

Autodesk Docs/256-031 - ARCare Clinic - Fort Smith, AR/ARCC MEP.rvt
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ARCare Fort Smith - Sequence of Operations

1. General

The building automation system shall be Siemens by Powers of Arkansas.

Occupied and unoccupied operation shall be determined by the BAS weekly schedule with holiday and event override capability. AAON rooftop units shall be provided with factory-mounted AAON unit controllers. Siemens BAS shall interface with each AAON RTU controller through BACnet.

AAON factory controls shall remain responsible for RTU internal operation and safeties, including supply fan control, compressor control, economizer control, modulating gas heat control, power exhaust control, A2L mitigation, and factory safety shutdowns.

Titus VAV terminal units shall be provided with Siemens terminal unit controllers and Siemens field devices/zone sensors as required for zone control.

All setpoints, delays, lockouts, reset ranges, alarms, and trend intervals indicated in this sequence shall be provided by the controls contractor. Values noted as adjustable shall be adjustable from the Siemens BAS.

The BAS contractor shall program the system to operate as described in this sequence. Deviations from this sequence shall be identified in writing during the submittal process and shall not be implemented without approval.

CO2 demand control ventilation shall not be provided on this project.

Hot gas reheat control shall not be provided unless hot gas reheat is specifically scheduled for an RTU.

2. Building Level Controller and BAS Architecture

Provide Siemens Designo PKC building level controllers or Siemens-approved current generation building controllers suitable for the required BAS architecture.

BAS controllers shall provide supervisory control, scheduling, alarming, trending, graphics, integration, and reset logic required by this sequence.

BAS network architecture shall support BACnet/IP communication to the AAON RTU factory controllers and Siemens terminal unit controllers. BACnet MS/TP may be used where required by final controller architecture.

BAS shall be configured so loss of any single terminal controller does not disable the remaining terminal units or RTU factory safeties.

BAS contractor shall submit a network riser showing BAS controllers, RTU BACnet interfaces, terminal unit controllers, operator interface/server connection, and required communication trunks.

BAS contractor shall submit a complete point list identifying read points, writable points, trends, alarms, setpoints, and command points required to execute this sequence.

3. AAON RTU-1 Through RTU-4 - VAV Gas-Fired Packaged Rooftop Units

3.1 System Description

RTUs shall be AAON packaged VAV rooftop units with factory controls and BACnet interface to Siemens BAS.

Units shall include variable speed supply fan, DX cooling, modulating natural gas heat, economizer/outdoor air damper, power exhaust, dirty filter switch, condensate overflow switch, return air smoke detector, low-limit protection, phase/brownout protection, A2L leak detection, and factory safeties.

Each RTU shall include outside air airflow measurement. Airflow measurement may be factory mounted by AAON or field installed by the BAS contractor. The outside air damper shall be controlled to maintain scheduled outside air CFM during occupied operation.

3.2 Occupied Mode

During occupied mode, the RTU supply fan shall operate continuously.

Supply fan shall start through the AAON factory controller. Factory minimum off timers and startup delays shall be maintained. On startup, the duct static pressure setpoint shall be ramped from zero to the active setpoint over 5 minutes, adjustable, to reduce nuisance high static trips.

Outdoor air damper shall open to maintain scheduled outside air CFM after supply fan proof is established.

During occupied operation, the RTU shall operate in cooling, ventilation, or heating mode as required by the Siemens BAS zone demand logic.

3.3 Unoccupied Mode

During unoccupied mode, the RTU shall be off unless required for unoccupied heating, unoccupied cooling, freeze protection, morning warm-up, morning cool-down, or BAS override.

Outdoor air damper shall remain closed during unoccupied operation unless unoccupied economizer cooling or purge mode is specifically enabled.

Power exhaust fan shall be off during unoccupied operation unless required by an active RTU operating mode or building pressure sequence.

3.4 Supply Fan and Duct Static Pressure Control

The AAON factory controller shall modulate the supply fan VFD to maintain duct static pressure setpoint.

Duct static pressure shall be sensed by a field-installed duct static pressure sensor located approximately two-thirds down the longest or most hydraulically remote duct run, unless otherwise indicated on the drawings.

Siemens BAS shall calculate the active duct static pressure reset value based on the most-open valid Siemens VAV damper served by the associated RTU.

Siemens BAS shall write the active duct static pressure setpoint to the AAON controller through BACnet where the required point is available and writable.

If the AAON duct static setpoint is not available as a reliable writable BACnet point, the AAON controller shall operate from a fixed duct static pressure setpoint. Fixed setpoint shall be adjusted during TAB.

Duct static reset logic shall ignore rogue zones, including VAV boxes that are not communicating, manually overridden, in alarm, or otherwise invalid.

Final minimum and maximum duct static pressure reset limits shall be documented in the BAS as-built setpoint report.

3.5 Duct High Static Safety

Provide a hardwired duct high static pressure safety switch downstream of the RTU supply fan.

High static safety shall be hardwired to shut down the RTU supply fan through the AAON factory controller or approved safety circuit.

Upon high static safety trip, the supply fan shall shut down, heating and cooling shall be disabled, the outdoor air damper shall close, power exhaust shall shut down unless required by life safety sequence, and Siemens BAS shall generate a high duct static alarm.

High static safety shall be manual reset unless otherwise indicated.

High static safety setting shall be coordinated with duct pressure class, RTU fan capability, and TAB requirements. Safety setting shall not exceed ductwork pressure rating.

3.6 Supply Air Temperature Control

AAON factory controller shall control cooling and heating capacity to maintain active supply air temperature setpoint.

Initial occupied cooling supply air temperature setpoint shall be 55°F, adjustable.

Supply air temperature reset shall be provided based on valid Siemens VAV zone cooling demand, electric heat demand, and space humidity where humidity sensors are provided.

Suggested initial SAT reset range: low limit 53°F, normal cooling SAT 55°F, high reset limit 60°F. All values shall be adjustable.

SAT reset shall be disabled when humidity control requires lower supply air temperature.

No hot gas reheat sequence shall be included unless hot gas reheat is included in the final RTU selection.

3.7 Cooling and Economizer Mode

Cooling mode shall be enabled when any valid VAV zone served by the RTU requires cooling, or when unoccupied cooling is required.

Economizer shall operate as first stage of cooling when outdoor air conditions are suitable.

Economizer operation shall be enabled based on outdoor air temperature or enthalpy limits as configured in the AAON controller.

When economizer is enabled, outdoor air damper shall modulate above minimum position to maintain active supply air temperature setpoint while maintaining required outside air CFM.

If economizer is fully open and cannot maintain supply air temperature setpoint, mechanical cooling shall be enabled.

Mechanical cooling shall be staged or modulated by the AAON factory controller to maintain active supply air temperature setpoint.

Mechanical cooling shall be subject to AAON factory compressor safeties, anti-short-cycle timers, outdoor air lockouts, refrigerant safeties, condenser fan controls, and A2L mitigation logic.

3.8 RTU Heating Mode

RTU gas heat shall be modulating natural gas heat controlled by the AAON factory controller.

Siemens BAS shall provide the system-level heating enable logic for each RTU based on valid heating requests from the Siemens VAV controllers served by that RTU.

A valid zone shall be a Siemens-controlled VAV zone assigned to the associated RTU that is communicating, not in alarm, not manually overridden, and included in the active operating mode.

Each VAV shall generate a heating request when space temperature is below active heating setpoint and the VAV is actively controlling in heating mode.

Each VAV shall generate a maximum terminal heat request when: space temperature remains below active heating setpoint; VAV is at scheduled heating airflow, or occupied minimum airflow if greater; SCR electric heat output is at or above 95% command; and the condition is maintained continuously for the adjustable sustained-demand delay.

Initial sustained-demand delay shall be 10 minutes, adjustable.

RTU gas heat shall be enabled only when all valid VAV zones served by the RTU are simultaneously calling for heat and all valid VAV zones have a maximum terminal heat request active.

RTU gas heat shall remain disabled if any valid served zone is in cooling mode, deadband/satisfied mode, not calling for heat, or not at maximum terminal heat output.

When Siemens BAS heating enable logic is satisfied, Siemens shall command or allow the AAON RTU to enter heating mode through the approved configured mode enable strategy.

During RTU heating mode, AAON controller shall modulate gas heat to maintain active heating supply air temperature setpoint. Initial heating supply air temperature setpoint shall be 90°F, adjustable.

During RTU heating mode, associated Siemens VAV boxes shall operate at scheduled heating airflow, or occupied minimum airflow if greater.

Terminal electric heat shall remain available as supplemental zone heat where the individual zone continues to require heating.

RTU heating mode shall end when any valid served zone is no longer calling for heat, any valid served zone electric heat output falls below the maximum terminal heat request threshold, or any safety condition disables heating. Initial release delay shall be 2 minutes, adjustable.

RTU gas heat shall be locked out upon supply fan proof failure, high duct static safety trip, smoke shutdown, emergency shutdown, high supply air temperature cutoff, gas heat safety trip, phase/brownout fault, A2L mitigation shutdown, or other factory safety condition.

3.9 Ventilation Mode

Ventilation mode shall occur during occupied operation when supply fan is operating and no valid system-level heating or cooling demand exists.

During ventilation mode, supply fan shall maintain duct static pressure setpoint.

Outdoor air damper shall maintain scheduled outside air CFM.

Heating and mechanical cooling shall be disabled in ventilation mode unless required by factory temperature protection.

3.10 Morning Warm-Up and Cool-Down

Morning warm-up may be enabled when the RTU transitions from unoccupied to occupied mode. If return air temperature is below the morning warm-up target setpoint, RTU shall enter morning warm-up mode.

During morning warm-up, outdoor air damper shall remain closed unless otherwise required. AAON controller shall modulate gas heat to maintain morning warm-up supply air temperature setpoint.

Associated Siemens VAV boxes shall open to warm-up airflow position during morning warm-up. Initial warm-up supply air temperature setpoint shall be 100°F, adjustable.

Morning warm-up shall end when return air temperature rises above target setpoint or maximum warm-up time expires. Morning warm-up shall occur only once per occupied cycle.

Morning cool-down may be enabled when the RTU transitions from unoccupied to occupied mode. If return air temperature is above morning cool-down target setpoint, RTU shall enter morning cool-down mode.

During morning cool-down, outdoor air damper shall remain closed unless economizer cooling is enabled for this mode. Associated Siemens VAV boxes shall open to cool-down airflow position during morning cool-down.

Morning cool-down shall end when return air temperature falls below target setpoint or maximum cool-down time expires. Morning cool-down shall occur only once per occupied cycle.

3.11 Power Exhaust and Building Pressure Control

Integral RTU power exhaust shall be controlled by AAON factory controller.

Building pressure shall be sensed by a field-installed building pressure sensor connected to the AAON controller.

When supply fan is operating and building pressure rises above building pressure setpoint plus deadband, AAON controller shall enable power exhaust and modulate exhaust fan speed to maintain building pressure setpoint.

Initial building pressure setpoint shall be +0.03 in. w.g., adjustable.

Building pressure control shall be coordinated with standalone exhaust fans and outside air requirements during TAB.

3.12 Smoke Shutdown, Life Safety, and A2L Safety

Duct-mounted smoke detectors shall shut down the associated RTU upon detection of smoke.

Upon smoke shutdown, supply fan shall stop, heating and cooling shall be disabled, outdoor air damper shall close, and BAS shall generate alarm.

Multiple-unit shutdown requirements shall be as indicated by fire alarm and code requirements.

A2L leak detection and mitigation shall remain under AAON factory control. Siemens BAS shall monitor A2L status and alarms through BACnet and shall not override factory mitigation logic.

3.13 Minimum RTU BAS Alarms and Trends

Alarms	Trends
Supply fan proof failure; high duct static safety trip; dirty filter; condensate overflow; smoke shutdown; emergency shutdown; phase/brownout fault; A2L leak detection alarm; high/low supply air temperature cutoff; mechanical cooling failure; mechanical heating failure; sensor failure; missing module alarm; BAS communication failure.	Occupied/unoccupied mode; RTU operating mode; supply fan command/status; supply fan speed; duct static setpoint and actual pressure; SAT setpoint and actual SAT; return air temperature; outdoor air temperature and humidity; economizer position; outside air CFM and setpoint; cooling status/capacity; heating status/capacity; modulating gas heat signal; building pressure setpoint and actual pressure; exhaust fan command/status and speed; alarm status.

4. Titus Single Duct VAV Terminal Units with SCR Electric Heat

4.1 System Description

VAV terminal units shall be Titus pressure-independent single duct terminal units with SCR/modulating electric heat.

Each VAV shall be controlled by a Siemens terminal unit controller with integral damper actuator and airflow sensing.

Each VAV shall include airflow sensor, electronic damper actuator, discharge air temperature sensor, SCR electric heat controller, and Siemens zone sensor.

Siemens terminal controller shall modulate the VAV damper to maintain active airflow setpoint and shall modulate the SCR electric heat controller to maintain space temperature during heating mode.

Electric heat shall be SCR/modulating. Staged electric heat shall not be provided.

VAV airflow setpoints shall be based on scheduled maximum cooling CFM, occupied minimum CFM, and heating CFM.

4.2 Occupied Cooling Mode

If space temperature is above active cooling setpoint, terminal controller shall modulate damper from occupied minimum CFM to maximum cooling CFM to maintain space temperature.

SCR electric heat shall be disabled.

VAV shall send cooling demand, active airflow setpoint, actual airflow, and damper position to Siemens BAS for supply air temperature reset and duct static reset logic.

4.3 Occupied Deadband Mode

If space temperature is between active cooling and heating setpoints, terminal controller shall maintain occupied minimum CFM.

SCR electric heat shall be disabled.

4.4 Occupied Heating Mode

If space temperature is below active heating setpoint, terminal controller shall enter heating mode.

Terminal controller shall modulate damper to scheduled heating CFM, or occupied minimum CFM if greater.

SCR electric heat shall be enabled only after airflow is proven and actual airflow is at or above the required heating airflow.

Terminal controller shall modulate SCR electric heat output to maintain active heating setpoint.

Terminal controller shall send heating demand, electric heat output, active airflow setpoint, actual airflow, discharge air temperature, and damper position to Siemens BAS.

Terminal controller shall send maximum terminal heat request when space temperature remains below active heating setpoint, the VAV is at scheduled heating airflow or occupied minimum airflow if greater, SCR electric heat output is at or above 95% command, and the condition is maintained continuously for 10 minutes, adjustable.

4.5 Unoccupied Operation

If space temperature rises above unoccupied cooling setpoint, terminal controller shall send cooling demand to Siemens BAS. Serving RTU shall be enabled as required. Terminal controller shall modulate damper to maximum cooling CFM or as required to satisfy unoccupied cooling demand.

If space temperature falls below unoccupied heating setpoint, terminal controller shall send heating demand to Siemens BAS. Terminal controller shall maintain scheduled heating airflow, or occupied minimum CFM if greater, and SCR electric heat shall modulate to satisfy unoccupied heating setpoint.

Serving RTU gas heat shall be enabled only when RTU-level heating enable criteria are satisfied.

4.6 Electric Heat Safeties

SCR electric heat shall be disabled if serving RTU supply fan is off, airflow is not proven, actual airflow is below required heating airflow, discharge air temperature exceeds high limit, electric heat safety circuit opens, fire alarm or smoke shutdown is active, or controller is in alarm state preventing safe operation.

Electric heater shall include manufacturer-required airflow, automatic reset, and manual reset high-limit safeties.

Controls contractor shall not rely on software command alone for electric heat safety. Required hardwired heater safeties shall remain in series with heater enable circuit.

4.7 VAV Minimum BAS Graphics and Trends

Minimum Graphics	Minimum Trends
Associated RTU; occupancy status; override status; space temperature; active heating and cooling setpoints; occupied and unoccupied setpoints; active airflow setpoint; actual airflow; minimum cooling CFM; maximum cooling CFM; heating CFM; damper position; discharge air temperature; SCR electric heat command; heating demand; cooling demand; maximum terminal heat request.	Active cooling setpoint; active heating setpoint; active CFM setpoint; actual airflow; damper position; discharge air temperature; space temperature; SCR electric heat signal; occupancy status; heating demand; cooling demand; maximum terminal heat request.

4.8 VAV Commissioning

BAS contractor shall perform terminal unit checkout for each VAV controller prior to TAB.

Each VAV shall be verified to modulate between scheduled minimum, maximum, and heating airflow setpoints.

Each VAV SCR electric heat output shall be verified for enable, modulation, safety interlock, and alarm functions.

BAS contractor shall submit VAV-to-RTU mapping for all terminal units. Mapping shall be used for duct static reset, supply air temperature reset, zone demand voting, morning warm-up, morning cool-down, and RTU heating enable logic.

5. Samsung Mini Split Systems with Low Ambient Cooling

5.1 System Description

Mini split systems shall be Samsung heat pump split systems with manufacturer-supplied factory controls.

Systems shall be installed with manufacturer-approved low ambient cooling capability. Provide wind baffles and manufacturer-approved accessories where required by installation conditions and Samsung instructions.

For the scheduled Samsung one-ton high wall system, published outdoor cooling operation range is 14°F to 115°F. If cooling is required below the published ambient range, provide equipment and accessories specifically rated for the required ambient condition.

Siemens BAS shall monitor space temperature and alarms as indicated. Mini split compressor capacity, indoor fan operation, lower control, defrost, and refrigeration safeties shall remain under Samsung factory control.

5.2 IT and Electrical Room Cooling

Mini split systems serving IT, data, electrical, or similar cooling-critical rooms shall be available for operation 24 hours per day, 7 days per week.

Units serving IT/electrical rooms shall be set for cooling operation unless heating is specifically indicated. Initial cooling setpoint shall be 75°F, adjustable.

Siemens BAS shall monitor space temperature in IT/electrical rooms and generate high space temperature alarm. Initial high temperature alarm shall be 80°F, adjustable.

Where a condensate pump or overflow device is provided with alarm contact, Siemens BAS shall monitor condensate alarm and annunciate alarm at BAS.

5.3 General Area Mini Split Operation

Mini split systems serving general occupied spaces shall be controlled by manufacturer-supplied local controller unless BAS interface is specifically indicated.

Initial occupied setpoints shall be 75°F cooling and 70°F heating, adjustable.

Initial unoccupied setpoints shall be 84°F cooling and 62°F heating, adjustable.

Indoor unit fan shall cycle or modulate under factory control to satisfy local space temperature setpoint.

BAS shall not directly control compressor capacity, indoor fan speed, electronic expansion valve, or internal refrigeration safety functions.

5.4 Mini Split BAS Points

Minimum BAS points for IT/electrical rooms shall include space temperature, high temperature alarm, low temperature alarm where required, and condensate overflow alarm where alarm contact is provided.

Where Samsung BAS interface accessories are provided, monitor unit run status, general alarm, and enable/disable command as indicated on the control drawings.

Where no Samsung BAS interface is provided, the unit shall operate from local Samsung factory controller and BAS shall monitor independent Siemens space temperature sensor.

6. Submittal and Closeout Requirements

BAS contractor shall submit full written sequence narratives matching this document. Submittal list identify any proposed deviations from this sequence.

BAS contractor shall submit RTU BACnet point list for each AAON RTU. Point list shall identify read-only points, writable points, alarms, trends, and command points required to execute this sequence.

BAS contractor shall submit VAV controller point list, VAV-to-RTU mapping, and terminal unit graphics samples.

BAS contractor shall submit network riser diagram and controller architecture, including Siemens building level controllers, AAON BACnet interfaces, and Siemens VAV terminal controllers.

BAS contractor shall submit trend setup for RTUs, VAVs, and mini split monitored points.

BAS contractor shall provide commissioning documentation verifying schedule operation, RTU modes, duct static reset, SAT reset, high static safety shutdown, VAV airflow control, SCR electric heat operation, RTU heating enable logic, power exhaust/building pressure control, mini split alarm monitoring, and BAS graphics.

HVAC CONTROL NOTES

- THIS CONTROLS INSTRUMENTATION AND SOFTWARE SHALL BE THE MOST RECENT TECHNOLOGY RELEASED BY THE MANUFACTURER. CONTROLS MANUFACTURER SHALL BE SIEMENS. SIEMENS BUILDING CONTROLS INSTALLED BY POWERS OF ARKANSAS.
- THE CONTROL SYSTEM SHALL BE A NEW SIEMENS BUILDING AUTOMATION SYSTEM AND ALL CONTROLLERS AND SOFTWARE SHALL BE THE LATEST VERSION OF SIEMENS' PRODUCTS.
- FOR FULL CONTROLS SPECIFICATIONS AND ANY CONTROLS-RELATED QUESTIONS, CONTACT KEITH CLEMENT AT POWERS OF ARKANSAS (KEITH.CLEMENT@POWERS-HVAC.COM)
- THE WORK COVERED BY THIS DIVISION CONSISTS OF PROVIDING ALL LABOR, EQUIPMENT AND MATERIALS AND PERFORMING ALL OPERATIONS NECESSARY FOR THE INSTALLATION OF THE INSTRUMENTATION AND CONTROLS WORK AS HEREIN CALLED FOR AND SHOWN ON THE DRAWINGS.
- ALL WORK SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH ALL APPLICABLE CODES, STANDARDS, AND LOCAL ORDINANCES. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT AND/OR ENGINEER OF ANY DRAWING OR SPECIFICATION THAT IS NON-CONFORMING PRIOR TO ORDERING EQUIPMENT OR INSTALLING WORK.
- COMPLY WITH REGULATIONS AND SPECIFICATIONS OF UTILITY SUPPLIERS.
- WHERE NO SPECIFIC METHOD OR FORM OF CONSTRUCTION IS CALLED FOR IN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL COMPLY WITH APPLICABLE CODE REQUIREMENTS WHEN CARRYING OUT SUCH WORK.
- WHERE CODE CONFLICT EXISTS, THE MOST RESTRICTIVE REQUIREMENT SHALL GOVERN. COMPLY WITH CURRENTLY ADOPTED CODE EDITION UNLESS NOTED OTHERWISE.
- ALL MATERIALS, INSTALLATION, AND SYSTEMS SHALL MEET THE REQUIREMENTS OF THE FOLLOWING STANDARDS, INCLUDING THE LATEST ADDENDA AND AMENDMENTS, TO THE EXTENT REFERENCED:
 - A. UNDERWRITERS' LABORATORIES (UL)
 - B. AMERICAN NATIONAL STANDARDS INSTITUTION (ANSI)
 - C. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
 - D. NATIONAL FIRE PROTECTION (NFPA)
 - E. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
 - F. AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
 - G. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
 - H. AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS (ASHRAE)
 - I. AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)



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FOR PERMIT & CONSTRUCTION

Revision Schedule		Description
Rev. #	Date	

NEW ARCADE MEDICAL OFFICE BUILDING
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AUGUSTA, AR 72606

DATE 06-15-2026	DRAWN BY CO
PROJECT # 2517	CHECKED BY JT

SHEET

M602

HVAC CONTROLS

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1 SEQUENCE OF OPERATIONS

NOT TO SCALE