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**SEQUENCE OF OPERATION AIR TERMINAL UNIT (ATU)**

THE CONTRACTOR SHALL PROVIDE POWER TO EACH AIR TERMINAL UNIT. EACH ATU SHALL BE PROVIDED WITH A FACTORY MOUNTED CONTROLS TRANSFORMER.

UNIT AIRFLOW SHALL BE MONITORED BY AN INTEGRAL, MULTIPLE POINT, AVERAGING FLOW SENSING DEVICE AND A TRANSDUCER TO MAINTAIN AIRFLOW WITHIN 5% OF RATED CFM DOWN TO A MINIMUM CFM AS SCHEDULED, INDEPENDENT OF CHANGES IN SYSTEM STATIC PRESSURE.

**COOLING MODE**  
THE UCM SHALL MONITOR THE ZONE TEMPERATURE AGAINST ITS SET POINT AND MODULATE THE DAMPER TO MEET THE ZONE SETPOINT. REFER TO AHU FAN SPEED CONTROL SEQUENCE.

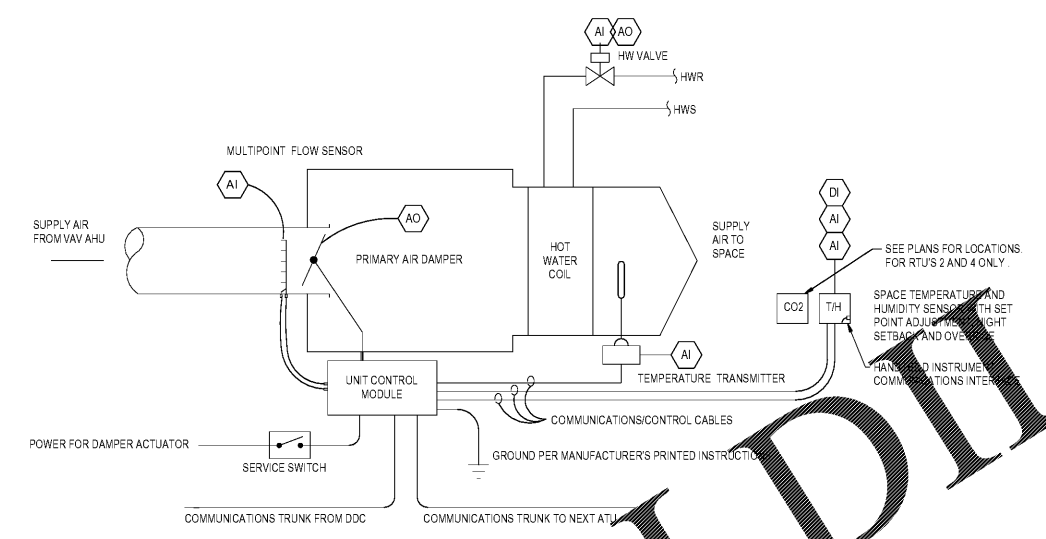
**HEATING MODE**  
IF THE DAMPER IS AT MINIMUM AND THE TEMPERATURE IN THE SPACE CONTINUES TO FALL, THE DAMPER SHALL MODULATE TO THE HEATING AIRFLOW (SEE ATU SCHEDULE) AND THE TWO WAY HOT WATER VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE.

THE ZONE TEMPERATURE SENSOR WITH SET POINT ADJUSTMENT SHALL BE PROVIDED WITH NIGHT SETBACK OVERRIDE, AND A COMMUNICATIONS JACK. ZONE TEMPERATURE SET POINT ADJUSTMENTS SHALL BE LIMITED BY THE DDC TO +/- 3°F OF THE PROGRAMMED VALUE.

**SPACE DEHUMIDIFICATION**  
WHEN THE HOA SWITCH IS IN THE "AUTO" POSITION AND THE DDC SYSTEM HAS THE BUILDING EITHER "OCCUPIED" OR "UNOCCUPIED", AND THE RELATIVE HUMIDITY IN ANY ZONE RISES ABOVE SETPOINT (60% RH, ADJUSTABLE), THEN THE CONTROLS SHALL BE OVERRIDDEN AND ALL AIR TERMINAL UNITS SHALL BE ENERGIZED. THE AIR TERMINAL UNITS SHALL MODULATE THEIR SUPPLY AIR AND THEIR HEATING WATER CONTROL VALVES TO MAINTAIN THE REQUIRED ZONE TEMPERATURE SET POINT UNTIL THE ZONE RELATIVE HUMIDITY IS SATISFIED (50%RH, ADJUSTABLE).

**OCCUPIED/UNOCCUPIED MODE**  
CONTROLS CONTRACTOR SHALL CONSULT WITH THE OWNER FOR EXACT SPACE TEMPERATURE SETPOINTS AND SCHEDULING.

**OVERRIDE MODE**  
THE OVERRIDE TIMER SHALL PLACE THE ATU AND AHU IN OCCUPIED MODE FOR TWO HOUR (ADJUSTABLE).



**1 SINGLE DUCT ATU CONTROL DIAGRAM**  
SCHEMATIC

**SEQUENCE OF OPERATION VAV AIR HANDLING UNIT (VAV AHU)**

**VARIABLE AIR VOLUME AIR HANDLING UNIT**  
STARTING AND STOPPING OF EQUIPMENT SHALL BE ACCOMPLISHED THROUGH A "HAND-OFF-AUTO" (HOA) SWITCH ON THE VFD. AN ALARM SHALL BE POSTED TO THE DDC SYSTEM ANY TIME THE HOA SWITCH IS INDEXED TO THE "HAND" OR "OFF" POSITIONS. WITH THE HOA SWITCH IN THE "AUTO" POSITION, THE UNIT SHALL BE STARTED AUTOMATICALLY BY THE DDC SYSTEM AND ALL CONTROLS ACTIVATED SUBJECT TO FIRE ALARM RELAY, SAFETIES AND OVERLOADS.

**OCCUPIED MODE**  
THE OA AND RA MOTORIZED DAMPERS SHALL OPEN TO THEIR BALANCED POSITIONS. THE AHU FAN SHALL OPERATE CONTINUOUSLY WITHIN THE SPECIFIED SETPOINTS. SEE AHU SCHEDULE.

**UNOCCUPIED MODE**  
THE OA MOTORIZED DAMPER SHALL BE CLOSED. THE RA MOTORIZED DAMPER SHALL BE OPEN. THE AHU SHALL OPERATE ONLY AS NECESSARY TO SATISFY SPACE TEMPERATURE OR HUMIDITY SETPOINTS.

**DISCHARGE TEMPERATURE CONTROL**  
THE DDC SYSTEM SHALL MODULATE THE AHU TWO-WAY CHILLED WATER VALVE AS REQUIRED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT SET POINT. SEE AIR HANDLING UNIT SCHEDULE.

**AHU FAN SPEED CONTROL**  
THE DDC SYSTEM SHALL CONTROL THE VAV AHU FAN SPEED THROUGH THE VFD TO MAINTAIN SUPPLY DUCT STATIC PRESSURE AT SETPOINT. THE FAN SPEED SHALL BE REDUCED DOWN TO A MINIMUM SPEED SETPOINT (SET BY TAB CONTRACTOR) TO PROVIDE SUFFICIENT PRESSURE TO DELIVER THE MINIMUM AIRFLOW OF ALL AIR TERMINAL UNITS. THE STATIC PRESSURE SETPOINT SHALL BE RESET EVERY 5 MINUTES BETWEEN THE MINIMUM AND THE MAXIMUM SETPOINT BASED ON THE ATU AIR DAMPER POSITION. IF THERE ARE NO VAV UNITS WITH DAMPERS OPEN GREATER THAN 80% THEN THE SETPOINT SHALL BE DECREASED BY 0.15" W.C. IF THERE IS MORE THAN ONE ATU DAMPER OPEN GREATER THAN 80% THEN THE SETPOINT SHALL BE INCREASED BY 0.15" W.C. AHU FAN SHALL RUN CONTINUOUSLY DURING OCCUPIED MODE.

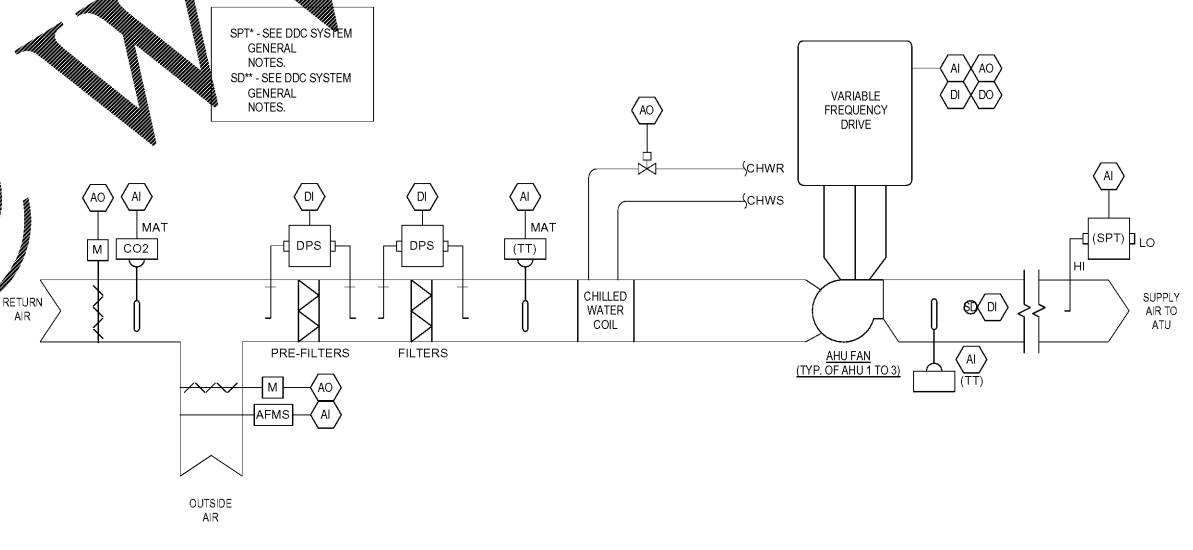
AHU FAN SHALL REMAIN CONSTANT DURING HEATING MODE. REFER TO AHU SCHEDULE.

**OUTSIDE AIR CONTROL**  
THE DDC SYSTEM, WITH DUCT MOUNTED AIR FLOW MEASURING STATION, SHALL MODULATE RA AND OA DAMPERS AS REQUIRED TO MAINTAIN OUTSIDE AIR QUANTITY AT SETPOINT REGARDLESS OF THE TOTAL AIRFLOW OF THE AIR HANDLING UNIT DURING OCCUPIED TIMES. READOUT OF OUTSIDE AIR QUANTITY SHALL BE IN CFM. UPON FAILURE, THE OA DAMPER SHALL BE MANUALLY CLOSED. WHENEVER THE AHU OPERATES DURING UNOCCUPIED MODE, THE OA DAMPER SHALL REMAIN CLOSED.

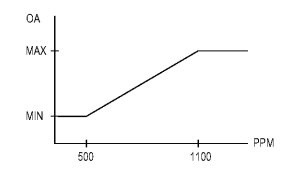
**CO2 LEVEL MONITORING**  
THE AIR HANDLING UNITS SHALL PROVIDE OUTSIDE AIRFLOW TO THE OCCUPIED ZONES DURING OCCUPIED MODE. CO2 SENSORS LOCATED IN HIGH DENSITY POPULATED AREAS (CONFERENCE ROOM, ETC.) AND THE RETURN DUCT SHALL MONITOR AND REPORT CO2 LEVELS. CO2 SENSORS IN THE OA DUCT SHALL BE CLOSED. THE WALL MOUNTED SENSOR SHALL MONITOR AND REPORT AMBIENT CO2 LEVELS. THE OUTSIDE AIR SHALL VARY BETWEEN THE SCHEDULED MAXIMUM AND MINIMUM OUTSIDE AIR VOLUMES BASED ON THE WORST CASE CO2 LEVEL. THE OUTSIDE AIR VOLUME SHALL VARY LINEARLY FROM MAX TO MIN BASED ON CO2 LEVELS OF 500 AND 1100 PPM. IN THE EVENT THAT THE INTERIOR CO2 LEVELS CONTINUE TO INCREASE THE DDC SHALL SIGNAL AN ALARM TO THE BAS TO REPORT THIS CONDITION. SEE PLANS FOR EXACT LOCATIONS OF CO2 SENSORS.

**ALARMS**  
THE FOLLOWING SOFTWARE ALARMS SHALL BE GENERATED AND DISPLAYED AT THE OPERATOR WORKSTATION:  
1. HIGH SUPPLY AIR TEMP (5°F GREATER THAN CURRENT SETPOINT, ADJ.)  
2. LOW SUPPLY AIR TEMP (5°F LESS THAN CURRENT SETPOINT, ADJ.)  
3. HIGH SUPPLY AIR TEMP SENSOR (GREATER THAN 180°F OR LESS THAN -20°F, ADJ.)  
4. LOW SUPPLY AIR TEMP SENSOR (GREATER THAN 180°F OR LESS THAN -20°F, ADJ.)  
5. AHU SUPPLY FAN ALARM (COMMAND AND STATUS DO NOT MATCH)  
6. VFD FAULT (STATUS INPUT FROM VFD)  
7. AIR FILTER DIFFERENTIAL PRESSURE SENSOR (DIRTY FILTER)

**SPACE DEHUMIDIFICATION**  
WHEN THE HOA SWITCH IS IN THE "AUTO" POSITION AND THE DDC SYSTEM HAS THE BUILDING EITHER "OCCUPIED" OR "UNOCCUPIED", AND THE RELATIVE HUMIDITY IN ANY ZONE RISES ABOVE SETPOINT (60% RH, ADJUSTABLE), THEN THE CONTROLS SHALL BE OVERRIDDEN AND THE SUPPLY AIR FAN AND ALL AIR TERMINAL UNITS SHALL BE ENERGIZED. THE CHILLED WATER CONTROL VALVE SHALL MODULATE TO MAINTAIN A CONSTANT COIL LEAVING AIR TEMPERATURE AS INDICATED IN THE AHU SCHEDULE AND THE AIR TERMINAL UNITS SHALL MODULATE THEIR SUPPLY AIR AND THE HOT WATER VALVE TO MAINTAIN THE ZONE TEMPERATURE SET POINT UNTIL THE ZONE RELATIVE HUMIDITY IS SATISFIED (50%RH, ADJUSTABLE).



**2 VARIABLE AIR VOLUME AHU CONTROL DIAGRAM**  
SCHEMATIC



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	2016.05.25

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**MECHANICAL CONTROLS**  
**M6.03**  
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