



Case Study

# The Salvation Army

Family Store & Adult Rehabilitation Center

Case Study on Upgraded HVAC Control System



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# About The Facility

## Facility and Purpose

More than a thrift store, The Salvation Army Facility located at 740 Marietta St., Atlanta, GA funds and sponsors a rehabilitation program for men and women who have lost the ability to cope and to provide for themselves.

## More Than a Thrift Store...

They provide assistance in the form of spiritual, social and emotional support through at least a six-month commitment to the rehabilitation program. The facility serves as a living, work, and worship center for up to 137 people in need.

The facility serves all the needs of the individuals during their stay from a place to sleep, meals, socialize, work, and worship. During the day all workers tend to different facility operation tasks as well as sort and distribute all of the donations received by all of the Thrift Stores and Donation Centers in the Georgia Area.

## Age of Structure and HVAC System Situation

Originally built in 1974, the building's original HVAC system centered around a Commercial Chilled Water and Hot Water Cooling and Heating system with 8 Air Handling Units spread throughout the facility.

Five of these Air Handling Units were the Hot Deck/Cold Deck Multi-Zone Type. These types of units were great for their time and provided superior comfort. They allowed both hot and cold air to be supplied at the same time to the zones which allows zones to both heat and cool simultaneously to maintain comfort.

While great for comfort it was also highly inefficient because a typical unit supplies both 55 degree cooling air and 100 degree heating air to all of the zones. The zones then use a mixing damper to mix the two air streams together in a proportional manner to achieve a 55-100 degree supply air temperature in the zone.





On the heels of the oil crisis of the 1970s, this type of equipment fell out of favor in the 1980s due to their inefficient operation and high energy costs. The original controls to operate the HVAC equipment throughout the facility were traditional Pneumatic Controls.

Pneumatic Controls use compressed air to control and operate actuators which open and close dampers and valves throughout the HVAC system at varying pressure. The pressure depends on the temperature mechanically sensed by the Pneumatic Thermostats and Controls.

Pneumatic Controls were very simplistic for their day and performed the basic functions of temperature control with moderate accuracy. As technology evolved, however, they lacked the ability to communicate and to work together. They were also difficult to adjust and maintain calibration. All of these issues added to the inefficiency of the current system.

### Original System Replaced

In 2005 the Salvation Army completed an extensive renovation of the facility which included replacement of the entire HVAC system of the building. Because of the original HVAC system designs the replacement HVAC systems had to mirror the original equipment.

As a result, they were built around the Chilled Water/Hot Water, Hot Deck/Cold Deck arrangement. While the equipment was built to be more efficient with less leakage and more efficient fan operations, the design concept continued to be a source of inefficiency.

### Additional Improvements

One major improvement was the replacement of the original Pneumatic Control system with a new Andover DDC Control System. The DDC system provided much better system efficiency, accuracy, and user-friendly adjustments. It still lacked energy efficiency as it couldn't communicate and work between the different system components and adjust the supply water and air temperatures based on building demands.

Four new traditional Roof Top Package Units were installed in newly built parts of the building and were connected to the Andover Controls System.





# Estes Commercial Gets Involved

In December of 2009, after years of disappointing service from the 2005 contractor, The Salvation Army sought a new HVAC partner. Estes Commercial began providing HVAC maintenance and repairs for the center's equipment.

Rather quickly, Estes Commercial won over the Salvation Army with their level of dedication and reputation. They proved they were trustworthy and would respond to all of the center's needs in a quick and timely manner as well as provide a higher quality of work.

Today, ten years later, the relationship and trust between the Salvation Army and Estes Commercial has grown to include not only with this facility's needs but the needs of all of the buildings under their jurisdiction.

## Relationship & Trust has Grown

In January of 2018 the kitchen, dining hall, and social hall Air Handling Unit, installed by a previous contractor, suddenly quit working and left the center very cold. Estes Commercial found the unit's Andover Controls had failed, leaving the unit inoperational until the controls could be replaced.

Years earlier, the central plant controls which controlled the Chiller, Boiler, Cooling Tower, and Pumps also failed. The decision made then was to place the Plant into Manual operation and run under its own control.

In 2018 The Salvation Army chose to upgrade the controller for the failed Air Handling Unit to a new Honeywell Eagle-AX Controller. This was an easy choice compared to a replacement Andover controller because the Andover system was out of date, was proprietary and did not offer advanced energy saving capabilities.

Once the new Eagle-AX controller was put into place the Kitchen, Dining Room, and Social Hall areas were back up and comfortable once again. Estes Commercial installed this original Eagle-AX controller as its own independent control system with its own User Interface hosted by the controller itself.







In March another Air Handling Unit serving some of the living quarters suddenly broke down. Once again, the issue was the failing Andover Controls. Within a week another controller serving another air handler started having problems. It became clear the Andover system was quickly failing all over the building.

An entire system upgrade was needed to keep the facility operational but the funds for such a project were not immediately available. So, to keep the facility operational each failed controller was replaced piece by piece independently to keep the building operational.

Finally, in October the funds were available to replace all of the remaining Andover Controls and to tie and program all of the new Honeywell controls together.

Replacing all of the controls with new technology allowed the system to remain operational and to have better system graphics with better ease of use for the customer.

It also allowed Estes Commercial to implement more complex controls schemes such as linking all of the units together. As the systems began to operate together, they provided better building comfort and made great leaps in energy efficiency.

Instead of the chiller and boiler always working to deliver 45 and 180 degree water respectively all year the water temperatures could vary from 45 to 60 degrees or turn off all together depending on building demands.

The same was true with the boiler as well, as it could adjust its supply water temperature from 120 to 180 degrees or turn itself off completely when not needed.

The more conservative water temperature setpoints not only allowed the chiller and boiler to operate more energy efficiently but also allowed the use of the water side economizer to operate more frequently during mild weather conditions. This further reduced energy consumption, which is very important to a nonprofit!

## “This Reduced Energy Consumption”

The central building plant operates more energy efficiently thanks to the new controls and the Hot Deck/Cold Deck Air Handling Units were able to be programmed for more energy efficient control strategies.

Instead of supplying 55 and 100 degree air streams at all times the units vary the cold deck temperature from 75 to 55 degrees and the hot deck temperatures from 75 to 100 degrees depending on zone comfort demands.

This allowed more efficient operation of the Air Handling Units themselves as well as reduced demands on the central plant. This allowed it to also adjust to more conservative settings when the zones are comfortable.



# Controls System Design & Installation

## Hot Deck/Cold Deck AHUs:

As all of the Hot Deck/Cold Deck AHUs had 3, 4, or 6 zones each the number of I/O points needed to control the equipment was larger than a standard Unitary controller. An expendable I/O controller became necessary for each system.

The Honeywell Eagle-AX Controller fit the criteria well as it allowed the controller's base I/O points to expand as needed using Honeywell's Panel BUS line of I/O Modules. The advanced logic programming capability of these controllers also allows for a more expansive and larger control program as well.

## Chilled Water/Hot Water Fan Coil Units:

As these were traditional and more common pieces of equipment only serving one zone each they did not require the expanded I/O capability that the larger AHUs did and so Estes Commercial recommended the traditional Honeywell Spyder controllers.

## Roof Top Package Units:

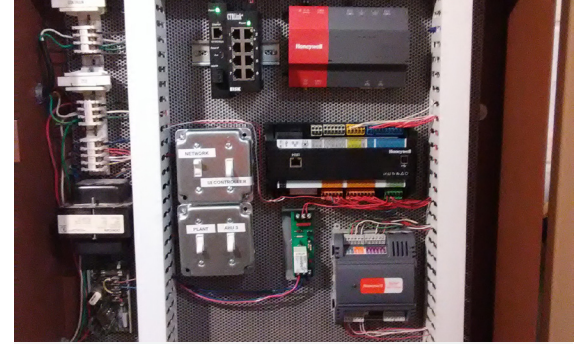
The RTUs were installed to serve the Store and the Chapel areas of the facility. Each area had two equally-sized RTUs installed per area. Before the controls upgrade each unit was treated as an independent system and programmed to control and maintain its own independent zone temperature.

This meant the units often fought each other due to uneven setpoints or calibration issues between the two zone temperature sensors.

Estes Commercial decided the best way to control each group of units was to combine them together and use one controller. The amount of I/O needed was more than a typical Unitary controller handles so Estes recommended an Eagle-AX controller instead. With this controller, the two units work together off of one temperature and one setpoint to comfort the space.

The two units also worked in a lead/lag arrangement with changeover based on unit runtime. This meant one unit was not always coming on first or doing all of the work but instead the two units take turns allowing equal runtime and work between the two units. This prevents one unit from wearing out before the other.





## Central Plant:

The central plant of this facility is very simplistic compared to most chiller and boiler plants consisting only of:

- Carrier 30HXC Chiller
- Raypak Raytherm Hot Water Boiler
- EvapCo Single Fan Cooling Tower
- Chilled Water Pump
- Condenser Water Pump
- Hot Water Pump
- Plate Heat Exchanger Water Side Economizer

While the design of the plant is simplistic, the I/O needed to signal, monitor, and operate the system. The necessity of a more advanced control logic prompted the need for a more advanced controller and Estes selected the Eagle-AX to perform the task.

Estes Commercial also installed a Bacnet gateway on the Chiller to allow direct communication with the chiller's factory controls. Finally, Estes installed a new VFD on the Hot Water Pump.

## Field Networks:

To keep the existing Andover system online during conversion and to make sure that the future network was able to carry the increased data traffic well enough at a fast enough rate the decision was made to install a new Bacnet MSTP network throughout the facility to communicate with all the AHUs, FCUs, RTUs, Central Plant, and RTUs. The new Bacnet network allowed all of the newly installed HVAC controllers to communicate and share data with each other for more efficient system operation together as a team instead of independently or simply just for user access of data.

## User Interface:

To serve as the central User Interface for all building systems Estes Commercial installed an independent Web-8000 JACE controller with N4 technology. It connects to the newly-installed Bacnet MSTP network where it gathers and records information from all of the field controllers for use in the User Interface.

# Total Devices Installed

1

Web-8000 User Interface Controller

8

Eagle-AX Field Controllers with Panel Bus Expansion Modules

3

Honeywell Spyder Controllers

1

Carrier 30HXC Chiller With Bacnet Gateway

1

Honeywell SmartVFD With Bacnet Communication

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# Results

The Salvation Army originally chose to replace the control system due to the rapid failures of the old and existing Andover Control System. The prospects of better system management through a more user-friendly, graphical user interface with remote access, which also allows Estes to help manage the system remotely at any time, were the main factors in the decision to replace the system.

The improved facility comfort came as a result of equipment optimization and the HVAC systems and controls communicating together and operating as a team.

“

While the prospect of energy savings was something we considered might be a result of the system conversion, we really didn't expect it to be that much because our facility operates 24/7 and leaves no real potential for setbacks or savings.

At the end of the day, keeping the facility operational was the key factor in making our decision to upgrade the system. What we found afterward was that we had much better system control than we ever had before and

**We Were Also A Lot  
More Comfortable  
As Well.**

Energy savings experienced from the system is also a plus.

- Major Michael Vincent, Salvation Army Atlanta, GA Officer

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