THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

LIST OF DRAWINGS

C-000	TITLE SHEET
C-001	CONTROL SYMBOLS & ABBREVIATIONS
C-101	FAN COIL UNIT (4-PIPE)
C-102	VAV BOX (COOL ONLY)
C-103	VAV TERMINAL UNIT WITH HOT WATER REHEAT
C-104	SERIES FAN POWERED VAV TERMINAL UNIT WITH HOT WATER REHEAT
C-105	PARALLEL FAN POWERED VAV TERMINAL UNIT WITH HOT WATER REHEAT
C-106	VRF (VARIABLE REFRIGERANT FLOW) SYSTEM INTERFACE
C-201	VAV AHU WITH PREHEAT, CHILLED WATER, AND RETURN FAN
C-202	VAV AHU WITH PREHEAT, AND CHILLED WATER
C-203	VAV AHU 100% OUTSIDE AIR WITH PREHEAT, AND CHILLED WATER
C-204	VAV AHU WITH PREHEAT, CHILLED WATER, AND REHEAT
C-301	CV AHU WITH PREHEAT, CHILLED WATER, MINIMUM OUTSIDE AIR, AND RETURN FAN
C-302	CV AHU 100% OUTSIDE AIR WITH PREHEAT, CHILLED WATER, AND ENERGY RECOVERY
C-401	STEAM TO HOT WATER CONVERTER WITH VARIABLE VOLUME PUMPS
C-402	PROCESS CHILLED WATER LOOP
C-501	VAV MANIFOLD LABORATORY EXHAUST
C-601	MISCELLANEOUS CONTROLS .A OUTSIDE AIR SENSORS .B HEADERED FAN .C ELECTRIC UNIT HEATER .D HUMIDIFIER .E FIRE/SMOKE DAMPER SAFETY .F INTERLOCKED EXHAUST FAN

DESIGNER NOTES

1. SEQUENCES SHOULD NOT BE COPY/PASTED AS IS INTO DESIGN DOCUMENTS. THESE DRAWINGS REPRESENT GENERAL UGA PREFERENCES RELATED TO MONITORING, FORMAT, CONTENT AND OPERATING CONTROL SEQUENCES. PROJECT SPECIFIC SEQUENCES SHOULD BE DEVELOPED WITH THIS UGA STANDARD AS A STARTING POINT. THE DESIGN ENGINEER SHALL MODIFY AS NEEDED TO INCORPORATE PROJECT REQUIREMENTS INTO THE SEQUENCES. THE SEQUENCES AS PRESENTED SHOULD NOT OVERRIDE SOUND ENGINEERING JUDGMENT BASED ON SPECIFIC PROJECT REQUIREMENTS.

2. ALL CONTROL DRAWINGS FROM INITIAL SUBMITTAL ONWARD SHALL BE SUBMITTED TO ALC FOR REVIEW AND COMMENT.

3. SEQUENCES HERE ASSUME ALC CONTROL OF ALL BUILDING SYSTEMS. DESIGNER SHALL FAMILIARIZE THEMSELVES WITH HOW THE BUILDING SYSTEMS NOT IN THE SCOPE OF THEIR PROJECT FUNCTION AND MODIFY SEQUENCES TO BE INTER OPERABLE.

The University of Georgia
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
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Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

TITLE SHEET

01 OF 18
SHEET NUMBER

C-000
DWG NUMBER

CONTROL SYMBOLS

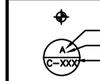
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
AI POINT NAME / POINT NAME AO	DDC POINT DESCRIPTOR WITH NAME AI – ANALOG INPUT DI – DIGITAL INPUT AO – ANALOG OUTPUT DO – DIGITAL OUTPUT		DISCONNECT SWITCH
TS1	TEMPERATURE SENSOR WITH AVERAGING ELEMENT	480V 120V	CONTROL TRANSFORMER
TS1	TEMPERATURE SENSOR WITH SINGLE POINT ELEMENT	MS EP S	RELAY COILS
TS1	TEMPERATURE SENSOR WITH PIPE WELL		FUSE
TS1	SPACE TEMPERATURE SENSOR	OL	THERMAL OVERLOAD
CO2	CARBON DIOXIDE DUCT SENSOR		NORMALLY OPEN AND NORMALLY CLOSED CONTACTS
	CURRENT SENSOR	HAND AUTO OFF	HAND–OFF–AUTO SELECTOR SWITCH
SD	SMOKE DETECTOR		WIRING DESIGNATION. (NO. OF HATCHES INDICATES NO. OF CONDUCTORS)
DPS2	DIFFERENTIAL PRESSURE SWITCH		WIRING CONNECTION
FS	WATER FLOW SWITCH	ON–OFF	ON–OFF SELECTOR SWITCH
N.C.	TWO WAY CONTROL VALVE	C. N.C. N.O.	THREE WAY CONTROL VALVE
DD	DAMPER ACTUATOR	LS1	LIMIT SWITCH
DPT1 0–5" w.c.	AIR DIFFERENTIAL PRESSURE TRANSMITTER (0 – 5" RANGE)	D–1	CONTROL DAMPER
VSD	VARIABLE SPEED DRIVE	DP	HYDRONIC DIFFERENTIAL PRESSURE TRANSMITTER
FZ	FREEZESTAT	FM1	HYDRONIC FLOWMETER
AFMS1	AIRFLOW MEASURING STATION	TS1	THERMOSTAT
TS1	TEMPERATURE SENSOR PIPE STRAP		AIR FLOW MONITORING STATION

ABBREVIATIONS

ALM	ALARM
AH	AIR HANDLER
BLDG	BUILDING
C	COMMON
CL	COOL
CHPS	CHILLED WATER PUMP, SECONDARY
CHWP	CHILLED WATER PUMP
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CW	CONDENSER WATER
CWP	CONDENSER WATER PUMP
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
DD	DOWN–DUCT
DP	DIFFERENTIAL PRESSURE
EF	EXHAUST FAN
FBK	FEEDBACK
FC	FAN COIL
HOA	HAND – OFF – AUTOMATIC
HT	HEAT
HWP	HOT WATER PUMP
HWPS	HOT WATER PUMP, SECONDARY
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
ISO	ISOLATION
MA	MIXED AIR
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTSIDE AIR
OVRD	OVERRIDE
RA	RETURN AIR
REQ	REQUEST
RF	RETURN FAN
RLF	RELIEF FAN
S/S	START / STOP
SA	SUPPLY AIR
SD	SMOKE DETECTOR
SEC	SECONDARY OR SECONDS
SF	SUPPLY FAN
SCHWR	SECONDARY CHILLED WATER RETURN
SCHWS	SECONDARY CHILLED WATER SUPPLY
SHWR	SECONDARY HOT WATER RETURN
SHWS	SECONDARY HOT WATER SUPPLY
T	TEMPERATURE
TB	TERMINAL BOX
TW	TEMPERED WATER
TWP	TEMPERED WATER PUMP
TWR	TEMPERED WATER RETURN
TWS	TEMPERED WATER SUPPLY
VP	VELOCITY PRESSURE
VSD	VARIABLE SPEED DRIVE

SYMBOL AND ABBREVIATION SCHEDULE

MISC. SYMBOLS AND ABBREVIATIONS



CONNECT NEW TO EXISTING
NUMBER INDICATES SECTION
LETTER INDICATES ELEVATION OR DETAIL
SHEET NUMBER WHERE ELEVATION, SECTION OR DETAIL IS DRAWN

200 — ROOM NUMBER

HEIGHT TO BOTTOM OF OBJECT

ADJ	ADJUSTABLE
C	COMMON
DB	DRY BULB
DIFF	DIFFERENTIAL
FAS	FIRE ALARM SYSTEM
HP	HORSEPOWER
I	INPUT
IN WG	INCHES WATER GAUGE
MBH	THOUSAND BTU/HR
MS	MOTOR STARTER
C	COMMON
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
O	OUTPUT
PH	PHASE
PSI, #	POUNDS PER SQUARE INCH (GAUGE)
RH	RELATIVE HUMIDITY
SP	SETPOINT
TDR	TIME DELAY RELAY
WB	WET BULB

LEGEND

WIRING DESIGNATIONS	
	NEW WIRING
	EXISTING WIRING (OR BY OTHERS)

GENERAL NOTES

1. WALL MOUNTED SPACE SENSORS FOR SINGLE ZONE EQUIPMENT: PROVIDE WITH COMMUNICATIONS PORT AND SET POINT ADJUSTMENT, EXCEPT FOR PUBLIC AREAS, AND MECHANICAL/ELECTRICAL SPACES; PROVIDE BASIC SENSOR WITH COMMUNICATIONS PORT, NO SET POINT ADJUSTMENT. PROVIDE SENSORS WITH LCD DISPLAY WHERE INDICATED ON FLOOR PLAN DRAWINGS.
2. PANEL LABELS: IDENTIFY EACH CONTROL PANEL WITH A UNIQUE PANEL NUMBER AND THE NAME OF EQUIPMENT/SYSTEM(S) CONTROLLED BY PANEL. SEE GUIDE SPECIFICATION 255500/3.09.

DESIGNER NOTES

1. LIFE SAFETY MONITORING AND SEQUENCES: THESE DRAWINGS TYPICALLY DO NOT INDICATE LIFE SAFETY DEVICES FOR MONITORING OR SEQUENCING THROUGH THE BAS. COORDINATE LIFE SAFETY DEVICE CONTROL AND MONITORING USING THE BAS WITH UGA. TYPICALLY ADDITIONAL CODE REQUIREMENTS NOT INCLUDED WITH THESE GUIDE DRAWINGS WILL BE REQUIRED.
2. UNINTERRUPTED POWER SUPPLY: INCLUDE IN DESIGN ONLY AFTER CONSULTATION WITH UGA. IF THE EQUIPMENT/SYSTEM APPLICATION REQUIRES UNINTERRUPTED OPERATION PROVIDE DETAILS FOR AN UNINTERRUPTIBLE POWER SUPPLY TO BE ADDED TO POWER THE EQUIPMENT CONTROL PANEL AND ACCESSORIES UNTIL GENERATOR POWER IS ONLINE OR NORMAL POWER IS RESTORED. (ALSO SEE GUIDE SPECIFICATION 255500/3.11).

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Engineering Department Facilities Management Division

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Eng	TRA
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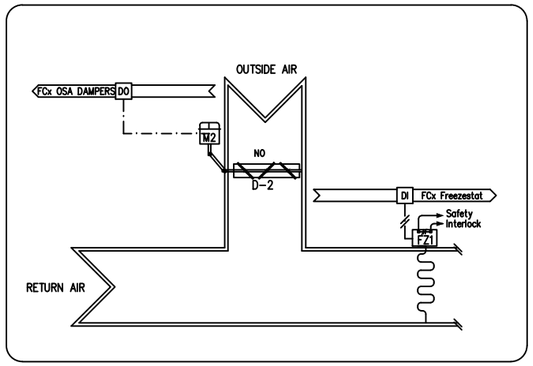
UGA STANDARDS UPDATE SPRING 2020

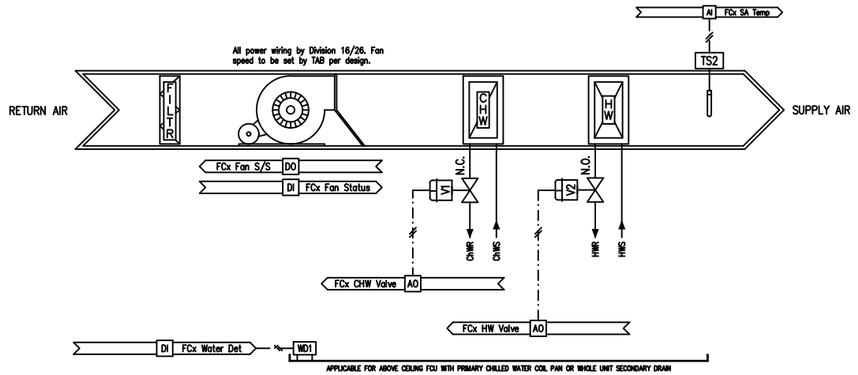
CONTROLS SYMBOLS AND ABBREVIATIONS

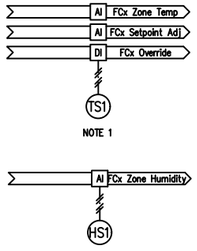
02 OF 18
SHEET NUMBER

C–001
DWG NUMBER

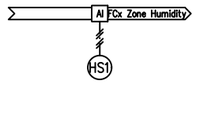
DESIGNER NOTE: For FCUs with ducted outside air connection, add sequence: When unit starts in occupied mode, the outside air damper shall open to minimum position. During unoccupied periods, the outside air damper shall remain closed. Whenever the freezestat is in alarm, the unit shall be commanded to stop, outside air damper commanded closed and hydronic valves commanded fully open.

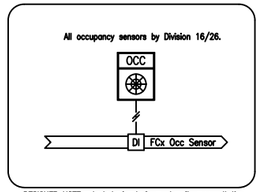




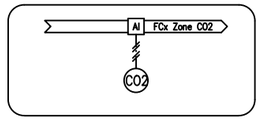


NOTE 1





DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: While occupancy sensor is active within a 15 minute (adj.) deadband the unit shall be energized in occupied mode. Unit shall revert to normal occupancy schedule after deadband expires with no activity sensed.

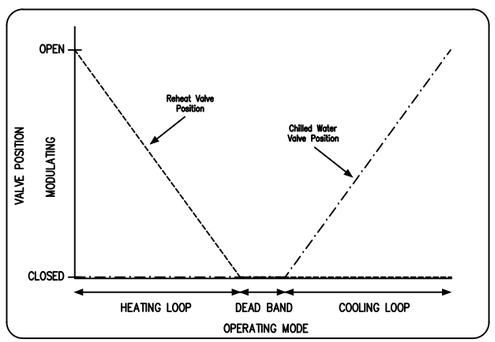


DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE. ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



VALVE CONTROL DIAGRAM

CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL: THE FOUR PIPE HORIZONTAL FAN COIL UNIT SHALL BE FULLY CONTROLLED BY THE BAS.

SPACE TEMPERATURE CONTROL: THREE SETPOINTS SHALL APPLY. NORMAL (72.5°F ADJ.), SETBACK HEATING (55°F), AND SETBACK COOLING (85°F). THESE VALUES SHALL BE THE ONLY VALUES CHANGED BY THE OPERATOR TO ADJUST SPACE TEMPERATURES. ALL OTHER DEADBANDS, DIFFERENTIALS, ETC. SHALL BE CALCULATED IN THE PROGRAM LOGIC (UNLESS ANOTHER MEANS IS PROVIDED TO PROHIBIT OVERLAP OF THE HEATING AND COOLING LOOPS). DURING THE NORMAL PERIODS, SEPARATE HEATING AND COOLING SETPOINTS SHALL BE CALCULATED:
1. NORMAL SPACE COOLING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT PLUS 2.5°F (ADJ.).
2. NORMAL SPACE HEATING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT MINUS 2.5°F (ADJ.).

OCCUPANCY OVERRIDE: OCCUPANCY OVERRIDE SHALL BE INITIATED AT THE LOCAL ZONE SENSOR OR VIA THE OCCUPANCY SENSOR. UNIT SHALL CHANGE TO THE OCCUPIED MODE WHENEVER THE OVERRIDE BUTTON IS DEPRESSED (OR SIGNAL IS RECEIVED FROM THE OCCUPANCY SENSOR) FOR A PERIOD OF 2 HOURS (ADJ.) AND RESET TO SCHEDULED OPERATION AT THE END OF THE PERIOD OR WHENEVER THE OVERRIDE BUTTON IS HELD FOR MORE THAN 5 SECONDS (ADJ.).

FAN: FAN SHALL BE ENABLED AND RUN CONTINUOUSLY DURING OCCUPIED MODE. DURING UNOCCUPIED MODE, FAN SHALL BE DEENERGIZED EXCEPT AS REQUIRED TO MAINTAIN SETBACK TEMPERATURE SETPOINTS FOR BOTH HEATING AND COOLING WITH A CYCLE DIFFERENTIAL OF 3°F (ADJ.). BAS SHALL PROVE FAN OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME.

VALVES: BAS SHALL MODULATE THE CHILLED WATER AND HOT WATER VALVES TO MAINTAIN THE ACTIVE SPACE TEMPERATURE SETPOINT (NORMAL OCCUPIED, SETBACK COOLING, SETBACK HEATING). LOGIC SHALL PREVENT OVERLAPPING CONTROL OF THE VALVES. VALVES SHALL BE COMMANDED CLOSED AND AN ALARM GENERATED WHENEVER THE DRAIN PAN FLOAT SWITCH OR WATER DETECTOR IS ACTIVATED.

DEHUMIDIFICATION: WHEN ZONE HUMIDITY RISES ABOVE SET POINT (60%, ADJ.) CHILLED WATER VALVE SHALL BE COMMANDED OPEN AND REHEAT VALVE SHALL MODULATE TO MAINTAIN ZONE TEMPERATURE SET POINT.

OPERATOR SHUTDOWN: THE BAS OPERATOR SHALL HAVE THE CAPABILITY, AT THE PROPER PASSWORD LEVEL, TO ISSUE A SINGLE SHUTDOWN COMMAND FROM THE OWS WHICH DEENERGIZES MULTIPLE FCU TERMINAL UNITS AS DESIGNATED BY THE OPERATOR.

HEATING REQUEST: A "HEATING REQUEST" SHALL BE BROADCAST TO THE HW SYSTEM SERVING THIS UNIT WHENEVER THE HW OUTPUT IS AT 100% (ADJ.) OR THE SPACE TEMPERATURE FALLS BELOW THE THROTTLING RANGE OF THE HEATING LOOP.

COOLING REQUEST: A "COOLING REQUEST" SHALL BE BROADCAST TO THE CHW SYSTEM SERVING THIS UNIT WHENEVER THE CHW OUTPUT IS AT 100% (ADJ.) OR THE SPACE TEMPERATURE RISES ABOVE THE THROTTLING RANGE OF THE COOLING LOOP.

GRAPHICS AND TRENDS: PROVIDE TRENDS AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.FCUxxx.HWV	HW Valve				1		
bldg.FCUxxx.CHWV	CHW Vlave				1		
bldg.FCUxxx.SAT	SA Temp		1				
bldg.FCUxxx.FANSS	Fan S/S			1			
bldg.FCUxxx.FANST	Fan Status	1					
bldg.FCUxxx.ZONET	Zone Temp		1				
bldg.FCUxxx.SPADJ	Setpoint Adj		1				
bldg.FCUxxx.OCCOVRD	Occ Override	1					
bldg.FCUxxx.WD	Water Detector	1					
bldg.FCUxxx.Zone CO2	Zone CO2		1				
	Htg Request					•	
	Clg Rqst					•	
	Normal SP					•	
	OA Temp					•	
	Clg Stpt					•	
	Htg Stpt					•	
	SB Htg Stpt					•	
	SB Clg Stpt					•	
	TOTALS	3	4	1	2	8	

NOTES

1. Provide with communications port and set point adjustment. For public areas, and mechanical/electrical spaces provide basic sensor with communications port; no set point adjustment. Provide sensors with LCD display where indicated on floor plan drawings.

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Engineering Department Facilities Management Division

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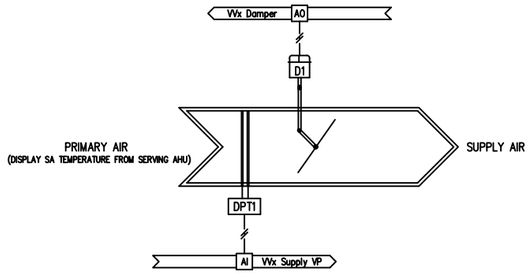
Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

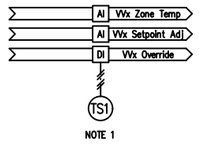
FAN COIL UNIT (4-PIPE)

03 OF 18
SHEET NUMBER

C-101
DWG NUMBER

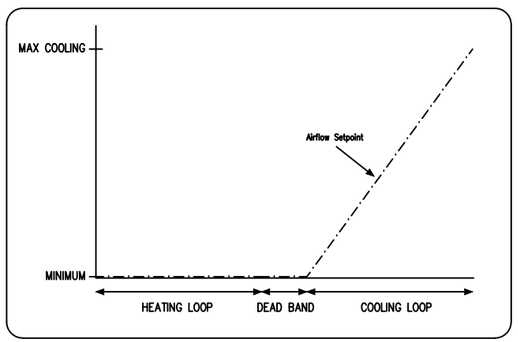


COOLING BOX



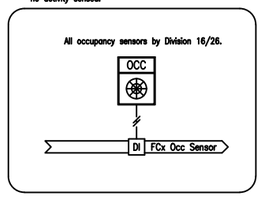
NOTE 1

1 C-102 VAV TERMINAL CONTROL SCHEMATIC

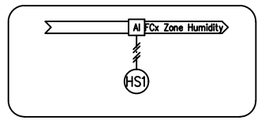


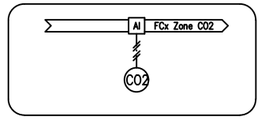
2 C-102 DAMPER CONTROL DIAGRAM

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: While occupancy sensor is active within a 15 minute (adj.) deadband the unit shall be energized in occupied mode. Unit shall revert to normal occupancy schedule after deadband expires with no activity sensed.



DESIGNER NOTE: Include in design only after consultation with UGA. Zone humidity may be used as a monitoring point or broadcast to parent AHU for sequencing humidity control..





DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE, ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.

SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME TERMINAL SHALL BE FULLY CONTROLLED BY THE BAS. CONTROL SHALL BE PRESSURE INDEPENDENT WITH MINIMUM AND MAXIMUM FLOW SETPOINTS, SCHEDULED OCCUPANCY WITH OPTIMMUM PREOCCUPANCY AND OCCUPANCY OVERRIDE. SCHEDULE SHALL BE THE SAME AS THE PARENT AHU.

SPACE TEMPERATURE CONTROL: THREE SETPOINTS SHALL APPLY. NORMAL (73F ADJ.), SETBACK HEATING (55F), AND SETBACK COOLING (85F). THESE VALUES SHALL BE THE ONLY VALUES CHANGED BY THE OPERATOR TO ADJUST SPACE TEMPERATURES. ALL OTHER DEADBANDS, DIFFERENTIALS, ETC. SHALL BE CALCULATED IN THE PROGRAM LOGIC (UNLESS ANOTHER MEANS IS PROVIDED TO PROHIBIT OVERLAP OF THE HEATING AND COOLING LOOPS AND ENSURE A DEAD BAND SUCH AS FUNCTION BLOCK TEMPLATES THAT RESTRICT THE SETPOINT INPUT). DURING THE NORMAL PERIODS, SEPARATE HEATING AND COOLING SETPOINTS SHALL BE CALCULATED:
1. NORMAL SPACE COOLING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT PLUS 3°F (ADJ.).
2. NORMAL SPACE HEATING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT MINUS 3°F (ADJ.).

OCCUPANCY OVERRIDE: OCCUPANCY OVERRIDE SHALL BE INITIATED AT THE LOCAL ZONE SENSOR OR VIA THE OCCUPANCY SENSOR. UNIT SHALL CHANGE TO THE OCCUPIED MODE WHENEVER THE OVERRIDE BUTTON IS DEPRESSED (OR SIGNAL IS RECEIVED FROM THE OCCUPANCY SENSOR) FOR A PERIOD OF 2 HOURS (ADJ.) AND RESET TO NORMAL OPERATION AT THE END OF THE PERIOD OR WHENEVER THE OVERRIDE BUTTON IS HELD FOR MORE THAN 5 SECONDS (ADJ.) OR THE OCCUPANCY SENSOR DOES NOT DETECT MOTION CONTINUOUSLY FOR 20 MINUTES (ADJ.).

ZONE DAMPER: ZONE DAMPER SHALL MODULATE IN A PI LOOP TO MAINTAIN ZONE VOLUME SETPOINT. ZONE VOLUME SETPOINT SHALL BE RESET BETWEEN MAXIMUM AND MINIMUM VOLUME SETTINGS TO MAINTAIN SPACE TEMPERATURE COOLING SETPOINT WITH A 2°F (ADJ.) RESET RANGE. ZONE VOLUME SETPOINT SHALL BE SET TO THE HEATING VOLUME SETPOINT WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE HEATING SPACE TEMPERATURE SETPOINT.
1. COOLING MINIMUM VOLUME SETPOINT SHALL BE DETERMINED AS SCHEDULED ON THE DRAWINGS. IN THE UNOCCUPIED PERIOD THE MINIMUM VOLUME SETPOINT SHALL BE 0 CFM.
2. COOLING MAXIMUM VOLUME SETPOINT SHALL BE AS SCHEDULED ON THE DRAWINGS DURING THE OCCUPIED PERIOD AND SHALL BE SET TO ZERO OTHERWISE.

COOLING REQUEST: THIS TERMINAL SHALL ISSUE A "COOLING REQUEST" TO THE PARENT AHU AS FOLLOWS.
1. WHENEVER THE ZONE DAMPER OUTPUT IS CONTROLLING FOR A COOLING SETPOINT AND THE CALCULATED SIGNAL IS GREATER THAN 90% (ADJ.), OR
2. WHENEVER THE SPACE TEMPERATURE RISES ABOVE THE THROTTLING RANGE OF THE COOLING LOOP.

GRAPHICS AND TRENDS: PROMDE TRENDS AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

NOTES

1. Provide with communications port and set point adjustment. For public areas, and mechanical/electrical spaces provide basic sensor with communications port; no set point adjustment. Provide sensors with LCD display where indicated on floor plan drawings.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.VAVxxx.SAVP	Supply VP		1			
bldg.VAVxxx.DMPR	Primary Damper				1	
bldg.VAVxxx.OCCOVRD	Occ Override	1				
bldg.VAVxxx.SPADJ	Setpoint Adj		1			
bldg.VAVxxx.ZONET	Zone Temp		1			
	TOTALS	1	3	0	1	

The University of Georgia
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

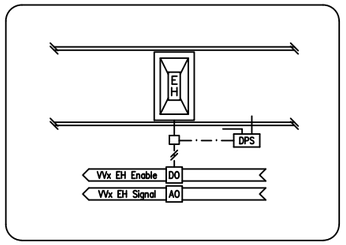
VAV TERMINAL UNIT (COOLING ONLY)

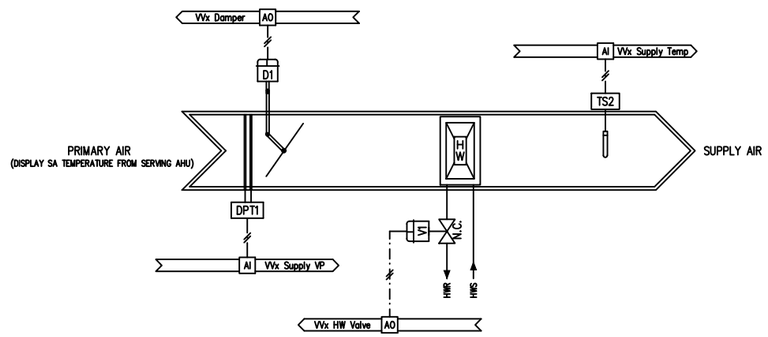
04 OF 18
SHEET NUMBER

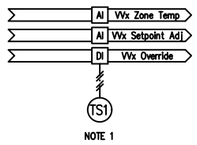
C-102
DWG NUMBER

VAV TERMINAL CONTROL SCHEMATIC

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: Whenever the heating minimum volume setpoint is active and flow is proven at the electric coil the electric heating coil shall be enabled and modulate to maintain space temperature heating setpoint as defined above with a 2°F throttling range. Electric heat shall be disabled whenever the parent AHU is off.

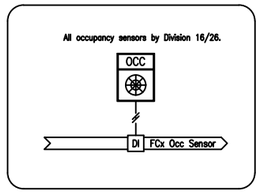




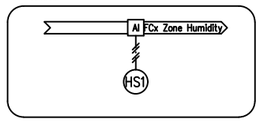


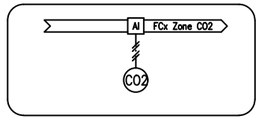
NOTE 1

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: While occupancy sensor is active within a 15 minute (adj.) deadband the unit shall be energized in occupied mode. Unit shall revert to normal occupancy schedule after deadband expires with no activity sensed. Designer shall specify occupancy sensors to have aux contact for BAS.



DESIGNER NOTE: Include in design only after consultation with UGA. Zone humidity may be used as a monitoring point or broadcast to parent AHU for sequencing humidity control..



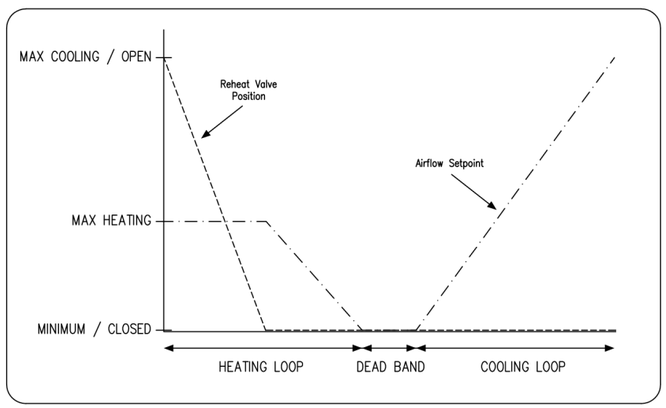


DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE. ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



TEMPERATURE CONTROL DIAGRAM

SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME TERMINAL SHALL BE FULLY CONTROLLED BY THE BAS. CONTROL SHALL BE PRESSURE INDEPENDENT WITH MINIMUM AND MAXIMUM FLOW SETPOINTS FOR BOTH HEATING AND COOLING OPERATING MODES, SCHEDULED OCCUPANCY WITH OPTIMUMUM PRECOCUPANCY AND OCCUPANCY OVERRIDE. SCHEDULE SHALL BE THE SAME AS THE PARENT AHU.

SPACE TEMPERATURE CONTROL: THREE SETPOINTS SHALL APPLY. NORMAL (73°F ADJ.), SETBACK HEATING (55°F), AND SETBACK COOLING (85°F). THESE VALUES SHALL BE THE ONLY VALUES CHANGED BY THE OPERATOR TO ADJUST SPACE TEMPERATURES. ALL OTHER DEADBANDS, DIFFERENTIALS, ETC. SHALL BE CALCULATED IN THE PROGRAM LOGIC (UNLESS ANOTHER MEANS IS PROVIDED TO PROHIBIT OVERLAP OF THE HEATING AND COOLING LOOPS AND ENSURE A DEAD BAND SUCH AS FUNCTION BLOCK TEMPLATES THAT RESTRICT THE SETPOINT INPUT). DURING THE NORMAL PERIODS, SEPARATE HEATING AND COOLING SETPOINTS SHALL BE CALCULATED:
1. NORMAL SPACE COOLING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT PLUS 3°F (ADJ.).
2. NORMAL SPACE HEATING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT MINUS 3°F (ADJ.).

OCCUPANCY OVERRIDE: OCCUPANCY OVERRIDE SHALL BE INITIATED AT THE LOCAL ZONE SENSOR OR VIA THE OCCUPANCY SENSOR. UNIT SHALL CHANGE TO THE OCCUPIED MODE WHENEVER THE OVERRIDE BUTTON IS DEPRESSED (OR SIGNAL IS RECEIVED FROM THE OCCUPANCY SENSOR) FOR A PERIOD OF 2 HOURS (ADJ.) AND RESET TO NORMAL OPERATION AT THE END OF THE PERIOD OR WHENEVER THE OVERRIDE BUTTON IS HELD FOR MORE THAN 5 SECONDS (ADJ.) OR THE OCCUPANCY SENSOR DOES NOT DETECT MOTION CONTINUOUSLY FOR 20 MINUTES (ADJ.).

ZONE DAMPER: ZONE DAMPER CONTROL SHALL FOLLOW DUAL MAXIMUM SETPOINT LOGIC. ZONE DAMPER SHALL MODULATE IN A PI LOOP TO MAINTAIN ZONE VOLUME SETPOINT. ZONE VOLUME SETPOINT SHALL BE RESET BETWEEN MAXIMUM AND MINIMUM VOLUME SETTINGS TO MAINTAIN SPACE TEMPERATURE COOLING SETPOINT WITH A 2°F (ADJ.) RESET RANGE. ZONE VOLUME SETPOINT SHALL BE SET TO THE HEATING VOLUME SETPOINT WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE HEATING SPACE TEMPERATURE SETPOINT.
1. COOLING MINIMUM VOLUME SETPOINT SHALL BE DETERMINED AS SCHEDULED ON THE DRAWINGS. IN THE UNOCCUPIED PERIOD THE MINIMUM VOLUME SETPOINT SHALL BE 0 CFM.
2. COOLING MAXIMUM VOLUME SETPOINT SHALL BE AS SCHEDULED ON THE DRAWINGS DURING THE OCCUPIED PERIOD AND SHALL BE SET TO ZERO OTHERWISE.
3. HEATING MAXIMUM VOLUME SETPOINT: WHENEVER HEATING IS REQUESTED FROM THE BOX IN ANY PERIOD, THE AIRFLOW VOLUME SHALL BE SET TO HEATING SETPOINT AIRFLOW, AS SCHEDULED.

HYDRONIC REHEAT: UPON CALL FOR HEATING VIA ZONE THERMOSTAT, THE NORMALLY CLOSED ZONE REHEAT COIL VALVE SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE HEATING SETPOINT AS DEFINED ABOVE WITH A 2°F THROTTLING RANGE. VALVE SHALL BE CLOSED WHENEVER THE PARENT AHU IS OFF.

HEATING REQUEST: THIS TERMINAL SHALL ISSUE A "HEATING REQUEST" TO THE HW SYSTEM AS FOLLOWS:
1. WHENEVER THE REHEAT OUTPUT IS GREATER THAN 90% (ADJ.), OR
2. WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE THROTTLING RANGE OF THE HEATING LOOP.

COOLING REQUEST: THIS TERMINAL SHALL ISSUE A "COOLING REQUEST" TO THE PARENT AHU AS FOLLOWS.
1. WHENEVER THE ZONE DAMPER OUTPUT IS CONTROLLING FOR A COOLING SETPOINT AND THE CALCULATED SIGNAL IS GREATER THAN 90% (ADJ.), OR
2. WHENEVER THE SPACE TEMPERATURE RISES ABOVE THE THROTTLING RANGE OF THE COOLING LOOP.

GRAPHICS AND TRENDS: PROVIDE TRENDS, HISTORIAN BACKUP AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

NOTES

1. Provide with communications port and set point adjustment. For public areas, and mechanical/electrical spaces provide basic sensor with communications port; no set point adjustment. Provide sensors with LCD display where indicated on floor plan drawings.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.VAVxxx.SAVP	VAVx Supply VP		1			
bldg.VAVxxx.DMPR	VAVx Damper				1	
bldg.VAVxxx.RHCV	VAVx HW Valve				1	
bldg.VAVxxx.SAT	VAVx SA Temp		1			
bldg.VAVxxx.OCCOVRD	VAVx Occ Override	1				
bldg.VAVxxx.SPT	VAVx Zone Temp		1			
TOTALS		1	3	0	2	

CONTROL SCHEMATIC

The University of Georgia
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

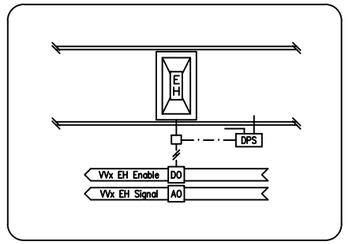
UGA STANDARDS UPDATE SPRING 2020

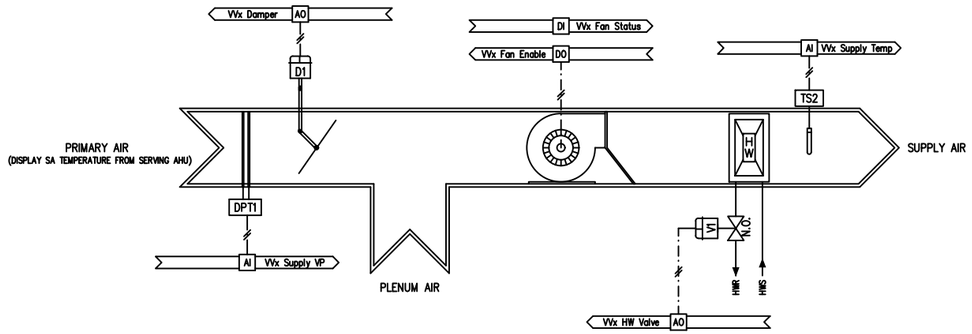
VAV TERMINAL UNIT WITH HOT WATER REHEAT

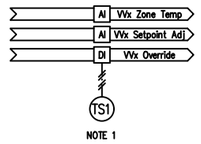
05 OF 18
SHEET NUMBER

C-103
DWG NUMBER

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: Whenever the heating minimum volume setpoint is active and flow is proven at the electric coil the electric heating coil shall be enabled and modulate to maintain space temperature heating setpoint as defined above with a 2°F throttling range. Electric heat shall be disabled whenever the parent AHU is off.

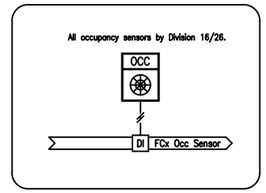




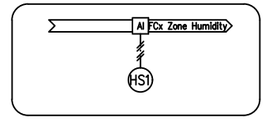


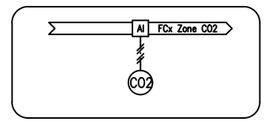
NOTE 1

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: While occupancy sensor is active within a 15 minute (adj.) deadband the unit shall be energized in occupied mode. Unit shall revert to normal occupancy schedule after deadband expires with no activity sensed.



DESIGNER NOTE: Include in design only after consultation with UGA. Zone humidity may be used as a monitoring point or broadcast to parent AHU for sequencing humidity control.



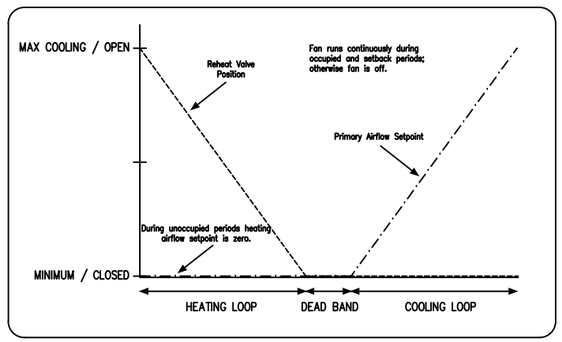


DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE. ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



TEMPERATURE CONTROL DIAGRAM

SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME TERMINAL SHALL BE FULLY CONTROLLED BY THE BAS. CONTROL SHALL BE PRESSURE INDEPENDENT WITH MINIMUM AND MAXIMUM FLOW SETPOINTS, SCHEDULED OCCUPANCY WITH OPTIMMUM PRECOCCUPANCY AND OCCUPANCY OVERRIDE. SCHEDULE SHALL BE THE SAME AS THE PARENT AHU.

SPACE TEMPERATURE CONTROL: THREE SETPOINTS SHALL APPLY. NORMAL (73°F ADJ.), SETBACK HEATING (55°F), AND SETBACK COOLING (85°F). NORMAL TEMPERATURE SETPOINT MAY BE ADJUSTED BY THE OCCUPANT VIA THE LOCAL SENSOR SETPOINT ADJUSTMENT (THE RANGE OF ADJUSTMENT SHALL BE CONFIGURABLE VIA THE BAS, INITIALLY +/-2°F). THESE VALUES SHALL BE THE ONLY VALUES CHANGED BY THE OPERATOR TO ADJUST SPACE TEMPERATURES.

DURING THE NORMAL PERIODS, SEPARATE HEATING AND COOLING SETPOINTS SHALL BE CALCULATED:
1. NORMAL SPACE COOLING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT PLUS 3°F (ADJ.).
2. NORMAL SPACE HEATING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT MINUS 3°F (ADJ.).

FAN: BAS SHALL START FAN AND IT SHALL RUN CONTINUOUSLY WHENEVER THE SPACE IS OCCUPIED OR IN SETBACK HEATING OR COOLING. FOR OCCUPIED OR SETBACK COOLING OPERATION, FAN SHALL BE STARTED 1 MINUTE (ADJ.) PRIOR TO THE AHU.

ZONE DAMPER: ZONE DAMPER SHALL MODULATE IN A PI LOOP TO MAINTAIN ZONE VOLUME SETPOINT. ZONE VOLUME SETPOINT SHALL BE RESET BETWEEN MAXIMUM AND MINIMUM VOLUME SETTINGS TO MAINTAIN SPACE TEMPERATURE COOLING SETPOINT WITH A 2°F (ADJ.) RESET RANGE. ZONE VOLUME SETPOINT SHALL BE SET TO THE HEATING VOLUME SETPOINT WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE HEATING SPACE TEMPERATURE SETPOINT.
1. COOLING MINIMUM VOLUME SETPOINT SHALL BE DETERMINED AS SCHEDULED ON THE DRAWINGS. IN THE UNOCCUPIED PERIOD THE MINIMUM VOLUME SETPOINT SHALL BE 0 CFM.
2. COOLING MAXIMUM VOLUME SETPOINT SHALL BE AS SCHEDULED ON THE DRAWINGS DURING THE OCCUPIED PERIOD AND SHALL BE SET TO ZERO OTHERWISE.
3. HEATING MINIMUM VOLUME SETPOINT: WHENEVER HEATING IS REQUESTED FROM THE BOX IN ANY PERIOD, THE MINIMUM VOLUME SHALL BE SET TO AN ADJUSTABLE HEATING SETPOINT AIRFLOW. INITIALLY, THIS SETPOINT SHALL EQUAL TO THE COOLING MINIMUM VOLUME SETPOINT.

HYDRONIC REHEAT: N.O. ZONE REHEAT COIL VALVE SHALL MODULATE IN A PI LOOP TO MAINTAIN SPACE TEMPERATURE HEATING SETPOINT AS DEFINED ABOVE WITH A 2°F THROTTLING RANGE.

OCCUPANCY OVERRIDE: OCCUPANCY OVERRIDE SHALL BE INITIATED AT THE LOCAL ZONE SENSOR. UNIT SHALL CHANGE TO THE OCCUPIED MODE WHENEVER THE OVERRIDE BUTTON IS DEPRESSED FOR A PERIOD OF 2 HOURS (ADJ.) AND RESET TO NORMAL OPERATION AT THE END OF THE PERIOD OR WHENEVER THE OVERRIDE BUTTON IS HELD FOR MORE THAN 5 SECONDS (ADJ.).

HEATING REQUEST: THIS TERMINAL SHALL ISSUE A "HEATING REQUEST" TO THE HW SYSTEM AS FOLLOWS:
1. WHENEVER THE REHEAT OUTPUT IS AT 100%, OR
2. WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE THROTTLING RANGE OF THE HEATING LOOP.

COOLING REQUEST: THIS TERMINAL SHALL ISSUE A "COOLING REQUEST" TO THE PARENT AHU AS FOLLOWS.
1. WHENEVER THE ZONE DAMPER OUTPUT IS AT 100% (FULL COOLING), OR
2. WHENEVER THE SPACE TEMPERATURE RISES ABOVE THE THROTTLING RANGE OF THE COOLING LOOP.

GRAPHICS AND TRENDS: PROVIDE TRENDS, HISTORIAN BACKUP AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

NOTES

1. Provide with communications port and set point adjustment. For public areas, and mechanical/electrical spaces provide basic sensor with communications port; no set point adjustment. Provide sensors with LCD display where indicated on floor plan drawings.
2. [DESIGN NOTE] SERIES BOXES ARE TO BE USED ONLY WITH PRIOR UGA APPROVAL.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.VAVxxx.SAVP	Supply VP		1			
bldg.VAVxxx.DMPR	Primary Damper				1	
bldg.VAVxxx.RHCV	HW Valve				1	
bldg.VAVxxx.SAT	SA Temp		1			
bldg.VAVxxx.OCCOVRD	Occ Override	1				
bldg.VAVxxx.SPT	Zone Temp		1			
bldg.VAVxxx.FAN	Fan Enable			1		
bldg.VAVxxx.FANSTAT	Fan Status	1				
	TOTALS	2	3	1	2	

The University of Georgia
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

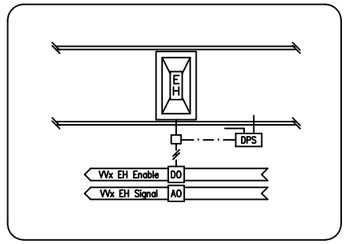
SERIES FAN POWERED VAV TERMINAL UNIT WITH HOT WATER REHEAT

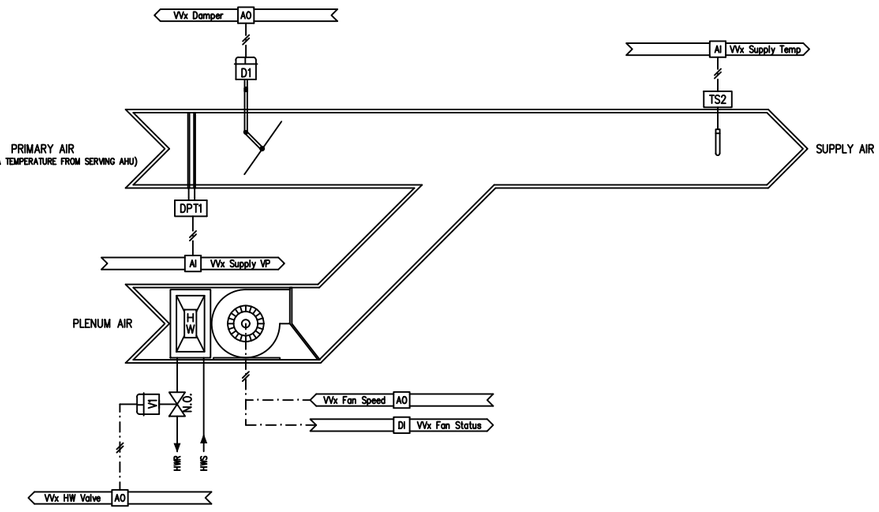
06 OF 18
SHEET NUMBER

C-104
DWG NUMBER

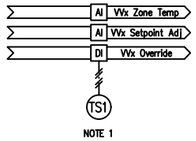
CONTROL SCHEMATIC

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: Whenever the heating minimum volume setpoint is active and flow is proven at the electric coil the electric heating coil shall be enabled and modulated via proportional SCR controller to maintain space temperature heating setpoint as defined above with a 2°F throttling range. Electric heat shall be disabled whenever the parent AHU is off.



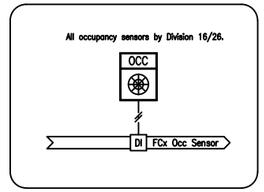


CONTROL SCHEMATIC

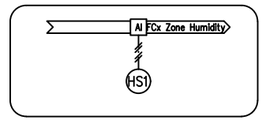


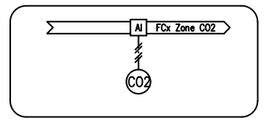
NOTE 1

DESIGNER NOTE: Include in design only after consultation with UGA. Add sequence: While occupancy sensor is active within a 15 minute (adj.) deadband the unit shall be energized in occupied mode. Unit shall revert to normal occupancy schedule after deadband expires with no activity sensed.



DESIGNER NOTE: Include in design only after consultation with UGA. Zone humidity may be used as a monitoring point or broadcast to parent AHU for sequencing humidity control.



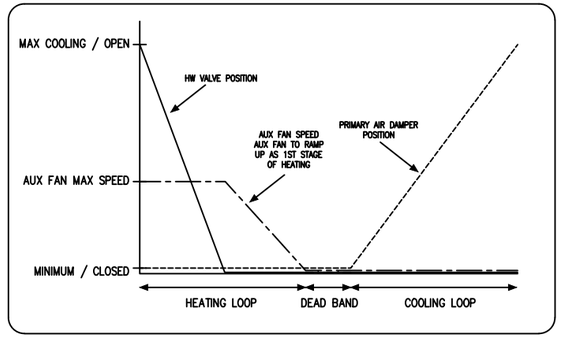


DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE, ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



TEMPERATURE CONTROL DIAGRAM

SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME TERMINAL SHALL BE FULLY CONTROLLED BY THE BAS. CONTROL SHALL BE PRESSURE INDEPENDENT WITH MINIMUM AND MAXIMUM FLOW SETPOINTS, SCHEDULED OCCUPANCY WITH OPTIMUMUM PRECOCCUPANCY AND OCCUPANCY OVERRIDE. SCHEDULE SHALL BE THE SAME AS THE PARENT AHU.

SPACE TEMPERATURE CONTROL: THREE SETPOINTS SHALL APPLY. NORMAL (73°F ADJ.), SETBACK HEATING (55°F), AND SETBACK COOLING (85°F). NORMAL TEMPERATURE SETPOINT MAY BE ADJUSTED BY THE OCCUPANT VIA THE LOCAL SENSOR SETPOINT ADJUSTMENT (THE RANGE OF ADJUSTMENT SHALL BE CONFIGURABLE VIA THE BAS, INITIALLY +/-2°F). THESE VALUES SHALL BE THE ONLY VALUES CHANGED BY THE OPERATOR TO ADJUST SPACE TEMPERATURES.

DURING THE NORMAL PERIODS, SEPARATE HEATING AND COOLING SETPOINTS SHALL BE CALCULATED:
1. NORMAL SPACE COOLING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT PLUS 3°F (ADJ.).
2. NORMAL SPACE HEATING SETPOINT SHALL BE THE EFFECTIVE SPACE TEMPERATURE SETPOINT MINUS 3°F (ADJ.).

FAN: FAN SHALL BE OFF WHENEVER THE TERMINAL UNIT IS IN EITHER COOLING OR SATISFIED MODE. THE FAN SHALL ENERGIZE AND RAMP UP VIA PID LOOP AS THE FIRST STAGE OF HEATING, UPON CALL FOR HEATING BY THE ZONE TEMP SENSOR. THE FAN SHALL OPERATE AT FULL SPEED PRIOR TO OPENING THE HW VALVE.

ZONE DAMPER: ZONE DAMPER SHALL MODULATE IN A PI LOOP TO MAINTAIN ZONE VOLUME SETPOINT. ZONE VOLUME SETPOINT SHALL BE RESET BETWEEN MAXIMUM AND MINIMUM VOLUME SETTINGS TO MAINTAIN SPACE TEMPERATURE COOLING SETPOINT WITH A 2°F (ADJ.) RESET RANGE. ZONE VOLUME SETPOINT SHALL BE SET TO THE HEATING VOLUME SETPOINT WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE HEATING SPACE TEMPERATURE SETPOINT.
1. COOLING MINIMUM VOLUME SETPOINT SHALL BE DETERMINED AS SCHEDULED ON THE DRAWINGS. IN THE UNOCCUPIED PERIOD THE MINIMUM VOLUME SETPOINT SHALL BE 0 CFM.
2. COOLING MAXIMUM VOLUME SETPOINT SHALL BE AS SCHEDULED ON THE DRAWINGS DURING THE OCCUPIED PERIOD AND SHALL BE SET TO ZERO OTHERWISE.
3. HEATING VOLUME SETPOINT: WHENEVER HEATING IS REQUESTED FROM THE BOX IN ANY PERIOD, THE PRIMARY DAMPER AIRFLOW SETPOINT SHALL BE THE MINIMUM VOLUME SETPOINT. DURING UNOCCUPIED HEATING PERIODS, THE PRIMARY AIR DAMPER SHALL BE CLOSED.

HYDRONIC REHEAT: IF AUX FAN SPEED IS AT DESIGN CFM FOR A PERIOD OF 2 MIN (ADJ) AND THE ZONE THERMOSTAT CALLS FOR HEATING, THE ZONE REHEAT COIL VALVE SHALL MODULATE IN A PI LOOP TO MAINTAIN SPACE TEMPERATURE HEATING SETPOINT AS DEFINED ABOVE WITH A 2°F THROTTLING RANGE.

OCCUPANCY OVERRIDE: OCCUPANCY OVERRIDE SHALL BE INITIATED AT THE LOCAL ZONE SENSOR. UNIT SHALL CHANGE TO THE OCCUPIED MODE WHENEVER THE OVERRIDE BUTTON IS DEPRESSED FOR A PERIOD OF 2 HOURS (ADJ.) AND RESET TO NORMAL OPERATION AT THE END OF THE PERIOD OR WHENEVER THE OVERRIDE BUTTON IS HELD FOR MORE THAN 5 SECONDS (ADJ.).

HEATING REQUEST: THIS TERMINAL SHALL ISSUE A "HEATING REQUEST" TO THE HW SYSTEM AS FOLLOWS:
1. WHENEVER THE REHEAT OUTPUT IS AT 100%, OR
2. WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE THROTTLING RANGE OF THE HEATING LOOP.

COOLING REQUEST: THIS TERMINAL SHALL ISSUE A "COOLING REQUEST" TO THE PARENT AHU AS FOLLOWS:
1. WHENEVER THE ZONE DAMPER OUTPUT IS AT 100% (FULL COOLING), OR
2. WHENEVER THE SPACE TEMPERATURE RISES ABOVE THE THROTTLING RANGE OF THE COOLING LOOP.

GRAPHICS AND TRENDS: PROVIDE TRENDS, HISTORIAN BACKUP AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

NOTES

1. Provide with communications port and set point adjustment. For public areas, and mechanical/electrical spaces provide basic sensor with communications port; no set point adjustment. Provide sensors with LCD display where indicated on floor plan drawings.
2. PIU fan motor shall be electronically commutated type with capability to dynamically ramp up and/or down according to output from controller.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.VAVxxx.SAVP	Supply VP		1			
bldg.VAVxxx.DMPR	Primary Damper				1	
bldg.VAVxxx.RHCV	HW Valve				1	
bldg.VAVxxx.SAT	SA Temp		1			
bldg.VAVxxx.OCCOVRD	Occ Override	1				
bldg.VAVxxx.SPT	Zone Temp		1			
bldg.VAVxxx.FANSS	Fan Enable			1		
bldg.VAVxxx.FANSTAT	Fan Status	1				
	TOTALS	2	3	1	2	

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STANDARD CONTROL DRAWINGS

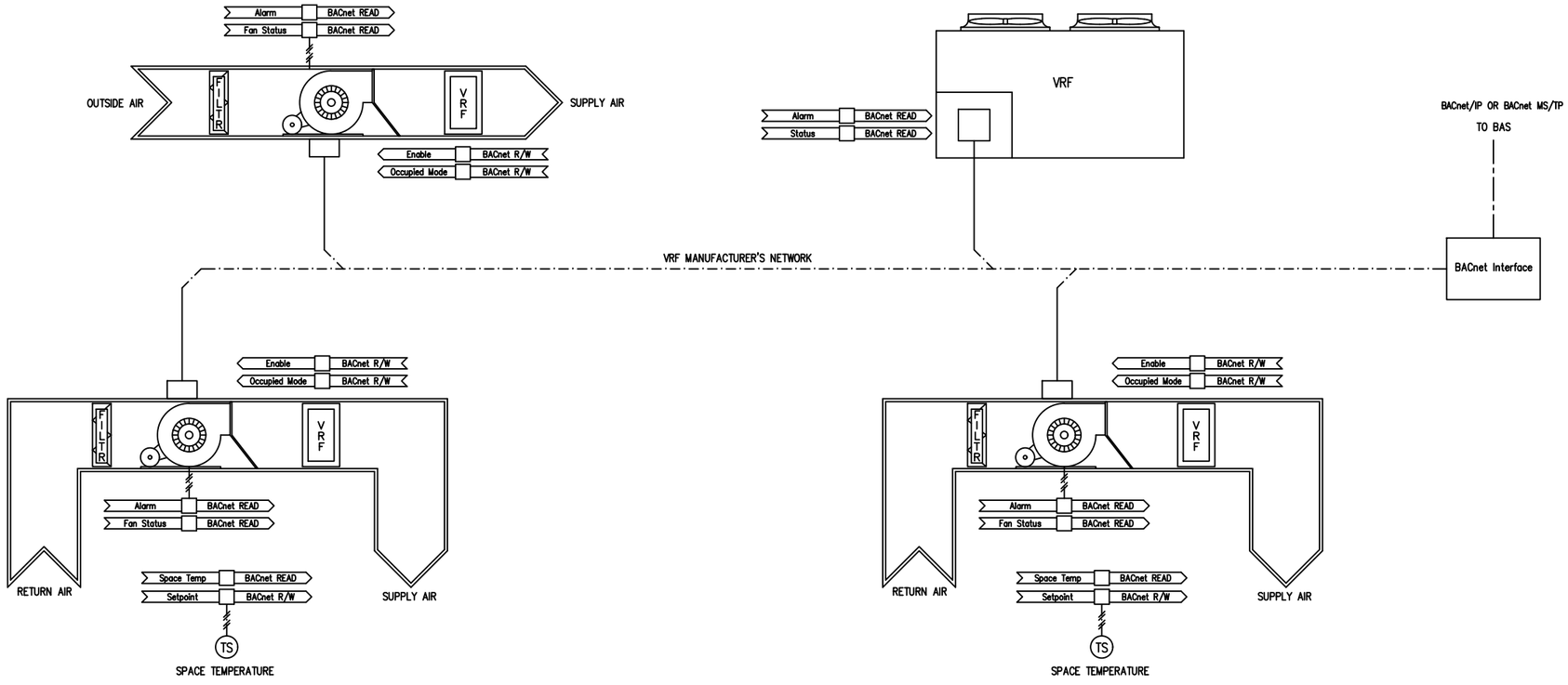
Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

PARALLEL FAN POWERED VAV TERMINAL UNIT WITH HOT WATER REHEAT

07 OF 18
SHEET NUMBER

C-105
DWG NUMBER



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL: THE BAS SHALL INTERFACE WITH TYPICAL VRF SYSTEMS THROUGH A BACNET NETWORK CONNECTION UTILIZING BACNET/IP AND/OR BACNET-MS/TP PROTOCOLS (ASHRAE 135).

ENABLE: VRF EQUIPMENT SHALL BE FULLY CONTROLLED BY THE VRF MANUFACTURER'S PACKAGED SYSTEM. BAS SHALL BE ABLE TO READ THE CURRENT ENABLED STATE FOR ALL EQUIPMENT AND WRITE OVERRIDE THE ENABLE STATE FOR ALL EQUIPMENT.

STATUS / ALARM MONITORING: BAS SHALL MONITOR EQUIPMENT STATUS AND ALARMS AND DISPLAY ON OPERATOR INTERFACE.

TEMPERATURE MONITORING: BAS SHALL MONITOR EQUIPMENT TEMPERATURE POINTS AND DISPLAY ON OPERATOR INTERFACE.

TEMPERATURE CONTROL: CONTROL SHALL BE PER THE VRF MANUFACTURER'S PACKAGED SEQUENCE. OCCUPIED AND UNOCCUPIED SPACE TEMPERATURE SET POINTS SHALL BE ADJUSTABLE THROUGH THE BAS INTERFACE. SUPPLY AIR TEMPERATURE SET POINTS SHALL BE ADJUSTABLE THROUGH THE BAS INTERFACE.

PROVIDE GRAPHIC INTERFACE AND ALL POINTS SHALL BE TRENDED TO THE BAS WITH HISTORIAN BACKUP.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.VRF.Zxxx.SAT	Zone SA Temp		•				BACnet-R
bldg.VRF.Zxxx.ENABLE	Zone Enable	•		•			BACnet-R/W
bldg.VRF.Zxxx.OCC	Zone Occ Mode	•		•			BACnet-R/W
bldg.VRF.Zxxx.FANST	Zone Fan Status	•					BACnet-R
bldg.VRF.Zxxx.ZONET	Zone Temp		•				BACnet-R
bldg.VRF.Zxxx.STPT	Zone Setpoint		•		•		BACnet-R/W
bldg.VRF.Zxxx.ALARM	Zone Alarm	•					BACnet-R
bldg.VRF.Dxxx.ENABLE	DOAS Enable	•		•			BACnet-R/W
bldg.VRF.Dxxx.OCC	DOAS Occ Mode	•		•			BACnet-R/W
bldg.VRF.Dxxx.FANST	DOAS Fan Status	•					BACnet-R
bldg.VRF.Dxxx.ALARM	DOAS Alarm	•					BACnet-R
bldg.VRF.CUxx.ST	CU Status	•					BACnet-R
bldg.VRF.CUxx.ALARM	CU Alarm	•					BACnet-R
	TOTALS	10	5	4	2	1	

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STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
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UGA STANDARDS UPDATE SPRING 2020

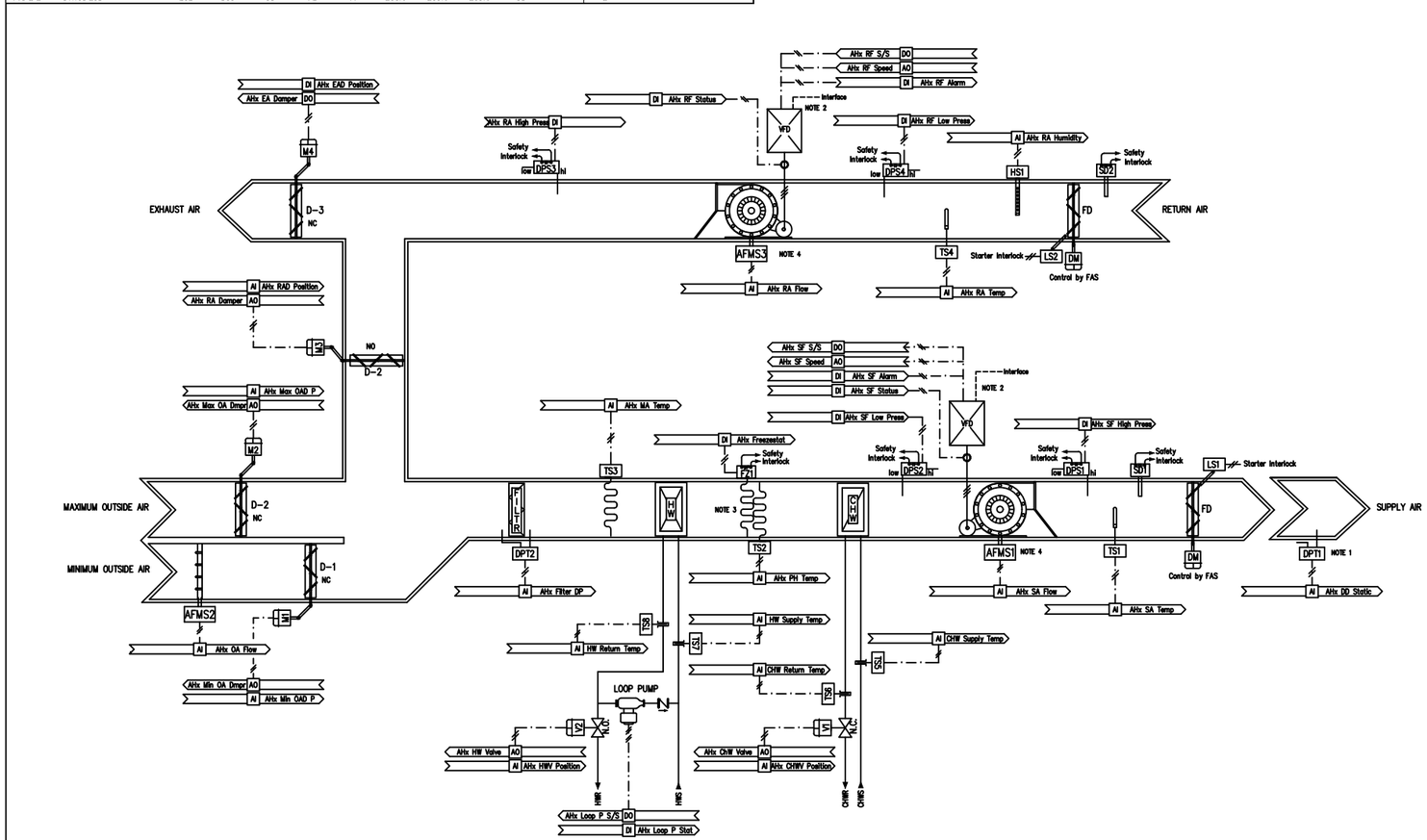
VRF SYSTEM INTERFACE

08 OF 18
SHEET NUMBER

C-106
DWG NUMBER

Ahxxx TERMINAL UNIT SUMMARY

TU/PID ID	Area Served	Operating Mode	Airflow (CFM)	Airflow SP (CFM)	Zone Temp (F)	Heating SP (F)	Cooling SP (F)	Damper Pos (% Open)	HW Valve Pos (% Open)	Fan Speed (%)	DA Temp (F)	CO2 Level (PPM)	*Static Pressure Reset* Airflow Requests	*Static Pressure Reset* Cumulative Req Hrs (%-req-hrs)	*Static Pressure Reset* Importance Multiplier
VAV 1-1	Office 101	Deadband	205	215	72	68	73	25%	0%	--	56.2	1000	0	2%	3
VAV 1-2	Classroom 102		1009	1000	76	70	75	70%	0%	--	56.2	--	0	6%	1
PIU 1-1	Office 103		202	300	68	72	77	100%	100%	100%	93	--	1		

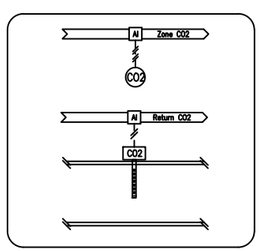


DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLOWING RESET SCHEDULE:

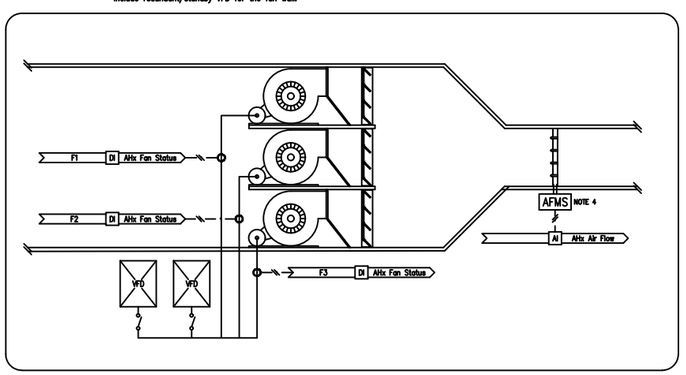
Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE, ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



DESIGNER NOTE: For designs utilizing fan walls include points for fan status at each fan. Include details for designs that include redundant/standby VFD for the fan wall.



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL:
1. THE VARIABLE AIR VOLUME AIR HANDLER SHALL BE FULLY CONTROLLED BY THE BAS.
2. THE AIR HANDLER SHALL BE ENERGIZED AS REQUIRED TO SATISFY TERMINAL UNITS SERVED DURING OCCUPIED AND SET BACK PERIODS.
3. SUPPLY AIR TEMPERATURE SET POINT:
   THE SUPPLY AIR TEMPERATURE SET POINT SHALL BE RESET FROM 55°F TO 60°F TO MAINTAIN TERMINAL UNIT COOLING REQUESTS LESS THAN 15% OF TOTAL TUS (ALL VALUES ADJUSTABLE).
4. PROVIDE TRENDS WITH HISTORIAN BACKUP AND DISPLAY ON GRAPHIC ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS. INCLUDE TAB VERIFIED FULL FLOW VALUE AT EACH AIR FLOW MONITORING STATION.
5. BAS SHALL MONITOR THE FOLLOWING POINTS AND INITIATE AN ALARM IF ANY IS NOT WITHIN OPERATING LIMITS:
   a. ALL HUMIDITY SENSORS
   b. ALL TEMPERATURE SENSORS
   c. ALL PRESSURE SWITCHES
   d. ALL AIR FLOW STATIONS
   e. ALL FREEZESTATS
   f. ALL FAN STATUSES
   g. ALL CONDENSATE WATER DETECTORS
   h. ALL VFD ALARM CONDITIONS
6. BAS SHALL PROVIDE A RELAY OUTPUT AND HOA SWITCH FOR EACH DIGITAL OUTPUT.

SAFETIES:
1. THE OUTSIDE AIR DAMPERS SHALL BE OVERRIDDEN CLOSED AS NECESSARY TO MAINTAIN A MINIMUM MIXED AIR TEMPERATURE OF 38°F (ADJ.).
2. REGARDLESS OF UNIT OPERATING MODE THE PREHEAT VALVE SHALL MODULATE TO MAINTAIN A MINIMUM 40°F (ADJ.) PREHEAT AIR TEMPERATURE.
3. THE PREHEAT LOOP PUMP SHALL ENERGIZE WHENEVER OUTSIDE AIR TEMPERATURE IS BELOW 38°F (ADJ.).
4. WHENEVER THE FREEZESTAT IS IN ALARM:
   a. UNIT FANS SHALL STOP
   b. HOT WATER AND CHILLED WATER VALVES SHALL OPEN
   c. LOOP PUMPS SHALL START
   d. OUTSIDE AIR, EXHAUST AIR AND RELIEF AIR DAMPERS SHALL CLOSE
   e. RETURN AIR DAMPERS SHALL OPEN
5. UPON ACTIVATION OF A HIGH OR LOW PRESSURE SAFETY SWITCH THE AIR HANDLER SHALL SHUTDOWN.

OCCUPIED MODE:
1. SUPPLY AND RETURN FANS SHALL BE COMMANDED TO START.
   a. SUPPLY FAN SPEED SHALL MODULATE TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE SET POINT.
      THE STATIC PRESSURE SET POINT SHALL BE RESET BETWEEN TAB DETERMINED LIMITS TO MAINTAIN THE MOST OPEN TERMINAL DAMPER AT 90% OPEN (ALL VALUES ADJUSTABLE).
   b. RETURN FAN SPEED SHALL MODULATE TO MAINTAIN THE RETURN FLOW SET POINT.
      THE RETURN FLOW SET POINT SHALL EQUAL THE SUPPLY FAN FLOW MINUS RETURN FLOW OFFSET (DETERMINED BY TAB).
2. DAMPERS:
   a. OCCUPIED:
      a.a. MINIMUM OUTSIDE AIR DAMPER SHALL BE COMMANDED OPEN.
      a.b. EXHAUST AIR DAMPER SHALL BE COMMANDED CLOSED.
      a.c. RETURN AIR DAMPER SHALL MODULATE TO MAINTAIN THE OUTSIDE AIR FLOW SET POINT.
      a.d. MAXIMUM OUTSIDE AIR DAMPER SHALL BE COMMANDED CLOSED.
   b. OCCUPIED ECONOMIZER (WHEN OUTSIDE AIR TEMPERATURE < 60°F ADJ.):
      b.a. MINIMUM OUTSIDE AIR DAMPER SHALL BE COMMANDED OPEN.
      b.b. EXHAUST AIR DAMPER SHALL BE COMMANDED OPEN.
      b.c. RETURN AIR DAMPER AND MAXIMUM OUTSIDE AIR DAMPER SHALL MODULATE TO MAINTAIN THE MIXED AIR TEMPERATURE SET POINT.
      THE MIXED AIR TEMPERATURE SET POINT SHALL BE EQUAL TO THE SUPPLY TEMPERATURE SET POINT MINUS 2°F (ADJ.).
3. PREHEAT COIL:
   THE PREHEAT VALVE SHALL MODULATE TO MAINTAIN THE SUPPLY AIR TEMPERATURE SET POINT MINUS 3°F (ADJ.).
4. CHILLED WATER COIL:
   THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN THE SUPPLY AIR TEMPERATURE SET POINT.
5. DEHUMIDIFICATION:
   WHENEVER RETURN AIR HUMIDITY EXCEEDS 60% (ADJ.) ECONOMIZER OPERATION SHALL BE DISABLED AND THE CHILLED WATER VALVE SHALL MODULATE TO BRING RETURN AIR HUMIDITY DOWN TO 55% (ADJ.).

UNOCCUPIED MODE:
1. SUPPLY AND RETURN FANS SHALL BE OFF.
2. OUTSIDE AIR DAMPERS SHALL BE CLOSED.
3. EXHAUST AIR DAMPER SHALL BE CLOSED.
4. RETURN AIR DAMPER SHALL BE OPEN.
5. CHILLED WATER VALVE SHALL BE CLOSED.
6. PREHEAT VALVE SHALL MODULATE TO MAINTAIN MINIMUM PREHEAT TEMPERATURE.

SETBACK MODE (AHU ENERGIZED DURING UNOCCUPIED PERIOD):
1. SUPPLY AND RETURN FANS SHALL ENERGIZE AS DESCRIBED IN OCCUPIED SEQUENCE.
2. OUTSIDE AIR DAMPERS SHALL BE CLOSED UNLESS ECONOMIZER IS AVAILABLE.
3. EXHAUST AIR DAMPER SHALL BE CLOSED UNLESS ECONOMIZER IS AVAILABLE.
4. RETURN AIR DAMPER SHALL BE OPEN UNLESS ECONOMIZER IS AVAILABLE.
5. CHILLED WATER VALVE SHALL MODULATE AS DESCRIBED IN OCCUPIED SEQUENCE.
6. PREHEAT VALVE SHALL MODULATE AS DESCRIBED IN OCCUPIED SEQUENCE.
7. DEHUMIDIFICATION SHALL OPERATE AS DESCRIBED IN OCCUPIED SEQUENCE.

NOTES

1. Locate down stream duct static pressure pitot tube approximately ⅔ down duct. See floor plans for designed location; show final installation location on as-builts.
2. Provide an ASHRAE 135 compliant (BACnet MS/TP or IP) communications interface to the control system for diagnostic point information. Include the following information for fan VFDs: operating frequency (Hz), RPM, percent fan speed, BAS signal to VFD, VFD output voltage, actual brake horsepower, and kW. On the VFD graphic screen also include the motor nameplate brake horsepower.
3. Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezestat to cover the exact same area. One set of contacts wired directly to drive safety input.
4. For single fan installation the AFMS may be duct or inlet type, see plans for design. For multiple fan/fan wall installation there will be a single AFMS installed in common duct served by all fans. Coordinate with mechanical design to ensure adequate upstream and downstream straight lengths for duct AFMS.
5. Include AHU Performance Graphic screen with a Terminal Unit Summary Table to match example table provided on this sheet. AHU Performance Graphic shall also include trend plots of AHU SP Setpoint and actual AHU SP along with AHU Trim and Respond Adjustment Tuning variables.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.AHxxx.RAT	RA Temperature		1			TS4:"RAT"
bldg.AHxxx.RAH	RA Humidity		1			HS1:"RAH"
bldg.AHxxx.RFALRM	RF VFD Alarm	1				"RF-A"
bldg.AHxxx.RFST	RF Status	1				"RF-STAT"
bldg.AHxxx.RFSS	RF Start/Stop			1		"RF-SS"
bldg.AHxxx.RFSPD	RF Speed				1	"RF-SPD"
bldg.AHxxx.SFALRM	SF VFD Alarm	1				"SF-A"
bldg.AHxxx.SFST	SF Status	1				"SF-STAT"
bldg.AHxxx.SFSS	SF Start/Stop			1		"SF-SS"
bldg.AHxxx.SFSPD	SF Speed				1	"SF-SPD"
bldg.AHxxx.SAFLOW	SA Flow		1			AFMS1:"SA-F"
bldg.AHxxx.OAFLOW	OA Flow		1			AFMS2:"OA-F"
bldg.AHxxx.RAFLOW	RA Flow		1			AFMS3:"RA-F"
bldg.AHxxx.EAD	EA Damper			1		M4:"EA-D"
bldg.AHxxx.EADP	EA Damper Position	1				M4:"EA-D-POS"
bldg.AHxxx.RAD	RA Damper				1	M3:"RA-D"
bldg.AHxxx.RADP	RA Damper Position		1			M3:"RA-D-POS"
bldg.AHxxx.OADMX	OA Max Damper				1	M2:"OA-D-MAX"
bldg.AHxxx.OADMXP	OAD Max Position		1			M2:"OA-D-MAX-POS"
bldg.AHxxx.OADMN	OA Min Damper				1	M1:"OA-D-MIN"
bldg.AHxxx.OADMNP	OAD Min Position		1			M1:"OA-D-MIN-POS"
bldg.AHxxx.MAT	MA Temperature		1			TS3:"MAT"
bldg.AHxxx.SAT	SA Temperature		1			TS1:"SAT"
bldg.AHxxx.PHT	PH Temperature		1			TS2:"PHT"
bldg.AHxxx.DDSP	DD Static		1			DPT1:"DDSP"
bldg.AHxxx.FLTSP	Filter DP		1			DPT2:"FILT-DP"
bldg.AHxxx.FRZ	Freezestat	1				FZ1:"FRZ"
bldg.AHxxx.SHSP	SF High Press	1				DPS1:"SF-HSP"
bldg.AHxxx.SLSP	SF Low Press	1				DPS2:"SF-LSP"
bldg.AHxxx.RHSP	RF High Press	1				DPS3:"RF-HSP"
bldg.AHxxx.RLSP	RF Low Press	1				DPS4:"RF-LSP"
bldg.AHxxx.LPSS	Loop Pump S/S			1		
bldg.AHxxx.LPST	Loop Pump Status	1				
bldg.AHxxx.HWV	HW Valve				1	V2:"HWV"
bldg.AHxxx.HWVP	HW Valve Position		1			V2:"HWV-POS"
bldg.AHxxx.CHWV	CHW Valve				1	V1:"CHWV"
bldg.AHxxx.CHWVP	CHW Valve Position		1			V1:"CHWV-POS"
bldg.AHxxx.HWST	HW Supply Temp		1			TS7:"HWST"
bldg.AHxxx.HWRT	HW Return Temp		1			TS8:"HWRT"
bldg.AHxxx.CHWST	CHW Supply Temp		1			TS5:"CHWST"
bldg.AHxxx.CHWRT	CHW Return Temp		1			TS6:"CHWRT"
	TOTALS	11	19	4	7	

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STANDARD CONTROL DRAWINGS

Eng	TRA
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UGA STANDARDS UPDATE SPRING 2020

VAV AHU: PREHEAT, CHW, RETURN FAN, ECONOMIZER

09 OF 18
SHEET NUMBER

C-201
DWG NUMBER

Ahxxx TERMINAL UNIT SUMMARY

TU/PID ID	Area Served	Operating Mode	Airflow (CFM)	Airflow SP (CFM)	Zone Temp (F)	Heating SP (F)	Cooling SP (F)	Damper Pos (% Open)	HW Valve Pos (% Open)	Fan Speed (%)	DA Temp (F)	CO2 Level (PPM)	*Static Pressure Reset*		
													Airflow Requests	Cumulative Req Hrs (%-req-hrs)	Importance Multiplier
VAV 1-1	Office 101	Deadband	205	215	72	68	73	25%	0%	--	56.2	1000	0	2%	3
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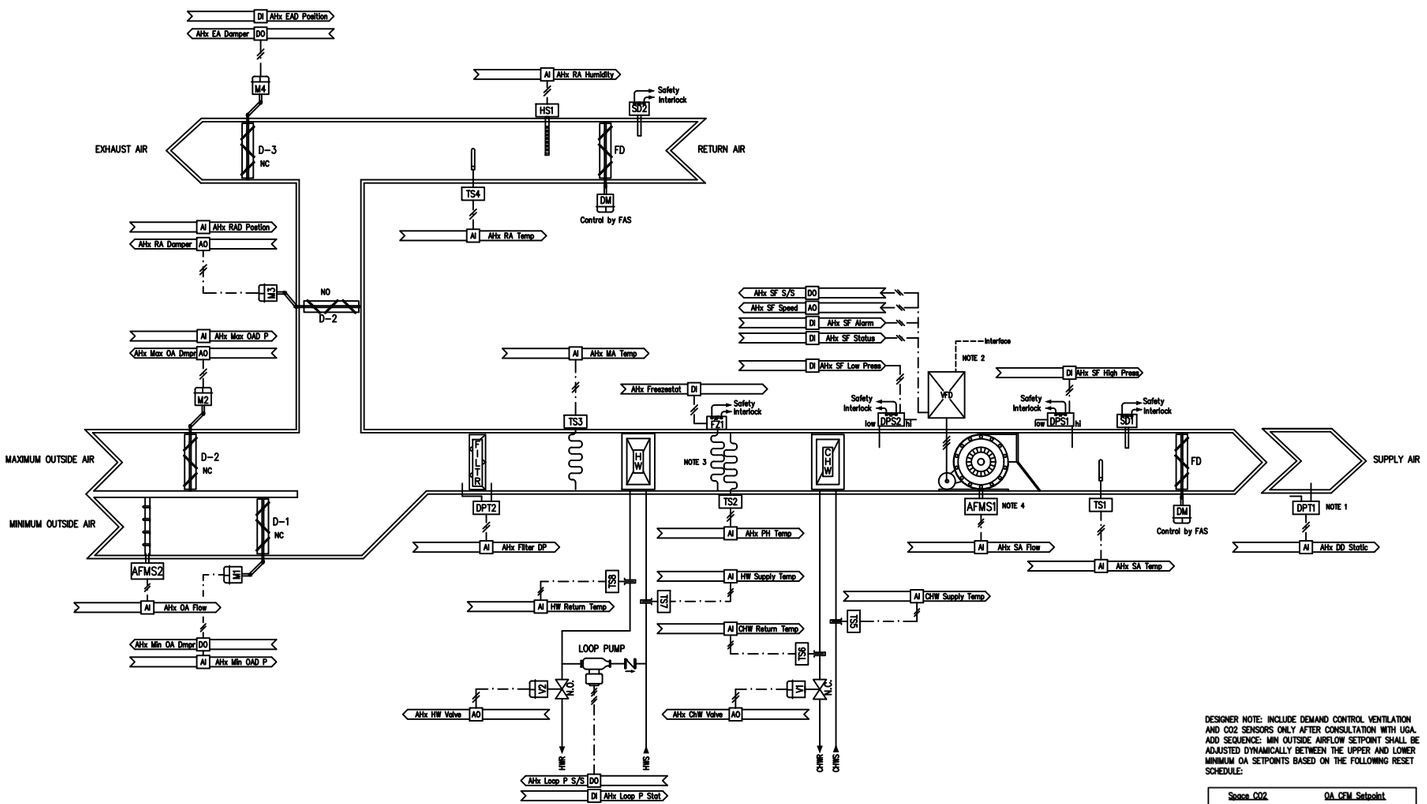
PIU 1-1	Office 103		202	300	68	72	77	100%	100%	100%	93	--	1		

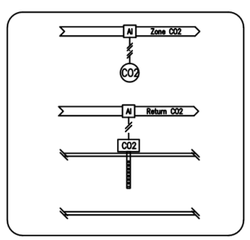


DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE, ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



SEQUENCE OF OPERATION

GENERAL:
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2. THE AIR HANDLER SHALL BE ENERGIZED AS REQUIRED TO SATISFY TERMINAL UNITS SERVED DURING OCCUPIED AND SET BACK PERIODS.
3. SUPPLY AIR TEMPERATURE SET POINT:
   a. THE SUPPLY AIR TEMPERATURE SET POINT SHALL BE RESET FROM 55°F TO 60°F TO MAINTAIN TERMINAL UNIT COOLING REQUESTS LESS THAN 15% OF TOTAL TUs (ALL VALUES ADJUSTABLE).
4. PROVIDE TRENDS AND DISPLAY ON GRAPHIC ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS. INCLUDE TAB VERIFIED FULL FLOW VALUE AT EACH AIR FLOW MONITORING STATION.
5. BAS SHALL MONITOR THE FOLLOWING POINTS AND INITIATE AN ALARM IF ANY IS NOT WITHIN OPERATING LIMITS:
   a. ALL HUMIDITY SENSORS
   b. ALL TEMPERATURE SENSORS
   c. ALL PRESSURE SWITCHES
   d. ALL AIR FLOW STATIONS
   e. ALL FREEZESTATS
   f. ALL FAN PROOFS
   g. ALL CONDENSATE WATER DETECTORS
   h. ALL VFD ALARM CONDITIONS
6. BAS SHALL PROVIDE A RELAY OUTPUT AND HOA SWITCH FOR EACH DIGITAL OUTPUT.

SAFETIES:
1. THE OUTSIDE AIR DAMPERS SHALL BE OVERRIDDEN CLOSED AS NECESSARY TO MAINTAIN A MINIMUM MIXED AIR TEMPERATURE OF 38°F (ADJ.).
2. REGARDLESS OF UNIT OPERATING MODE THE PREHEAT VALVE SHALL MODULATE TO MAINTAIN A MINIMUM 40°F (ADJ.) PREHEAT AIR TEMPERATURE.
3. THE PREHEAT LOOP PUMP SHALL ENERGIZE WHENEVER OUTSIDE AIR TEMPERATURE IS BELOW 38°F (ADJ.).
4. WHENEVER THE FREEZESTAT IS IN ALARM:
   a. UNIT FANS SHALL STOP
   b. HOT WATER AND CHILLED WATER VALVES SHALL OPEN
   c. LOOP PUMPS SHALL START
   d. OUTSIDE AIR, EXHAUST AIR AND RELIEF AIR DAMPERS SHALL CLOSE
   e. RETURN AIR DAMPERS SHALL OPEN
5. UPON ACTIVATION OF A HIGH OR LOW PRESSURE SAFETY SWITCH THE AIR HANDLER SHALL SHUTDOWN.

OCCUPIED MODE:
1. SUPPLY FAN SHALL BE COMMANDED TO START.
   a. SUPPLY FAN SPEED SHALL MODULATE TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE SET POINT.
      THE STATIC PRESSURE SET POINT SHALL BE RESET BETWEEN TAB DETERMINED LIMITS TO MAINTAIN THE MOST OPEN TERMINAL DAMPER AT 90% OPEN (ALL VALUES ADJUSTABLE).
2. DAMPERS:
   a. OCCUPIED:
      a.a. MINIMUM OUTSIDE AIR DAMPER SHALL BE COMMANDED OPEN.
      a.b. EXHAUST AIR DAMPER SHALL BE COMMANDED CLOSED.
      a.c. RETURN AIR DAMPER SHALL MODULATE TO MAINTAIN THE OUTSIDE AIR FLOW SET POINT.
      a.d. MAXIMUM OUTSIDE AIR DAMPER SHALL BE COMMANDED CLOSED.
   b. OCCUPIED ECONOMIZER (WHEN OUTSIDE AIR TEMPERATURE < 60°F ADJ.):
      b.a. MINIMUM OUTSIDE AIR DAMPER SHALL BE COMMANDED OPEN.
      b.b. EXHAUST AIR DAMPER SHALL BE COMMANDED OPEN.
      b.c. RETURN AIR DAMPER AND MAXIMUM OUTSIDE AIR DAMPER SHALL MODULATE TO MAINTAIN THE MIXED AIR TEMPERATURE SET POINT.
      THE MIXED AIR TEMPERATURE SET POINT SHALL BE EQUAL TO THE SUPPLY TEMPERATURE SET POINT MINUS 2°F (ADJ.).
3. PREHEAT COIL:
   a. THE PREHEAT VALVE SHALL MODULATE TO MAINTAIN THE SUPPLY AIR TEMPERATURE SET POINT MINUS 3°F (ADJ.).
4. CHILLED WATER COIL:
   a. THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN THE SUPPLY AIR TEMPERATURE SET POINT.
5. DEHUMIDIFICATION:
   a. WHENEVER RETURN AIR HUMIDITY EXCEEDS 60% (ADJ.) ECONOMIZER OPERATION SHALL BE DISABLED AND THE CHILLED WATER VALVE SHALL MODULATE TO BRING RETURN AIR HUMIDITY DOWN TO 55% (ADJ.).

UNOCCUPIED MODE:
1. SUPPLY FAN SHALL BE OFF.
2. OUTSIDE AIR DAMPERS SHALL BE CLOSED.
3. EXHAUST AIR DAMPER SHALL BE CLOSED.
4. RETURN AIR DAMPER SHALL BE OPEN.
5. CHILLED WATER VALVE SHALL BE CLOSED.
6. PREHEAT VALVE SHALL MODULATE TO MAINTAIN MINIMUM PREHEAT TEMPERATURE.

SETBACK MODE (AHU ENERGIZED DURING UNOCCUPIED PERIOD):
1. SUPPLY FAN SHALL ENERGIZE AS DESCRIBED IN OCCUPIED SEQUENCE.
2. OUTSIDE AIR DAMPERS SHALL BE CLOSED UNLESS ECONOMIZER IS AVAILABLE.
3. EXHAUST AIR DAMPER SHALL BE CLOSED UNLESS ECONOMIZER IS AVAILABLE.
4. RETURN AIR DAMPER SHALL BE OPEN UNLESS ECONOMIZER IS AVAILABLE.
5. CHILLED WATER VALVE SHALL MODULATE AS DESCRIBED IN OCCUPIED SEQUENCE.
6. PREHEAT VALVE SHALL MODULATE AS DESCRIBED IN OCCUPIED SEQUENCE.
7. DEHUMIDIFICATION SHALL OPERATE AS DESCRIBED IN OCCUPIED SEQUENCE.

NOTES

1. Locate down stream duct static pressure pitot tube approximately ⅔ down duct. See floor plans for designed location; show final installation location on as-builts.
2. Provide an ASHRAE 135 compliant (BACnet MS/TP or IP) communications interface to the control system for diagnostic point information.
3. Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezestat to cover the exact same area. One set of contacts wired directly to drive safety input.
4. For single fan installation the AFMS may be duct or inlet type, see plans for design. For multiple fan/fan wall installation there will be a single AFMS installed in common duct served by all fans. Coordinate with mechanical design to ensure adequate upstream and downstream straight lengths for duct AFMS.
5. Include AHU Performance Graphic screen with a Terminal Unit Summary Table to match example table provided on this sheet. AHU Performance Graphic shall also include trend plots of AHU SP Setpoint and actual AHU SP along with AHU Trim and Respond Adjustment Tuning variables.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.AHxxx.SFALRM	SF VFD Alarm	1				"SF-A"
bldg.AHxxx.SFST	SF Status	1				"SF-STAT"
bldg.AHxxx.SFSS	SF Start/Stop			1		"SF-SS"
bldg.AHxxx.SFSPD	SF Speed				1	"SF-SPD"
bldg.AHxxx.SAFLOW	SA Flow		1			AFMS1: "SA-F"
bldg.AHxxx.OAFLOW	OA Flow		1			AFMS2: "OA-F"
bldg.AHxxx.EAD	EA Damper			1		
bldg.AHxxx.EADP	EA Damper Position	1				M4: "EA-D"
bldg.AHxxx.RAD	RA Damper				1	M3: "RA-D"
bldg.AHxxx.OADMX	OA Max Damper				1	M2: "OA-D-MAX"
bldg.AHxxx.OADMN	OA Min Damper			1		M1: "OA-D-MIN"
bldg.AHxxx.OADMXP	OA Max Dmpr Pos.		1			
bldg.AHxxx.RAT	RA Temperature		1			TS4: "RAT"
bldg.AHxxx.RAH	RA Humidity		1			HS1: "RAH"
bldg.AHxxx.MAT	MA Temperature		1			TS3: "MAT"
bldg.AHxxx.SAT	SA Temperature		1			TS1: "SAT"
bldg.AHxxx.PHT	PH Temperature		1			TS2: "PHT"
bldg.AHxxx.DDSP	DD Static		1			DPT1: "DDSP"
bldg.AHxxx.FLTSP	Filter DP		1			DPT2: "FILT-DP"
bldg.AHxxx.FRZ	Freezestat	1				FZ1: "FRZ"
bldg.AHxxx.SHSP	SF High Press	1				DPS1: "SF-HSP"
bldg.AHxxx.SLSP	SF Low Press	1				DPS2: "SF-LSP"
bldg.AHxxx.LPSS	Loop Pump S/S			1		
bldg.AHxxx.LPST	Loop Pump Status	1				
bldg.AHxxx.HWV	HW Valve				1	V2: "HWV"
bldg.AHxxx.CHWV	CHW Valve				1	V1: "CHWV"
bldg.AHxxx.HWST	HW Supply Temp		1			TS7: "HWST"
bldg.AHxxx.HWRT	HW Return Temp		1			TS8: "HWRT"
bldg.AHxxx.CHWST	CHW Supply Temp		1			TS5: "CHWST"
bldg.AHxxx.CHWRT	CHW Return Temp		1			TS6: "CHWRT"
	TOTALS	7	15	4	5	

CONTROL SCHEMATIC

The University of Georgia
1785
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

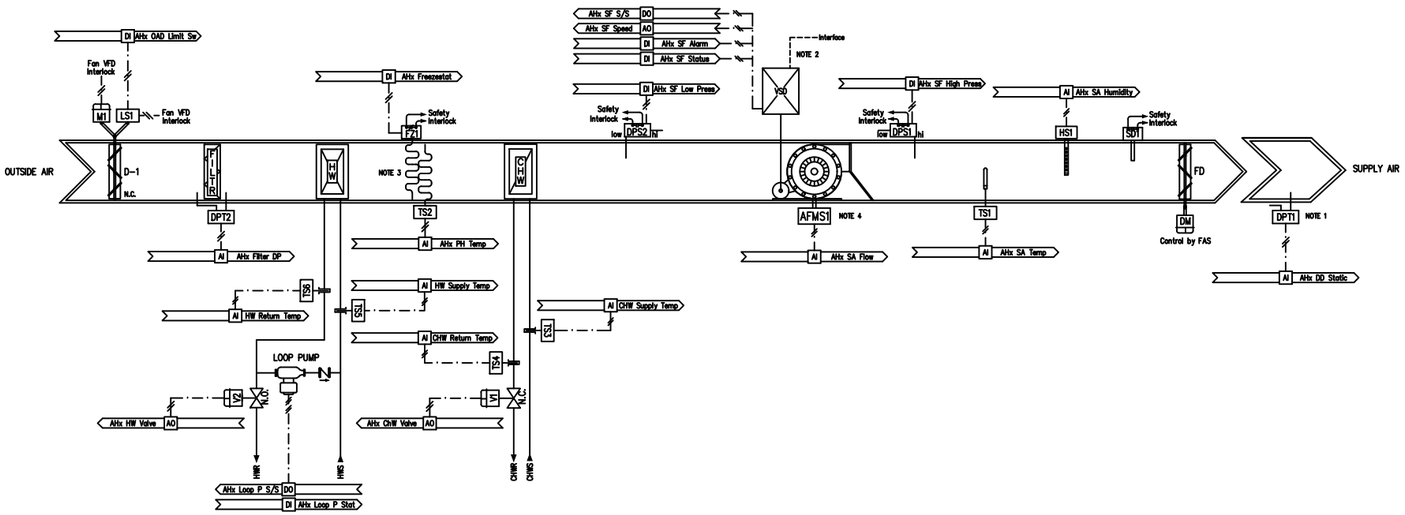
VAV AHU: PREHEAT, CHW, ECONOMIZER

10 OF 18
SHEET NUMBER

C-202
DWG NUMBER

Ahxxx TERMINAL UNIT SUMMARY

TU/PID ID	Area Served	Operating Mode	Airflow (CFM)	Airflow SP (CFM)	Zone Temp (F)	Heating SP (F)	Cooling SP (F)	Damper Pos (% Open)	HW Valve Pos (% Open)	Fan Speed (%)	DA Temp (F)	CO2 Level (PPM)	*Static Pressure Reset*		
													Airflow Requests	Cumulative Req Hrs (%-req-hrs)	Importance Multiplier
VAV 1-1	Office 101	Deadband	205	215	72	68	73	25%	0%	--	56.2	1000	0	2%	3
VAV 1-2	Classroom 102		1009	1000	76	70	75	70%	0%	--	56.2	--	0	6%	1
PIU 1-1	Office 103		202	300	68	72	77	100%	100%	100%	93	--	1		



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME AIR HANDLER SHALL BE FULLY CONTROLLED BY THE BAS. GENERAL CONTROL SEQUENCES INCLUDE:

1. SCHEDULED OCCUPANCY: BAS SHALL DETERMINE THE OCCUPANCY PERIODS BASED ON OPERATOR SCHEDULE.
   A) OCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH DURING ALL OCCUPIED PERIODS, OPTIMIZED START SHALL APPLY.
   B) UNOCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH AS REQUIRED TO MAINTAIN SET BACK SPACE TEMPERATURES. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED, EXCEPT WHERE ECONOMIZER OPERATION IS AVAILABLE.
2. SEQUENCED HEATING AND COOLING: BAS SHALL PROHIBIT THE HEATING AND COOLING VALVES AS WELL AS THE HEATING VALVE AND ECONOMIZER DAMPER TO BE OPEN SIMULTANEOUSLY. THIS DOES NOT APPLY TO COOLING AND REHEAT VALVES THAT ARE USED SIMULTANEOUSLY FOR DEHUMIDIFICATION.
3. FREEZE SAFETY: UPON OPERATION OF A FREEZESTAT THE FOLLOWING SEQUENCE SHALL OCCUR:
   A) THE UNIT FANS SHALL BE DEENERGIZED.
   B) ALL HOT WATER VALVES AND CHILLED WATER VALVES WILL BE COMMANDED TO 100% OPEN.
   C) ALL HOT WATER COIL PUMPS AND CHILLED WATER COIL PUMPS WILL BE COMMANDED TO RUN.
   D) OUTSIDE AIR DAMPERS SHALL FULLY CLOSE AND RETURN AIR DAMPERS SHALL FULLY OPEN.
   E) BAS SHALL ENUNCIATE APPROPRIATE ALARM.
4. HIGH OR LOW PRESSURE SAFETY: UPON ACTIVATION OF A HIGH OR LOW PRESSURE SAFETY SWITCH, AH SHALL BE DEENERGIZED, AND BAS SHALL ENUNCIATE AN ALARM.

SUPPLY FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE SUPPLY FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE SUPPLY FAN TO RUN CONTINUOUSLY AS REQUIRED BY SCHEDULE OR TERMINAL UNIT REQUEST. THE BAS COMMAND TO THE FAN VFD ENERGIZES THE DAMPER MOTOR. ONCE THE DAMPER END SWITCH IS PROVEN THE FAN IS ALLOWED TO START.
2. PROOF: BAS SHALL PROVE FAN OPERATION. UPON FAILURE OF THE SUPPLY FAN, BAS SHALL REPORT AN ALARM.
3. VFD CONTROL: WHENEVER THE FAN IS ENERGIZED, BAS SHALL CONTROL THE SPEED OF THE VFD TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE SETPOINT. ON START AND STOP, THE VFD SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM THE DRIVE AND REPORT WHEN ACTIVE.
4. SUPPLY DUCT PRESSURE SETPOINT: THE DOWN DUCT STATIC PRESSURE SETPOINT SHALL BE RESET BETWEEN THE LIMITS OF 1/2" TO 2" TO MAINTAIN THE MOST OPEN TERMINAL DAMPER AT 90% (WITH ALL VALVES ADJUSTABLE).

SPACE TEMPERATURE CONTROL: THE SPACE TEMPERATURES SHALL BE CONTROLLED VIA INDIVIDUAL VAV BOXES.

DISCHARGE TEMPERATURE CONTROL: THE DISCHARGE TEMPERATURE SETPOINT SHALL BE CALCULATED AND CONTROLLED AS FOLLOWS:

1. SETPOINT SHALL BE RESET FROM 55F TO 60F (BOTH ADJUSTABLE) TO MAINTAIN VAV BOX COOLING REQUESTS AT 15% OF TOTAL TUs (ADJ.)
2. WHEN THE UNIT IS ENERGIZED FOR SETBACK HEATING DURING THE UNOCCUPIED PERIOD, THE DISCHARGE TEMPERATURE SETPOINT SHALL BE 75F (ADJ.)
3. WHEN THE UNIT IS ENERGIZED FOR MORNING COOL-DOWN OR SETBACK COOLING, THE DISCHARGE SETPOINT SHALL BE THE WARMEST ZONE TEMPERATURE, MINUS 15F.

PREHEATING SECTION: CONTROL SHALL BE AS FOLLOWS:
WHENEVER THE AH IS ENERGIZED, THE HOT WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT MINUS 3F (ADJ.).
REGARDLESS OF AH OPERATING MODE THE HOT WATER VALVE SHALL MODULATE TO MAINTAIN A LOW LIMIT OF 40F PREHEAT AIR TEMPERATURE.

COOLING SECTION: CONTROL SHALL BE AS FOLLOWS:
WHENEVER THE AH IS ENERGIZED, THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.
WHENEVER THE RETURN AIR HUMIDITY EXCEEDS 55% (ADJ.) DURING NORMAL OPERATION THE CHILLED WATER VALVE SHALL BE OVERRIDDEN OPEN.

LOOP PUMP CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE LOOP PUMP AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE OPERATION OF THE LOOP PUMP AND IT SHALL RUN CONTINUOUSLY WHENEVER THE OUTSIDE AIR TEMPERATURE IS BELOW 38F (ADJ.).
2. PROOF: BAS SHALL PROVE PUMP OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME.

FILTER ALARM: WHEN THE FILTER DIFFERENTIAL PRESSURE SENSOR READING EXCEEDS THE DESIGN SPECIFIED PRESSURE DROP AN ALARM SHALL BE GENERATED AT THE BAS.

GRAPHICS AND TRENDS: PROVIDE TRENDS AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

NOTES

1. Locate down stream duct static pressure pitot tube approximately ⅔ down duct. See floor plans for designed location; show final installation location on as-builts.
2. Provide an ASHRAE 135 compliant (BACnet MS/TP or IP) communications interface to the control system for diagnostic point information.
3. Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezestat to cover the exact same area. One set of contacts wired directly to drive safety input.
4. For single fan installation the AFMS may be duct or inlet type, see plans for design. For multiple fan/fan wall installation there will be a single AFMS installed in common duct served by all fans. Coordinate with mechanical design to ensure adequate upstream and downstream straight lengths for duct AFMS.
5. Include AHU Performance Graphic screen with a Terminal Unit Summary Table to match example table provided on this sheet. AHU Performance Graphic shall also include trend plots of AHU SP Setpoint and actual AHU SP along with AHU Trim and Respond Adjustment Tuning variables.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.AHxxx.SFALRM	AHx SF VFD Alarm	1				"SF-A"
bldg.AHxxx.SFST	AHx SF Status	1				"SF-STAT"
bldg.AHxxx.SFSS	AHx SF Start/Stop			1		"SF-SS"
bldg.AHxxx.SFSPD	AHx SF Speed				1	"SF-SPD"
bldg.AHxxx.SAFLOW	SA Flow		1			AFMS1:"SA-F"
bldg.AHxxx.OADL	AHx OAD Limit Sw	1				LS1:"OAD-LS"
bldg.AHxxx.SAH	AHx SA Humidity		1			HS1:"SAH"
bldg.AHxxx.SAT	AHx SA Temperature		1			TS1:"SAT"
bldg.AHxxx.PHT	AHx PH Temperature		1			TS2:"PHT"
bldg.AHxxx.DDSP	AHx DD Static		1			DPT1:"DDSP"
bldg.AHxxx.FRZ	AHx Freezestat	1				FZ1:"FRZ"
bldg.AHxxx.SHSP	AHx SF High Press	1				DPS1:"SF-HSP"
bldg.AHxxx.SLSP	AHx SF Low Press	1				DPS2:"SF-LSP"
bldg.AHxxx.LPSS	Loop Pump S/S			1		
bldg.AHxxx.LPST	Loop Pump Status	1				
bldg.AHxxx.HWV	AHx HW Valve				1	V2:"HWV"
bldg.AHxxx.CHWV	AHx CHW Valve				1	V1:"CHWV"
bldg.AHxxx.CHWST	CHW Supply Temp		1			TS3:"CHWST"
bldg.AHxxx.CHWRT	CHW Return Temp		1			TS4:"CHWRT"
bldg.AHxxx.HWST	HW Supply Temp		1			TS5:"HWST"
bldg.AHxxx.HWRT	HW Return Temp		1			TS6:"HWRT"
bldg.AHxxx.FLTSP	Filter DP		1			DPT2:"FILT-DP"
	TOTALS	7	10	2	3	

The University of Georgia
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

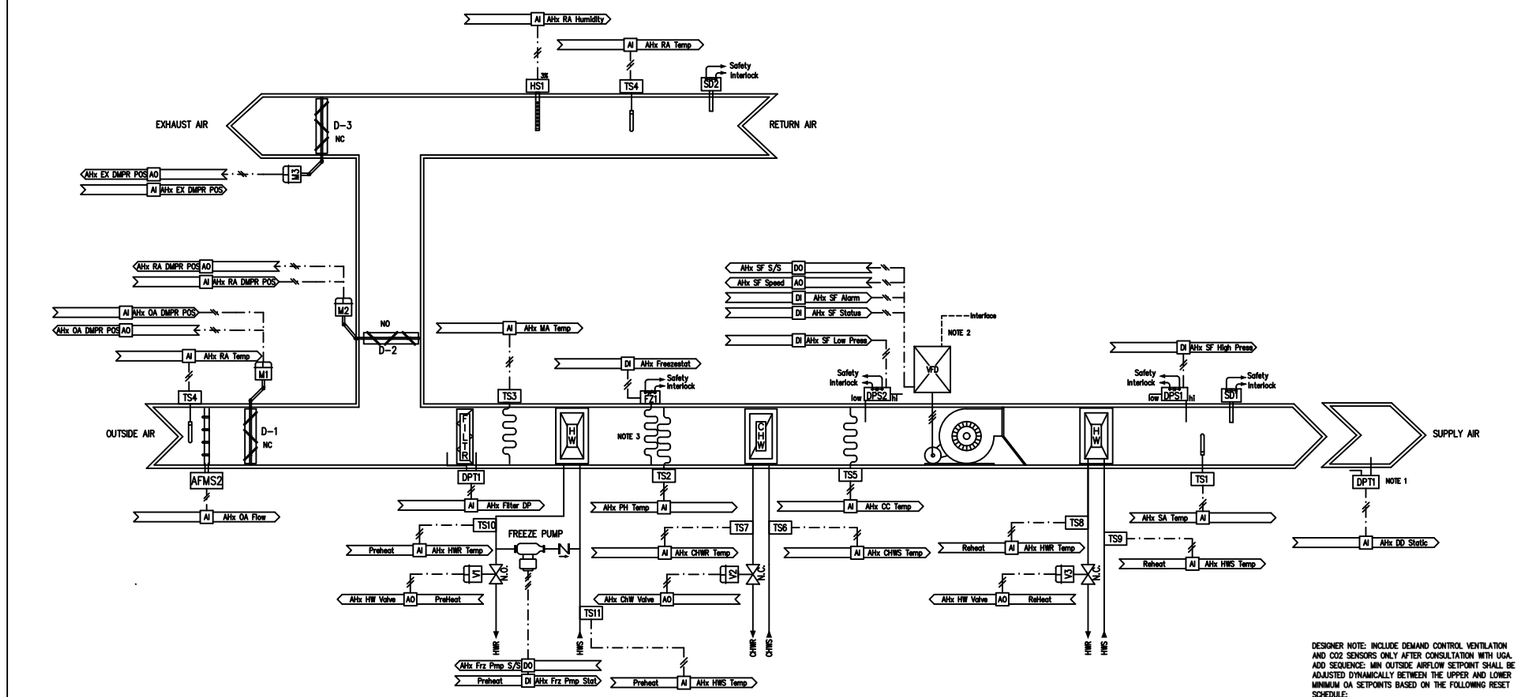
VAV AHU: 100% OA, PREHEAT, CHW

11 OF 18
SHEET NUMBER

C-203
DWG NUMBER

Ahxxx TERMINAL UNIT SUMMARY

TU/PID ID	Area Served	Operating Mode	Airflow (CFM)	Airflow SP (CFM)	Zone Temp (F)	Heating SP (F)	Cooling SP (F)	Damper Pos (% Open)	HW Valve Pos (% Open)	Fan Speed (%)	DA Temp (F)	CO2 Level (PPM)	*Static Pressure Reset*		
													Airflow Requests	Cumulative Req Hrs (%-req-hrs)	Importance Multiplier
VAV 1-1	Office 101	Deadband	205	215	72	68	73	25%	0%	--	56.2	1000	0	2%	3
VAV 1-2	Classroom 102		1009	1000	76	70	75	70%	0%	--	56.2	--	0	6%	1
PIU 1-1	Office 103		202	300	68	72	77	100%	100%	100%	93	--	1		



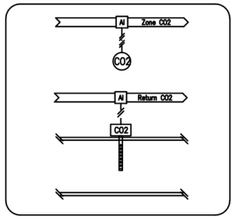
CONTROL SCHEMATIC

DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE, ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.



SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME AIR HANDLER SHALL BE FULLY CONTROLLED BY THE BAS. GENERAL CONTROL SEQUENCES INCLUDE:

1. SCHEDULED OCCUPANCY: BAS SHALL DETERMINE THE OCCUPANCY PERIODS BASED ON OPERATOR SCHEDULE.
   A) OCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH DURING ALL OCCUPIED PERIODS, OPTIMIZED START SHALL APPLY.
   B) UNOCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH AS REQUIRED TO MAINTAIN SET BACK SPACE TEMPERATURES. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED, EXCEPT WHERE ECONOMIZER OPERATION IS AVAILABLE.
2. AIRSIDE ECONOMIZER: BAS SHALL MODULATE THE MIXING DAMPERS TO PROVIDE 'FREE' COOLING WHEN CONDITIONS ALLOW. THE FREE COOLING SHALL BE STAGED BEFORE ANY MECHANICAL COOLING. DAMPERS WILL BE MODULATED TO MAINTAIN MIXED AIR TEMPERATURE SETPOINT. THE FOLLOWING STRATEGY SHALL BE USED TO ENABLE THE ECONOMIZER MODE:
   A) DRY BULB SWITCH: ECONOMIZER MODE SHALL BE ACTIVE WHILE THE UNIT IS ENERGIZED AND WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW THE SUPPLY AIR TEMPERATURE SET POINT MINUS 2F (ADJ.). ECONOMIZER MODE SHALL BE INACTIVE WHEN OUTSIDE AIR TEMPERATURE RISES ABOVE THE SUPPLY AIR TEMPERATURE SET POINT.
3. SEQUENCED HEATING AND COOLING: BAS SHALL PROHIBIT THE HEATING AND COOLING VALVES AS WELL AS THE HEATING VALVE AND ECONOMIZER DAMPER TO BE OPEN SIMULTANEOUSLY. THIS DOES NOT APPLY TO COOLING AND REHEAT VALVES THAT ARE USED SIMULTANEOUSLY FOR DEHUMIDIFICATION.
4. MIXED AIR LOW LIMIT OVERRIDE: BAS SHALL OVERRIDE THE SIGNAL TO THE OUTSIDE AIR DAMPER TO MAINTAIN A MINIMUM MIXED AIR TEMPERATURE OF 35ºF (ADJ.).
5. FREEZE SAFETY: UPON OPERATION OF A FREEZESTAT THE FOLLOWING SEQUENCE SHALL OCCUR:
   A) THE UNIT FANS SHALL BE DEENERGIZED.
   B) ALL HOT WATER VALVES AND CHILLED WATER VALVES WILL BE COMMANDED TO 100% OPEN.
   C) ALL HOT WATER COIL PUMPS WILL BE COMMANDED TO RUN.
   D) OUTSIDE AIR AND EXHAUST AIR DAMPERS SHALL FULLY CLOSE AND RETURN AIR DAMPERS SHALL FULLY OPEN.
   E) BAS SHALL ENUNCIATE APPROPRIATE ALARM.
6. HIGH OR LOW PRESSURE SAFETY: UPON ACTIVATION OF A HIGH OR LOW PRESSURE SAFETY SWITCH, AH SHALL BE DEENERGIZED, AND BAS SHALL ENUNCIATE AN ALARM.

SUPPLY FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE SUPPLY FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE SUPPLY FAN TO RUN CONTINUOUSLY AS REQUIRED BY SCHEDULE OR TERMINAL UNIT REQUEST.
2. PROOF: BAS SHALL PROVE FAN OPERATION. UPON FAILURE OF THE SUPPLY FAN, BAS SHALL REPORT AN ALARM.
3. VFD CONTROL: WHENEVER THE FAN IS ENERGIZED, BAS SHALL CONTROL THE SPEED OF THE VFD TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE SETPOINT. ON START AND STOP, THE VFD SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM THE DRIVE AND REPORT WHEN ACTIVE.
4. SUPPLY DUCT PRESSURE SETPOINT: THE DOWN DUCT STATIC PRESSURE SETPOINT SHALL BE RESET BETWEEN THE LIMITS OF 1/2" TO 2" TO MAINTAIN THE MOST OPEN TERMINAL DAMPER AT 90% (WITH ALL VALVES ADJUSTABLE).

DAMPER CONTROL: BAS SHALL CONTROL THE DAMPERS AS FOLLOWS:

1. AIR HANDLER OFF: WHEN AH IS COMMANDED OFF, ALL DAMPERS SHALL REMAIN IN THEIR OFF POSITIONS. WHEN AH IS ENERGIZED DURING THE UNOCCUPIED PERIOD THE OA DAMPER SHALL REMAIN CLOSED UNLESS ECONOMIZER MODE IS AVAILABLE.
2. AIR HANDLER ON OCCUPIED: WHEN AH IS COMMANDED ON IN OCCUPIED MODE THE OUTSIDE AIR, RETURN AIR, AND EXHAUST AIR DAMPERS SHALL MODULATE TO MAINTAIN THE MINIMUM OUTSIDE AIR FLOW SET POINT.
3. AIR HANDLER ON UNOCCUPIED: WHEN AH IS COMMANDED ON IN UNOCCUPIED MODE THE OUTSIDE AIR DAMPER SHALL REMAIN FULLY CLOSED, EXHAUST DAMPER FULLY CLOSED AND RETURN DAMPER FULLY OPEN UNLESS ECONOMIZER MODE IS AVAILABLE.
4. ECONOMIZER: WHEN ECONOMIZER MODE IS AVAILABLE THE BAS SHALL MODULATE THE OUTSIDE AIR, RETURN AIR, AND EXHAUST AIR DAMPERS TO MAINTAIN THE MIXED AIR TEMPERATURE SET POINT. THE MIXED AIR TEMPERATURE SETPOINT SHALL BE EQUAL TO THE DISCHARGE AIR TEMPERATURE SETPOINT MINUS 3F (ADJ.).

SPACE TEMPERATURE CONTROL: THE SPACE TEMPERATURES SHALL BE CONTROLLED VIA INDIVIDUAL VAV BOXES.

DISCHARGE TEMPERATURE CONTROL: THE DISCHARGE TEMPERATURE SETPOINT SHALL BE CALCULATED AND CONTROLLED AS FOLLOWS:

1. SETPOINT SHALL BE RESET FROM 55F TO 60F (BOTH ADJUSTABLE) TO MAINTAIN VAV BOX COOLING REQUESTS AT 4 (ADJ.)
2. WHEN THE UNIT IS ENERGIZED FOR SETBACK HEATING DURING THE UNOCCUPIED PERIOD, THE DISCHARGE TEMPERATURE SETPOINT SHALL BE 75F (ADJ.)

PREHEATING VALVE: CONTROL SHALL BE FOR HEATING AS FOLLOWS:
WHENEVER THE AH IS ENERGIZED, THE HOT WATER PRE-HEAT VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT MINUS 3F (ADJ.).
REGARDLESS OF AH OPERATING MODE THE HOT WATER VALVE SHALL MODULATE TO MAINTAIN A LOW LIMIT OF 40F PREHEAT AIR TEMPERATURE.

COOLING SECTION: CONTROL SHALL BE FOR COOLING AND DEHUMIDIFICATION AS FOLLOWS:
WHENEVER THE AH IS ENERGIZED, THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.
WHENEVER THE RETURN AIR HUMIDITY EXCEEDS 55% (ADJ.) DURING NORMAL OPERATION THE CHILLED WATER VALVE SHALL BE OVERRIDDEN OPEN.

REHEATING SECTION: CONTROL SHALL BE FOR DEHUMIDIFICATION AS FOLLOWS:
WHENEVER THE AH IS ENERGIZED AND RETURN AIR HUMIDITY IS ABOVE SET POINT (SEE COOLING SECTION), THE HOT WATER RE-HEAT VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT (ADJ.).

FREEZE PUMP CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE FREEZE PUMP AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE OPERATION OF THE FREEZE PUMP AND IT SHALL RUN CONTINUOUSLY WHENEVER THE OUTSIDE AIR TEMPERATURE IS BELOW 38ºF (ADJ.).
2. PROOF: BAS SHALL PROVE PUMP OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME.

FILTER ALARM: WHEN THE FILTER DIFFERENTIAL PRESSURE SENSOR READING EXCEEDS THE DESIGN SPECIFIED PRESSURE DROP AN ALARM SHALL BE GENERATED AT THE BAS.

GRAPHICS AND TRENDS: PROVIDE TRENDS WITH HISTORIAN BACKUP AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

NOTES

1. Locate down stream duct static pressure pitot tube approximately ⅔ down duct. See floor plans for designed location; show final installation location on as-builts.
2. Provide communications interface to the control system for diagnostic point information.
3. Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezestat to cover the exact same area. One set of contacts wired directly to drive safety input.
4. For single fan installation the AFMS may be duct or inlet type, see plans for design. For multiple fan/fan wall installation there will be a single AFMS installed in common duct served by all fans. Coordinate with mechanical design to ensure adequate upstream and downstream straight lengths for duct AFMS.
5. Include AHU Performance Graphic screen with a Terminal Unit Summary Table to match example table provided on this sheet. AHU Performance Graphic shall also include trend plots of AHU SP Setpoint and actual AHU SP along with AHU Trim and Respond Adjustment Tuning variables.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.AHxxx.RAT	AHx RA Temperature		1			
bldg.AHxxx.RAH	AHx RA Humidity		1			
bldg.AHxxx.SFALRM	AHx SF VFD Alarm	1				
bldg.AHxxx.SFST	AHx SF Status	1				
bldg.AHxxx.SFSS	AHx SF Start/Stop			1		
bldg.AHxxx.SFSPD	AHx SF Speed				1	
bldg.AHxxx.OAFLOW	AHx OA Flow		1			
bldg.AHxxx.OARAD	AHx Mixing Dmprs				1	
bldg.AHxxx.MAT	AHx MA Temperature		1			
bldg.AHxxx.SAT	AHx SA Temperature		1			
bldg.AHxxx.PHT	AHx PH Temperature		1			
bldg.AHxxx.DDSP	AHx DD Static		1			
bldg.AHxxx.FRZ	AHx Freezestat	1				
bldg.AHxxx.SHSP	AHx SF High Press	1				
bldg.AHxxx.SLSP	AHx SF Low Press	1				
bldg.AHUxx.FPSS	AHUx Freeze Pmp			1		
bldg.AHUxx.CFPST	AHUx CHW FP Stat	1				
bldg.AHUxx.HFPST	AHUx HW FP Status	1				
bldg.AHxxx.PHWV	AHx PreHeat Valve				1	
bldg.AHxxx.CHWV	AHx ChW Valve				1	
bldg.AHxxx.RHWV	AHx ReHeat Valve				1	
bldg.AHxxx.EXDP	AHx EX Dmpr Pos.				1	
bldg.AHxxx.EXDP	AHx EX Dmpr Pos.		1			
bldg.AHxxx.RADP	AHx RA Dmpr Pos.				1	
bldg.AHxxx.RADP	AHx RA Dmpr Pos.		1			
bldg.AHxxx.OADP	AHx OA Dmpr Pos.		1			
bldg.AHxxx.OADP	AHx OA Dmpr Pos.				1	
bldg.AHxxx.FDP	AHx Filter DP		1			
bldg.AHxxx.HWRT	AHx HWR Temp.		1			
bldg.AHxxx.HWV	AHx HW Valve				1	
bldg.AHxxx.CHWRT	AHx CHWR Temp.		1			
bldg.AHxxx.HWST	AHx HWS Temp.		1			
bldg.AHxxx.CCT	AHx CC Temp.		1			
bldg.AHxxx.CHWST	AHx CHWS Temp.		1			
bldg.AHxxx.HWRT	AHx HWR Temp.		1			
bldg.AHxxx.HWV	AHx HW Valve				1	
	TOTALS	7	17	2	10	

The University of Georgia
1785
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

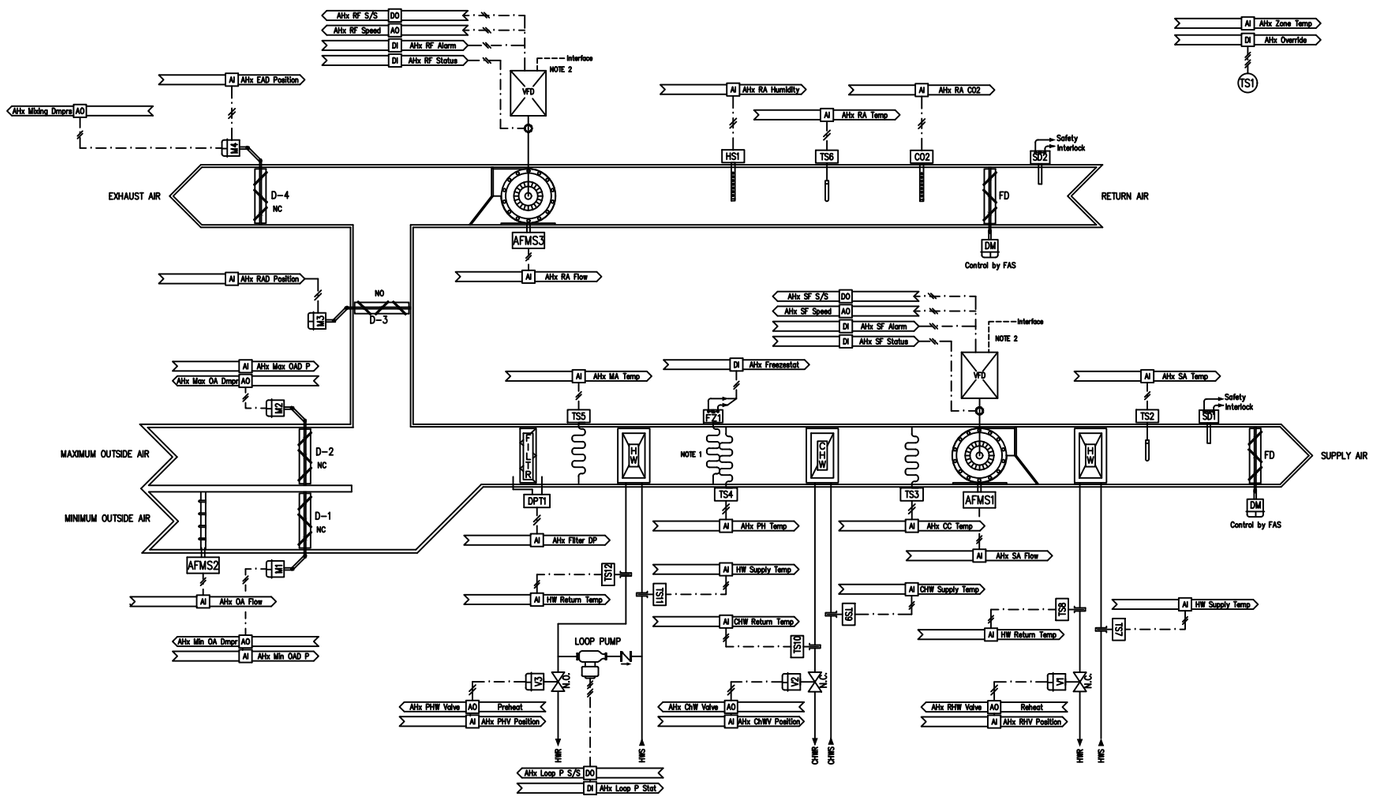
Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

VAV AHU: PREHEAT, CHW, REHEAT, ECONOMIZER

12 OF 18
SHEET NUMBER

C-204
DWG NUMBER



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL: THE CONSTANT AIR VOLUME AIR HANDLER SHALL BE FULLY CONTROLLED BY THE BAS. GENERAL CONTROL SEQUENCES INCLUDE:

1. SCHEDULED OCCUPANCY: BAS SHALL DETERMINE THE OCCUPANCY PERIODS BASED ON OPERATOR SCHEDULE.
   A) OCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH DURING ALL OCCUPIED PERIODS, OPTIMIZED START SHALL APPLY.
   B) UNOCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH AS REQUIRED TO MAINTAIN SET BACK SPACE TEMPERATURES. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED, EXCEPT WHERE ECONOMIZER OPERATION IS AVAILABLE.
2. AIRSIDE ECONOMIZER: BAS SHALL MODULATE THE MIXING DAMPERS TO PROVIDE FREE COOLING WHEN CONDITIONS ALLOW. THE FREE COOLING SHALL BE STAGED BEFORE ANY MECHANICAL COOLING. DAMPERS WILL BE MODULATED TO MAINTAIN MIXED AIR TEMPERATURE SETPOINT. THE FOLLOWING STRATEGY SHALL BE USED TO ENABLE THE ECONOMIZER MODE:
   A) DRY BULB SWITCH: ECONOMIZER MODE SHALL BE ACTIVE WHILE THE UNIT IS ENERGIZED AND WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW 60°F (ADJ.). ECONOMIZER MODE SHALL BE INACTIVE WHEN OUTSIDE AIR TEMPERATURE RISES 3°F (ADJ.) ABOVE THE ENABLE SET POINT.
3. SEQUENCED HEATING AND COOLING: BAS SHALL PROHIBIT THE HEATING AND COOLING VALVES AS WELL AS THE HEATING VALVE AND ECONOMIZER DAMPER TO BE OPEN SIMULTANEOUSLY. THIS DOES NOT APPLY TO COOLING AND REHEAT VALVES THAT ARE USED SIMULTANEOUSLY FOR DEHUMIDIFICATION.
4. MIXED AIR LOW LIMIT OVERRIDE: BAS SHALL OVERRIDE THE SIGNAL TO THE OUTSIDE AIR DAMPER TO MAINTAIN A MINIMUM MIXED AIR TEMPERATURE OF 38°F (ADJ.).
5. FREEZE SAFETY: UPON OPERATION OF A FREEZESTAT THE FOLLOWING SEQUENCE SHALL OCCUR:
   A) THE UNIT FANS SHALL BE DEENERGIZED.
   B) ALL HOT WATER VALVES AND CHILLED WATER VALVES WILL BE COMMANDED TO 100% OPEN.
   C) ALL HOT WATER COIL PUMPS AND CHILLED WATER COIL PUMPS WILL BE COMMANDED TO RUN.
   D) OUTSIDE AIR DAMPERS SHALL FULLY CLOSE AND RETURN AIR DAMPERS SHALL FULLY OPEN.
   E) BAS SHALL ENUNCIATE APPROPRIATE ALARM.

SUPPLY FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE SUPPLY FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE SUPPLY FAN TO RUN CONTINUOUSLY AS REQUIRED BY SCHEDULE.
2. PROOF: BAS SHALL PROVE FAN OPERATION THROUGH THE VFD INTERFACE. UPON FAILURE OF THE SUPPLY FAN, BAS SHALL REPORT AN ALARM.
3. VFD CONTROL: WHENEVER THE FAN IS ENERGIZED, BAS SHALL MODULATE THE SPEED OF THE VFD TO A FIXED VALUE DETERMINED BY THIS TO MEET SCHEDULED FLOW AND FAN PERFORMANCE SCHEDULES. ON START AND STOP, THE VFD SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM THE DRIVE AND REPORT WHEN ACTIVE.

RETURN FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE RETURN FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE RETURN FAN TO RUN CONTINUOUSLY WHENEVER THE SUPPLY FAN IS RUNNING.
2. PROOF: BAS SHALL PROVE FAN OPERATION. UPON FAILURE OF THE RETURN FAN, BAS SHALL REPORT AN ALARM.
3. VFD CONTROL: WHENEVER THE FAN IS ENERGIZED, BAS SHALL MODULATE THE SPEED OF THE VFD TO A FIXED VALUE DETERMINED BY THIS TO MEET SCHEDULED FLOW AND FAN PERFORMANCE SCHEDULES. ON START AND STOP, THE VFD SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM THE DRIVE AND REPORT WHEN ACTIVE.

DAMPER CONTROL: BAS SHALL CONTROL THE DAMPERS AS FOLLOWS:

1. AIR HANDLER OFF: WHEN AH IS COMMANDED OFF, ALL DAMPERS SHALL REMAIN IN THEIR OFF POSITIONS. (OA DAMPERS CLOSED, EXHAUST DAMPER CLOSED, RETURN DAMPER OPEN)
2. AIR HANDLER ON OCCUPIED: WHEN AH IS COMMANDED ON IN OCCUPIED MODE THE MINIMUM OUTSIDE AIR DAMPER WILL BE COMMANDED OPEN. THE RETURN DAMPERS SHALL MODULATE TO MAINTAIN THE MINIMUM OUTSIDE AIR FLOW SET POINT. (MAX OUTSIDE AIR DAMPERS CLOSED, EXHAUST AIR DAMPER IS CLOSED, AND RETURN AIR DAMPERS MODULATING).
3. AIR HANDLER ON UNOCCUPIED: WHEN AH IS COMMANDED ON IN UNOCCUPIED MODE THE OUTSIDE AIR DAMPERS SHALL REMAIN FULLY CLOSED, EXHAUST DAMPER FULLY CLOSED AND RETURN DAMPER FULLY OPEN UNLESS ECONOMIZER MODE IS AVAILABLE.
4. ECONOMIZER: WHEN ECONOMIZER MODE IS AVAILABLE THE BAS SHALL MODULATE THE MAXIMUM OUTSIDE AIR DAMPER TO MAINTAIN THE MIXED AIR TEMPERATURE SET POINT. THE MIXED AIR TEMPERATURE SETPOINT SHALL BE EQUAL TO THE DISCHARGE AIR TEMPERATURE SETPOINT MINUS 3°F (ADJ.). THE EXHAUST AIR DAMPER AND RETURN AIR DAMPERS SHALL MODULATE PROPORTIONALLY WITH THE MAX OUTSIDE AIR DAMPER DURING ECONOMIZER MODE.
5. DESIGNER NOTE: INCLUDE DEMAND CONTROL VENTILATION AND CO2 SENSORS ONLY AFTER CONSULTATION WITH UGA. ADD SEQUENCE: MIN OUTSIDE AIRFLOW SETPOINT SHALL BE ADJUSTED DYNAMICALLY BETWEEN THE UPPER AND LOWER MINIMUM OA SETPOINTS BASED ON THE FOLLOWING RESET SCHEDULE:

Space CO2	OA CFM Setpoint
600 ppm (adj)	Lower Min OA CFM (Area based OA CFM)
1100 ppm (adj)	Upper Min OA CFM (Design Min OA CFM)

AN ALARM SHALL BE GENERATED IF SPACE CO2 EXCEEDS 1500 PPM.

DCV SEQUENCE SHALL NOT INCREASE OA CFM SETPOINT GREATER THAN MIN VENTILATION REQUIRED BY CODE. ITS PURPOSE IS TO REDUCE VENTILATION BELOW CODE MINIMUM FOR PERIODS OF PARTIAL OCCUPANCY AND SHALL NOT REDUCE OA CFM TO DRIVE THE BUILDING NEGATIVE.

SPACE TEMPERATURE CONTROL: THE BAS SHALL MAINTAIN THE SPACE TEMPERATURE SET POINTS BY RESETTING THE DISCHARGE AIR TEMERATURE. THE NORMAL COOLING SETPOINT SHALL BE 78°F (ADJ.) AND NORMAL HEATING SETPOINT SHALL BE 70°F (ADJ.). THE SETBACK COOLING SETPOINT SHALL BE 80°F (ADJ.) AND SETBACK HEATING SETPOINT SHALL BE 55°F (ADJ.).

DISCHARGE TEMPERATURE SETPOINT: THE DISCHARGE TEMPERATURE SETPOINT SHALL BE RESET AS FOLLOWS:

1. AS THE SPACE TEMPERATURE FALLS BELOW THE SPACE HEATING SETPOINT A PID LOOP WILL CALCULATE THE HEATING DEMAND FROM 0-100%. AS THE HEATING DEMAND RISES FROM 0 TO 100% THE DISCHARGE AIR TEMPERATURE SETPOINT SHALL RISE FROM 75°F TO 100°F (WITH ALL VALUES ADJUSTABLE).
2. AS THE SPACE TEMPERATURE RISES ABOVE THE SPACE COOLING SETPOINT A PID LOOP WILL CALCULATE THE COOLING DEMAND FROM 0-100%. AS THE COOLING DEMAND RISES FROM 0 TO 100% THE DISCHARGE AIR TEMPERATURE SETPOINT SHALL FALL FROM 70°F TO 50°F (WITH ALL VALUES ADJUSTABLE).
3. WHEN THE SPACE TEMPERATURE IS BETWEEN THE ACTIVE HEATING AND COOLING SET POINTS THE HEATING AND COOLING DEMAND WILL BOTH BE 0.

PREHEATING VALVE: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED, THE HOT WATER PREHEAT VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT MINUS 3F (ADJ.).
2. REGARDLESS OF AH OPERATING MODE THE HOT WATER PREHEAT VALVE SHALL MODULATE TO MAINTAIN A LOW LIMIT OF 40F PREHEAT AIR TEMPERATURE.

COOLING SECTION: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED, THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.
2. WHENEVER THE RETURN AIR HUMIDITY EXCEEDS 55% (ADJ.) DURING UNIT OPERATION THE CHILLED WATER VALVE SHALL BE OVERRIDDEN OPEN FOR DEHUMIDIFICATION.

REHEATING SECTION: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED IN DEHUMIDIFICATION MODE, THE HOT WATER REHEAT VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.
2. WHEN THE AH IS DEENERGIZED OR NOT OPERATING IN DEHUMIDIFICATION MODE THE REHEAT VALVE SHALL BE CLOSED.

LOOP PUMP CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE LOOP PUMP AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE OPERATION OF THE LOOP PUMP AND IT SHALL RUN CONTINUOUSLY WHENEVER THE OUTSIDE AIR TEMPERATURE IS BELOW 38°F (ADJ.).
2. PROOF: BAS SHALL PROVE PUMP OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME.

FILTER ALARM: WHEN THE FILTER DIFFERENTIAL PRESSURE SENSOR READING EXCEEDS THE DESIGN SPECIFIED PRESSURE DROP AN ALARM SHALL BE GENERATED AT THE BAS.

GRAPHICS AND TRENDS: PROVIDE TRENDS AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS. INCLUDE TAB VERIFIED FULL FLOW VALUE AT EACH AFMS.

NOTES

1. Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezestat to cover the exact same area. One set of contacts wired directly to drive safety input.
2. Provide an ASHRAE 135 compliant (BACnet MS/TP or IP) communications interface to the control system for diagnostic point information. Include the following information for fan VFDs: operating frequency (Hz), RPM, percent fan speed, BAS signal to VFD, VFD output voltage, actual brake horsepower, and kW. On the VFD graphic screen also include the motor nameplate brake horsepower.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.AHxxx.RAT	RA Temperature		1			TS6:"RAT"
bldg.AHxxx.RAH	RA Humidity		1			HS1:"RAH"
bldg.AHxxx.RACO2	RA CO2		1			CO2:"CO2"
bldg.AHxxx.RFALRM	RF VFD Alarm	1				"RF-A"
bldg.AHxxx.RFST	RF Status	1				"RF-STAT"
bldg.AHxxx.RFSS	RF Start/Stop			1		"RF-SS"
bldg.AHxxx.RFSPD	RF Speed				1	"RF-SPD"
bldg.AHxxx.SFALRM	SF VFD Alarm	1				"SF-A"
bldg.AHxxx.SFST	SF Status	1				"SF-STAT"
bldg.AHxxx.SFSS	SF Start/Stop			1		"SF-SS"
bldg.AHxxx.SFSPD	SF Speed				1	"SF-SPD"
bldg.AHxxx.MINOAD	Min OA Damper				1	M1:"OA-D-MIN"
bldg.AHxxx.OADMNP	OAD Min Position		1			M1:"OA-D-MIN-POS"
bldg.AHxxx.MAXOAD	Max OA Damper				1	M2:"OA-D-MAX"
bldg.AHxxx.OADMXP	OAD Max Position		1			M2:"OA-D-MAX-POS"
bldg.AHxxx.MIXD	Mixing Dmprs				1	M3:"MIX-D"
bldg.AHxxx.EADP	EA Damper Position		1			M4:"EA-D-POS"
bldg.AHxxx.RADP	RA Damper Position		1			M3:"RA-D-POS"
bldg.AHxxx.SAT	SA Temperature		1			TS2:"SAT"
bldg.AHxxx.CCT	CC Temperature		1			TS3:"CCT"
bldg.AHxxx.MAT	MA Temperature		1			TS4:"MAT"
bldg.AHxxx.PHT	PH Temperature		1			TS5:"PHT"
bldg.AHxxx.FRZ	Freezestat	1				FZ1:"FRZ"
bldg.AHxxx.LPSS	Loop Pump S/S			1		
bldg.AHxxx.LPST	Loop Pump Status	1				
bldg.AHxxx.PHWV	PHW Valve				1	V3:"PHWV"
bldg.AHxxx.PHWVP	PHW Valve Position		1			V3:"PHWV-POS"
bldg.AHxxx.CHWV	ChW Valve				1	V2:"CHWV"
bldg.AHxxx.CHWVP	ChW Valve Position		1			V2:"CHWV-POS"
bldg.AHxxx.RHWV	RHW Valve				1	V1: "RHWV"
bldg.AHxxx.RHWVP	RHW Valve Position		1			V1:"RHWV-POS"
bldg.AHxxx.HWST	HW Supply Temp		1			TS7:"HWST"
bldg.AHxxx.HWRT	HW Return Temp		1			TS8:"HWRT"
bldg.AHxxx.CHWST	CHW Supply Temp		1			TS9:"CHWST"
bldg.AHxxx.CHWRT	CHW Return Temp		1			TS8:"CHWRT"
bldg.AHxxx.ZONET	Zone Temp		1			TS1:"ZONET"
bldg.AHxxx.OCCOVRD	Occ Override	1				TS1:"OVRD"
bldg.AHxxx.SAFLOW	SA Flow		1			AFMS1:"SA-F"
bldg.AHxxx.OAFLOW	OA Flow		1			AFMS2:"OA-F"
bldg.AHxxx.RAFLOW	RA Flow		1			AFMS3:"RA-F"
bldg.AHxxx.FLTSP	Filter DP		1			DPT1:"FILT-DP"
	TOTALS	7	23	3	8	

The University of Georgia
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA
STANDARD CONTROL DRAWINGS

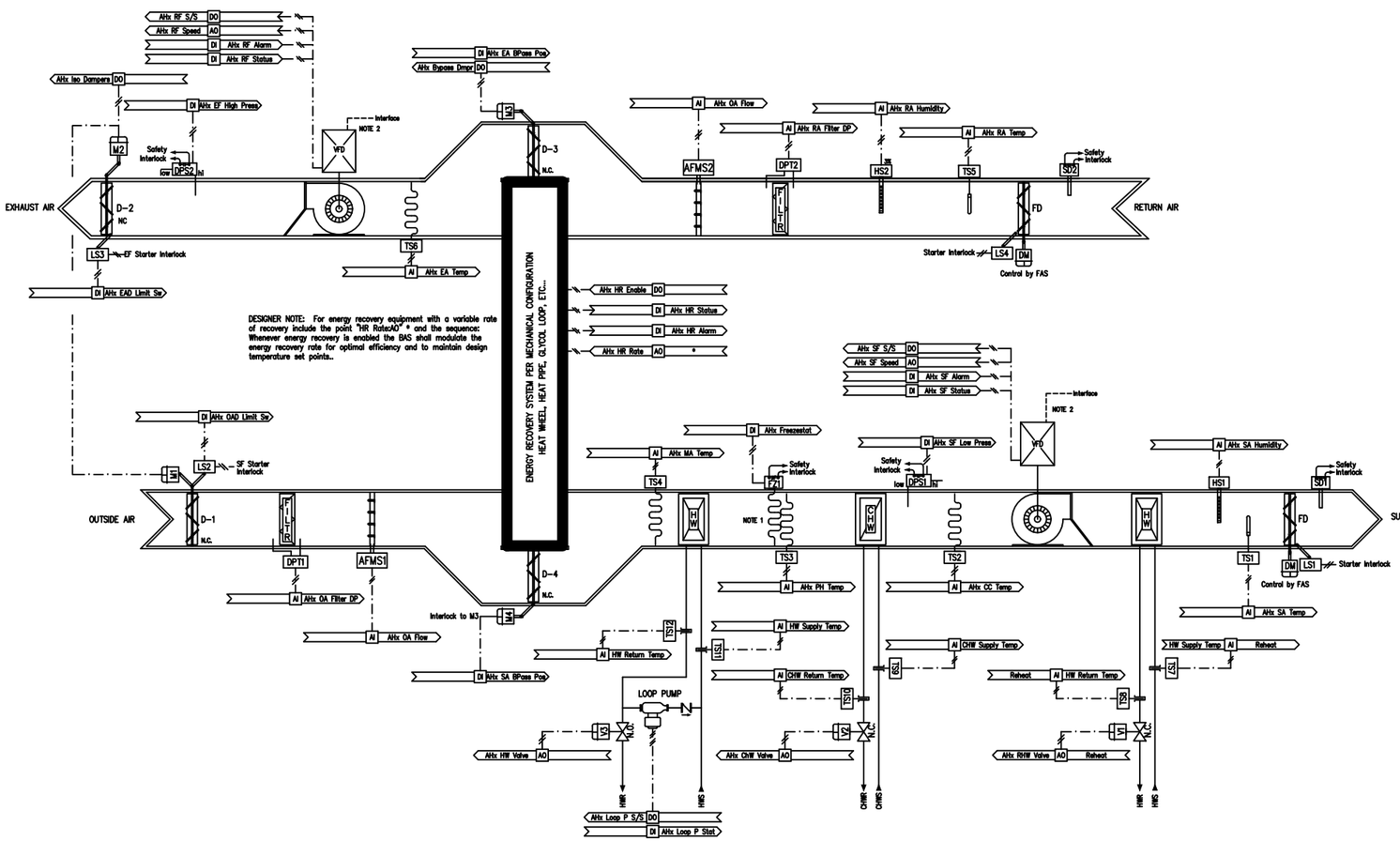
Eng	TRA
Drawn	RMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

CV AHU: PREHEAT, CHW, REHEAT, RETURN FAN, MIN OA, CO2, ECONOMIZER

13 OF 18
SHEET NUMBER

C-301
DWG NUMBER



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL: THE CONSTANT AIR VOLUME AIR HANDLER SHALL BE FULLY CONTROLLED BY THE BAS. GENERAL CONTROL SEQUENCES INCLUDE:

1. SCHEDULED OCCUPANCY: BAS SHALL DETERMINE THE OCCUPANCY PERIODS BASED ON OPERATOR SCHEDULE.
   - A) OCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH DURING ALL OCCUPIED PERIODS, OPTIMIZED START SHALL APPLY.
   - B) UNOCCUPIED PERIOD: BAS SHALL ENERGIZE THE AH AS REQUIRED TO MAINTAIN SET BACK SPACE TEMPERATURES. THE OUTSIDE AIR DAMPER SHALL REMAIN CLOSED, EXCEPT WHERE ECONOMIZER OPERATION IS AVAILABLE.
2. AIRSIDE ECONOMIZER: BAS SHALL MODULATE THE MIXING DAMPERS TO PROVIDE FREE COOLING WHEN CONDITIONS ALLOW. THE FREE COOLING SHALL BE STAGED BEFORE ANY MECHANICAL COOLING. DAMPERS WILL BE MODULATED TO MAINTAIN MIXED AIR TEMPERATURE SETPOINT. THE FOLLOWING STRATEGY SHALL BE USED TO ENABLE THE ECONOMIZER MODE:
   - A) DRY BULB SWITCH: ECONOMIZER MODE SHALL BE ACTIVE WHILE THE UNIT IS ENERGIZED AND WHEN OUTSIDE AIR TEMPERATURE FALLS WITHIN 3°F (ADJ.) OF THE SUPPLY AIR TEMPERATURE SET POINT. ECONOMIZER MODE SHALL BE INACTIVE WHEN OUTSIDE AIR TEMPERATURE IS OUTSIDE OF THIS RANGE.
3. SEQUENCED HEATING AND COOLING: BAS SHALL PROHIBIT THE HEATING AND COOLING VALVES AS WELL AS THE HEATING VALVE AND ECONOMIZER DAMPER TO BE OPEN SIMULTANEOUSLY. THIS DOES NOT APPLY TO COOLING AND REHEAT VALVES THAT ARE USED SIMULTANEOUSLY FOR DEHUMIDIFICATION.
4. FREEZE SAFETY: UPON OPERATION OF A FREEZESTAT THE FOLLOWING SEQUENCE SHALL OCCUR:
   - A) THE UNIT FANS SHALL BE DEENERGIZED.
   - B) ALL HOT WATER VALVES AND CHILLED WATER VALVES WILL BE COMMANDED TO 100% OPEN.
   - C) ALL HOT WATER COIL PUMPS AND CHILLED WATER COIL PUMPS WILL BE COMMANDED TO RUN.
   - D) OUTSIDE AIR DAMPERS SHALL FULLY CLOSE AND RETURN AIR DAMPERS SHALL FULLY OPEN.
   - E) BAS SHALL ENUNCIATE APPROPRIATE ALARMS.
4. HIGH OR LOW PRESSURE SAFETY: UPON ACTIVATION OF A HIGH OR LOW PRESSURE SAFETY SWITCH, AH SHALL BE DEENERGIZED, AND BAS SHALL ENUNCIATE AN ALARM.

SUPPLY FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE SUPPLY FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE SUPPLY FAN TO RUN CONTINUOUSLY AS REQUIRED BY OPERATOR SCHEDULE. ONCE THE OUTSIDE AIR ISOLATION DAMPER END SWITCH IS PROVEN THE FAN IS ALLOWED TO START.
2. PROOF: BAS SHALL PROVE FAN OPERATION. UPON FAILURE OF THE SUPPLY FAN, BAS SHALL REPORT AN ALARM.
3. VFD CONTROL: WHENEVER THE FAN IS ENERGIZED, BAS SHALL MODULATE THE SPEED OF THE VFD TO A FIXED VALUE DETERMINED BY TAB TO MEET SCHEDULED FLOW AND FAN PERFORMANCE SCHEDULES. ON START AND STOP, THE VFD SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM THE DRIVE AND REPORT WHEN ACTIVE.

EXHAUST FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE EXHAUST FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE EXHAUST FAN TO RUN CONTINUOUSLY WHENEVER THE SUPPLY FAN IS RUNNING. ONCE THE EXHAUST AIR ISOLATION DAMPER END SWITCH IS PROVEN THE FAN IS ALLOWED TO START.
2. PROOF: BAS SHALL PROVE FAN OPERATION. UPON FAILURE OF THE EXHAUST FAN, BAS SHALL REPORT AN ALARM.
3. VFD CONTROL: WHENEVER THE FAN IS ENERGIZED, BAS SHALL MODULATE THE SPEED OF THE VFD TO A FIXED VALUE DETERMINED BY TAB TO MEET SCHEDULED FLOW AND FAN PERFORMANCE SCHEDULES. ON START AND STOP, THE VFD SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM THE DRIVE AND REPORT WHEN ACTIVE.

ISOLATION DAMPER CONTROL: WHENEVER THE AH IS COMMANDED TO RUN AND THERE ARE NO ACTIVE SAFETY ALARMS BOTH ISOLATION DAMPERS (EXHAUST AND OUTSIDE AIR) SHALL BE COMMANDED TO OPEN. A LIMIT SWITCH FOR EACH DAMPER SHALL INDICATE WHEN THE DAMPER IS FULLY OPEN AND ALLOW THE ASSOCIATED FAN TO ENERGIZE.

DISCHARGE TEMPERATURE CONTROL: THE DISCHARGE TEMPERATURE SET POINT SHALL BE FIXED AT 72F.

ENERGY RECOVERY: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED AND ECONOMIZER IS NOT AVAILABLE THE ENERGY RECOVERY SYSTEM SHALL BE ENABLED. THE BAS WILL MONITOR THE ENERGY RECOVERY SYSTEM OPERATING STATUS AND ALARM. WHENEVER THE AH IS ENERGIZED AND ECONOMIZER OPERATION IS AVAILABLE THE ENERGY RECOVERY SYSTEM SHALL REMAIN OFF AND THE BYPASS DAMPERS SHALL BE COMMANDED OPEN.

PREHEATING SECTION: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED, THE HOT WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT MINUS 3F (ADJ.).
2. REGARDLESS OF AH OPERATING MODE THE HOT WATER VALVE SHALL MODULATE TO MAINTAIN A LOW LIMIT OF 40F PREHEAT AIR TEMPERATURE.

REHEATING SECTION: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED IN DEHUMIDIFICATION MODE, THE HOT WATER REHEAT VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.
2. WHEN THE AH IS DEENERGIZED OR NOT OPERATING IN DEHUMIDIFICATION MODE THE REHEAT VALVE SHALL BE CLOSED.

COOLING SECTION: CONTROL SHALL BE AS FOLLOWS:

1. WHENEVER THE AH IS ENERGIZED, THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT.
2. WHENEVER THE RETURN AIR HUMIDITY EXCEEDS 55% (ADJ.) DURING UNIT OPERATION THE CHILLED WATER VALVE SHALL BE OVERRIDDEN OPEN FOR DEHUMIDIFICATION.

LOOP PUMP CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE LOOP PUMP AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE OPERATION OF THE LOOP PUMP AND IT SHALL RUN CONTINUOUSLY WHENEVER THE OUTSIDE AIR TEMPERATURE IS BELOW 38°F (ADJ.).
2. PROOF: BAS SHALL PROVE PUMP OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME.

FILTER ALARM: WHEN THE FILTER DIFFERENTIAL PRESSURE SENSOR READING EXCEEDS THE DESIGN SPECIFIED PRESSURE DROP AN ALARM SHALL BE GENERATED AT THE BAS.

GRAPHICS AND TRENDS: PROVIDE TRENDS AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS. INCLUDE TAB VERIFIED FULL FLOW VALUE AT EACH AFMS.

NOTES

1. Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezestat to cover the exact same area. One set of contacts wired directly to drive safety input.
2. Provide an ASHRAE 135 compliant (BACnet MS/TP or IP) communications interface to the control system for diagnostic point information.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.AHxxx.EFALRM	EF VFD Alarm	1				"EF-A"
bldg.AHxxx.EFST	EF Status	1				"EF-STAT"
bldg.AHxxx.EFSS	EF Start/Stop			1		"EF-SS"
bldg.AHxxx.EFSPD	EF Speed				1	"EF-SPD"
bldg.AHxxx.SFALRM	SF VFD Alarm	1				"SF-A"
bldg.AHxxx.SFST	SF Status	1				"SF-STAT"
bldg.AHxxx.SFSS	SF Start/Stop			1		"SF-SS"
bldg.AHxxx.SFSPD	SF Speed				1	"SF-SPD"
bldg.AHxxx.EHSP	AHx EF High Press	1				DPS2:"EF-HSP"
bldg.AHxxx.SLSP	AHx SF Low Press	1				DPS1:"SF-LSP"
bldg.AHxxx.ISOD	AHx Iso Dampers			1		Mc:"ISO-D"
bldg.AHxxx.SAT	AHx SA Temp		1			TS1:"SAT"
bldg.AHxxx.CCT	AHx CC Temp		1			TS2:"CCT"
bldg.AHxxx.PHT	AHx PH Temp		1			TS3:"PHT"
bldg.AHxxx.MAT	AHx MA Temp		1			TS4:"MAT"
bldg.AHxxx.RAT	AHx RA Temperature		1			TS5:"RAT"
bldg.AHxxx.EAT	AHx EA Temp		1			TS6:"EAT"
bldg.AHxxx.SRH	AHx SA Humidity		1			HS1:"SAH"
bldg.AHxxx.RRH	AHx RA Humidity		1			HS2:"RAH"
bldg.AHxxx.FRZ	AHx Freezestat	1				FZ1:"FRZ"
bldg.AHxxx.PHWV	PHW Valve				1	V3:"PHWV"
bldg.AHxxx.CHWV	ChW Valve				1	V2:"CHWV"
bldg.AHxxx.RHWV	RHW Valve				1	V1:"RHWV"
bldg.AHxxx.BYPDMPR	AHx Bypass Damper			1		Mc:"BYP-D"
bldg.AHxxx.HRS	AHx HR Status	1				Heat Wheel Units
bldg.AHxxx.HRSS	AHx HR Enable			1		Heat Wheel Units
bldg.AHxxx.HRA	AHx HR Alarm	1				Heat Wheel Units
bldg.AHxxx.LPSS	Loop Pump S/S			1		
bldg.AHxxx.LPST	Loop Pump Status	1				
bldg.AHxxx.RHWST	RHW Supply Temp		1			TS7:"RHWST"
bldg.AHxxx.RHWRT	RHW Return Temp		1			TS8:"RHWRT"
bldg.AHxxx.CHWST	CHW Supply Temp		1			TS9:"CHWST"
bldg.AHxxx.CHWRT	CHW Return Temp		1			TS10:"CHWRT"
bldg.AHxxx.PHWST	PHW Supply Temp		1			TS11:"PHWST"
bldg.AHxxx.PHWRT	PHW Return Temp		1			TS12:"PHWRT"
bldg.AHxxx.OAFLTSP	OA Filter DP		1			DPT1:"OAFILT-DP"
bldg.AHxxx.RAFLTSP	RA Filter DP		1			DPT2:"RAFILT-DP"
bldg.AHxxx.OAFMS	OA Flow Station		1			AFMS1:"OAFMS"
bldg.AHxxx.RAFMS	RA Flow Station		1			AFMS2:"RAFMS"
bldg.AHxxx.HRRATE	HR Rate				1	HR:"RATE"
bldg.AHxxx.RFSS	RF Start/Stop			1		
bldg.AHxxx.RFS	RF Speed				1	
bldg.AHxxx.RFA	RF Alarm	1				
bldg.AHxxx.RFST	RF Status	1				
bldg.AHxxx.EBDS	AHx EA BPass Pos	1				
bldg.AHxxx.SBDS	AHx SA BPass Pos	1				
bldg.AHxxx.ELS	EAD Limit Sw	1				
bldg.AHxxx.OLS	OAD Limit Sw	1				
bldg.AHxxx.HWV	HW Valve				1	
bldg.AHxxx.HWRT	HW Return Temp		1			
bldg.AHxxx.HWST	HW Supply Temp.		1			
	TOTALS	16	20	7	8	

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STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
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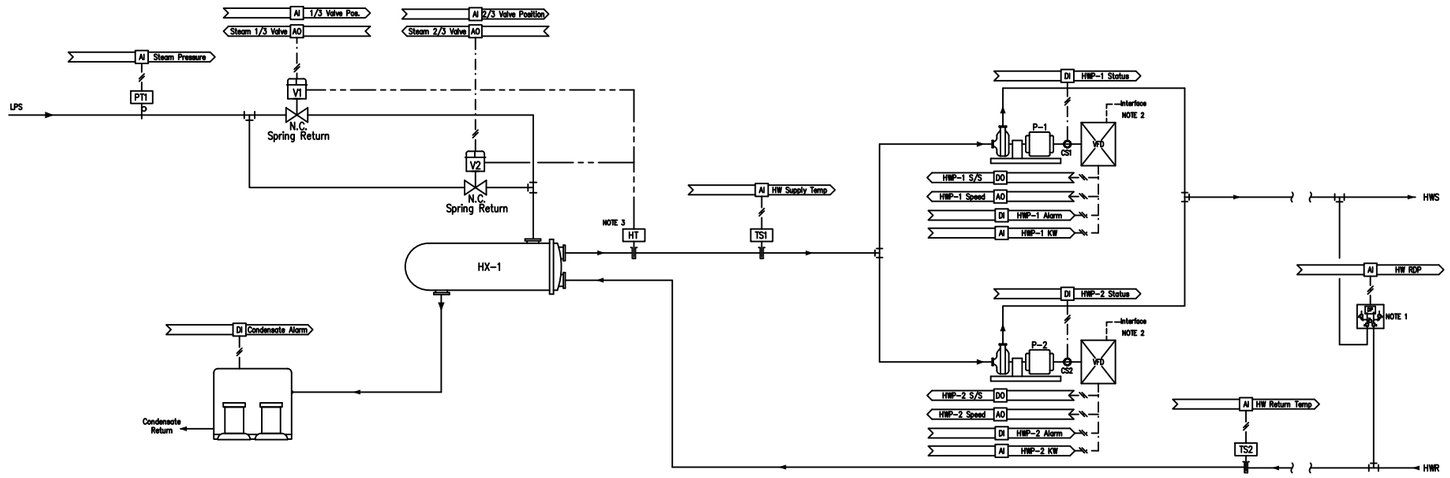
UGA STANDARDS UPDATE SPRING 2020

CV AHU: 100% OA, ENERGY RECOVERY, PREHEAT, CHW

14 OF 18
SHEET NUMBER

C-302
DWG NUMBER



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

General: BAS shall fully control the hot water converter system and equipment and provide monitoring and diagnostic information for management purposes.

Heating Enable: Heating shall be enabled whenever:
1. Any hot water valve served opens more than 50% (adj.) for 10 min. (adj.) continuously.
2. OR, the operator at the operator interface enables the system via a graphic icon.
3. OR, outside air temperature is less than 55F (adj.) with a 5F cycle differential.

Once enabled, heating shall remain enabled for at least one hour.

HW Pumps (P-1 & P-2): BAS shall control the pumps as follows:
1. Whenever the system is enabled, a minimum of one heating water pump shall run continuously.
2. BAS shall use a PID loop to maintain the differential pressure setpoint across the remote differential pressure sensor. The differential pressure setpoint shall initially be set at 15 psi (adj. as determined by the balance contractor).
3. The output of this loop shall control the starting, stopping, and speed of the pumps as follows:
   a) On a PID output of greater than 95% for 5 min (adj.), the BAS shall start an additional pump. The new pump shall ramp to speed per adjustable acceleration rates.
   b) If more than one pump is running, on a PID output of less than 50% for 5 min (adj.), the BAS shall stop a pump.
4. The output of the PID loop shall control the VSD's of all operating pumps at the same speed.
5. BAS shall prove operation of each pump individually. Upon failure of a pump, the standby shall be started (lead pump command is not removed) and an alarm shall be enunciated.
6. BAS shall monitor pump status and accumulate runtime of the pumps. The BAS shall rotate the lead and lag pumps as follows:
   a) Whenever a pump is started, the BAS shall start the pump with the least runtime.
   b) Whenever a pump is stopped, the BAS shall stop the pump with the highest runtime.
   c) If the lead pump has not changed after 7 (adj.) days BAS shall force a lead pump change.

HW Temperature Control: BAS shall reset the hot water supply temperature setpoint linearly from 180F (adj.) to 130F (adj.) as the OA temperature rises from 20F (adj.) to 60F (adj.)
1. The BAS shall modulate the 1/3 and 2/3 steam valves to the Heat Exchanger in sequence via a PID loop to maintain the HW supply temperature set point.
   1.1. As the PID capacity output rises from 0% to 50%, the 1/3 steam valve shall open from 0% to 100% (all values adjustable).
   1.2. As the PID capacity output rises from 45% to 100% the 2/3 steam valve shall open from 0% to 100% (all values adjustable).
2. The valves shall remain closed under the following conditions:
   2.1. Pump status is not proven.
   2.2. Loss of power to steam valve actuators.
   2.3. Loss of command signal to valve actuators.

Steam Pressure: Steam supply pressure to the heat exchanger shall be monitored by the BAS and enunciate an alarm if it falls below 5 psi (adj.)

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.HX.DP	Remote Diff Press		1				
bldg.HX.HWST	HWS Temp		1				
bldg.HX.HWRT	HWR Temp		1				
bldg.HX.PxALRM	P-x VFD Alarm	2					
bldg.HX.PxSTAT	P-x Status	2					
bldg.HX.PxSS	P-x Start/Stop			2			
bldg.HX.PxC	P-x Control				2		
bldg.HX.V13	1/3 Steam Valve				1		
bldg.HX.V23	2/3 Steam Valve				1		
bldg.HX.STMP	Steam Pressure		1				
bldg.COND.ALA	Condensate Alarm	1					
bldg.HX.V13P	1/3 Valve Pos		1				
bldg.HX.V23	2/3 Valve Pos		1				
bldg.HX.HWP1ST	HWP-1 Status	1					
bldg.HX.HWP1SS	HWP-1 Start/Stop			1			
bldg.HX.HWP1S	HWP-1 Speed				1		
bldg.HX.HWP1A	HWP-1 Alarm	1					
bldg.HX.HWP1KW	HWP-1 K/W		1				
bldg.HX.HWP2KW	HWP-2 K/W		1				
bldg.HX.HWP2ST	HWP-2 Status	1					
bldg.HX.HWP2SS	HWP-2 Start/Stop			1			
bldg.HX.HWP2S	HWP-2 Speed				1		
bldg.HX.HWP2A	HWP-2 Alarm	1					
	Heat Requests					•	
	OA Temp					•	
	TOTALS	9	8	4	6	2	

NOTES

1. Locate remote differential pressure sensor at most remote HW coil, as directed. Install transmitter and bypass assembly no higher than 6 feet AFF.
2. Provide communications interface to the control system for diagnostic point information.
3. Provide high temperature (200F, adj.) safety switch wired directly to steam valve actuators. Switch will override valves closed and auto-reset once temperature falls below 170F (adj.).

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STANDARD CONTROL DRAWINGS

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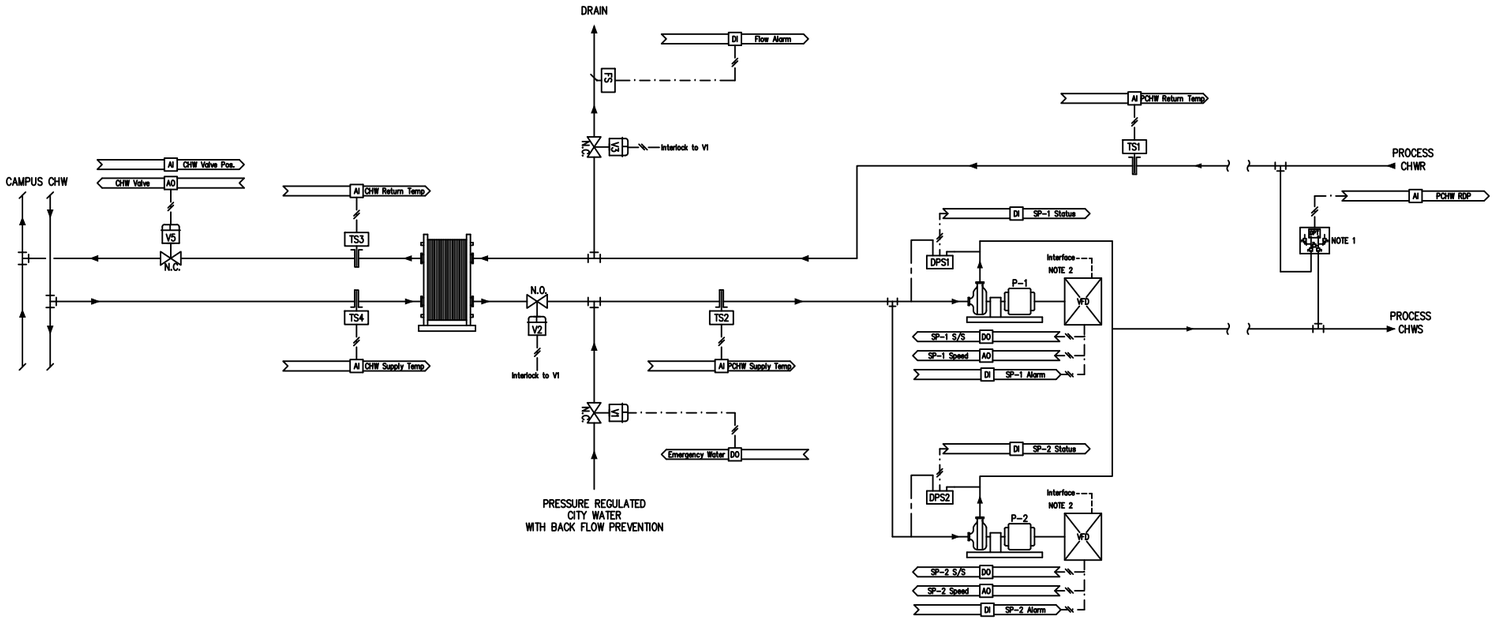
UGA STANDARDS UPDATE SPRING 2020

Steam to HW Converter (VV Pumps)

15 OF 18
SHEET NUMBER

C-401
DWG NUMBER



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

General: BAS shall fully control the secondary chilled water system and equipment and provide monitoring and diagnostic information for management purposes.

Cooling Enable: Cooling shall be enabled by the operator at the operator interface via a graphic icon.

Secondary CHW Pumps: BAS shall control the pumps as follows:

1. START/STOP: BAS shall command the operation of the lead pump and it shall run continuously whenever cooling is enabled. The pump with the least runtime shall be selected as lead. If the current lead pump has been in operation for more than 160 hours continuously (adj.) lead shall change to the lag pump.
2. PROOF: BAS shall prove pump operation and use the status indication to accumulate runtime. Upon failure of the lead pump, BAS shall energize the lag pump and enunciate a level 1 alarm.
3. VFD CONTROL: Whenever cooling is enabled, BAS shall control the output of the active pump VFDs to maintain the CHW remote differential pressure (RDP) setpoint (determined by TAB; initially 10 PSID). If the lead pump is unable to maintain the RDP set point the lag pump shall be started and ramped to match the lead pump speed. If the lead and lag pumps are both operating and the commanded speed is less than 40% (adj.) of the individual pump capacity the lag pump shall be ramped down to minimum speed and stopped.
4. On start and stop, the VFD shall ramp to speed and slow down within adjustable acceleration and deceleration limits.

Chilled Water Valve: BAS shall modulate the primary chilled water valve via PID loop to maintain the secondary chilled water temperature set point. Whenever secondary pump flow is not proven the primary chilled water valve shall be closed.

Water Flow Alarm:
BAS shall monitor the secondary chilled water system and enunciate an alarm whenever flow is proven through the emergency water drain.

Emergency Water Mode (Critical Process Only): BAS shall enunciate an alarm AND enable City Water whenever the following is true:

1. Process chilled water system has been enabled for at least 15 minutes (adj.) AND
2. Secondary pump status has been proven for at least 5 minutes (adj.) AND
3. Secondary chilled water supply temperature exceeds set point plus 7F (adj.) for 10 minutes (adj.) continuously.

Operators shall be able to manually enable emergency water through the OWS with proper password authorization. When emergency water mode is active the secondary chilled water isolation valve shall be closed and domestic water isolation valves shall be opened to provide cooling. Emergency water mode must be manually reset by the Operator.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.PROCCHW.PCHWDPT	Remote Diff Press		1				
bldg.PROCCHWSYS.PCHWST	Proc CHWS Temp		1				
bldg.PROCCHWSYS.PCHWRT	Proc CHWR Temp		1				
bldg.PROCCHW.SP1ALRM	SP-1 VFD Alarm	1					
bldg.PROCCHW.SP1STAT	SP-1 Status	1					
bldg.PROCCHW.SP1SS	SP-1 Start/Stop			1			
bldg.PROCCHW.SP1SPD	SP-1 Speed				1		
bldg.PROCCHW.SP2ALRM	SP-2 VFD Alarm	1					
bldg.PROCCHW.SP2STAT	SP-2 Status	1					
bldg.PROCCHW.SP2SS	SP-2 Start/Stop			1			
bldg.PROCCHW.SP2SPD	SP-2 Speed				1		
bldg.PROCCHW.CHWST	Pri CHWS Temp		1				
bldg.PROCCHW.CHWRT	Pri CHWR Temp		1				
bldg.PROCCHW.EWATER	Emergency Water			1			
bldg.PROCCHW.FI.OWA	Flow Alarm	1					
bldg.PROCCHW.CHWV	ChW Valve				1		
bldg.PROCCHW.CHWV	ChW Valve Pos.		1				
	Cooling Request					•	
	TOTALS	5	6	3	3	1	

NOTES

1. Locate remote differential pressure sensor at most remote CHW coil, as directed. Install transmitter and bypass assembly no higher than 6 feet AFF.
2. Provide communications interface to the control system for diagnostic point information.
3. City water connection and sequencing only applies to critical process water systems.

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STANDARD CONTROL DRAWINGS

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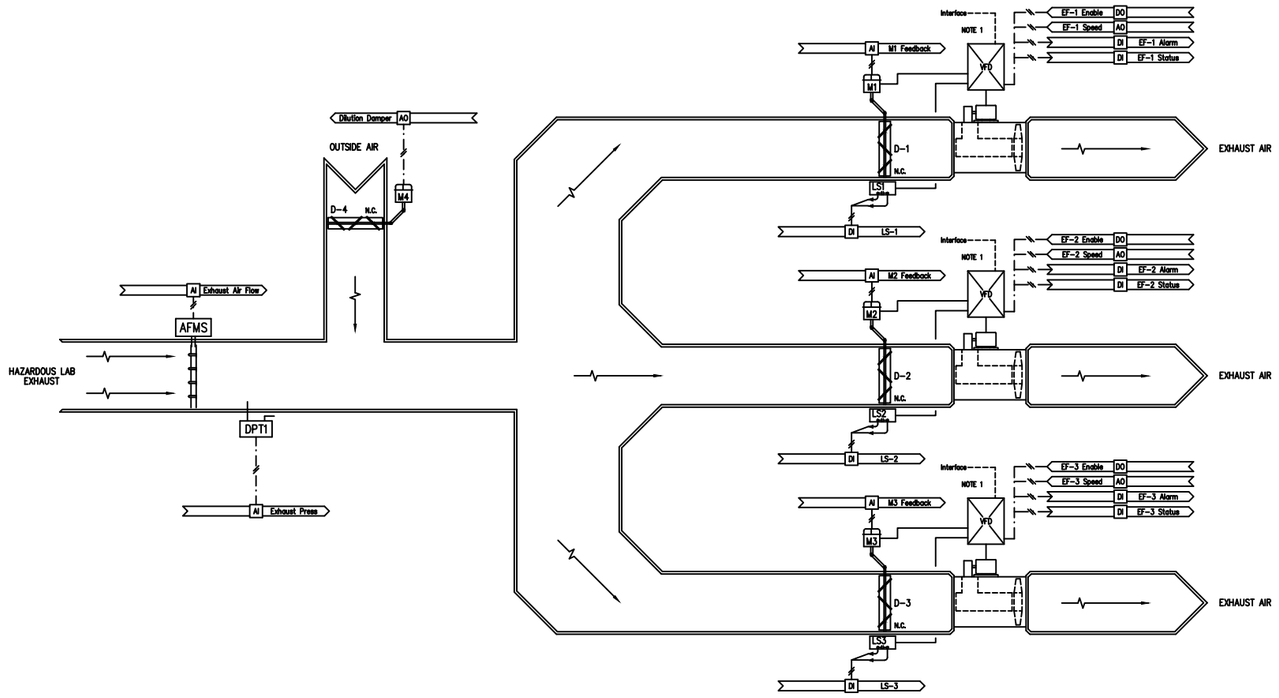
UGA STANDARDS UPDATE SPRING 2020

Process Chilled Water

16 OF 18
SHEET NUMBER

C-402
DWG NUMBER



CONTROL SCHEMATIC

SEQUENCE OF OPERATION

GENERAL: THE VARIABLE AIR VOLUME REDUNDANT MANIFOLD EXHAUST FAN SYSTEM SHALL BE FULLY CONTROLLED BY THE BAS. BY DEFAULT THIS SYSTEM SHALL RUN CONTINUOUSLY AND REQUIRE OPERATOR OVERRIDE TO STOP.

TYPICAL EXHAUST FAN CONTROL: BAS SHALL CONTROL THE STARTING AND STOPPING OF EACH EXHAUST FAN AS FOLLOWS:

1. START/STOP: BAS SHALL COMMAND THE EXHAUST FAN TO RUN CONTINUOUSLY. TWO FANS SHALL OPERATE SIMULTANEOUSLY AT ALL TIMES. THE THIRD FAN WILL OPERATE AS STANDBY. THE TWO LEAD FANS AND STANDBY FAN SHALL ROTATE EVERY 170 HOURS (ADJ.) OR WHEN MANUALLY SELECTED BY THE OPERATOR.
2. PROOF: BAS SHALL PROVE FAN OPERATION VIA VFD STATUS INPUT. UPON FAILURE OF A FAN, BAS SHALL IMMEDIATELY START THE STANDBY FAN.
3. VFD CONTROL: WHEN THE FANS ARE ENERGIZED, BAS SHALL CONTROL THE SPEED OF ALL VFDS TO MAINTAIN THE EXHAUST STATIC PRESSURE SET POINT. ON START AND STOP, THE VFDS SHALL RAMP TO SPEED AND SLOW DOWN WITHIN ADJUSTABLE ACCELERATION AND DECELERATION LIMITS. UPON INITIAL START EXHAUST FAN SPEED SHALL BE CONSTRAINED TO MINIMUM UNTIL ISOLATION DAMPER LIMIT POSITION (LS-1, 2, 3) IS PROVEN.
4. VFD ALARM: THE BAS SHALL MONITOR A COMMON ALARM OUTPUT FROM EACH DRIVE AND REPORT WHEN ACTIVE.
5. EXHAUST DUCT PRESSURE SETPOINT: THE EXHAUST DUCT STATIC PRESSURE SETPOINT SHALL BE SET BY TAB TO MEET SCHEDULED HAZARDOUS EXHAUST FLOW AND PREVENT EXHAUST FAN PLUME DISCHARGE FROM FALLING BELOW ITS LOW LIMIT THRESHOLD.

TYPICAL DAMPER CONTROL: BAS SHALL CONTROL THE DAMPERS AS FOLLOWS:

1. EXHAUST FAN ISOLATION DAMPER: ISOLATION DAMPERS SHALL BE HARDWIRED TO THE VFD OF THE EXHAUST FAN SERVED TO OPEN WHEN THE VFD IS COMMANDED TO START. LIMIT SWITCHES SHALL BE HARDWIRED TO THE VFD TO ALLOW FANS TO RAMP UP FROM MINIMUM SPEED ONCE MINIMUM DAMPER OPENING POSITION IS ACHIEVED. BAS SHALL MONITOR CONTACTS ON LIMIT SWITCHES AND DAMPER ACTUATORS TO REFLECT ACTUAL POSITION ON GRAPHICS. BAS SHALL GENERATE AN ALARM WHEN COMMANDED DAMPER POSITION DOES NOT MATCH ACTUAL WITHIN 30 SECONDS (ADJ.).
2. DILUTION DAMPER: UPON SYSTEM START THE DILUTION DAMPER SHALL BE CLOSED. WHEN EXHAUST FANS ARE OPERATING AT MINIMUM SPEED FOR 1 MINUTE (ADJ.) CONTINUOUSLY AND THE EXHAUST STATIC PRESSURE IS BELOW SET POINT, DUCT STATIC PRESSURE IS TOO LOW, THE DILUTION DAMPER WILL BE MODULATED OPEN TO MAINTAIN THE EXHAUST STATIC PRESSURE AS READ AT DPT1 AT THE EXHAUST STATIC PRESSURE SET POINT MINUS 0.1" W.C. (ADJ.) TO MAINTAIN CONSTANT DISCHARGE VELOCITY (ADJ.) AT THE STACK OUTLET.

GRAPHICS AND TRENDS: PROVIDE TRENDS AND GRAPHIC DISPLAY FOR ALL CONTROL POINTS AND CALCULATED SET POINTS PER SPECIFICATIONS.

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	REMARKS
bldg.EFx.ALRM	EFx VFD Alarm	3				"EFx-A"
bldg.EFx.ST	EFx Status	3				"EFx-STAT"
bldg.EFx.SS	EFx Enable			3		"EFx-SS"
bldg.EFx.SPD	EFx Speed				3	"EFx-SPD"
bldg.EFx.DFDBK	EFx Damper Feedbk		3			Mic"EFx-DFDBK"
bldg.EFx.LS	EFx Limit Switch	3				LSic"EFx-LS"
bldg.EF.DP	Exhaust Pressure		1			DPTI:"EF-DP"
bldg.EF.AFMS	Exhaust Air Flow		1			AFMS:"EF-AFMS"
bldg.EF.DILUTION	Dilution Damper				1	M4:"DILUTION-D"
	TOTALS	9	5	3	4	

NOTES

1. Provide an ASHRAE 135 compliant (BACnet MS/TP or IP) communications interface to the control system for diagnostic point information. Include the following information for fan VFDs: operating frequency (Hz), RPM, percent fan speed, BAS signal to VFD, VFD output voltage, actual brake horsepower, and kW. On the VFD graphic screen also include the motor nameplate brake horsepower.

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STANDARD CONTROL DRAWINGS

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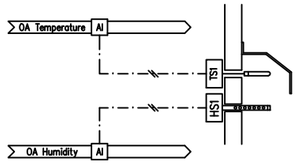
UGA STANDARDS UPDATE SPRING 2020

VAV MANIFOLD LABORATORY EXHAUST

17 OF 18
SHEET NUMBER

C-501
DWG NUMBER

Locate outside air temperature and humidity sensors on North exterior wall as directed. One set of sensors shall be installed for each building and tied to the nearest controller. Values shall be broadcast to all other controllers in the building that require outside air values.



A C-601

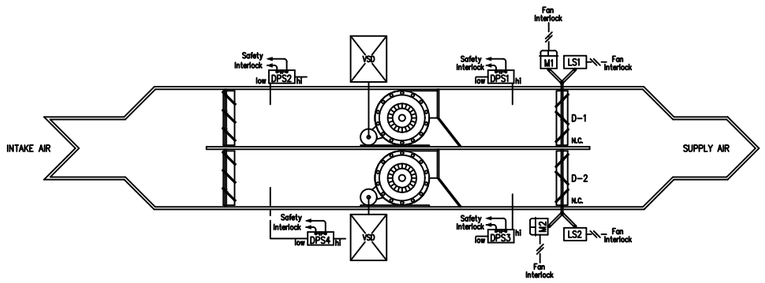
OUTSIDE AIR SENSORS

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.OA-T	OA Temperature			1			
bldg.OA-H	OA Humidity	1					
	OA Enthalpy					*	

NOTES

1. MOUNT OUTSIDE AIR SENSORS UNDER A SUN SHIELD, AS HIGH ON THE WALL AS POSSIBLE, ON THE NORTH SIDE OF THE BUILDING. LOCATION SHALL BE SELECTED SUCH THAT SOLAR RADIATION, EXHAUST, HEATING SOURCES, AND COOLING SOURCES WILL NOT AFFECT SENSOR READINGS.
2. BAS SHALL CONTINUOUSLY CALCULATE ACTIVE OA ENTHALPY FOR USE BY BUILDING SUBROUTINES.
3. GRAPHICS SHALL DISPLAY CAMPUS OUTSIDE AIR STATION VALUES ALONG WITH THESE LOCAL OUTSIDE AIR STATION VALUES. LOCAL VALUES SHALL BE USED FOR ALL BUILDING SEQUENCES BY DEFAULT. AN ON GRAPHIC OPTION SHALL BE PROVIDED FOR THE OPERATOR TO CHANGE TO CAMPUS VALUES FOR SEQUENCING.



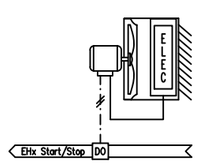
B C-601

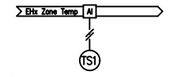
HEADERED FAN CONTROL

NOTES

HEADERED FAN SYSTEMS WILL TYPICALLY APPLY TO CRITICAL 100% OUTSIDE AIR UNITS REQUIRING REDUNDANCY. STANDARD UNIT POINT MONITORING AND CONTROL WILL STILL APPLY.

THE FOLLOWING IS IN ADDITION TO STANDARD CONTROL FOR HEADERED FAN SYSTEMS: BAS SHALL CONTROL LEAD/STAND-BY OPERATION OF HEADERED FANS. A COMMAND TO ENERGIZE A FAN WILL SIMULTANEOUSLY ENERGIZE THE ASSOCIATED ISOLATION DAMPER, ONCE THE DAMPER PROVES OPEN THE FAN WILL BE ALLOWED TO START. LOW AND HIGH PRESSURE SAFETY SWITCHES WILL ALLOW OPERATION OF FANS WITHIN DUCT PRESSURE LIMITS. BAS SHALL ENUNCIATE AN ALARM UPON FAILURE OF ANY FAN AND AUTOMATICALLY START THE STANDBY FAN. BAS SHALL MONITOR RUNTIME FOR EACH FAN AND START THE FAN WITH THE LEAST RUNTIME AS LEAD.





LOCATE AS SHOWN ON MECHANICAL PLANS

C C-601

ELECTRIC UNIT HEATER

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.EHxx.SS	EHx Start/Stop			1			
bldg.EHxx.ZONET	EHx Zone Temp		1				

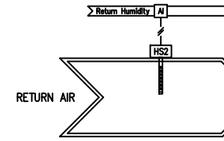
SEQUENCE OF OPERATION

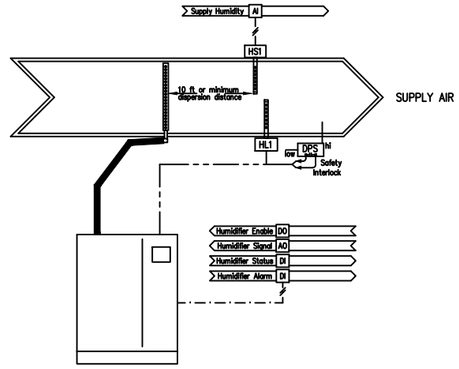
GENERAL: THE ELECTRIC UNIT HEATER SHALL BE FULLY CONTROLLED BY THE BAS.

SPACE TEMPERATURE CONTROL: ONE USER ADJUSTABLE SETPOINT SHALL APPLY; NORMAL SPACE HEATING (68F ADJ.)..

ELECTRIC UNIT HEATER ENABLE: WHENEVER THE SPACE TEMPERATURE FALLS BELOW THE NORMAL SPACE HEATING SET POINT THE ELECTRIC UNIT HEATER WILL BE ENABLED BY THE BAS. ONCE ENABLED THE UNIT HEATER FACTORY CONTROLS WILL ENERGIZE THE FAN AND ELECTRIC COIL PER THE FACTORY SEQUENCE AND FACTORY SAFETIES.

ALARM: WHENEVER SPACE TEMPERATURE FALLS BELOW 50F (ADJ.) BAS WILL ACTIVATE AN ALARM AT THE WORKSTATION.





D C-601

HUMIDIFIER

POINTS LIST

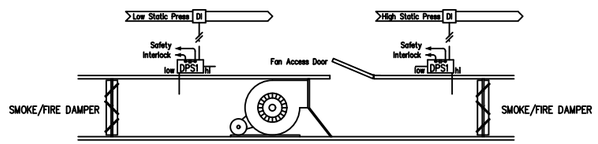
POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.AHxx.HUMEN	Humidifier Enable			1			
bldg.AHxx.SAH	Supply Humidity		1				HS1:"SAH"
bldg.AHxx.RAH	Return Humidity		1				HS2:"RAH"
bldg.AHxx.HUMC	Humidifier Signal				1		
bldg.AHxx.HUMST	Humidifier Status	1					
bldg.AHxx.HUMALRM	Humidifier Alarm	1					

SEQUENCE OF OPERATION

GENERAL: ADD THIS SCHEMATIC AND SEQUENCE TO AHU WHERE REQUIRED BY MECHANICAL DESIGN.

HUMIDIFIER CONTROL: BAS SHALL CONTROL THE HUMIDIFIER AS FOLLOWS:

1. HUMIDIFIER ENABLE: WHENEVER THE AH IS ENERGIZED IN OCCUPIED MODE, OUTSIDE AIR TEMPERATURE IS BELOW 55F (ADJ.), AND RETURN HUMIDITY IS BELOW SET POINT THE HUMIDIFIER SHALL BE ENABLED.
2. HUMIDIFIER SIGNAL: WHEN THE HUMIDIFIER IS ENABLED THE HUMIDIFIER SIGNAL SHALL BE MODULATED TO MAINTAIN THE HUMIDIFICATION SETPOINT PER THE LOWER OF:
   - 2.1. A RA PID LOOP TO MAINTAIN THE HUMIDIFICATION SETPOINT (INITIALLY 40%, ADJUSTABLE)
   - 2.2. A PROPORTIONAL ONLY LOOP MAINTAINING MAXIMUM SUPPLY HUMIDITY AT 90% (ADJ.).
3. HUMIDIFIER ALARM: WHEN HUMIDIFIER ALARM OUTPUT IS ACTIVE BAS WILL REMOVE HUMIDIFIER ENABLE AND SEND ALARM TO OWS.



E C-601

TYPICAL FIRE/SMOKE DAMPER SAFETY

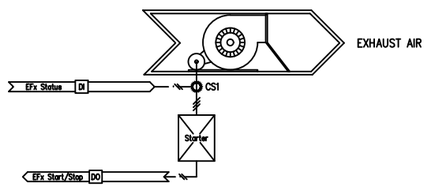
POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.AHxx.vHSP	High Static Press	1					
bldg.AHxx.vLSP	Low Static Press	1					

NOTES

GENERAL: WHERE SMOKE/FIRE DAMPERS ARE INSTALLED THAT CAN ISOLATE THE DISCHARGE OR SUCTION SIDE OF A FAN APPROPRIATE PRESSURE SWITCHES SHALL BE INSTALLED TO PROTECT THE DUCT WORK.
SMOKE/FIRE DAMPERS ARE DIRECTLY CONTROLLED BY THE FIRE ALARM SYSTEM AND POWERED PER DIVISION 26. NO CONTROL OR POWER OF LIFE SAFETY DEVICES THROUGH THE BUILDING AUTOMATION SYSTEM..

PRESSURE SWITCH: UPON ACTIVATION OF A HIGH OR LOW PRESSURE SAFETY SWITCH THE FAN SHALL BE HARDWIRED TO SHUT DOWN IMMEDIATELY. AUXILIARY CONTACTS ON THE SWITCH SHALL BE USED TO GENERATE AN ALARM AT THE BAS.



F C-601

TYPICAL INTERLOCKED EXHAUST FAN

POINTS LIST

POINT NAME	POINT DESCRIPTOR	POINT TYPE DI	AI	DO	AO	VP	REMARKS
bldg.EFxx.EFSS	EF Start/Stop			1			
bldg.EFxx.EFST	EF Status	1					

SEQUENCE OF OPERATION

EXHAUST FAN: BAS SHALL CONTROL THE EXHAUST FAN AS FOLLOWS.

1. THE EXHAUST FAN SHALL BE ENERGIZED WHENEVER THE ASSOCIATED AHU IS OPERATING IN THE OCCUPIED MODE.
2. BAS SHALL PROVE FAN OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME.

The University of Georgia
1785
Engineering Department Facilities Management Division

THE UNIVERSITY OF GEORGIA STANDARD CONTROL DRAWINGS

Eng	TRA
Drawn	HMJ
Issued	1/1/2020
Scale	N/A

UGA STANDARDS UPDATE SPRING 2020

MISCELLANEOUS CONTROLS

18 OF 18
SHEET NUMBER

C-601
DWG NUMBER