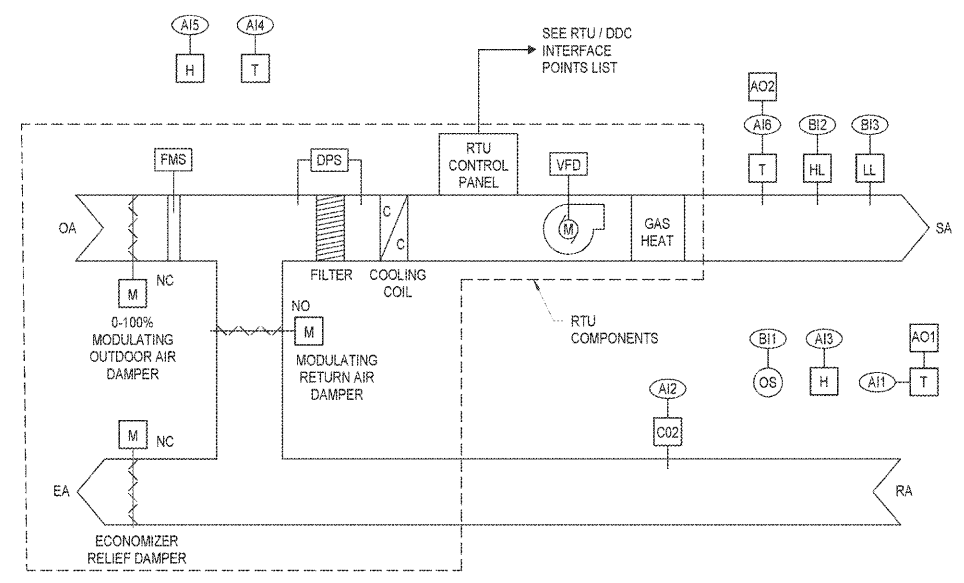


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RTU-4 AIR HANDLING SYSTEM SEQUENCE OF OPERATION

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 OCCUPANCY AS REPORTED BY ROOM OCCUPANCY SENSOR. THERE SHALL BE A MINIMUM 5°F DEAD-BAND BETWEEN HEATING AND COOLING MODES FOR THE UNIT.

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.

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

ROOM TEMPERATURE SET POINTS ARE ADJUSTABLE AND ARE INITIALLY AS FOLLOWS:
 HEATING - 80°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 DROP IN ROOM TEMPERATURE 2°F BELOW SETPOINT, 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 UNTIL THE UNOCCUPIED ROOM TEMPERATURE IS 2°F ABOVE SETPOINT (SATISFIED). UPON REPORTING SATISFIED UNOCCUPIED TEMPERATURE, THE GAS HEAT IS DISABLED AND THE UNIT CYCLES OFF. A BUILT-IN 15-MIN SHORT-CYCLE TIMER SHALL PREVENT UNIT FROM CYCLING ON/OFF TOO FREQUENTLY.

COOLING REQUIRED: ON A RISE IN ROOM TEMPERATURE 2°F ABOVE SETPOINT, 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 UNTIL THE UNOCCUPIED ROOM TEMPERATURE IS 2°F BELOW SETPOINT (SATISFIED). UPON 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.

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

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.

ROOM 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: ON A DROP IN ROOM TEMPERATURE 2°F BELOW HEATING SETPOINT, THE UNIT OPERATES UNDER ITS FACTORY INSTALLED CONTROLS TO STAGE THE GAS HEAT AND MODULATE SUPPLY FAN SPEED IN ORDER TO SATISFY ROOM TEMPERATURE SETPOINT.

COOLING REQUIRED: ON A RISE IN ROOM TEMPERATURE 2°F ABOVE COOLING SETPOINT, THE UNIT OPERATES UNDER ITS FACTORY INSTALLED CONTROLS TO STAGE THE COMPRESSORS AND MODULATE SUPPLY FAN SPEED IN ORDER TO SATISFY ROOM TEMPERATURE SETPOINT.

CARBON DIOXIDE SENSOR: UPON SENSING CO2 CONCENTRATION ABOVE 1750-PPM (ADJ.) THE RTU OUTSIDE AIR DAMPER SHALL MODULATED OPEN UNTIL THE CO2 CONCENTRATION FALLS BELOW 1500-PPM. ON FURTHER RISE IN CO2 CONCENTRATION ABOVE 2000-PPM ADJ., AN AUDIBLE ALARM IS GENERATED AT THE WALL-MOUNTED CO2 CONCENTRATION DISPLAY MODULE AND SENT TO THE BAS. THE ALARM SHALL AUTOMATICALLY RESET ON A FALL IN CO2 CONCENTRATION BELOW 1750-PPM.

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 ACROSS THE AIR FILTERS (90% (ADJ.) OF FILTER MANUFACTURER'S RECOMMENDED FINAL RESISTANCE), A WARNING SIGNAL IS SENT TO THE BAS.

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.

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.

DDC POINTS LIST

INPUT					
	POINT #	POINT DESCRIPTION	TREND	ALARM	GRAPHIC
ANALOG	AI1	ROOM TEMPERATURE	X		X
	AI2	ROOM CO2 CONCENTRATION	X		X
	AI3	ROOM RELATIVE HUMIDITY	X		X
	AI4	OUTDOOR AIR TEMPERATURE	X		X
	AI5	OUTDOOR AIR RELATIVE HUMIDITY	X		X
	AI6	DISCHARGE AIR TEMPERATURE			X
BINARY	BI1	OCCUPANCY STATUS			X
	BI2	DISCHARGE AIR HIGH LIMIT TEMPERATURE		X	
	BI3	DISCHARGE AIR LOW LIMIT TEMPERATURE		X	

OUTPUT					
	POINT #	POINT DESCRIPTION	TREND	ALARM	GRAPHIC
ANALOG	AO1	ROOM TEMPERATURE SETPOINT			X
	AO2	DISCHARGE AIR TEMPERATURE SETPOINT			X
BINARY					

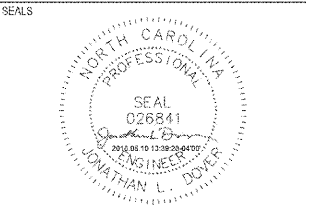
RTU / DDC INTERFACE POINTS LIST

INPUT (RTU TO DDC)					
	POINT DESCRIPTION	TREND	ALARM	GRAPHIC	
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		X
	SUPPLY FAN VFD FAULT		X		X

OUTPUT (DDC TO RTU)					
	POINT DESCRIPTION	TREND	ALARM	GRAPHIC	
ANALOG	OUTDOOR AIR TEMPERATURE				X
	DISCHARGE AIR TEMPERATURE SETPOINT				X
	ROOM CO2 CONCENTRATION				X
	OUTDOOR AIR RELATIVE HUMIDITY				X
BINARY	UNIT ENABLE				
	HEATING MODE - ENABLE / DISABLE				
	COOLING MODE - ENABLE / DISABLE				
	ECONOMIZER - ENABLE / DISABLE				

RTU-4 AIR HANDLING UNIT SYSTEM CONTROLS
 NO SCALE

(ADDITIVE BID ITEM # 1)



SUBMITTAL
 4 MAY 2018
CONSTRUCTION DOCUMENTS

REVISIONS

NO.	DESCRIPTION

SHEET
CONTROLS

M-805

DESIGN: JLD
 DRAWN: DRL
 REVIEW: EES
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