C7632A1004	0-10 Vdc (fixed)	No	Yes	Wall	0 to 2,000 ppm fixed
C7632B1002	0-10 Vdc (fixed)	No	Yes	Duct	

P7640B

P7640 Pressure Transducer Models					
Model	**Mounting**	**Selectable W.C. Range**	**Display**	**Output**	**Supply Voltage**
P7640A1000	Panel	0-.1", 0-.25", 0-.5", 0-1"	Yes	0-10 Vdc, 0-5 Vdc, and 4-20 mA selectable	12-30 Vdc or 24 Vac
P7640A1018			No		
P7640A1026		0-1", 0-2.5", 0-5", 0-10"	Yes		
P7640A1034			No		
P7640B1008	Duct	0-.1", 0-.25", 0-.5", 0-1"	Yes		
P7640B1016			No		
P7640B1024		0-1", 0-2.5", 0-5", 0-10"	Yes		
P7640B1032			No		
P7640U1040	Universal	0-.1", 0-.25", 0-.5", 0-1" 0-2.5", 0-5", 0-10"	No		
P7640U1052		0-.1", 0-.25", 0-.5", 0-1" 0-2.5", 0-5", 0-10"	Yes		

PWT250

PWT Series Wet Differential Pressure Transducers			
Model	**Selectable Pressure Range**	**Output**	**Supply Voltage**
PWT50	0-5, 0-10, 0-25, 0-50 psid	0-10Vdc, 0-5Vdc, and 4-20mA selectable	12-30Vdc or 24Vac
PWT100	0-10, 0-20, 0-50, 0-100 psid		
PWT250	0-25, 0-50, 0-125, 0-250 psid		

PWT-BV Bypass Valve (sold spearately)

50035430

5003540 Gauge Pressure Sensors				
Model	**Pressure Range**	**Pressure Connection**	**Output**	**Excitation**
50035430-050	0-50 psig	1/4" -18 NPT	4-20mA	9.5 Vdc to 30 Vdc
50035430-050	0-100 psig	1/4" -18 NPT		
50035430-300	0-300 psig	1/4" -18 NPT		
50035430-500	0-500 psig	1/4" SAE female Schrader		
50035430-01K	0-1000 psig	1/4" SAE female Schrader		

CONTROLLER SPECIFIC TEMPERATURE SENSORS

	Part Number	Sensor Type		Description
		Temp	Humid-ity	
Spyder Sylk Enhanced	TR70	✔		Customizable, 2-wire, non-polarity sensitive, Sylk bus communicating wall module with network bus jack and LCD panel.
	TR70-H	✔	✔	

	Model Number	Sensor Type		Selectable Setpoint Adjustment 55° to 85°F, 13° to 30°C or Relative (- to +)	Occupied Override	Comments
	Honeywell TR20 Wireless Sensor	Temp	Humid-ity			
Controllers and Thermostats*	TR21-WK	✔				Includes one prebound sensor and receiver.
	TR21-WKU	✔				Includes one prebound sensor and receiver. No Honeywell logo.
	TR23-WK	✔		✔	✔	Includes one prebound sensor and receiver.
	TR23-WKU	✔		✔	✔	Includes one prebound sensor and receiver. No Honeywell logo.
	TR21-WS	✔				Sensor only. For replacement. Requires a wireless receiver.
	TR23-WS	✔		✔	✔	
	WRECVR					Wireless receiver only. For replacement. Requires a wireless sensor.

	Model Number		Sensor Element Type	Sensor Type		Selectable Setpoint Adjustment 55° to 85°F, 13° to 30°C or Relative (- to +)	Occupied Override	LON Jack	Fan Switching	Comments
	Honeywell Wall Module Model	Replaces Honeywell Model		Temp	Humid-ity					
Excel 10, 15, 50, 100, 500, Spyder, T7350	TR21	T7770A1006	20K ohms non-linear	✔						
	TR21-A	T7770A3002	10K ohms non-linear for averaging only	✔						
	TR21-H	N/A	20K ohms non-linear	✔	✔			✔		
	TR21-J	T7770A2004		✔				✔		
	TR22	T7770B1004 T7770B1020 T7770B1046		✔		✔		✔		
	TR23	T7770C1002 T7770C1028 T7770C1044		✔		✔	✔	✔		
	TR23-H	N/A		✔	✔	✔	✔	✔		
	TR23-KL	N/A		✔		✔	✔	✔		Knobs not included
	TR23-H-KL	N/A		✔	✔	✔	✔	✔		
	TR23-N	T7770C1051		✔		✔	✔	✔		No Honeywell logo
	TR24	T7770D1000		✔			✔	✔		
	TR22-F5	N/A		✔		✔		✔	5 position	Not for use with T7350
	TR23-F3	T7770E1023		✔		✔	✔	✔	3 position	
	TR23-F5	T7770F1005		✔		✔	✔	✔	5 position	
	C7772A1004	N/A		✔						No Honeywell logo
	C7772A1012	N/A		✔						With Honeywell logo
XL 10	T7560A1018	N/A		✔		✔	✔	Optional	Yes	LCD Display/ white and blue
	T7560A1042	N/A		✔		✔	✔			LCD Display/ all white
	T7560B1016	N/A		✔	✔	✔	✔			LCD Display/ white and blue
	T7560B1032	N/A		✔	✔	✔	✔			LCD Display/ all white
	KNOB-C	N/A	N/A	N/A	N/A	For use on TR23	N/A	N/A	N/A	Replacement Knob (C°)
	KNOB-F	N/A	N/A	N/A	N/A	For use on TR23	N/A	N/A	N/A	Replacement Knob (F°)

CONTROLLER SPECIFIC TEMPERATURE SENSORS

	Part Number	Sensing Element/Sensor Type	Color/Mounting	Features
T7300 Applications	T7047C2007	1420 ohms	Taupe, new styling	
	T7047C2015		Premier white, new styling	
	T7047G2008	710 ohms	Taupe, new styling	Averaging only
	T7047G2016		Premier white, new styling	
	T7147A2000	1420 ohms	Taupe, new styling	Override
	T7147A2018			Override, warmer, cooler
	T7147G2015	710 ohms		Override, averaging only
	T7147G2023			Override, warmer, cooler, averaging only
	T7022A1010	1420 ohms	Duct mount	
	C7031G2014[a]	PT3000	Outdoor mount	For use with T7350
	C7013G2006[b]	1715 ohms	Outdoor mount	For use with W7100

[a] For use with T7350 applications.
[b] For use with W7100 applications.

	Part Number	Sensing Element	Description	Temperature Range	Use With
T775	50021579-001	1097 ohms at 77˚ F	Standard temperature probe	-40˚ to 350˚ F (-40˚ to 177˚ C)	All T775 Series 2000 models
	T775-SENS-WR		Water-resistant probe with 5-ft. leads	-40˚ to 270˚ F (-40˚ to 132˚ C)	
	T775-SENS-WT		Water-tight probe with 6-ft. leads		
	T775-SENS-OAT		Outdoor air temperature sensor	-40˚ to 158˚ F (-40˚ to 70˚ C)	
	T775-SENS-STRAP		Strap-on	-40˚ to 250˚ F (-40˚ to 121˚ C)	
	C7031D2003		5-in. immersion sensor with wiring box (well included, 50001774-	-40˚ to 350˚ F (4˚ to 177˚ C)	
	C7031B2005		6-in duct with wiring box	-40˚ to 250˚ F (-40˚ to 121˚ C)	
	C7031J2009	1097 ohms at 77˚ F	12-in. duct averaging sensor with four elements with wiring box	40˚ to 180˚ F (4˚ to 82˚ C)	All T775 Series 2000 models
	C7046D1008		8-in. duct probe with mounting flange	40˚ to 150˚ F (4˚ to 66˚ C)	
	C7100D1001		12-in. flat response, duct averaging sensor with flange	40˚ to 220˚ F (4˚ to 104˚ C)	
	C7130B1009		Room mount sensor	-40˚ to 100˚ F (-40˚ to 38˚ C)	
	C7170B1000		3/8-in. diameter temperature probe	-40˚ to 250˚ F (-40˚ to 121˚ C)	


T775-SENS-OAT


T775-SENS-WR


T775-SENS-WT


50021579-001


T775-SENS-STRAP

GENERAL TEMPERATURE SENSORS

	Part Number	Sensing Element	Temperature Range	Insertion Length	Type	Mounting & Application
Analog Economizer	C7150B1004	3K ohms NTC at 77˚ F	-40˚ to 110˚ F (-40˚ to 43˚ C)	N/A	Duct - Temp Sensor	Mixed or discharge air sensor
	C7660A1000	4 or 20 mA	-40˚ to 149˚ F (-40˚ to 65˚ C)	N/A		Dry-bulb temperature sensor
	C7046A1004	3K ohms NTC at 77˚ F	40˚ to 150˚ F (4˚ to 66˚ C)	8 in.		Mixed or discharge air sensor
	C7046A1038	3K ohms NTC at 77˚ F	40˚ to 150˚ F (4˚ to 66˚ C)	12 in.		
	C7400A2001	4 - 20 mA	-40˚ to 150˚ F (-40˚ to 66˚ C)	NA*	Duct - Enthalpy Sensor	Outdoor or return air sensor
Communicating Economizer	C7400S1000	S-bus Temperature & Humidity	-40˚ to 150˚ F (-40˚ to 66˚ C)	N/A*	Duct - Temp Sensor	Outdoor, return, discharge air sensor
	C7250A1001	20K NTC	-40˚ to 150˚ F (-40˚ to 66˚ C)	N/A*	Duct - Temp Sensor	Outdoor, mixed dry bulb sensor
Other Temp Sensors	C7130A1001	3,484 ohms PTC at 77˚ F	-40˚ to 100˚ F (-40˚ to 38˚ C)	N/A		Wall mount
	C7130B1009	1,097 ohms PTC at 77˚ F	-40˚ to 100˚ F (-40˚ to 38˚ C)	N/A		Wall mount

* May be used with Duct Mounting Kit- Part # 50053060-001

GENERAL TEMPERATURE SENSORS

C7041B

C7041D

C7041J

C7041R

C7041F

C7041P

TB-WALL

	Part Number	Sensing Element	Resistance	Operating Range	Mounting and Application
Duct Mount	C7021B2005	10K ohms NTC Type II	10K ohms NTC at 77°F	-40° to 250° F	6" duct w/wiring enclosure
	C7021B2013				12" duct w/wiring enclosure
	C7021C2003				18" duct w/wiring enclosure
	C7021J2007				12' duct averaging w/wiring enclosure
	C7021R2000				12' duct averaging flexible copper
	C7021R2018				24' duct averaging flexible copper
	C7776A1006			45° to 99° F	6" duct probe w/flange, 8.5 in stranded wire
	C7776A1040				6" duct probe w/flange, 6 ft plenum cable
	C7023B2005	10K ohms NTC Type III	10K ohms NTC at 77°F	-40° to 250° F	6" duct w/wiring enclosure
	C7023B2013				12" duct w/wiring enclosure
	C7023C2003				18" duct w/wiring enclosure
	C7023J2007				12' duct averaging w/wiring enclosure
	C7023R2000				12' duct averaging flexible copper
	C7023R2018				24' duct averaging flexible copper
	C7778A1006			45° to 99° F	6" duct probe w/flange
	C7778A1040				6" duct probe w/flange, 6 ft plenum cable
	C7041B2005	20K ohms NTC	20K ohms NTC at 77°F	-40° to 250° F	6" duct w/wiring enclosure
	C7041B2013				12" duct w/wiring enclosure
	C7041C2003				18" duct w/wiring enclosure
	C7041J2007				12 ft. Duct (Averaging) w/wiring enclosure
	C7041R2000				12 ft. Duct flexible copper (Averaging)
	C7041R2018				24 ft. Duct flexible copper (Averaging)
	C7770A1006			45° to 99° F	6" duct probe w/flange
	C7770A1040				6" duct probe w/flange and 6 ft. plenum rated cable
	C7046D1008	PT1000	1,097K ohms PTC at 77°F	40° to 150° F	8" duct (Discharge probe w/flange)
	C7100D1001				13" duct (Averaging)
	C7100A1015	PT3000	3,484K ohms PTC at 77°F	40° to 220° F	
	C7100C1003				
	C7046A1004	3K ohms NTC	3K ohms NTC at 77°F	40° to 150° F	8" duct w/flange
	C7046A1038				12" duct w/flange
	C7046C1000				8" duct discharge w/flange
	C7150B1004			40° to 250° F	Duct (internal)
	C7046B1010	22.8K ohms NTC	22.8K ohms NTC at 77°F	40° to 150° F	6" Zone (Discharge w/flange)
	C7100B1013				13" duct (Averaging)
Water	C7021D2001	10K ohms NTC Type II	10K ohms NTC at 77°F	-40° to 250° F	6" w/wiring enclosure, use well 50001774-001
	C7021K2005				Strap-on pipe sensor with wiring enclosure
	C7023D2001	10K ohms NTC Type III	10K ohms NTC at 77°F		6" w/wiring enclosure, use well 50001774-001
	C7023K2005				Strap-on pipe sensor with wiring enclosure
	C7041D2001	20K ohms NTC	20K ohms NTC at 77°F		6" w/wiring enclosure, use well 50001774-001
	C7041K2005				Strap-on with with wiring enclosure
Outdoor	C7021F2009	10K ohms NTC Type II	10K ohms NTC at 77°F	-40° to 158° F	Outdoor weatherproof, connects to 1/2" conduit
	C7023F2009	10K ohms NTC Type III			
	C7041F2006	20K ohms NTC	20K ohms NTC at 77°F		
Wall Mount	C7772F1004	10K ohms NTC Type II	10K ohms NTC at 77°F	45° to 99° F	Flush wall mount, without logo
	C7772F1012			45° to 99° F	Flush wall mount, with logo
	C7021P2004			-40° to 250° F	Small metal button sensor
	TB-WALL-1014			32° to 122° F	Wall sensor
	TB-WALLOVR-1014			32° to 122° F	Wall sensor with override
	C7772G1004	10K ohms NTC Type III		45° to 99° F	Flush wall mount, without logo
	C7772G1012				Flush wall mount, with logo
	C7023P2004			-40° to 250° F	Small metal button sensor
	C7772A1004	20K ohms NTC	20K ohms NTC at 77°F	45° to 99° F	Flush wall mount/no logo
	C7772A1012				Flush wall mount/with logo
	C7041P2004			-40° to 250° F	Small metal button sensor
	C7130B1009	PT1000	1,097 Ohms PTC at 77°F	-40° to 100° F	Wall mount
	C7130A1001	PT3000	3,484 ohms PTC at 77°F	-40° to 250° F	
Water/Air	C7021N2001	10K ohms NTC Type II	10K ohms NTC at 77°F	-40° to 250° F	Probe Sensor with 6' Lead
	C7023N2001	10K ohms NTC Type III			
	C7041N2020	20K ohms NTC	20K ohms NTC at 77°F		

NOTE: 20K ohms NTC sensors are used with Excel 10, 15, 50, 100 and 500. See controller product data sheets for details. PT1000 sensors are used with Excel 15, 100, 500, and 600. See controller product data sheets for details. PT3000 sensors are used on certain Excel and Microcell products. See controller product data sheets for details. 3K ohm NTC sensors are used on W7100, W7459, W7215, W7212 an dall economizer modules. 10K ohms NTC Type II sensors are used with TB7600, TB7300, and TB7600 Series communicating thermostats. 10K ohms NTC Type III sensors are used with WEBs-AX I/O Modules.

	Part Number	Description	Core Type	Normally Open or Normally Closed	Trip Point	Operating Range	Output Switch Rating	LEDs
Current Switches	CSS-O-F5-001	"Go/No Go" current switch	Solid	N/O	0.5 A	0-250 A	0.3 A at 200 Vac/Vdc	Red
	CSS-O-F1-001				0.2 A			
	CSS-C-F5-001			N/C	1.0 A		0.15 A at 300 Vac/Vdc	
	CSS-C-F1-001				0.5 A			
	CSS-O-A300-001	Adjustable current switch		N/O	1.0 A to 250 A		0.3 A at 200 Vac/Vdc	Red and green
	CSS-O-A200-001				0.5 A to 250 A			
	CSP-O-F15-001	"Go/No Go" current switch	Split		2.5 A	0-200 A		Red
	CSP-O-F10-001				1.5 A			
	CSP-O-A300-001	Adjustable current switch			3.0 A to 200 A			Red and green
	CSP-O-A200-001				2.0 A to 200 A			
	CSP-C-A200-001			N/C	2.5 A to 250 A	0-250 A	0.15 A at 300 Vac/Vdc	

	Part Number	Description	Core Type	Output	Current Range	Type	Loop Powered	True RMS or average
Current Transmitters	CTS-20-250-AVG-001	Loop powered current sensor	Solid	4-20 mA	0-100, 0-200, 0-250 A	Adjustable	Yes	Average
	CTS-20-250-VFD-001							True RMS
	CTP-20-200-AVG-001		Split		0-100, 0-150, 0-200 A			Average
	CTP-20-050-VFD-001				0-10, 0-20, 0-50 A			True RMS
	CTS-05-050-VDC-001	Current sensors	Solid	0-5 Vdc			No	Average
	CTS-10-250-VDC-001			0-10 Vdc	0-100, 0-200, 0-250 A			

Solid Core

Split Core

Automation and Control Solutions
In the US:
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422-3992

In Canada:
Honeywell Limited
35 Dynamic Drive
Toronto, Ontario M1V 4Z9
customer.honeywell.com

Honeywell

63-9285 RL
July 2011

ADVANCED TRAINING

WELCOME TO LCBS CONNECT PROGRAM

ACCESSORY LOOP CONTROL TRAINING PROGRAM

Honeywell

The Accessory Loop

- The LCBS Connect controller is designed for the control of 3-25 ton RTU, Air to air Heat Pumps, and Split Systems. We refer to this equipment classification as CVAHU system.

- Control of these systems across North America varies based on climate and infrastructure age.

  - We provide capability to control modulating hydronic heating, via “accessory loop” application tool for “rust belt” and “heating” areas including Northeast, Midwest, Mountain West, Pacific Northwest, Canada and Alaska.

- There are other things that need to be controlled in “light commercial” buildings. Accessory Loop tool can address other applications

  - Control of exterior lighting loops based on photosensor input.

  - Control of exhaust fan based on OA damper position or building pressurization with VFD.

  - Anything control relationship you have envision can probably be addressed with the accessory loop function.

Broad application footprint!

Advanced Control Topics

- Before we start. Interesting information. There are three (3) paths to follow to construct an Accessory Loop. 1] Modulating 2] Staged and 3] Thermostatic. We aren't covering the Thermostatic track; it is infrequently used.
  - There are methods to expand the capability of the Accessory Loop by using VDC relays. We are not going to cover this. Advanced user will figure this out.

The LCBS Connect Wall Module must be connected to the system even if use "internal" setpoints are used. It controls heating, cooling changeover.

- Application notes: For those of you who have used "Accessory Loop" capability, it's important to remember the following:

Limitation. One modulating cooling or heating loop only. Not both. Control can be accompanied by an auxiliary point, digital or analog that operates in sequence with loop output.

Acceptable control loop examples: One modulating heat (discharge or space temp controlled), staged cooling. One modulating cooling (discharge or space temp controlled), staged heating. One modulating heat (discharge or space temp controlled), economizer control.

Broad application footprint!

Advanced Control Topics

- Before we start (*continued*).
  - **Sketch, Plan your app.** It is essential that you "sketch out" your application before you attempt to enter the application data in the LCBS Connect wall module or LCBS Connect remote user interface.
  - **Preconfigure IO Points.** It is essential that you configure analog inputs and outputs; digital inputs and outputs before you start configuring the Accessory Loop. The system WILL NOT ALLOW YOU TO COMPLETE your work if you don't
  - **Use the Remote UI.** You will probably find that the LCBS Connect remote user interface will be easier to use, but it is possible to enter your application of LCBS Connect wall module.

Advanced Control Topics – Accessory Loop Setup

ADVANCED CONFIGURATION
SELECT CONTROL STRATEGY

1

CONFIGURE DIGITAL, ANALOG OUTPUT AND DIGITAL, ANALOG INPUT POINTS.

IF YOU ARE USING CUSTOM SENSORS, CONFIGURE UI2, UI4, UI5, OR UI6; OUTPUTS DO1, AO2, AO3

Note: If points aren't configured, configuration is impossible.

- Outputs. Configure analog output points for "modulating" accessory loops and digital output points for "staged" accessory loops.
  - AO2 and AO3 must be configured for modulating accessory loops
  - DO1 must me configured for staged accessory loops.
- Inputs. There are numerous actual and virtual inputs that can be used to construct the accessory loop. Temperature option are UI2, UI4, UI5 and UI6.
- If you are constructing custom analog inputs, you must do it before you configure the accessory loop.
  - For custom inputs, you must provide low and high DC voltage (0-10 VDC only) to scale the sensor.
  - Need to assign engineering units to your custom entry (CFM, V(olts), %, PPM, GPM, PSI, FC (foot-candles).

Advanced Control Topics – Detail

1 SELECT CONTROL STRATEGY

- ☐ STAGED
- ☐ MODULATING

1a SELECT ANALOG OUTPUT ASSIGNMENT MODULATING

AO2
- ☐ ACCESSORY LOOP MODULATING
- ☐ ACCESSORY LOOP STAGE (RELAY REQUIRED)
- ☐ ACCESSORY LOOP AUXILIARY

AO3
- ☐ ACCESSORY LOOP MODULATING
- ☐ ACCESSORY LOOP STAGE (RELAY REQUIRED)
- ☐ ACCESSORY LOOP AUXILIARY

1b SELECT DIGITAL OUTPUT ASSIGNMENT STAGED

D01
- ☐ ACCESSORY LOOP STAGE (RELAY REQUIRED)

1c SELECT ANALOG INPUT ASSIGNMENT MODULATING AND STAGED

CONFIGURE U2, U4, U5, OR U6

UI2
- ☐ NONE
- ☐ MONITOR SENSOR (20K)

UI4
- ☐ NONE
- ☐ CO2 (VDC)
- ☐ MONITOR 1 TEMP (20K)
- ☐ MONITOR 1 SENSOR (VDC)
- ☐ MONITOR 2 TEMP (20K)
- ☐ MONITOR 2 SENSOR (VDC)
- ☐ COMPRESSOR DISCHARGE TEMP (HOT GAS)

UI5
- ☐ NONE
- ☐ MONITOR 1 TEMP (20K)
- ☐ MONITOR 1 SENSOR (VDC)
- ☐ COMPRESSOR DISCHARGE TEMP (HOT GAS)

UI6
- ☐ NONE
- ☐ MONITOR 2 TEMP (20K)
- ☐ MONITOR 2 SENSOR (VDC)
- ☐ COMPRESSOR DISCHARGE TEMP (HOT GAS)

IF SELECTING 0-10 VDC SENSOR (U5, U6) MUST DEFINE VOLTAGE AND SELECT ENGINEERING UNITS

MONITOR SENSOR 1 RANGE					
0	VDC	=		START VALUE	
10	VDC	=		END VALUE	

MONITOR SENSOR 2 RANGE					
0	VDC	=		START VALUE	
10	VDC	=		END VALUE	

ENGINEERING UNITS
- ☐ NO UNITS
- ☐ CFM (CUBIC FEET PER MINUTE)
- ☐ V (VOLTS)
- ☐ % (PERCENTAGE)
- ☐ PPM (PARTS PER MILLION)
- ☐ GPM (GALLONS PER MINUTE)
- ☐ PSI (POUNDS PER SQUARE INCH)
- ☐ FC (FOOTCANDLES)

Advanced Control Topics – Accessory Loop Setup

SELECT PRIMARY ACCESSORY LOOP SENSOR

2

SELECT SENSOR CONFIGURED IN STEP 1 OR SELECT FROM XX ANALOG INPUT SENSORS

There are a large number of actual sensors, virtual sensors, and calculated values that can be used as control inputs to the accessory loop.

- Make sure these sensors and values are configured and exist. Qualified list, see below:

PRIMARY ACCESSORY LOOP SETPOINT

- ☐ SPACE TEMPERATURE
- ☐ SPACE RH
- ☐ SPACE CO2
- ☐ MIN ZONE TEMPERATURE
- ☐ MAX ZONE TEMPERATURE
- ☐ AVERAGE ZONE TEMPERATURE
- ☐ SMART ZONE TEMPERATURE
- ☐ TS120 TEMPERATURE_1
- ☐ TS120 RH_1
- ☐ TR40 TEMPERATURE_3
- ☐ TR40 RH_3
- ☐ TR40 CO2_3
- ☐ TR40 TEMPERATURE_4
- ☐ TR40 TEMPERATURE_5
- ☐ TR40 TEMPERATURE_6
- ☐ OUTDOOR TEMPERATURE
- ☐ OUTDOOR RH
- ☐ OUTDOOR ENTHALPY
- ☐ RETURN TEMPERATURE
- ☐ RETURN RH
- ☐ RETURN ENTHALPY
- ☐ DISCHARGE TEMPERATURE
- ☐ MIXED AIR TEMPERATURE
- ☐ MONITOR 1 SENSOR
- ☐ MONITOR 2 SENSOR
- ☐ MONITOR TEMPERATURE
- ☐ FILTER PRESSURE
- ☐ FAN CURRENT
- ☐ COMP CURRENT
- ☐ PULSE METER
- ☐ OA DAMPER
- ☐ FREE 1 MOD
- ☐ FAN SPEED
- ☐ EFFECT SETPOINT
- ☐ COOLING MOD
- ☐ HEATING MOD
- ☐ AUX HEATING MOD
- ☐ MONITOR 1 TEMPERATURE
- ☐ MONITOR 2 TEMPERATURE
- ☐ COMP DISCHARGE TEMPERATURE

Advanced Control Topics – Details

SELECT PRIMARY ACCESSORY LOOP SETPOINT

3

IF "INTERNAL" IS SELECTED, SET CUSTOM SETPOINTS.

IF OTHER, EXISTING SETPOINTS ARE USED.

Note: Existing temperature control setpoints are calculated and can be used to control standard heating and cooling loops. This combination is used for cascaded hot water temperature control; discharge and zone temperature

- Use internal setpoints if there is a secondary loop being controlled in the systems.

- Likely use for internal setpoints is independent of standard temperature control including discharge air temperature control, lighting control using foot-candles as inputs, and percentage that would be used for damper position.

- When you select "internal setpoints" the following inputs will become available

MAIN INTERNAL SETPOINTS		
OCCUPIED		°F
UNOCCUPIED		°F
STANDBY		°F

Engineering Units

Advanced Control Topics – Details

SELECT PRIMARY ACCESSORY LOOP SETPOINT

3

IF “INTERNAL” IS SELECTED, SET CUSTOM SETPOINTS.

IF OTHER, EXISTING SETPOINTS ARE USED.

Note: Existing temperature control setpoints are calculated and can be used to control standard heating and cooling loops. This combination is used for cascaded hot water temperature control; discharge and zone temperature

You can also select effective setpoint, **effective heating and cooling setpoints, and monitoring 1 and 2 sensors. If you select these, the system will use these values as set points, control points.**

Effective setpoints are those that are impacted by all reset, offset, and adaptive intelligent recover action.

Monitor Sensor 1 and Monitoring Sensor 2 require additional creativity and are available to use as primary setpoints.

Advanced Control Topics – Accessory Loop Setup

SELECT RESET SENSOR AND DEVELOP RESET SCHEDULE

4

How to set up a reset schedule.

FOLLOW GUIDELINES, INSTRUCTIONS AND CONSTRUCT RESET SCHEDULE.

SELECT ONE OF XX SENSORS TO INITIATE RESET.

- Select a sensor to execute the reset. Common reset sensor is outdoor air temperature that provides input to heating loop reset.

- Select when it is desired to start and stop reset. What secondary temperature do you want reset to start? to stop? How much reset do you want to perform? See details next page.

ACCESSORY LOOP RESET SENSOR

- ☐ SPACE TEMPERATURE
- ☐ SPACE RH
- ☐ SPACE CO2
- ☐ MIN ZONE TEMPERATURE
- ☐ MAX ZONE TEMPERATURE
- ☐ AVERAGE ZONE TEMPERATURE
- ☐ SMART ZONE TEMPERATURE
- ☐ TS120 TEMPERATURE_1
- ☐ TS120 RH_1
- ☐ TR40 TEMPERATURE_3
- ☐ TR40 RH_3
- ☐ TR40 CO2_3
- ☐ TR40 TEMPERATURE_4
- ☐ TR40 TEMPERATURE_5
- ☐ TR40 TEMPERATURE_6
- ☐ OUTDOOR TEMPERATURE
- ☐ OUTDOOR RH
- ☐ OUTDOOR ENTHALPY
- ☐ RETURN TEMPERATURE
- ☐ RETURN RH
- ☐ RETURN ENTHALPY
- ☐ DISCH AIR TEMPERATURE
- ☐ MIXED AIR TEMPERATURE
- ☐ MONITOR 1 SENSOR
- ☐ MONITOR 2 SENSOR
- ☐ MONITOR TEMPERATURE
- ☐ FILTER PRESSURE
- ☐ FAN CURRENT
- ☐ COMP CURRENT
- ☐ PULSE METER
- ☐ OA DAMPER
- ☐ FREE 1 MOD
- ☐ FAN SPEED
- ☐ EFFECT SETPOINT
- ☐ COOLING MOD
- ☐ HEATING MOD
- ☐ AUX HEATING MOD
- ☐ MONITOR 1 TEMPERATURE
- ☐ MONITOR 2 TEMPERATURE
- ☐ COMP DISCH TEMPERATURE
- ☐ NONE

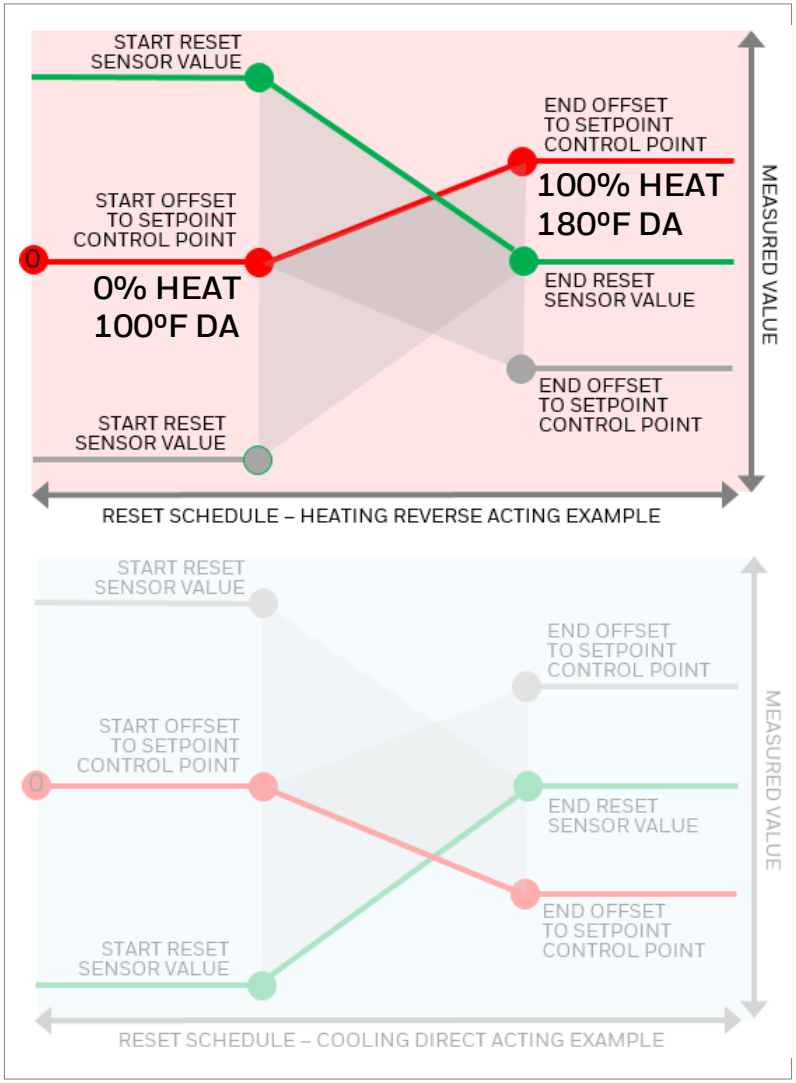
Advanced Control Topics – Accessory Loop Setup

DEVELOP RESET SCHEDULE				
	START		END	
OFFSET TO MAIN SETPOINT	**100°**	°F	**180°F**	°F
RESET SENSOR VALUE	**0**	%	**100**	%

Demonstration. Using a real case.

Sequence of operation

On a call for heat in the space, (0%) the heating discharge air temperature will be controlled at 100º F. At a maximum call for heat in the space (100%), the discharge air temperature will be controlled at 180º. If there is no call for heating, heating system will be disabled.



Advanced Control Topics – Accessory Loop Setup

SELECT ACCESSORY LOOP DIABLE STRATEGY

5

Disabling the accessory loop.

SELECT DESIRED DIGITAL INPUT, OUTPUT TO DISABLE LOOP. DIRECT OR REVERSE IMPACTS ARE AVAILABLE.

UNDERSTAND THE “REVERSE IT” PRINCIPLE.

- There are 30 actual and calculated digital inputs that can be used to turn the loop “off,” or to unoccupied condition.
- You can use the “reverse” of this logic to “enable” the accessory loop as well.

DISABLE INPUT POINTS

- ☐ COOL OA LOCKOUT
- ☐ HEAT OA LOCKOUT
- ☐ COMP HEAT OA LOCKOUT
- ☐ AUX HEAT OA LOCKOUT
- ☐ COOL DISABLE
- ☐ HEAT DISABLE
- ☐ AUX HEAT DISABLE
- ☐ COOL STAGE 1
- ☐ HEAT STAGE 1
- ☐ AUX HEAT STAGE 1
- ☐ FAN OUT
- ☐ FAN STATUS (CALLED PROOF OF AIR FLOW)
- ☐ FREEZE STAT
- ☐ DIRTY FILTER
- ☐ OCC SENSOR
- ☐ MONITOR SWITCH
- ☐ FREE 1 DIG
- ☐ FREE COOL AVAILABLE
- ☐ ECONOMIZING
- ☐ ECON ENABLE
- ☐ DCV OVERRIDE
- ☐ AUX ECON OUT
- ☐ OCCUPANCY OUT
- ☐ SIMPLE DEHUMIDIFICATION
- ☐ CHANGEOVER RELAY
- ☐ DEHUMIDIFICATION ACTIVE
- ☐ DLC SHED (CALLED DEMAND RESPONSE)
- ☐ SHUTDOWN
- ☐ WSHP ENABLE

REVERSE IT LOGIC

DISABLE INPUT POINT: COOL OA LOCKOUT ▶ REVERSE IT LOGIC: DO NOT LOCKOUT COOLING

DISABLE INPUT POINT : COOL STAGE 1 ▶ REVERSE IT LOGIC: ACTIVATE LOOP ON COOL STAGE 1

DISABLE INPUT POINT: HEAT OA LOCKOUT ▶ REVERSE IT LOGIC: DO NOT LOCKOUT HEATING

DISABLE INPUT POINT : HEAT STAGE 1 ▶ REVERSE IT LOGIC: ACTIVATE LOOP ON HEAT STAGE 1

DISABLE INPUT POINT: FREE COOL AVAILABLE ▶ REVERSE IT LOGIC: DO NOT USE OUTOOR AIR

Advanced Control Topics – Accessory Loop Setup

SELECT OCCUPANCY STRATEGY

6

LOOP CAN FOLLOW 1] NO SCHEDULE 2] EFFECTIVE SCHEDULE OR 3] SCHEDULED OCCUPANCY

- Select “no schedule” for occupancy strategy. The accessory loop won’t react to the any schedule. An example of this is outdoor air lighting and refrigeration control. You don’t want these loops to become inactive for obvious reasons.
- “Effective schedule” is selected, the schedule will follow any override, bypass intervention. Undesirable to have outdoor lighting to go on and off based on a request for override indoors. Typically use this when controlling a temperature loop.
- “Schedule Only” is schedule, the schedule will strictly follow the programmed on and off times only. Indoor lighting is a good application for this. While I want the lights on when it’s dark in the space, I want them off during overnight hours and just emergency lights provide lighting.

Advanced Control Topics – Accessory Loop Setup

PROVIDE PROPORTIONAL, INTEGRAL, DERAVITIVE TIMES, VALUES

7

IF YOU SELECTED “INTERNAL” SETPOINT FOR LOOP, CONFIGURER NEEDS TO PROVIDE STATED VALUES

- Follow existing proportional, integral, derivative timings that are parameters in the system. Do not change these unless you receive a request to do so by Honeywell Engineering or Customer Care.
- Follow external application information from Honeywell to set PID timing for accessory loops.
- It is very rare to use derivative timing for HVAC control loops in light commercial buildings. Do not change derivative timing unless you receive a request to do so by Honeywell Engineering or Customer Care.

Advanced Control Topics – Accessory Loop Setup

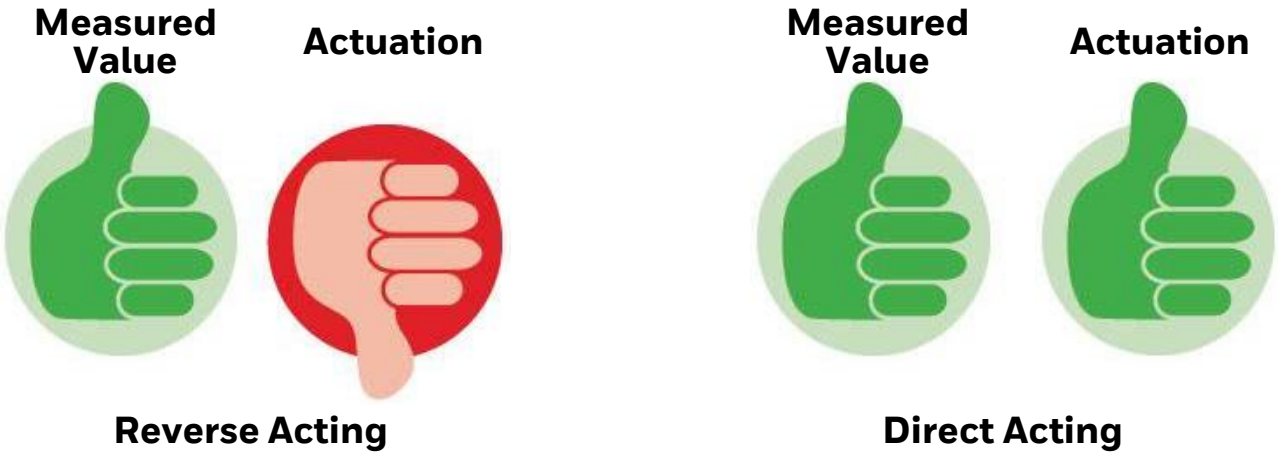
SELECT LOOP ACTION, SELECT AUXILIARY LOOP ACTION

8

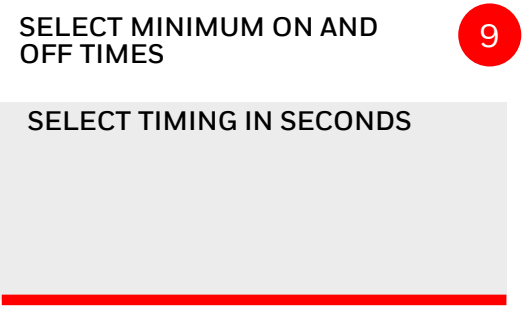
SELECT DIRECT OR REVERSE ACTING CONTROL.

SELECT HOW AUXILIARY LOOP POINT OPERATES BASED ON SCHEDULE SELECTED

- **Staged control.** If the measured value increases and causes the load to go on, this is a direct acting accessory loop. Likewise if the measured value decreases and causes the load to go on, this is a reverse acting accessory loop.
- **Modulating control.** If the measured value increases and causes the actuation to open, this is a direct acting accessory loop. Likewise if the measured value decreases and causes the actuator to close, this is a reverse acting accessory loop.



Advanced Control Topics – Accessory Loop Setup



- Set desired minimum on and off times for controlled output. If the output is digital, make sense to use these timers.
  - Options set minimum time off, minimum time on from 0 to 900 seconds.
- Set "Auxiliary Action." An auxiliary output operates in conjunction with the primary output to control desired loop.

Example: **Control small heater** with a modulating value and a fan. Hints:

- Primary output modulating, configure AO2 or AO3
- Auxiliary output is DO1

Rules: **Two choices for Auxiliary Action:**

- "Auto" (on with call for output, off otherwise) or
- "Continuous" (on during occupied, auto otherwise).
- If modulating loop, set position you wish auxiliary point to come on (0-100%)

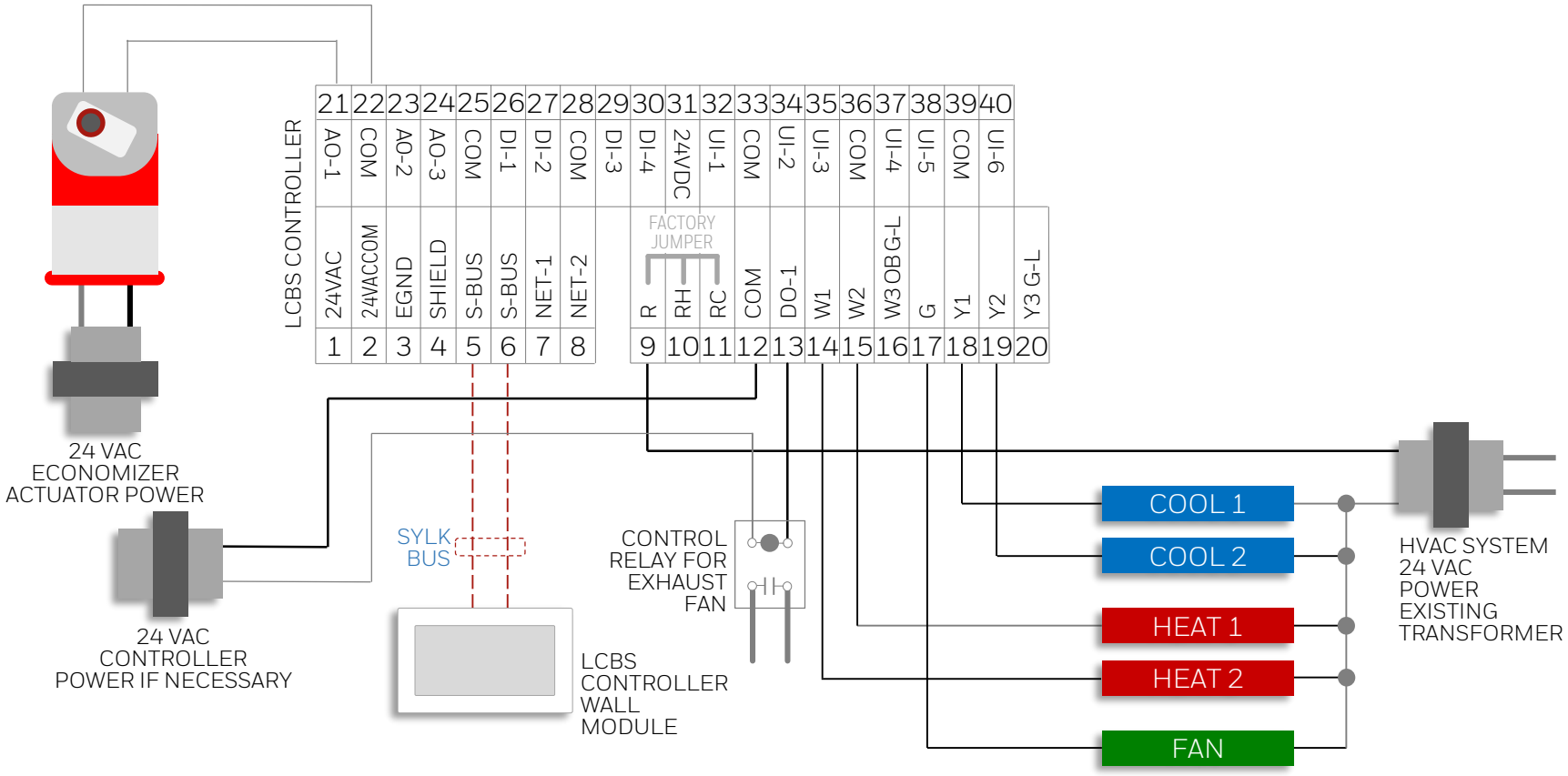
Application: **Small Heater:**

- Set for Auto.
- When heater is calling for heating, fan is energized when there is a call for heating.
- Set DO1 to energize at 25% (selectable) modulating travel.

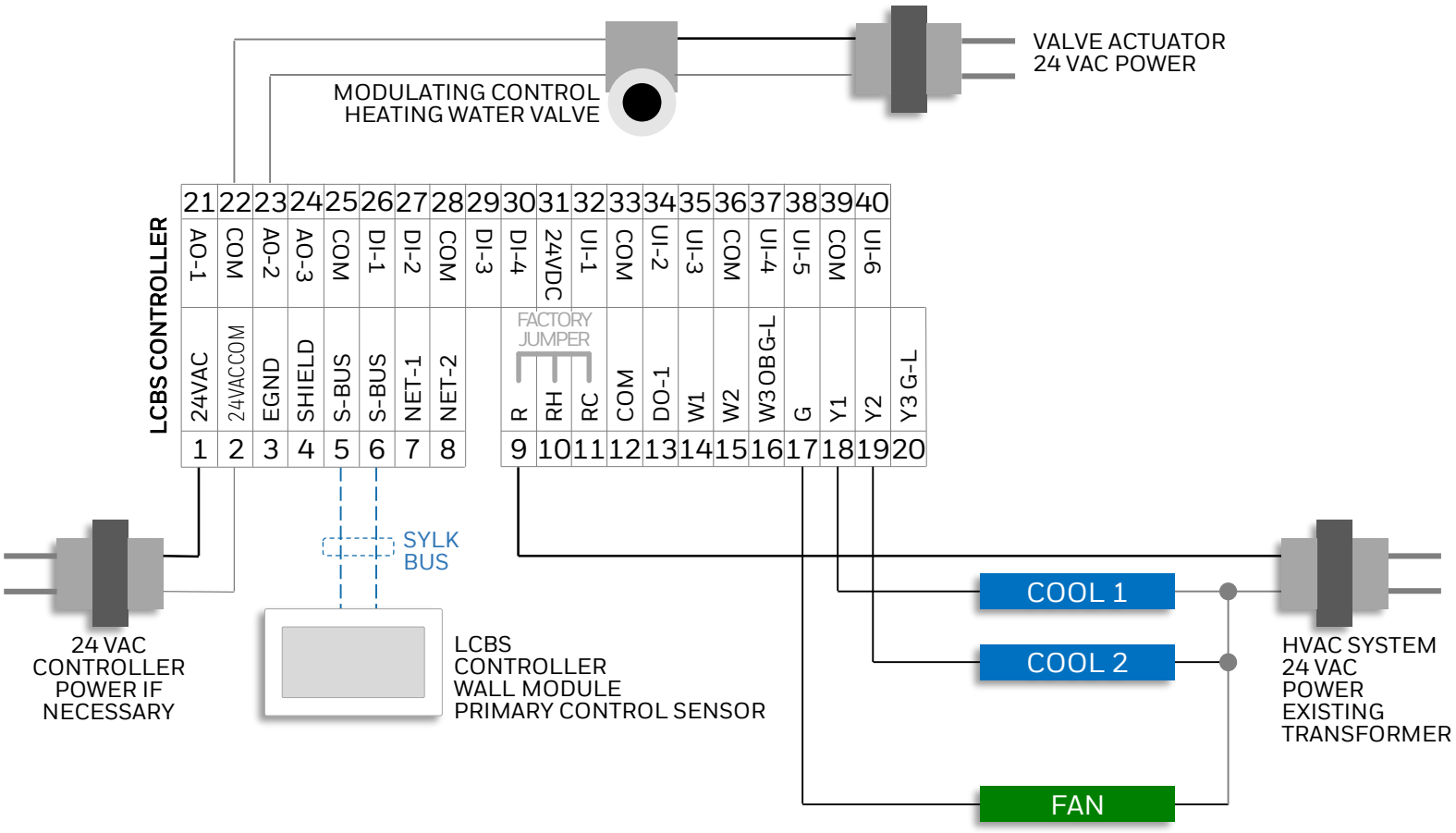
Honeywell

THE POWER OF **CONNECTED**

Exhaust Fan Control



Simple Modulating Heating



Cascade Modulating Heating Control