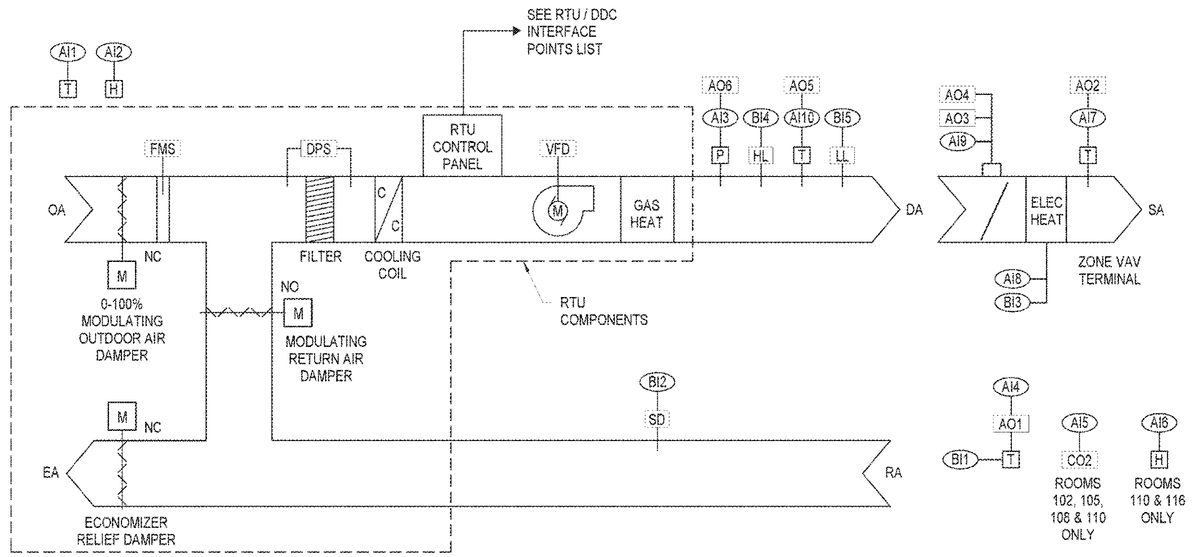

DDC POINTS LIST

	POINT #	POINT DESCRIPTION	TREND	ALARM	GRAPHIC
INPUT					
ANALOG	AI1	OUTDOOR AIR TEMPERATURE			X
	AI2	OUTDOOR AIR RELATIVE HUMIDITY			X
	AI3	SUPPLY AIR DUCT STATIC PRESSURE			X
	AI4	ZONE TEMPERATURE	X		X
	AI5	ZONE CO2 CONCENTRATION	X	X	X
	AI6	ZONE RELATIVE HUMIDITY	X		X
	AI7	VAV TERMINAL SUPPLY AIR TEMPERATURE			X
	AI8	VAV TERMINAL ELECTRIC HEAT CAPACITY			X
	AI9	VAV TERMINAL AIR FLOW RATE	X		X
	AI10	RTU DISCHARGE AIR TEMPERATURE	X		X
BINARY	BI1	ZONE OCCUPANCY STATUS OVERRIDE			
	BI2	DUCT SMOKE DETECTOR		X	
	BI3	VAV TERMINAL ELECTRIC HEAT STATUS			
	BI4	RTU DISCHARGE AIR HIGH LIMIT TEMPERATURE		X	
	BI5	RTU DISCHARGE AIR LOW LIMIT TEMPERATURE		X	
OUTPUT					
ANALOG	AO1	ZONE TEMPERATURE SETPOINT			X
	AO2	VAV TERMINAL SUPPLY AIR TEMPERATURE SETPOINT			X
	AO3	VAV TERMINAL MINIMUM AIR FLOW RATE SETPOINT			X
	AO4	VAV TERMINAL MAXIMUM AIR FLOW RATE SETPOINT			X
	AO5	RTU DISCHARGE AIR TEMPERATURE SETPOINT			X
	AO6	SUPPLY AIR DUCT STATIC PRESSURE SETPOINT			X
BINARY					

RTU / DDC INTERFACE POINTS LIST

	POINT DESCRIPTION	TREND	ALARM	GRAPHIC
INPUT (RTU TO DDC)				
ANALOG	HEATING CAPACITY (%)			X
	COOLING CAPACITY (%)			X
	SUPPLY FAN CAPACITY (%)			X
	MIXED AIR TEMPERATURE			X
	DISCHARGE AIR TEMPERATURE			X
	OUTDOOR AIR FLOW RATE			X
	RETURN AIR DAMPER POSITION			X
	ECONOMIZER RELIEF AIR DAMPER POSITION			X
	OUTDOOR AIR DAMPER POSITION			X
BINARY	UNIT STATE (OFF, HEATING, COOLING, ECONOMIZER)			X
	UNIT STATUS			X
	COOLING STATUS			X
	HEATING STATUS			X
	ECONOMIZER STATUS			X
	OCCUPANCY			X
	DIRTY FILTER		X	X
	SUPPLY FAN STATUS			X
	SUPPLY FAN VFD FAULT		X	X
OUTPUT (DDC TO RTU)				
ANALOG	ZONE TEMPERATURE			X
	DISCHARGE AIR TEMPERATURE SETPOINT			X
	ZONE CO2 CONCENTRATION			X
	OUTDOOR AIR RELATIVE HUMIDITY			X
BINARY	UNIT ENABLE			
	HEATING MODE - ENABLE / DISABLE			
	COOLING MODE - ENABLE / DISABLE			
	ECONOMIZER - ENABLE / DISABLE			

AIR HANDLING SYSTEM SEQUENCE OF OPERATION

OVERVIEW:
THE AIR HANDLING UNIT IS CONTROLLED BY THE BUILDING AUTOMATION SYSTEM (BAS). THE BAS SHALL PLACE THE UNIT IN OCCUPIED OR UNOCCUPIED MODE BASED ON ITS USER DEFINABLE INTERNAL OCCUPANCY SCHEDULE. THERE SHALL BE A MINIMUM 5°F DEAD-BAND BETWEEN HEATING AND COOLING MODES FOR THE UNIT.

THE DDC SYSTEM SHALL HAVE WEB ACCESSIBILITY FOR REMOTE ACCESS OF ALL MONITORING AND CONTROL FUNCTIONS.

THE DDC SYSTEM SHALL INCORPORATE A START / STOP OPTIMIZATION PROGRAM CAPABLE OF ADJUSTING OR MODIFYING A USER DEFINABLE OCCUPANCY SCHEDULE. THE OCCUPANCY SCHEDULE SHALL INCORPORATE USER DEFINABLE OCCUPIED AND UNOCCUPIED TEMPERATURE SETPOINTS. THE CONTROL SYSTEM SHALL PROVIDE FOR PARTIAL OPERATION OF THE BUILDING SYSTEMS INCLUDING OPERATION OF INDIVIDUAL SYSTEMS. DIGITAL OVERRIDE TIMERS SHALL BE PROVIDED INTEGRAL TO ZONE TEMPERATURE SENSORS TO ALLOW FOR TEMPORARY OVERRIDE OF THE UNOCCUPIED MODE OF OPERATION OF THE INDIVIDUAL SYSTEMS AND UPON ACTIVATION SHALL SEND A SIGNAL TO THE BUILDING CONTROL PANEL INDICATING A CHANGE TO OCCUPIED STATUS FOR THAT ZONE.

THE DDC SYSTEM SHALL INTERFACE WITH THE BUILDING FIRE ALARM CONTROL PANEL. SEE FIRE ALARM SYSTEM SEQUENCE OF OPERATION MATRIX ON SHEET F-001 FOR REQUIREMENTS.

ENABLEMENT:
THE BAS ENABLES OR DISABLES THE UNIT UNLESS THE UNIT IS MANUALLY SHUT DOWN OR DIRECTED BY THE BAS TO SHUT DOWN. ONCE ENABLED, THE UNIT OPERATES UNDER ITS FACTORY INSTALLED CONTROLS.

THE UNIT SHALL BE CONTROLLED BY THE BUILDING AUTOMATION SYSTEM (BAS). THE UNIT SHALL RUN DURING OCCUPIED HOURS AS DETERMINED BY A USER DEFINABLE OCCUPANCY SCHEDULE OR DURING UNOCCUPIED HOURS WHENEVER ANY ZONE IS OCCUPIED AS INDICATED BY ZONE TEMPERATURE WITH OCCUPANCY OVERRIDE BUTTON. DURING UNOCCUPIED HOURS, THE UNIT SHALL RUN WHEN EVER A DEFINABLE NUMBER OF UNOCCUPIED ZONES CALLS FOR HEATING AND COOLING.

OPERATION - UNOCCUPIED MODE:
IN THE UNOCCUPIED MODE THE AIR HANDLING UNIT SHALL BE DE-ENERGIZED, AND THE OUTDOOR AIR DAMPER SHALL BE CLOSED.

ZONE TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
HEATING - 60°F
COOLING - 80°F

UNIT DISCHARGE AIR TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
HEATING - 90°F
COOLING - 55°F

HEATING REQUIRED: ON A CALL FOR HEATING (DETERMINED BY THE BAS POLLING ALL ASSOCIATED ZONE SENSORS TO SEE IF 50% OF THE SENSORS ARE AT LEAST 2°F BELOW THE UNOCCUPIED TEMPERATURE SET POINT OR IF ANY INDIVIDUAL ZONE SENSOR IS BELOW 55°F), THE RTU FAN CYCLES ON AND RUNS CONTINUOUSLY. THE OUTDOOR AIR DAMPER REMAINS CLOSED AND THE RETURN AIR DAMPER IS 100% OPEN. THE UNIT GAS HEAT IS ENERGIZED AND THE UNIT OPERATES UNDER ITS FACTORY INSTALLED CONTROLS TO MODULATE THE GAS HEAT. UPON ALL ZONES REPORTING SATISFIED UNOCCUPIED TEMPERATURE THE GAS HEAT IS DISABLED AND THE UNIT CYCLES OFF. A BUILT-IN ANTI-SHORT-CYCLE TIMER SHALL PREVENT UNIT FROM CYCLING ON/OFF TOO FREQUENTLY.

COOLING REQUIRED: ON A CALL FOR COOLING (DETERMINED BY THE BAS POLLING ALL ASSOCIATED ZONE SENSORS TO SEE IF 50% OF THE SENSORS ARE AT LEAST 2°F ABOVE THE UNOCCUPIED TEMPERATURE SET POINT OR IF ANY INDIVIDUAL ZONE SENSOR IS ABOVE 85°F) THE RTU FAN CYCLES ON AND RUNS CONTINUOUSLY. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED AND THE RETURN AIR DAMPER IS 100% OPEN. THE UNIT OPERATES UNDER ITS FACTORY INSTALLED CONTROLS TO STAGE THE COMPRESSORS AS NECESSARY. UPON ALL ZONES REPORTING SATISFIED UNOCCUPIED TEMPERATURE COOLING IS DISABLED AND THE UNIT CYCLES OFF. BUILT-IN ANTI-SHORT-CYCLE TIMER SHALL PREVENT UNIT FROM CYCLING ON/OFF TOO FREQUENTLY.

MORNING WARM-UP/COOL DOWN: PRIOR TO SCHEDULED OCCUPANCY PERIODS, THE SYSTEM SHALL BE PLACED IN WARM-UP OR COOL-DOWN MODE TO BRING SPACES TO THEIR OCCUPIED TEMPERATURE SET POINTS. THIS SHALL BE ACHIEVED BY STAGING THE UNIT FOR HEATING OR COOLING AS DETERMINED BY THE BAS. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED AND THE RETURN AIR DAMPER IS 100% OPEN DURING WARM-UP OR COOL- DOWN MODE.

OPERATION - OCCUPIED MODE:
IN THE OCCUPIED MODE THE AIR HANDLING UNIT IS ENERGIZED AND RUNS CONTINUOUSLY UNDER ITS FACTORY INSTALLED CONTROLS. THE OUTDOOR AIR DAMPER OPENS TO ACHIEVE DESIGN OUTSIDE AIR FLOW AS DETERMINED BY THE UNIT AIR FLOW MEASURING DEVICE

ZONE TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
HEATING - 70°F
COOLING - 75°F

UNIT DISCHARGE AIR TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
HEATING - 90°F
COOLING - 55°F

HEATING REQUIRED: WHEN THE SYSTEM IS IN HEATING MODE, THE FAN IS ENERGIZED AND RUNS CONTINUOUSLY. THE UNIT GAS HEAT IS DE-ENERGIZED AND HEATING IS PROVIDED BY THE ZONE VAV TERMINALS.

COOLING REQUIRED: WHEN THE SYSTEM IS IN THE COOLING MODE, THE FAN IS ENERGIZED AND RUNS CONTINUOUSLY. THE UNIT OPERATES UNDER ITS FACTORY INSTALLED CONTROLS TO STAGE THE COMPRESSORS AS NECESSARY TO MAINTAIN THE LEAVING AIR TEMPERATURE SET POINT. A BUILT-IN ANTI-SHORT-CYCLE TIMER SHALL PREVENT THE COMPRESSORS FROM CYCLING ON/OFF TOO FREQUENTLY. IF ANY INDIVIDUAL ZONE TEMPERATURE SET POINT IS NOT SATISFIED WHEN ALL ZONE AIR VALVES ARE 100% OPEN, THEN THE AIR HANDLING UNIT LEAVING AIR TEMPERATURE SHALL BE GRADUALLY RESET LOWER TO A MINIMUM OF 48°F AND THE UNIT CONTROLS SHALL STAGE THE COMPRESSORS FOR MAXIMUM CAPACITY.

OUTDOOR AIR CONTROL:
DURING OCCUPIED MODE, THE OUTDOOR AIR DAMPER SHALL BE OPEN TO ITS MINIMUM POSITION TO MAINTAIN MINIMUM OUTDOOR AIR VOLUME. DURING UNOCCUPIED MODE, OUTDOOR AIR DAMPER SHALL BE CLOSED.

BUILDING PRESSURIZATION:
DURING OCCUPIED MODE, THE UNIT EXHAUST DAMPER SHALL MODULATE TO MAINTAIN BUILDING PRESSURIZATION AT +0.03 (ADJ) INCHES OF WATER WITH RESPECT TO OUTSIDE AMBIENT AIR PRESSURE. THE EXHAUST AIR DAMPER SHALL BE ENABLED WHEN THE SUPPLY FAN STATUS IS PROVEN AND SHALL CLOSE WHEN THE UNIT IS OFF.

RETURN AIR SMOKE DETECTION:
UPON ANY UNIT RECEIVING A RETURN AIR SMOKE DETECTOR STATUS, ALL UNITS SHALL BE SHUT DOWN AND AN ALARM SHALL BE GENERATED . SMOKE DETECTOR ALARM SHALL ALSO BE SENT TO THE BUILDING FIRE ALARM PANEL. UPON RECEIVING A FIRE ALARM SIGNAL FROM THE BUILDING FIRE ALARM PANEL. ALL UNITS SHALL SHUT DOWN. UNITS SHALL RETURN TO SCHEDULED MODE OF OPERATION UPON CLEARING OF ALARMS.

AHU OPTIMAL START:
THE UNIT SHALL START PRIOR TO SCHEDULED OCCUPANCY BASED ON THE TIME NECESSARY FOR THE ZONES TO REACH THEIR OCCUPIED SETPOINTS. THE START TIME SHALL AUTOMATICALLY ADJUST BASED ON CHANGES IN OUTSIDE AIR TEMPERATURE AND ZONE TEMPERATURES. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED DURING OPTIMAL START OPERATION.

SUPPLY AIR DUCT STATIC PRESSURE:
THE CONTROLLER SHALL MEASURE DUCT STATIC PRESSURE AND SHALL MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF [illegible] INCHES (ADJ). STATIC PRESSURE SETPOINT SHALL BE RESET BASED ON THE ZONE REQUIRING THE MOST PRESSURE, THAT IS, THE SETPOINT IS RESET LOWER UNTIL ONE ZONE DAMPER MODULATES WIDE OPEN. THE SUPPLY FAN VFD SPEED SHALL NOT DROP BELOW 30% (ADJ).

HIGH STATIC SHUTDOWN:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A HIGH STATIC PRESSURE SHUTDOWN SIGNAL.

SUPPLY AIR TEMPERATURE SETPOINT:
DURING NORMAL OPERATING MODE, THE CONTROLLER SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SHALL MAINTAIN A FIXED SUPPLY AIR TEMPERATURE SETPOINT OF 55°F (ADJ). DURING OPTIMAL MORNING START-UP (HEATING MODE), THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE 90°F (ADJ). UPON COMPLETION OF MORNING START-UP (HEATING MODE), THE SUPPLY AIR TEMPERATURE SHALL BE RESET TO 55°F (ADJ).

ECONOMIZER:
RTU SHALL OPERATE IN ECONOMIZER MODE WHENEVER THE UNIT IS IN COOLING MODE AND THE OUTDOOR AIR ENTHALPY IS LESS THAN 28 BTU/LB. ECONOMIZER SHALL PROVIDE UP TO 100% OF THE DESIGN SUPPLY AIR QUANTITY AS OUTDOOR AIR FOR COOLING. ECONOMIZER SHALL AUTOMATICALLY REDUCE OUTDOOR AIR INTAKE TO THE DESIGN MINIMUM WHEN OUTDOOR AIR INTAKE WILL NO LONGER SATISFY COOLING DEMAND. ECONOMIZER MODE SHALL BE DISABLED AND MECHANICAL COOLING ENABLED WHENEVER THE UNIT IS IN THE COOLING MODE AND THE OUTDOOR TEMPERATURE IS GREATER THAN 65°F.

SAFETIES:
EQUIPMENT FAILURE: IF THE UNIT'S INTERNAL CONTROLS SHUT IT DOWN DUE TO A FAULT CONDITION,
AN EQUIPMENT FAILURE ALARM IS ISSUED AND THE UNIT CONTROLS MUST BE MANUALLY RESET BEFORE IT IS ALLOWED TO RE-START.

FILTER DIFFERENTIAL PRESSURE: UPON SENSING EXCESSIVE DIFFERENTIAL PRESSURE (90% (ADJ) OF FILTER MANUFACTURER'S RECOMMENDED FINAL RESISTANCE) ACROSS THE AIR FILTERS A WARNING SIGNAL IS SENT TO THE BAS.

DUCT SMOKE DETECTOR: ON SENSING PRODUCTS OF COMBUSTION AT THE RETURN AIR DUCT SMOKE DETECTOR, THE SYSTEM IS SHUT DOWN AND AN ALARM IS SENT TO THE BAS, AND SMOKE DETECTION STATUS IS SENT TO THE BUILDING FIRE ALARM CONTROL PANEL.

HIGH LIMIT LEAVING AIR TEMPERATURE: ON SENSING A SUPPLY AIR TEMPERATURE ABOVE 105°F (ADJ), THE SYSTEM SHALL SHUT DOWN. AN ALARM IS ISSUED TO THE BAS AND THE CONDITION MUST BE RESET MANUALLY.

LOW LIMIT LEAVING AIR TEMPERATURE: ON SENSING A SUPPLY AIR TEMPERATURE BELOW 45°F (ADJ), THE SYSTEM SHALL SHUT DOWN. AN ALARM IS ISSUED TO THE BAS AND THE CONDITION MUST BE MANUALLY RESET.

ZONE VAV TERMINALS SEQUENCE OF OPERATION

ENABLEMENT:
THE BAS ENABLES THE SYSTEM AND PLACES THE SYSTEM IN OCCUPIED MODE OR UNOCCUPIED MODE ACCORDING TO THE USER DEFINABLE OCCUPANCY SCHEDULE UNLESS THE SYSTEM IS MANUALLY SHUT DOWN OR DIRECTED BY THE BAS TO SHUT DOWN.

ZONE CONTROL DAMPERS ARE UNDER CONTROL OF THEIR RESPECTIVE ZONE TEMPERATURE SENSORS.

OPERATION - UNOCCUPIED MODE:
IN THE UNOCCUPIED MODE ALL ZONE DAMPERS ARE AT THEIR MINIMUM POSITIONS.

ZONE TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
HEATING - 60°F
COOLING - 80°F

HEATING REQUIRED: WHENEVER THE BAS DETERMINES THAT HEATING IS REQUIRED (AS DESCRIBED ABOVE), THE ZONE DAMPER SHALL MODULATE OPEN UNTIL THE ZONE TEMPERATURE IS SATISFIED.

COOLING REQUIRED: WHENEVER THE BAS DETERMINES THAT COOLING IS REQUIRED (AS DESCRIBED ABOVE), THE ZONE DAMPER SHALL MODULATE OPEN UNTIL THE ZONE TEMPERATURE IS SATISFIED.

OCCUPANCY OVERRIDE: ZONE TEMPERATURE SENSORS HAVE AN OCCUPANCY OVERRIDE PUSHBUTTON THAT, WHEN INITIATED, TEMPORARILY PLACES THE SYSTEM IN THE OCCUPIED MODE FOR A MINIMUM OF 1 HOUR (ADJ).

OPERATION - OCCUPIED MODE:
ZONE TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
HEATING - 70°F
COOLING - 75°F

HEATING REQUIRED: ON A FALL IN ZONE TEMPERATURE BELOW THE OCCUPIED SET POINT, THE ZONE TERMINAL ELECTRIC HEAT IS ENERGIZED AND THE ZONE DAMPER SHALL MODULATE OPEN UNTIL THE ZONE TEMPERATURE IS SATISFIED. ON A RISE IN ZONE TEMPERATURE ABOVE THE OCCUPIED SET POINT, THE REVERSE SHALL OCCUR.

COOLING REQUIRED: ON A RISE IN ZONE TEMPERATURE ABOVE THE OCCUPIED SET POINT, THE ZONE DAMPER SHALL MODULATE OPEN UNTIL THE ZONE TEMPERATURE IS SATISFIED. ON A FALL IN ZONE TEMPERATURE BELOW THE OCCUPIED SET POINT, THE REVERSE SHALL OCCUR.

MORNING WARM-UP: WHEN THE BAS SCHEDULE PLACES THE SYSTEM IN MORNING WARM-UP MODE, ZONE TEMPERATURES ARE SET TO THE OCCUPIED MODE HEATING TEMPERATURE SET POINT, ZONE AIR VALVES MODULATE TO THEIR FULL OPEN POSITION, AND ZONE TERMINAL ELECTRIC HEAT IS ENERGIZED. UPON ACHIEVING THE ZONE TEMPERATURE, THE AIR VALVE MODULATES TO ITS MINIMUM POSITION.

MORNING COOL DOWN: WHEN THE BAS SCHEDULE PLACES THE SYSTEM IN MORNING COOL DOWN MODE, ZONE TEMPERATURES ARE SET TO THE OCCUPIED MODE, COOLING TEMPERATURE SET POINT AND THE ZONE AIR VALVES MODULATE TO THEIR FULL OPEN POSITION. UPON ACHIEVING THE ZONE TEMPERATURE, THE AIR VALVE MODULATES TO ITS MINIMUM POSITION.

CARBON DIOXIDE (CO2) SENSOR: ON SENSING ZONE CO2 CONCENTRATION ABOVE 1500-PPM (ADJ), THE CORRESPONDING ZONE AIR VALVE MODULATES FULLY OPEN. ON A FURTHER RISE IN ZONE CO2 CONCENTRATION ABOVE 1750-PPM (ADJ) THE BAS COMMANDS THE RTU OUTSIDE AIR DAMPER TO MODULATE OPEN UNTIL THE ZONE CONCENTRATION FALLS BELOW 1500-PPM. ON FURTHER RISE IN ZONE CO2 CONCENTRATION ABOVE 2000-PPM (ADJ), AN AUDIBLE ALARM IS GENERATED AT THE ZONE CO2 SENSOR AND SENT TO THE BAS. THE ALARM SHALL AUTOMATICALLY RESET ON A FALL IN CO2 CONCENTRATION BELOW 1750-PPM.

SAFETIES:
HIGH ZONE TERMINAL UNIT SUPPLY AIR TEMPERATURE: UPON SENSING A ZONE TERMINAL UNIT SUPPLY AIR TEMPERATURE ABOVE 105°F (ADJ), AN ALARM IS ISSUED TO THE BAS AND THE CONDITION MUST BE MANUALLY RESET.

HIGH CO2 CONCENTRATION: UPON SENSING A ZONE CO2 CONCENTRATION ABOVE 2000-PPM AN ALARM IS ISSUED AT THE BAS AND AT THE ZONE CO2 SENSOR.

HIGH ROOM RELATIVE HUMIDITY: UPON SENSING ROOM RELATIVE HUMIDITY ABOVE 65% (ADJ), AN ALARM IS ISSUED TO THE BAS AND THE CONDITION MUST BE MANUALLY RESET.

AIR HANDLING UNIT AND VAV SYSTEM CONTROLS (RTU-1, RTU-2 & RTU-3)
NO SCALE

WILMINGTON, NC

HAYNES / LACEWELL POLICE AND FIRE TRAINING FACILITY

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